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<th>Description</th>
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<tr>
<td>ACS</td>
<td>Adaptive Control Software</td>
</tr>
<tr>
<td>AD</td>
<td>Archived Data Management</td>
</tr>
<tr>
<td>AMBER</td>
<td>America’s Missing: Broadcast Emergency Response</td>
</tr>
<tr>
<td>APTS</td>
<td>Advanced Public Transportation System</td>
</tr>
<tr>
<td>ATIP</td>
<td>Area Transportation Improvement Program</td>
</tr>
<tr>
<td>ATIS</td>
<td>Advanced Traveler Information System</td>
</tr>
<tr>
<td>ATMS</td>
<td>Advanced Traffic Management System</td>
</tr>
<tr>
<td>ATP</td>
<td>Area Transportation Partnership</td>
</tr>
<tr>
<td>AVL</td>
<td>Automatic Vehicle Location</td>
</tr>
<tr>
<td>AVSS</td>
<td>Advanced Vehicle Safety System</td>
</tr>
<tr>
<td>AWOS</td>
<td>Automated Weather Observation System</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer Aided Dispatch</td>
</tr>
<tr>
<td>CARS</td>
<td>Condition Acquisition and Reporting System</td>
</tr>
<tr>
<td>CCTV</td>
<td>Closed Circuit Television</td>
</tr>
<tr>
<td>CICAS</td>
<td>Cooperative Intersection Collision Avoidance System</td>
</tr>
<tr>
<td>CTS</td>
<td>Center for Transportation Studies (University of Minnesota)</td>
</tr>
<tr>
<td>CVIEW</td>
<td>Commercial Vehicle Information Exchange Window</td>
</tr>
<tr>
<td>CVO</td>
<td>Commercial Vehicle Operations</td>
</tr>
<tr>
<td>DARTS</td>
<td>Dakota Area Resources and Transportation for Seniors</td>
</tr>
<tr>
<td>DMS</td>
<td>Dynamic Message Sign</td>
</tr>
<tr>
<td>DOT</td>
<td>Department of Transportation</td>
</tr>
<tr>
<td>DPS</td>
<td>Department of Public Safety</td>
</tr>
<tr>
<td>DTA</td>
<td>Duluth Transit Authority</td>
</tr>
<tr>
<td>DVR</td>
<td>Digital Video Recording</td>
</tr>
<tr>
<td>EM</td>
<td>Emergency Management</td>
</tr>
<tr>
<td>EMS</td>
<td>Emergency Medical Services</td>
</tr>
<tr>
<td>EVP</td>
<td>Emergency Vehicle Preemption</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>FIRST</td>
<td>Freeway Incident Response Safety Team</td>
</tr>
<tr>
<td>FMCSA</td>
<td>Federal Motor Carrier Safety Administration</td>
</tr>
<tr>
<td>FTA</td>
<td>Federal Transit Administration</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>HAR</td>
<td>Highway Advisory Radio</td>
</tr>
<tr>
<td>HAZMAT</td>
<td>Hazardous Materials</td>
</tr>
<tr>
<td>HOT</td>
<td>High-Occupancy Toll</td>
</tr>
<tr>
<td>HOV</td>
<td>High-Occupancy Vehicle</td>
</tr>
<tr>
<td>ICM</td>
<td>Integrated Corridor Management</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>IFTA</td>
<td>International Fuel Tax Agreement</td>
</tr>
<tr>
<td>IRC</td>
<td>Interregional Corridor</td>
</tr>
<tr>
<td>IRP</td>
<td>International Registration Plan</td>
</tr>
<tr>
<td>ISP</td>
<td>Information Service Provider</td>
</tr>
<tr>
<td>ITS</td>
<td>Intelligent Transportation Systems</td>
</tr>
<tr>
<td>IWZ</td>
<td>Intelligent Work Zone</td>
</tr>
<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
</tr>
<tr>
<td>MCM</td>
<td>Maintenance and Construction Management</td>
</tr>
<tr>
<td>MCMIS</td>
<td>Motor Carrier Management Information System</td>
</tr>
<tr>
<td>MDSS</td>
<td>Maintenance Decision Support System</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>MDT</td>
<td>Mobile Data Terminal</td>
</tr>
<tr>
<td>Mn/DOT</td>
<td>Minnesota Department of Transportation</td>
</tr>
<tr>
<td>MPCA</td>
<td>Minnesota Pollution Control Agency</td>
</tr>
<tr>
<td>MPO</td>
<td>Metropolitan Planning Organization</td>
</tr>
<tr>
<td>MSP</td>
<td>Minnesota State Patrol</td>
</tr>
<tr>
<td>MTC</td>
<td>Metropolitan Transit Commission (St. Cloud)</td>
</tr>
<tr>
<td>MVTA</td>
<td>Minnesota Valley Transit Authority</td>
</tr>
<tr>
<td>NTCIP</td>
<td>National Transportation Communications for Intelligent Transportation System Protocol</td>
</tr>
<tr>
<td>OS/OW</td>
<td>Oversize/Overweight</td>
</tr>
<tr>
<td>OTST</td>
<td>Office of Traffic, Safety, and Technology (Mn/DOT)</td>
</tr>
<tr>
<td>PCMS</td>
<td>Portable Changeable Message Sign</td>
</tr>
<tr>
<td>PDA</td>
<td>Personal Digital Assistant</td>
</tr>
<tr>
<td>PRISM</td>
<td>Performance and Registration Information Systems Management</td>
</tr>
<tr>
<td>PSAP</td>
<td>Public Safety Answering Point</td>
</tr>
<tr>
<td>RASAWI</td>
<td>Rest Area Sponsorship, Advertising, and Wireless Internet</td>
</tr>
<tr>
<td>RDC</td>
<td>Regional Development Commission</td>
</tr>
<tr>
<td>RFID</td>
<td>Radio-Frequency Identification</td>
</tr>
<tr>
<td>RTMC</td>
<td>Regional Transportation Management Center</td>
</tr>
<tr>
<td>RWIS</td>
<td>Road Weather Information System</td>
</tr>
<tr>
<td>SAFER</td>
<td>Safety and Fitness Electronic Records</td>
</tr>
<tr>
<td>SAFETEA-LU</td>
<td>Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users</td>
</tr>
<tr>
<td>SEOC</td>
<td>State Emergency Operations Center</td>
</tr>
<tr>
<td>SHSP</td>
<td>Strategic Highway Safety Plan</td>
</tr>
<tr>
<td>SHVSP</td>
<td>Statewide Heavy Vehicle Safety Plan</td>
</tr>
<tr>
<td>SOV</td>
<td>Single Occupancy Vehicle</td>
</tr>
<tr>
<td>STIP</td>
<td>Statewide Transportation Improvement Program</td>
</tr>
<tr>
<td>TEA-21</td>
<td>Transportation Equity Act for the 21st Century</td>
</tr>
<tr>
<td>TMC</td>
<td>Transportation/Traffic Management Center</td>
</tr>
<tr>
<td>TOCC</td>
<td>Transportation Operation and Communications Center</td>
</tr>
<tr>
<td>TSP</td>
<td>Transit Signal Priority</td>
</tr>
<tr>
<td>TZD</td>
<td>Toward Zero Deaths</td>
</tr>
<tr>
<td>UPA</td>
<td>Urban Partnership Agreement</td>
</tr>
<tr>
<td>VSL</td>
<td>Variable Speed Limit</td>
</tr>
<tr>
<td>VWS</td>
<td>Virtual Weigh Station</td>
</tr>
<tr>
<td>WIM</td>
<td>Weigh-in-Motion</td>
</tr>
<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
</tr>
</tbody>
</table>
1. Overview

1.1 Background

The state of Minnesota is developing and documenting the Minnesota ITS Planning and Regional Architecture Update based on the National ITS Architecture. The purpose is to meet the requirements of Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) for receiving Federal funds for ITS projects and to provide a high-level planning for enhancing the state transportation systems using ITS technologies. Volume 9 is the final volume of a series of reports that have been developed as part of the Minnesota ITS Planning and Regional Architecture Update project. 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 ITS Architecture in the planning, design, implementation, and operation stages of ITS systems and projects.

Eight other documents were developed as part of this project and are listed below:

- **Volume 1 – Overview**: Volume 1 identifies the purpose/need, a general description of the region, development objectives, and performance measures for the Minnesota Statewide Regional ITS Architecture.

- **Volumes 2 thru 7 – Development and Documentation of Market Package Bundles**: Each volume is specific to the corresponding Market Package Bundle and includes: a description of the Market 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 market packages to address needs and services, interconnects and architecture flows, and functional requirements).

- **Volume 8 – Regional ITS Architecture**: Volume 8 consists of the hard copies of the Turbo Architecture outputs and the corresponding electronic files.

Volumes 2 through 7 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 projects 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 projects. Based on stakeholders’ input on transportation issues and needs, the long-range project implementation document provides the corresponding details for each project which include project descriptions, agency involved, project champion, implementation timeframe, project readiness, dependencies, benefits, market packages, estimated costs, relevant ITS standards, and agreements needed. The document identifies the approach for mainstreaming ITS into the Minnesota Transportation Investment Process, which
is the SAFETEA-LU required transportation planning and project development 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 projects to address needs, analysis of project dependencies, identification of project sequencing, investigation of technology and ITS standards maturity and readiness, and consideration of agency agreements and project funding requirements. Projects identified in this document will accomplish the needs and services documented in the Statewide 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 projects over time. Priority, desired timeframe and duration are examined and assigned to each ITS project, and an overall deployment schedule is compiled to ensure successful implementation.

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

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

- Prioritization of projects based on existing conditions and stakeholder needs. The ITS projects 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 projects can build upon one another. Project dependencies influence the project sequencing. It is beneficial to identify the information and functional dependencies between projects.

1.4 Document Organization

This document is organized into four sections:

- Section 1 provides a brief introduction to the plan.
- Section 2 describes the approach and key process for ITS program development focusing on stakeholder needs, project 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 ITS Project Development Checklist which is an approval document required to be completed prior to appropriating federal funding for a project.
• Section 4 identifies the important implementation considerations including project costs and short, medium and long term projects that may affect project implementation and integration.

In summary, Volume 9 describes the general approach and key process used to develop this document and how Minnesota ITS Development 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 ITS Planning and Regional Architecture Update provides Minnesota state, regional and local agencies, and other involved transportation entities with an updated framework for planning, defining, and integrating the ITS systems in Minnesota. As part of the effort, Volume 9 identifies and defines specific ITS projects 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 identification process, categorize and prioritize ITS projects planned to be implemented in the next 15 to 20 years.
• Description of the process and method for identifying, evaluating and prioritizing ITS projects based on needs, goals and objectives, investment priorities and benefits.
• Description of the process of identifying needs for developing project architectures consistent with the Minnesota Statewide Architecture and in conformance with the National ITS Architecture.
• Defines the criteria, considerations and process of the ITS project timeline and sequencing for future ITS projects.
• Describes Mn/DOT’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.
• Provides 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 projects:
Short term projects (0-4 years) including a summary of: category; description; agency/stakeholder involved; project champion; elements and interconnects; estimated costs; dependencies, and market packages.

Medium (5-8 years) and long term (>8 years) will provide a high level summary for each project concept including: category; description; agency/stakeholder; project champion; dependencies and market packages.

Planned projects will accomplish the user services and system functions defined in Volume 8: 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 projects over time. Priority, desired timeframe and duration are examined and assigned to each ITS project, and an overall deployment schedule is compiled to ensure successful implementation.

The key to the ITS planning process is to define the project definition and project sequencing process. The project definition outlines the project concepts and the associated details including project title, stakeholder, project scope, costs, benefits and the marketing packages defined in Volume 8: Regional ITS Architecture. The project sequencing provides an approximate timeframe in which an ITS project may be implemented based on the understanding of the projects, project dependencies\(^1\) of the project, as well as other existing or planned ITS systems.

### 2.2 Stakeholder Needs Identification and Prioritization

Stakeholder outreach has been a key component even prior to the Minnesota ITS Planning and Regional Architecture Update. Between May and August 2006, Mn/DOT conducted a series of workshops with stakeholders from throughout Minnesota focusing on the six Market Package Bundles. The purpose of those workshops was to obtain feedback on the Minnesota ITS Development Objectives to enhance safety, efficient movement of people and goods. Based on those development objectives each of the six stakeholder groups were provided ITS functional/informational needs and participated in a voting exercise to determine the highest rated need that would benefit the traveling public.

In the spring and early summer of 2008 the six stakeholder groups were again brought together as part of Minnesota ITS Planning and Regional Architecture Update to further review and refine the needs and services identified two years prior, as well as review needs and services added since 2006 for each of the six Market Package Bundles (Volumes 2 through 7). The stakeholders accomplished this by providing detailed feedback from Appendix C – Needs and Service Detail, on the following categories:

- Need/Service
- Operational Concept
- Existing Capabilities
- Gaps/Planned Enhancements
- Roles/Responsibilities
- Interconnect
- Archive Needs
- Associated Market Package Bundles

---

\(^1\) Project dependencies show how successive ITS projects can build on one another.
Because additional identified Needs and Services have been added since 2006, new
technologies have come on-line, and new technologies have replaced out-of-date technology a
Needs Survey was developed as part of this project in the late summer of 2008 for the six
stakeholder group participants. Stakeholder participants were asked to identify either a high,
medium or low priority box for each Need listed on the Needs Survey. This provided an up-to-
date list of ITS projects to determine short (0-4 years), medium (5-8 years) and long term (>8
years) projects identified in this volume.

On November 14, 2008 stakeholders with knowledge of and/or previous input to the six market
package bundles were invited to attend an open house workshop. The workshop was broken
into two sessions. The first session provided the stakeholders an overview of the Volume 9 with
brief summaries of the four sections and associated subsections. The second session broke the
stakeholders into six groups for each of the six market package bundles. Facilitators guided the
stakeholders through the short, medium and long term projects to verify the information
provided was correct as well as determine whether the projects were placed the correct
implementation timeframe.

2.3 Project 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 projects. Based on the
previously identified needs and services, stakeholders identified and prioritized, in each of the
six market bundles, a list of projects 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
market packages were developed. Project selection included a detail review of those needs and
service details, keying in on operational concepts and gaps and/or planned enhancements to
establish the list projects.

2.4 ITS Architecture Development and Systems Engineering

2.4.1 ITS Architecture Development Process
ITS architecture development describes the process of identifying needs and steps for
developing project architectures that are consistent with the Minnesota Statewide Regional ITS
Architecture and is in conformance with the National ITS Architecture. Specifically, descriptions
will include ITS elements, associated market packages, functional requirements interface and
informational flows. ITS standards that are applicable to systems and architecture flows will be
defined in the architecture system, including identifying the status and maturity of applicable
standards.

The purpose of updating the statewide architecture is to illustrate and document regional
integration to allow planning and deployment of ITS systems to occur in an organized and
coordinated process. In the case of Minnesota ITS Regional Architecture there are multiple
transportation agencies and jurisdictions with overlapping geographies. These transportation
agencies and jurisdictions have similar transportation issues (i.e. mobility, safety, traveler
information, information sharing, etc.). The Minnesota ITS Planning and Regional Architecture
Update provides ITS solutions to address cross-jurisdictional issues in an economic manner,
utilizing public funds in a responsible manner.
To better understand the process of ITS architecture development, Figure 2-1 depicts a process recommended by the FHWA. A more detailed description of the five step process as it relates to the Minnesota ITS Regional Architecture can be found in Appendix A.

**Figure 2-1. ITS Architecture Development Process**

---

2.4.2 Systems Engineering

Final Rule 940 (http://ops.fhwa.dot.gov/its_arch_imp/docs/20010108.pdf) 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 system 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 2-2, 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. 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 ITS Architecture serves to meet the criteria of Final Rule 940.

![Figure 2-2. Systems Engineering Approach](image-url)
The development and implementation of the Minnesota Statewide Regional ITS Architecture is within the framework of the National ITS Architecture, and using the system engineering approach will help ensure the stability and longevity of ITS projects and systems deployed throughout Minnesota.

2.5 Project Timeframe and Sequencing

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

<table>
<thead>
<tr>
<th>Category</th>
<th>Timeframe</th>
<th>Year of Deployment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Term</td>
<td>0 – 4 years</td>
<td>2009 – 2013</td>
</tr>
<tr>
<td>Medium Term</td>
<td>5 – 8 years</td>
<td>2014 – 2018</td>
</tr>
<tr>
<td>Long Term</td>
<td>Beyond 8 years</td>
<td>2019 and beyond</td>
</tr>
</tbody>
</table>

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

- Project funding
- Project dependency
- Technology assessment
- Identification of estimated capital, operations and maintenance costs
- Identify existing and new agreements required for implementation and operations of ITS systems

2.6 Mainstreaming ITS into the Statewide Transportation Investment Process

2.6.1 Statewide Transportation Investment Process – 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 Mn/DOT, cities, counties, MPOs, 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. **Mn/DOT Strategic Plan:** This is the overarching document in which Mn/DOT’s policy and transportation directions are based, and sets directions for subsequent plans. Mn/DOT’s vision and mission, as stated in the Strategic Plan, is to focus on priority...
transportation improvements and investments that result in a transportation system that helps travelers on Minnesota roadways travel safer, smarter, and more efficiently.

2. **Mn/DOT 20-Year Statewide Transportation Plan:** The Statewide Transportation Plan establishes the policies and performance measures required to implement the Strategic Plan and provides for early and continuous opportunities for the involvement of local officials, the public and other potentially affected parties.

3. **Mn/DOT District Long-Range Transportation Plans:** The eight Mn/DOT District Long-Range Transportation Plans serve as the critical planning link between the 20-Year Statewide Transportation Plan and transportation projects to Minnesota’s highway system. The plans identify what are the system deficiencies and needs for improvement.

4. **“Local” Plans:** Local plans are described, in this case, as MPOs; RDCs; Tribal governments; city; county; etc., located within the Mn/DOT District boundaries. Mn/DOT 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 Mn/DOT 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 DOT.

2.6.2 Minnesota Guidestar – ITS: Role in Minnesota Transportation Investment Process

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

• Since its inception in 1991, Minnesota Guidestar has performed a broad range of ITS activities including needs assessments, research and development, full-scale operational testing, and deployment of ITS strategies and technologies. Minnesota Guidestar has been a key player in advancing ITS technology and programs to help achieve statewide and local transportation objectives. This success continues because of Minnesota Guidestar’s strong partnerships with the public sector, the private sector and academia. It is because of these partnerships, that Minnesota Guidestar has successfully produced innovative and unique programs and projects.

• Minnesota Guidestar Strategic Plans were issued in 1997, 2000 and 2006. These plans have provided statewide and local strategic direction to Minnesota Guidestar and have initiated more than 200 ITS programs and projects over the years.

• Minnesota’s ITS Safety Plan was developed in 2006. The purpose of the plan was to develop ITS strategies and initiatives that reduce the number of vehicle traffic fatalities and life changing injuries on Minnesota roadways. The plan is a component document of the Minnesota Strategic Highway Safety Plan (SHSP), the Toward Zero Deaths (TZD) Program, and the Minnesota Statewide Heavy Vehicle Safety Plan (SHVSP).

• This Minnesota Guidestar Program: Deployment Assessment was created in 2007 by Mn/DOT, in cooperation with other transportation stakeholders. The intent was to assess current programs and future opportunities for deployment of ITS projects in Minnesota that focus on safety and mobility. The overriding goal of this project was to develop an assessment in sufficient detail that Mn/DOT can use the assessment to help establish priorities and secure funding for ITS deployment projects that improve safety and mobility in Minnesota.

• The subject of this most recent document, Minnesota ITS Planning and Regional Architecture Update helps to set up the next step to integrate ITS into the Minnesota Transportation Investment Process. The Minnesota ITS Planning and Regional Architecture Update, incorporated with the Mn/DOT District Long-Range Transportation Plans, 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:
  o 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.
  o 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.
  o The definition of an integrated transportation system described by the ITS Architecture can support a key element of the transportation plan.
  o 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 region’s ITS needs and priorities to incorporate and plan improvements to address those identified needs and priorities. The Minnesota ITS Planning and Regional Architecture Update, and associated ITS planning and deployment documents, were built upon a foundation provided by previous Mn/DOT transportation planning and Guidestar 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 Mn/DOT transportation planning documents is the Mn/DOT Strategic Plan. This high-level plan defines Mn/DOT’s principles and outlines strategies that it can satisfy its vision and mission. The 20-Year Statewide Transportation Plan further clarifies these strategies and lays out Policies to be used to implement the Strategic Directions identified in the Strategic Plan. These Policies are further developed in several different types of planning documents: District Long-Range Transportation Plans, the Interregional Corridor (IRC) Plans, Modal Plans, and local agency plans. These plans develop strategies, concepts, and projects to implement higher level policies. This Minnesota ITS Planning and Regional Architecture Update 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.

2.7 Funding Needs and Sources – ITS Future Funding Resources

2.7.1 ITS Migration from Guidestar Project Development to the Minnesota Transportation Investment Process

Throughout the 1990s and early 2000s, major Minnesota Guidestar ITS funding was through congressional earmarks. Congressional earmarks worked well for previous studies, research planning, and operational tests. As the possibilities for ITS have become realized, it has become apparent that a more stable and reliable funding program, which incorporates ITS into the regular ongoing transportation programs, is necessary for long-term transportation planning in Minnesota. SAFETEA-LU, passed by Congress in 2005, set the stage for integrating ITS into the Minnesota State Transportation Investment Process on an equal basis with all other transportation projects. As noted in the previous section, the Minnesota ITS Planning and Regional Architecture Update and other related ITS planning and deployment documents prepared for Minnesota are key planning documents for identifying, prioritizing, and integrating critical ITS projects into the Minnesota Transportation Investment Process.

Migrating ITS programs and projects from the Guidestar funding/deployment process to the mainstream statewide planning process requires careful review and assessment of many of Minnesota’s ITS programs. This assessment is part of the process that will help set the new directions for ITS in Minnesota. The overarching goal of mainstreaming the Minnesota Guidestar program into the Minnesota Transportation Investment Process is to secure funding for ITS deployment projects to improve safety and mobility in Minnesota. As Minnesota moves forward with ITS programs, the funding and deployment of ITS projects represent: (1) a recognition of the need and (2) value of ITS and Minnesota’s commitment to future transportation system demands. The following provides a brief summary of funding sources identified in the STIP financial plan process as guided by the requirements of SAFETEA-LU.
2.7.2 STIP – Funding Sources

**Federal Funding:** SAFETEA-LU requires that federal-aid highway and federal-aid transit projects in the STIP be based on financing reasonably expected to be available in the four year funding period. Federal-aid revenues are based on estimates of apportionment (formula), allocations and high priority project funding.

- **Federal-Aid Highway Formula Funding**
  - Apportioned to states by formulas established by law.
  - Federal-aid apportionments have typically been highly variable.
  - Minnesota developed the most recent STIP based on a forecast estimate of obligation authority - $484 for FY 2008 and $485 for FYs 2009-2011.
  - The annual obligation limitation of apportionment funds under SAFETEA-LU has been approximately 85 percent.

- **Federal-Aid Highway Allocation Funding**
  - Federal-aid high allocation funding is distributed to the states by an administrative formula or by means of a competitive application.
  - Allocated funds include many categories of federal-aid, including but not limited to, Public Lands; Indian Reservation Roads; Forest Highways; and Scenic Byways.
  - Allocations of categorically funding generally consist of several small projects distributed to specific areas of the state.

- **Federal-Aid Highway Earmarked Funding**
  - SAFETEA-LU had $90 million for each in Earmarked funds by Congress. This is up from approximately $30 million from previous transportation acts.
  - Earmarked funding is subject to obligation limitation but is available until spent.
  - The actual level of funding committed each is variable due to project schedules and rules pertaining to the spending of these funds.

- **Federal Transit Funding**
  - Federal transit funding includes both formula (bulleted below) and discretionary programs including:
    - Urbanized Area Formula Program
    - Non-urbanized Area (rural, small urban, and intercity bus) Formula Program
    - Special Needs for Elderly Individuals and Individuals with Disabilities Formula Program
    - Job Access and Reverse Commute Formula Program
    - New Freedom Formula Program
    - A discretionary program for major capital needs
  - The discretionary program provides for discretionary/competitive allocations as well as SAFETEA-LU Statutory Provisions projects for bus and bus-related facilities.

**State Highway and Transit Funding:** The State of Minnesota has a biennial budget with state agency programs and operating budgets based on a balanced budget. The 2008-2011 STIP is based on two years of approved funding and two years of estimated funding. The funding level for the STIP is estimated to be approximately the same the entire four year duration.

- **State Highway Funding**
  - Based on existing revenue sources state highway funding is anticipated to average $290 million per year.
  - State fund cash flow also permits advance constructing projects prior to actual federal dollars being available.

- **State Transit Funding**
The majority of funding for the Minneapolis-St. Paul area transit system is provided through local and state revenues.

Transit is primarily a local program; estimates of urbanized transit system funding are based on MPO TIPs.

Small urban and rural transit systems have a portion of their funding provided by assistance from the state general fund. The local share typically comes from a large variety of resources.

- 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 Mn/DOT.
  - The agency using the Advance Construction procedure must “front-end” the project with their funds.

### 3. ITS Project Development

#### 3.1 ITS Project Development Process

Throughout Minnesota Guidestar’s 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 be carefully analyzed and disseminated on a national level so as to allow future projects to build on the successes of the original project. Figure 3-1 depicts the Minnesota Guidestar project development Process.

![Figure 3-1. Historical Minnesota Guidestar Project Development Process](image)

The migration of ITS programs and projects from the Minnesota Guidestar ITS program and projects, lies in large part, to documents such as this Plan, ITS Safety Plan and Minnesota Guidestar: Deployment Assessment, which have laid the groundwork that will help set the new directions for ITS in Minnesota. Figure 3-2 provides a high level overview of the ITS mainstreaming process into the Minnesota Investment Process.
3.2 ITS Project Development – Rule 940 Conformity Process

FHWA Rule 940 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 Mn/DOT 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: Mn/DOT has developed a checklist for Rule 940 compliance and FTA National ITS Architecture Policy. The checklist is a guide for project managers to determine what documents, steps and analyses need to be developed over the life of the project. The checklist is broken down into seven sections (Appendix B). 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. A completed checklist for a sample project is included in Appendix C. The project manager will complete the checklist based on information already available to them. Questions that arise pertaining to the ITS checklist during the completion process will be directed to the Mn/DOT contact noted on the ITS checklist.

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

5. Send Completed Checklist to FHWA: Once the Rule 940 checklist is completed and checked, the lead agency’s project manager will forward the checklist and supporting documents to FHWA and Mn/DOT Office of Traffic, Safety, and Technology (OTST). Mn/DOT OTST staff will verify information included on the checklist and supporting documentation, and if necessary will forward any additional information to the FHWA. FHWA staff will review checklist and supporting documentation and make a

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3 Similar to FHWA Rule 940, the FTA National Architecture Policy provides procedures for implementing section 5206(e) of the Transportation Equity Act for the 21st Century. All projects funded with mass transit funds from the highway trust fund will be based on a systems engineering process.
determination as to whether the proposed project demonstrates compliance with Rule 940.

4. ITS Implementation Projects

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 projects and their relationships with the Minnesota ITS Development Objectives. Section 4.2 summarizes the implementation sequencing and schedule of the identified short-term projects, along with the costs for implementation. Section 4.3 provides detailed descriptions of the short-term projects, while Section 4.4 describes the medium- and long-term projects that have been identified in this study.

4.1 Summary of Potential Projects

This section presents a list of all potential ITS projects and their relationships with the Minnesota ITS Development Objectives. The Minnesota ITS Development Objectives were presented in Volume 1 (Overview), Section 2.2. More specific objectives – labeled as O-1, O-2, etc. – were categorized under the following five higher-level Minnesota ITS Development Objectives:

A. Improve the Safety of the State’s Transportation System
B. Increase Operational Efficiency and Capacity of the State’s Transportation System
C. Enhance Mobility, Security, Convenience, and Comfort for the Transportation System User
D. Enhance the Present and Future Economic Productivity of Individuals, Organizations and the Economy as a Whole
E. Reduce Energy Consumption, Environmental Impacts and Costs of Transportation

The specific objectives that would be achieved with potential ITS projects have been linked to those projects, and such linkages are presented in Table 4-1.

4.2 Project Schedule and Cost Summary

Table 4-2 illustrates the implementation sequencing and schedule for the 53 potential short-term ITS projects identified in Section 4.3. These projects are organized based on their implementation timeframes and sequencing. Implementation schedule is subject to change over time as projects are deployed or priorities change. Factors such as funding, impact of previous deployments, and unforeseen circumstances may require alternations of some projects, 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 projects are estimated at approximately $80,000,000. Cost estimates for individual projects 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>
<thead>
<tr>
<th>ID</th>
<th>Minnesota ITS Development Objectives</th>
<th>Short Term Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-1</td>
<td>Reduce crashes due to road weather conditions</td>
<td>Provide Updated Toll Information on 511 Website</td>
</tr>
<tr>
<td>O-2</td>
<td>Reduce crashes due to red-light running</td>
<td>Email Alerts to Major Employers and Government Entities</td>
</tr>
<tr>
<td>O-3</td>
<td>Reduce crashes due to red-light running</td>
<td>Enhance Traveler Information Map for Mobile Devices</td>
</tr>
<tr>
<td>O-4</td>
<td>Reduce crashes due to red-light running</td>
<td>511 Telephone Interface Upgrade</td>
</tr>
<tr>
<td>O-5</td>
<td>Reduce crashes due to red-light running</td>
<td>Rest Area Internet Access</td>
</tr>
<tr>
<td>O-6</td>
<td>Reduce crashes due to red-light running</td>
<td>Email Alerts to Major Employers and Government Entities</td>
</tr>
<tr>
<td>O-7</td>
<td>Reduce crashes due to red-light running</td>
<td>ATIS Customization</td>
</tr>
<tr>
<td>O-8</td>
<td>Reduce crashes due to red-light running</td>
<td>Rest Area Truck Parking Availability</td>
</tr>
<tr>
<td>O-9</td>
<td>Reduce crashes due to red-light running</td>
<td>Sharing CCTV Images Between Agencies</td>
</tr>
<tr>
<td>O-10</td>
<td>Reduce crashes due to red-light running</td>
<td>Traffic Signal ACS Lite Operational Test</td>
</tr>
<tr>
<td>O-11</td>
<td>Reduce crashes due to red-light running</td>
<td>Traffic Signal Timing and Control Improvements</td>
</tr>
<tr>
<td>O-12</td>
<td>Reduce crashes due to red-light running</td>
<td>Develop an Automated System for Traffic Data Archiving</td>
</tr>
<tr>
<td>O-13</td>
<td>Reduce crashes due to red-light running</td>
<td>Dynamic Speed Display Signs (“Your Speed Is”)</td>
</tr>
<tr>
<td>O-14</td>
<td>Reduce crashes due to red-light running</td>
<td>Expand Provision of Operating Speed and Delay Information</td>
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<tr>
<td>O-15</td>
<td>Reduce crashes due to red-light running</td>
<td>Advance Warning Flasher Deployment Expansion</td>
</tr>
<tr>
<td>O-16</td>
<td>Reduce crashes due to red-light running</td>
<td>Arterial Traffic Management Systems for TH55 and TH65</td>
</tr>
<tr>
<td>O-17</td>
<td>Reduce crashes due to red-light running</td>
<td>Integrated Corridor Management (ICM)</td>
</tr>
<tr>
<td>O-18</td>
<td>Reduce crashes due to red-light running</td>
<td>Dynamic Lane Control and Variable Speed Limit Signs on Freeways</td>
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<tr>
<td>O-19</td>
<td>Reduce crashes due to red-light running</td>
<td>Metro Area Ramp Meter Expansion and Enhancements</td>
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<tr>
<td>O-20</td>
<td>Reduce crashes due to red-light running</td>
<td>Travel Time Freeway Sign Expansion</td>
</tr>
<tr>
<td>O-21</td>
<td>Reduce crashes due to red-light running</td>
<td>Automated Surveillance and Signal Control Software</td>
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<tr>
<td>O-22</td>
<td>Reduce crashes due to red-light running</td>
<td>Transit Route and Schedule Information Systems</td>
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<tr>
<td>O-23</td>
<td>Reduce crashes due to red-light running</td>
<td>Expand CAD/AVL/GPS Technologies to Rural Systems</td>
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<tr>
<td>O-24</td>
<td>Reduce crashes due to red-light running</td>
<td>Data Analysis Tools for Transit Route Performance</td>
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<td>O-25</td>
<td>Reduce crashes due to red-light running</td>
<td>Bus Authorized Shoulders Assistant System</td>
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<td>O-26</td>
<td>Reduce crashes due to red-light running</td>
<td>Security Surveillance at Transit Facilities</td>
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<td>O-27</td>
<td>Reduce crashes due to red-light running</td>
<td>Reduce crashes due to red-light running</td>
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<tr>
<td>O-28</td>
<td>Reduce crashes due to red-light running</td>
<td>Reduce traffic congestion due to road weather conditions</td>
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<td>O-29</td>
<td>Reduce crashes due to red-light running</td>
<td>Reduce crashes due to red-light running</td>
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<td>Reduce crashes due to red-light running</td>
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<td>Reduce crashes due to red-light running</td>
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<td>Reduce crashes due to red-light running</td>
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<td>Reduce crashes due to red-light running</td>
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<td>Reduce crashes due to red-light running</td>
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<td>Reduce crashes due to red-light running</td>
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<td>Reduce crashes due to red-light running</td>
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<td>O-41</td>
<td>Reduce crashes due to red-light running</td>
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<td>O-42</td>
<td>Reduce crashes due to red-light running</td>
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<td>O-43</td>
<td>Reduce crashes due to red-light running</td>
<td>Reduce crashes due to red-light running</td>
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<tr>
<td>O-44</td>
<td>Reduce crashes due to red-light running</td>
<td>Reduce crashes due to red-light running</td>
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</tbody>
</table>

**Table 4-1. Mapping of Minnesota ITS Development Objectives and Potential ITS Projects**
<table>
<thead>
<tr>
<th>ID</th>
<th>Minnesota ITS Development Objectives</th>
<th>Short Term Projects</th>
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</thead>
<tbody>
<tr>
<td>0-1</td>
<td>Reduce crashes due to road weather conditions</td>
<td>XX X XX</td>
</tr>
<tr>
<td>0-2</td>
<td>Reduce crashes due to unexpected congestion</td>
<td>X</td>
</tr>
<tr>
<td>0-3</td>
<td>Reduce secondary crashes</td>
<td>V</td>
</tr>
<tr>
<td>0-4</td>
<td>Reduce incident clearance time</td>
<td>X X X</td>
</tr>
<tr>
<td>0-5</td>
<td>Reduce crashes due to red-light running</td>
<td></td>
</tr>
<tr>
<td>0-6</td>
<td>Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system</td>
<td></td>
</tr>
<tr>
<td>0-7</td>
<td>Reduce lane departure crashes</td>
<td></td>
</tr>
<tr>
<td>0-8</td>
<td>Reduce crashes due to crashes/accidents restrictions</td>
<td>X</td>
</tr>
<tr>
<td>0-9</td>
<td>Reduce crashes at railroad crossings</td>
<td></td>
</tr>
<tr>
<td>0-10</td>
<td>Reduce crashes at intersections</td>
<td>X X</td>
</tr>
<tr>
<td>0-11</td>
<td>Reduce speed differential</td>
<td></td>
</tr>
<tr>
<td>0-12</td>
<td>Reduce crashes due to driver errors and limitations</td>
<td></td>
</tr>
<tr>
<td>0-13</td>
<td>Reduce crashes involving pedestrians or non-motorized vehicles</td>
<td></td>
</tr>
<tr>
<td>0-14</td>
<td>Reduce variation of traffic flows</td>
<td></td>
</tr>
<tr>
<td>0-15</td>
<td>Reduce emergency/incident response time</td>
<td></td>
</tr>
<tr>
<td>0-16</td>
<td>Enhance emergency/incident response effectiveness</td>
<td>X</td>
</tr>
<tr>
<td>0-17</td>
<td>Safeguard public safety personnel while they are at roadway incidents and emergencies</td>
<td></td>
</tr>
<tr>
<td>0-18</td>
<td>Reduce speed violations</td>
<td></td>
</tr>
<tr>
<td>0-19</td>
<td>Reduce security risks to transit passengers and transit vehicle operators</td>
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</tr>
<tr>
<td>0-20</td>
<td>Reduce security risks to motorists and travelers</td>
<td>X X</td>
</tr>
<tr>
<td>0-21</td>
<td>Reduce security risks to transportation infrastructure</td>
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</tr>
<tr>
<td>0-22</td>
<td>Reduce exposure due to Hazard &amp; homeland security incidents</td>
<td>X</td>
</tr>
<tr>
<td>0-23</td>
<td>Enhance tracking and monitoring of sensitive Hazmat shipments</td>
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</tr>
<tr>
<td>0-24</td>
<td>Reduce congestion and delay</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>0-25</td>
<td>Enhance safety of workers</td>
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</tr>
<tr>
<td>0-26</td>
<td>Maintain smooth traffic flow</td>
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<td>0-27</td>
<td>Reduce incident detection and verification time</td>
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</tr>
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<td>0-28</td>
<td>Improve transit reliability</td>
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<td>0-29</td>
<td>Enhance transit operations efficiency</td>
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<td>0-30</td>
<td>Increase carpoolers</td>
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<td>0-31</td>
<td>Increase throughput of highways</td>
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<tr>
<td>0-32</td>
<td>Reduce delays at border crossings</td>
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</tr>
<tr>
<td>0-33</td>
<td>Keep travelers informed of travel conditions</td>
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</tr>
<tr>
<td>0-34</td>
<td>Enhance parking facility services and management</td>
<td>X X X</td>
</tr>
<tr>
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Minnesota Statewide Regional ITS Architecture Version 2009

Volume 9: Regional ITS Architecture Implementation Projects
Table 4-2. Implementation Schedule of Short-Term Projects

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<td>Provide Updated Toll Information on 511 Website</td>
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<td>S02</td>
<td>Email Alerts to Major Trucking Companies</td>
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<td>Enhance Traveler Information Map for Mobile Devices</td>
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<td>Develop an Automated System for Traffic Data Archiving</td>
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<td>MSP CAD and CARS Integration</td>
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<td>Dynamic Speed in Work Zones to Advise Drivers</td>
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<td>S44</td>
<td>CCTV Cameras at RWIS Sites</td>
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<td>S45</td>
<td>Expand Automated Flagging System for Work Zones</td>
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<td>S46</td>
<td>Portable Queue Detection and Stopped Traffic Advisory</td>
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<td>ID</td>
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<tr>
<td>S47</td>
<td>Expand Roadway Automated Treatment System Deployment</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<tr>
<td>S48</td>
<td>Expand Dynamic Late Merge System Deployment</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S49</td>
<td>GIS Mapping Enhancement</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<tr>
<td>S50</td>
<td>Enhanced Data Entry and Integration of Work Zone Information</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S51</td>
<td>Expand IWZ Deployment to Greater Minnesota</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S20</td>
<td>Metro Area Ramp Meter Expansion and Enhancements</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S30</td>
<td>Expand Real-Time Transit Departure Information</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S31</td>
<td>Real-Time Transit Transfer Information</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S53</td>
<td>Bridge Inspection / Structural Monitoring Roadside Equipment</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S09</td>
<td>Sharing CCTV Images Between Agencies</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S21</td>
<td>Travel Time Freeway Sign Expansion</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S22</td>
<td>Automated Surveillance and Signal Control Software</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S04</td>
<td>511 Telephone Interface Upgrade</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S05</td>
<td>Rest Area Internet Access</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S06</td>
<td>Email Alerts to Major Employers and Government Entities</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S07</td>
<td>ATIS Customization</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S17</td>
<td>Arterial Traffic Management Systems for TH55 and TH65</td>
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<td>S18</td>
<td>Integrated Corridor Management (ICM)</td>
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<td>S34</td>
<td>Congestion Reduction in Major Freight Bottlenecks</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S35</td>
<td>Enhance Automated Permit Routing System</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S38</td>
<td>Enhance Dynamic Routing of Emergency Vehicles</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S08</td>
<td>Rest Area Truck Parking Availability</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S19</td>
<td>Dynamic Lane Control and Variable Speed Limit Signs on Freeways</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<td>S36</td>
<td>Enhanced Online Permitting and Tax Features</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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<tr>
<td>S52</td>
<td>Work Zone Intrusion Alarm System</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
</tr>
<tr>
<td>S39</td>
<td>Critical Infrastructure Surveillance</td>
<td>0 1 2 3 4 5 6 7 8 9 &amp; Beyond</td>
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</table>
4.3 Short Term Projects

ID: S01

Project Title: Provide Updated Toll Information on 511 Website

Timeframe: Short Term – Years 0-2

Transportation Policy Area: Twin Cities Mobility

ITS Service Area: ATIS

Type: Deployment

Description
This project will provide updated toll information to users of the 511 Traveler Information website through a link to the MnPASS website for updated toll information. This will provide real-time pricing information to travelers as they make travel decisions before approaching the MnPASS lanes. In the future, real-time dynamic pricing information might be incorporated into traffic flow maps on the Mn/DOT 511 website.

Project Champion and Stakeholder
Project Champion: Mn/DOT (RTMC)
Stakeholders: Mn/DOT

Project Element
• 511 Traveler Information Website
• MnPASS Service Center

Market Package
• ATIS01 – Broadcast Traveler Information

Interconnect
• MnPASS Service Center and 511 Traveler Information Website

Technology Assessment
MnPASS and 511 Traveler Information websites currently exist. This project can initially provide links between the two sites. Ultimately, the real-time toll information will be fed and integrated into 511 website.

Project Dependency
This project is not dependent upon any other projects.

Cost Estimate
Total project costs have been estimated at $10,000.

Needs and Objectives Addressed
Need: TI07 – Provide information on tollways
Objectives: O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow
O-33 – Keep travelers informed of travel conditions

Agreement
There are no agreements required for this project.
ID: S02

Project Title: Email Alerts to Major Trucking Companies

Timeframe: Short Term – Years 0-2

Transportation Policy Area: Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: ATIS, CVO

Type: Operational Test

Description
This pilot project will provide email 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. Mn/DOT will send automated updates to participating trucking companies when weight restrictions change. Initially this project 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 project is successful, the service will be expanded to cover additional roadways and to allow more trucking companies to participate.

Project Champion and Stakeholder
Project Champion: Mn/DOT (Office of Materials)
Stakeholders: Mn/DOT, Major Trucking Companies

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

Market Package
- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- CVO01 – Fleet Administration

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 project is an expansion of existing technologies.

Project Dependency
This project is not dependent upon any other projects.

**Cost Estimate**
Total project costs have been estimated at $10,000.

**Needs and Objectives Addressed**

**Need:** TI08 – Provide information about seasonal road weight restrictions

**Objectives:**
- O-24 – Reduce congestion and delay
- O-26 – Maintain smooth traffic flow
- O-33 – Keep travelers informed of travel conditions

**Agreement**
Agreements may be necessary between Mn/DOT and participating trucking firms regarding the use and distribution of information in the information in this pilot project.
**ID:** S03

**Project Title:** Enhance Traveler Information Map for Mobile Devices

**Timeframe:** Short Term – Years 0-3

**Transportation Policy Area:** Traveler Safety, Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**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 Mn/DOT's website for use by mobile devices that can access the Internet. This project will enhance this service to provide travelers with a better view of the traffic flow map using handheld wireless devices such as cell phones and 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 Mn/DOT 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT (RTMC), Private Companies
Stakeholders: Mn/DOT

**Project Element**
- RTMC
- 511 Traveler Information Website
- User Personal Portable Computing Devices

**Market 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 Mn/DOT website. Technology for making information formatted in a way that is usable on handheld devices is readily available.

**Project Dependency**
This project is not dependent upon any other projects.

**Cost Estimate**
TBD.

**Needs and Objectives Addressed**

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

**Objectives:**
- O-2 – Reduce crashes due to unexpected congestion
- O-24 – Reduce congestion and delay
- O-26 – Maintain smooth traffic flow
- O-33 – Keep travelers informed of travel conditions

**Agreement**

Agreements may be required for this project between Mn/DOT and Private Companies that distribute handheld devices that disseminate traveler information.
ID: S04

Project Title: 511 Telephone Interface Upgrade

Timeframe: Short Term – Years 1-2

Transportation Policy Area: Traveler Safety, Maintenance and Security, Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: ATIS

Type: Deployment

Description
This project 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 project was identified by the Statewide ITS Strategic Plan (2006).

Project Champion and Stakeholder
Project Champion: Mn/DOT (RTMC)

Project Element
- CARS
- 511 Telephone Information Service
- Travelers

Market 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 project aims to improve a traveler information service that is currently available.

Project Dependency
This project is not dependent upon any other projects.

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

Needs and Objectives Addressed
**Needs:**
- TM05 – Provide incident and congestion information to travelers
- TI10 – Operate a statewide web-based and telephone 511 system

**Objectives:**
- O-1 – Reduce crashes due to road weather conditions
- O-2 – Reduce crashes due to unexpected congestion
- O-3 – Reduce secondary crashes
- O-8 – Reduce crashes due to roadway/geometric restrictions
- O-22 – Reduce exposure due to Hazmat & homeland security incidents
- O-24 – Reduce congestion and delay
- O-26 – Maintain smooth traffic flow
- O-27 – Reduce incident detection and verification time
- O-33 – Keep travelers informed of travel conditions
- O-35 – Inform traveler of travel mode options

**Agreement**
There are no agreements required for this project.
ID: S05

Project Title: Rest Area Internet Access

Timeframe: Short Term – Years 1-3

Transportation Policy Area: Statewide Connections

ITS Service Area: ATIS

Type: Deployment

Description
This project will allow travelers stopping at state rest areas to access the Internet via wireless access points with laptops and other web-enabled portable devices to view real-time traveler information. Wireless access points will be deployed at rest areas throughout the state and information will be provided at those locations on how travelers can use those access points with their laptops or mobile devices. An investigation on other states’ experience with providing wireless internet access at rest areas will be conducted to provide models on how the system will be deployed and operated. This project will be deployed under the Rest Area Sponsorship, Advertising and Wireless Internet (RASAWI) program and meets needs brought up in the Traveler Information stakeholder meeting.

Project Champion and Stakeholder
Project Champion: Mn/DOT (Technical Support)
Stakeholders: Mn/DOT

Project Element
- 511Traveler Information Website
- Rest Area WiFi

Market Package
- ATIS01 – Broadcast Traveler Information

Interconnect
- Rest Area WiFi and 511 Traveler Information Website

Technology Assessment
Wireless access points are common throughout urban areas. This project would deploy them in rest areas in urban settings.

Project Dependency
This project is not dependent upon any other projects.

Cost Estimate
Project cost is to be determined based on the business model for this system.

Needs and Objectives Addressed
Need: TI11 – Provide traveler information at rest areas
Objective: O-33 – Keep travelers informed of travel conditions
**Agreement**

This project will require agreements and contracts between Mn/DOT and internet service providers.
ID: S06

Project Title: Email Alerts to Major Employers and Government Entities

Timeframe: Short Term – Years 1-3

Transportation Policy Area: Twin Cities Mobility

ITS Service Area: ATIS

Type: Deployment

Description
This project will run a pilot project for providing e-mail alerts of major incidents to major employers and government entities in the metro area. Mn/DOT and some local government agencies currently send messages to key contacts at major employers about construction. This project would adapt that system send information about major incidents to participating employers to allow them to inform their employees of major incidents that could impact their travel. If this pilot project is successful, it will be expanded to allow more companies to participate.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Metro Area Cities and Counties, Major Employers

Project Element
- CARS
- RTMC
- Private Information Service Providers (Major Employers)

Market Package
- ATIS01 – Broadcast Traveler Information

Interconnect
- CARS and RTMC
- RTMC and Private Information Service Providers (Major Employers)

Technology Assessment
Mn/DOT currently uses email distribution systems and incident information is already entered into CARS.

Project Dependency
This project is not dependent upon any other projects.

Cost Estimate
Total project costs have been estimated at $10,000.

Needs and Objectives Addressed
Need: TI13 – Send email alerts of major incidents to major employers
Objectives:
O-22 – Reduce exposure due to Hazmat & homeland security incidents
O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow
O-33 – Inform travelers of travel conditions

Agreement
An agreement between Mn/DOT and participating employers might be necessary regarding the use and distribution of information in this pilot project.
ID: S07

Project Title: ATIS Customization

Timeframe: Short Term – Years 1-3

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

ITS Service Area: ATIS

Type: Deployment

Description
This project 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 project was identified in the Minnesota Guidestar ITS Strategic Plan (2006).

This project can follow the Short Term Project S03 - Enhance Traveler Information Map for Mobile Devices. Additionally, a Mn/DOT study on Vehicle Infrastructure Integration (VII) will be started in FY09, and the results might have implications on this project.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Travelers, Private Companies

Project Element
• CARS
• 511 Telephone Information Service and Traveler Information Website
• User Personal Portable and Computing Devices

Market 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.
Project Dependency
This project may be dependent upon the success of the Short Term Project S03 – Enhance Traveler Information Map for Mobile Devices. Data generated from the VII program could also support this project.

Cost Estimate
TBD.

Needs and Objectives Addressed
Need: TI16 – Improve quality, consistency, and thoroughness of traveler information

Objectives:
O-33 – Keep travelers informed of travel conditions
O-36 – Enhance asset and resource management
O-41 – Enhance planning with better data
O-42 – Enhance investment decision making

Agreement
There are no agreements required for this project.
ID: S08

Project Title: Rest Area Truck Parking Availability

Timeframe: Short Term – Years 2-4

Transportation Policy Area: Statewide Connections

ITS Service Area: ATIS, ATMS

Type: Operational Test

Description
This project will provide parking availability information at roadside rest areas and truck stops to truck drivers through multiple forms of currently available traveler information dissemination, such as Dynamic Message Signs (DMS), 511 traveler information via the internet and telephone, 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 project sites have yet to be determined. A Mn/DOT study on Vehicle Infrastructure Integration (VII) will be started in FY09, and the results might have implications on this project. This project was identified by the Statewide ITS Strategic Plan (2006).

Project Champion and Stakeholder
Project Champion: Mn/DOT OFCVO
Stakeholders: Mn/DOT, Minnesota 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

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

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 project 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 project 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 project.

**Project Dependency**
This project is not dependent upon any other projects. However, the results of the VII project may support this project.

**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 project 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

**Objectives:**
- O-26 – Maintain smooth traffic flow
- O-33 – Keep travelers informed of travel conditions

**Agreement**
There are no agreements required for this project.
ID: S09

**Project Title:** Sharing CCTV Images Between Agencies

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

**Transportation Policy Area:** Traveler Safety, Maintenance and Security, Statewide Connections, Twin Cities Mobility

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

**Type:** Deployment

**Description**
This project 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 project is to improve the effectiveness of emergency response to traffic incidents, emergencies, and other events. This project was identified by 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).

**Project Champion and Stakeholder**
Project Champion: Mn/DOT (RTMC), Minnesota DPS
Stakeholders: Mn/DOT, Local Transportation Agencies, Minnesota DPS, Local EM Agencies, Transit Agencies

**Project Element**
- CCTV Roadside Equipment
- RTMC
- TOCCs
- Local TMCs
- 911 Dispatch Centers
- Minnesota State Emergency Operations Center (SEOC)
- County Emergency Operations Centers
- Local Transit Management Centers
- Metro Area Transit Management Centers

**Market Package**
- ATMS01 – Network Surveillance
- ATMS08 – Traffic Incident Management System
- ATIS06 – Transportation Operations Data Sharing
- EM01 – Emergency Call-Taking and Dispatch

**Interconnect**
- CCTV Roadside Equipment and RTMC/TOCCs/Local TMCs/Local and Metro Transit Management Centers
- RTMC/TOCCs/Local TMCs/Local and Metro Transit Management Center and 911 Dispatch Centers
- RTMC/TOCCs/Local TMCs/Local and Metro Transit Management Centers and Minnesota State Emergency Operations Center (SEOC)
- RTMC/TOCCs/Local TMCs/Local and Metro Transit Management Centers and County Emergency Operations Centers
- RTMC/TOCCs and Local TMCs/Local Transit Management Centers
- CCTV Roadside Equipment and 911 Dispatch Centers
- CCTV Roadside Equipment and Minnesota State Emergency Operations Center (SEOC)
- CCTV Roadside Equipment and County Emergency Operations Centers

Technology Assessment
Stream videos and camera control can be shared with emergency responders via the Internet. Technology for sharing stream videos is currently deployed throughout the metro area and CCTV cameras images are currently shared with local media. Technology for share camera control via the Internet is readily available. NTCIP C2C: NTCIP Center-to-Center Standards Group and NTCIP C2F: Center-to-Field Standards Group are ITS standards that will apply to this project.

Project Dependency
This project is not dependent upon any other projects.

Cost Estimate
The estimated cost for CCTV image sharing via the Internet ranges from $20,000 to $50,000 per system. The cost for shared camera control via the Internet adds another $30,000 to $50,000 per system. Annual O&M costs are estimated at $3,000 to $5,000 per system. Costs would be shared between agencies sharing video images.

Needs and Objectives Addressed
Need:  
- TM09 – Share surveillance video, data, and other information with PSAPs
- TI21 – Make real-time transportation operations data available to other transportation system operators

Objectives:  
- O-4 – Reduce incident clearance time
- O-15 – Reduce emergency/incident response time
- O-16 – Enhance emergency/incident response effectiveness
- O-24 – Reduce congestion and delay
- O-26 – Maintain smooth traffic flow
- O-27 – Reduce incident detection and verification time
- O-36 – Enhance asset and resource management

Agreement
This project may require inter-agency agreements between transportation operations agencies, transit agencies, and emergency responders regarding the transmission of camera images between agencies.
ID: S10

**Project Title:** Traffic Signal ACS Lite Operational Test

**Timeframe:** Short Term – Years 0-1

**Transportation Policy Area:** Statewide Connections, Twin Cities Mobility

**ITS Service Area:** ATMS

**Type:** Operational Test

**Description**
This project is designed to improve the operation of closed loop signal systems by utilizing Adaptive Control Software (ACS) Lite software. ACS Lite is a low cost solution to provide traffic signal timing that is appropriate for real time traffic conditions. ACS Lite is designed specifically for closed loop arterial traffic signal systems. This software resides with the master controller and interacts with intersection controllers in the closed loop system to determine traffic flow and signal timing parameters and may provide updates to the signal timing on a cycle by cycle basis. ACS Lite recognizes and records trends and shifts in traffic demand to keep the signal timing up to date; reducing the need for signal retiming. This project was identified by the Statewide ITS Strategic Plan (2006).

This operational test will meet a highly prioritized need from the ATMS stakeholder meeting – TM01: Provide efficient signal timing.

**Project Champion and Stakeholder**
Mn/DOT (District Traffic), Local Agencies

**Project Element**
- Traffic Signal Roadside Equipment
- RTMC
- Local TMCs
- Minneapolis TMC

**Market Package**
- ATMS03 – Surface Street Control

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

**Technology Assessment**
ACS Lite software is readily available from vendors and is compatible with four major traffic signal manufacturers. 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.

**Project Dependency**
This project is not dependent upon any other projects.

Cost Estimate
The per-intersection cost for deploying ACS Lite software is estimated to range from $2,000 to $4,000.

Needs and Objectives Addressed
Need: TM01 – Provide efficient signal timing
Objectives: O-24 – Reduce congestion and delay
           O-26 – Maintain smooth traffic flow

Agreement
This project will not require any agreements.
ID: S11

**Project Title:** Traffic Signal Timing and Control Improvements

**Timeframe:** Short Term – Years 0-4

**Transportation Policy Area:** Statewide Connections, Twin Cities Mobility

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**
This project 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 project was identified by the Statewide ITS Strategic Plan (2006).

This deployment will meet a highly prioritized need from the ATMS stakeholder meeting – TM01: Provide efficient signal timing.

**Project Champion and Stakeholder**
Mn/DOT (District Traffic), Local Agencies

**Project Element**
- Traffic Signal Roadside Equipment
- RTMC
- Local TMCs

**Market Package**
- ATMS03 – Surface Street 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.

**Project Dependency**
This project is not dependent upon any other projects.

**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

Objectives:
O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow

Agreement
This project may require jurisdictional agreements for signal timing work performed on arterial coordinated signal systems that span more than one jurisdiction.
**ID:** S12

**Project Title:** Develop an Automated System for Traffic Data Archiving

**Timeframe:** Short Term – Years 0-4

**Transportation Policy Area:** Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** ATMS, AD

**Type:** Deployment

**Description**
This project 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. Mn/DOT Office of Transportation Data Analysis (OTDA) currently manages an archive which stores Automated Traffic Recorder (ATR) data. This project will expand and centralize the archived database to include other information such as GIS 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.

**Project Champion and Stakeholder**
Mn/DOT, Local Agencies

**Project Element**
- Traffic Data Archive
- RTMC
- TOCCs
- Local TMCs

**Market Package**
- ATMS09 – Traffic Forecast 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 project utilizes current technology that is readily available. Project will require coordination between Mn/DOT and Local agencies. Applicable ITS standards include: NTCIP C2C: NTCIP Center-to-Center Standards Group; ITE TMDD 2.1: Traffic Management Data Dictionary and

Project Dependency
This project is not dependent upon any other projects.

Cost Estimate
TBD.

Needs and Objectives Addressed
Need: TM03 – Use archived data for traffic management strategy development and long range planning
Objectives: O-41 – Enhance planning with better data
          O-42 – Enhance investment decision making

Agreement
This project may require jurisdictional agreements between state and local agencies for usage of automated data archiving system.
ID: S13

Project Title: MSP CAD and CARS Integration

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Traveler Safety, Statewide Connections, Twin Cities Mobility

ITS Service Area: ATMS, ATIS, EM

Type: Deployment

Description
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 Mn/DOT 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 project 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 project meets an identified stakeholder need for providing incident information to emergency management agencies.

Project Champion and Stakeholder
Project Champion: Mn/DOT (RTMC)
Stakeholders: Mn/DOT, Minnesota State Patrol

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

Market 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.

Project Dependency
This project is not dependent upon any other projects.

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

Objectives:
- O-2 – Reduce crashes due to unexpected congestion
- O-3 – Reduce secondary crashes
- O-4 – Reduce incident clearance time
- O-15 – Reduce emergency/incident response time
- O-16 – Enhance emergency/incident response effectiveness
- O-24 – Reduce delay and congestion
- O-26 – Maintain smooth traffic flow
- O-33 – Keep travelers informed of travel conditions

Agreement
This project may require agency agreements between Mn/DOT and MSP over the integration of CAD system and Mn/DOT CARS.
ID: S14

Project Title: Dynamic Speed Display Signs ("Your Speed Is")

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Description
This project 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 project will address deployment of these systems on both a temporary and permanent basis. These systems are currently in operation at select locations throughout the metro area.

The purpose of the project 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 project was identified in the Minnesota Guidestar ITS Strategic Plan (2006).

Project Champion and Stakeholder
Project Champion: Mn/DOT (District Traffic)
Stakeholders: Mn/DOT, Local Agencies

Project Element
- Speed Monitoring Roadside Equipment
- Dynamic Message Sign Roadside Equipment

Market Package
- ATMS19 – Speed Monitoring

Interconnect
- Speed Monitoring Roadside Equipment and Dynamic Message Sign Roadside Equipment

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

Project Dependency
This project is not dependent upon any other projects.

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

Needs and Objectives Addressed
Need: TM18 – Provide dynamic speed feedback to drivers and enforcement agencies
Objectives:
O-1 – Reduce crashes due to road weather conditions
O-2 – Reduce crashes due to unexpected congestion
O-3 – Reduce secondary crashes
O-8 – Reduce crashes due to roadways/geometric restrictions
O-11 – Reduce speed differential
O-26 – Maintain smooth traffic flow

Agreement
This project does not require any agreements.
ID: S15

Project Title: Expand Provision of Operating Speed and Delay Information

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Statewide Connections

ITS Service Area: ATMS

Type: Deployment

Description
This project will expand the provision of travel time or operating speed information outside of the Twin Cities area. Mn/DOT 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 project 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.).

Project Champion and Stakeholder
Mn/DOT (District Traffic)

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

Market Package
- ATMS01 – Network Surveillance
- ATMS06 – Traffic Information Dissemination
- ATMS19 – Speed Monitoring
- 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
- 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.

**Project Dependency**
This project is not dependent upon any other projects.

**Cost Estimate**
Costs for this project 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
- **Objectives:**
  - O-24 – Reduce congestion and delay
  - O-26 – Maintain smooth traffic flow
  - O-33 – Keep travelers informed of travel conditions

**Agreement**
This project does not require any working agreements.
ID: S16

Project Title: Advance Warning Flasher Deployment Expansion

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Description
This project will expand the deployment of Advance Warning Flashers (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.

Project Champion and Stakeholder
Project Champion: Mn/DOT

Project Element
- Advance Warning Flasher Roadside Equipment
- Traffic Signal Roadside Equipment

Market Package
- ATMS03 – Surface Street Control

Interconnect
- Traffic Signal Roadside Equipment and Advance Warning Flasher Roadside Equipment

Technology Assessment
This technology is currently deployed and operational statewide.

Project Dependency
This project is not dependent upon any other projects.

Cost Estimate
Based on unit cost estimates for advance warning flashers, capital costs for this project range from $4,000 to $7,000 for each project location.

Needs and Objectives Addressed
Need: TM37 – Provide safe signal phase transition
Objectives: O-5 – Reduce crashes due to red-light running
           O-10 – Reduce crashes at intersections
           O-14 – Reduce violation of traffic laws
Agreement
This project does not require any agreements.
ID: S17

Project Title: Arterial Traffic Management Systems for TH55 and TH65

Timeframe: Short Term – Years 1-3

Transportation Policy Area: Traveler Safety, Twin Cities Mobility

ITS Service Area: ATMS

Type: Deployment

Description
Mn/DOT 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 two-phase project will expand surveillance and traveler information dissemination services to other signalized arterial roadway network. Phase 1 will add the same equipment along TH 55 and TH 7 in the west metro between I-94 and I-494. This will add to the existing CCTV surveillance on TH 55 and add to the redundancy of the existing fiber-optic system. Phase 2 will add the same ITS equipment along TH 65 from I-694 north to TH10.

The ITS systems identified for this project 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 project 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 project boundary through federal funding under the ICM program (see Project S18).

Project Champion and Stakeholder
Project Champion: Mn/DOT (District Traffic)
Stakeholders: Mn/DOT, Local Agencies

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

Market Package
- ATMS01 – Network Surveillance
- ATMS06 – Traffic Information Dissemination

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

Technology Assessment
This project 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 project.

Project Dependency
This project is not dependent upon any other projects. Equipment in phase 1 of this project will support and be integrated with other existing systems in Project S18: Integrated Corridor Management.

Cost Estimate
Total project costs of this project 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

Objectives:  O-2 – Reduce crashes due to unexpected congestion
             O-3 – Reduce secondary crashes
             O-11 – Reduce speed differential
             O-21 – Reduce security risks to transportation infrastructure
             O-24 – Reduce congestion and delay
             O-26 – Provide smooth traffic flow
             O-27 – Reduce incident detection and verification time
             O-33 – Keep travelers informed of travel conditions

Agreement
There are no agreements required for this project.
**ID: S18**

**Project Title:** Integrated Corridor Management (ICM)

**Timeframe:** Short Term – Years 1-3

**Transportation Policy Area:** Twin Cities Mobility

**ITS Service Area:** ATMS

**Type:** Deployment

**Description**
This project will integrate existing systems that manage the dispersal of traffic along the I-394 corridor from Minneapolis to County Road 101 by coordinating multiple transportation and transit networks. This project will utilize currently deployed technologies, 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 (TH 55 to the north and TH 7 to the south, HOT lanes on I-394, and the transit network) to effectively use the available lane capacity in the area. There are already a number of network and corridor management strategies in place in the corridor and this project will integrate these capabilities and the operations of the different facilities and agencies in a more effective manner to decrease congestion.

This project is part of a broader ICM program initiated by the U.S. Department of Transportation (USDOT) Research and Innovative Technology Administration (RITA). The I-394 corridor area has been selected as one of eight pioneer sites that will proceed through three stages: 1) Concept of Operations development, 2) Analysis, modeling, and simulation (AMS) to determine which ICM solutions are most effective, and 3) Demonstration, where selected sites will conduct a demonstration project and assist in the evaluation of the demonstration.

This project is currently in stage two. Final selection of pioneer sites and deployment of stage three will occur in Fall 2009.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT (RTMC)
Stakeholders: City of Minneapolis, Hennepin County, Mn/DOT (Metro District), Minnesota State Patrol, Emergency Management Providers, FHWA, Metro Transit, Southwest Transit, Plymouth Metrolink

**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

Market Package
• ATMS01 – Network Surveillance
• ATMS03 – Surface Street Control
• ATMS04 – Freeway Control
• ATMS05 – HOV Lane Management
• ATMS07 – Regional Traffic 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 project will integrate existing technology and systems already deployed in the project 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 project.

Project Dependency
Stage three of this project is dependent upon selection as a demonstration site by USDOT. This project is also dependent on the deployment of equipment along TH 55 and TH 7 under S17: Arterial Traffic Management System.

Cost Estimate
Total project costs have been estimated between $4-5 Million.

Needs and Objectives Addressed
Need: TM 36 – Implement Integrated Corridor Management (ICM) Strategies
Objectives: O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow
O-27 – Reduce incident detection and verification time
O-28 – Increase transit ridership
O-31 – Increase throughput of roadways

Agreement
This project will require a Memorandum of Understanding between Mn/DOT, City of Minneapolis, Hennepin County, FHWA, Metro Transit, and other stakeholders.
ID: S19

Project Title: Dynamic Lane Control and Variable Speed Limit Signs on Freeways

Timeframe: Short Term – Years 2-4

Transportation Policy Area: Traveler Safety, Statewide Connections, Twin Cities Mobility

ITS Service Area: ATMS

Type: Deployment

Description
This project 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. 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 Mn/DOT 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 project, as well as identify modifications that are needed throughout the project.

This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT (RTMC)
Stakeholder: Mn/DOT

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

Market Package
- ATMS04 – Freeway Control

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.

**Project Dependency**
This project is dependent upon examination of traffic data that will assist Mn/DOT in guiding the final selection of a corridor for an operational test.

**Cost Estimate**
The project 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 UPA project.

**Needs and Objectives Addressed**

**Need:** TM10 – Utilize variable speed limits  
**Objectives:**
- O-1 – Reduce crashes due to road weather conditions  
- O-2 – Reduce crashes due to unexpected congestion  
- O-3 – Reduce secondary crashes  
- O-8 – Reduce crashes due to roadway/geometric restrictions  
- O-11 – Reduce speed differential  
- O-26 – Maintain smooth traffic flow

**Agreement**
There are no agreements required for this project.
ID: S20

Project Title: Metro Area Ramp Meter Expansion and Enhancements

Timeframe: Short to Medium Term – Years 0-8

Transportation Policy Area: Traveler Safety, Twin Cities Mobility

ITS Service Area: ATMS

Type: Deployment

Description
This project 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 Mn/DOT RTMC. Ramp metering operations and algorithms will be evaluated and enhanced as necessary to improve traffic operations and safety.

Project Champion and Stakeholder
Mn/DOT (RTMC)

Project Element
• Ramp Meter Roadside Equipment
• RTMC

Market Package
• ATMS04 – Freeway Control

Interconnect
• Ramp Meter Roadside Equipment and RTMC

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

Project Dependency
This project is not dependent upon any other projects.

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
Objectives:  O-2 – Reduce crashes due to unexpected congestion
             O-3 – Reduce secondary crashes
             O-11 – Reduce speed differential
             O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow
O-31 – Increase throughput of roadways

Agreement
This project does not require any agreements.
ID: S21

Project Title: Travel Time Freeway Sign Expansion

Transportation Policy Area: Traveler Safety, Twin Cities Mobility

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

ITS Service Area: ATMS

Type: Deployment

Description
This project will expand Mn/DOT’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 Mn/DOT RTMC calculates estimated travel times between freeway interchanges. Mn/DOT has recently expanded the display of freeway travel times at 25 additional locations in the metro area. In order to expand coverage, Mn/DOT 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 project was identified in the Minnesota Guidestar Program: Deployment Assessment (2007) and supports Mn/DOT’s development of mobility measures by providing data to measure duration and extent of congestion as well as travel time reliability.

Project Champion and Stakeholder
Project Champion: Mn/DOT (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

Market Package
- ATMS01 – Network Surveillance
- 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 project 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.

Project Dependency
This project 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 project will rely on data from detectors and DMS that are either already in place or will be deployed under a separate project. 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
Objectives: O-2 – Reduce crashes due to unexpected congestion
O-3 – Reduce secondary crashes
O-11 – Reduce speed differential
O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow
O-31 – Increase throughput to workers

Agreement
There are no agreements required for this project.
ID: S22

Project Title: Automated Surveillance and Signal Control Software

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

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

ITS Service Area: ATMS

Type: Deployment

Description
This project 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. Mn/DOT could lead the deployment of the project and provide lessons learned to local agencies for further deployment statewide.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Local Agencies

Project Element
• Traffic Signal Roadside Equipment
• RTMC
• Minneapolis TMC
• Local TMCs

Market Package
• ATMS03 – Surface Street 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).

Project Dependency
This project is not dependent upon any other projects.

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

**Objectives:**
- O-24 – Reduce delay and congestion
- O-26 – Maintain smooth traffic flow

**Agreement**

This project does not require any agreements.
ID: S23

Project Title: Static Transit Route and Schedule Information Systems

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

ITS Service Area: APTS

Type: Deployment

Description
This project 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 project has the potential to increase transit customer satisfaction and improve overall transit ridership.

Project Champion and Stakeholder
Transit Agencies, Mn/DOT (Office of Transit)

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

Market 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 project features technology that is readily available and currently operational in the metropolitan area.

Project Dependency
This project is not dependent upon any other projects.

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

**Objectives:**
- O-28 – Increase transit ridership
- O-35 – Inform traveler of travel mode options

**Agreement**
Agreements might be necessary to place schedule systems providing route and schedule information on property not owned by listed stakeholders.
ID: S24

**Project Title:** Expand CAD/AVL/GPS Technologies to Rural Systems

**Timeframe:** Short Term – Years 0-4

**Transportation Policy Area:** Statewide Connections, Twin Cities Mobility

**ITS Service Area:** APTS

**Type:** Deployment

**Description**
This project 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

**Project Champion and Stakeholder**
Local transit providers, Intercity transit providers, paratransit providers, Mn/DOT (Office of Transit)

**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

**Market Package**
- 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 project have been or are being deployed in the metropolitan area.

Project Dependency
This project is not dependent upon any other projects.

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
Objectives: O-24 – Reduce congestion and delay
           O-28 – Increase transit ridership

Agreement
There are no agreements required for this project.
ID: S25

Project Title: Data Analysis Tools for Transit Route Performance

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: APTS

Type: Deployment

Description
The project 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.

Project Champion and Stakeholder
Metro area transit providers, 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

Market Package
- APTS01 – Transit Vehicle Tracking
- 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.

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

Cost Estimate
Cost estimates for this project 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

**Objectives:**
- O-29 – Enhance transit operations efficiency
- O-36 – Enhance asset and resource management
- O-41 – Enhance planning with better data
- O-42 – Enhance investment decision making

**Agreement**

There are no agreements required for this project.
ID: S26

Project Title: Bus Authorized Shoulders Assistant System

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Twin Cities Mobility

ITS Service Area: APTS, AVSS

Type: Deployment

Description
This project will install a high-accuracy GPS system on Metro Transit and other regional transit provider vehicles for bus authorized shoulder use assistance. Mn/DOT 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 Mn/DOT, 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 project, assistance systems will be deployed by Metro Transit and other regional transit providers.

Project Champion and Stakeholder
Metro Transit

Project Element
• Transit Vehicle Equipment
• Metro Area Transit Management Centers

Market 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.
**Project Dependency**
Results and lessons learned from the MTVA deployment should be considered for this project.

**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
- **Objectives:**
  - O-7 – Reduce lane departure crashes
  - O-12 – Reduce crashes due to driver errors and limitations

**Agreement**
Transit agencies might need to enter agreements with Mn/DOT to use assistance equipment on bus authorized shoulders.
ID: S27

Project Title: Security Surveillance at Transit Facilities

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Maintenance and Security

ITS Service Area: APTS

Type: Deployment

Description
This project 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 project will include the following types of deployment:

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

Project Champion and Stakeholder
Stakeholders: Metro area transit providers, 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

Market 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 project utilizes technology that is currently available from numerous technology vendors.

Project Dependency
This project can provide additional data to and support S09: 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
Objectives: O-19 – Reduce security risks to transit passengers and transit vehicle operators
O-34 – Enhance parking facility services and management

Agreement
Agreements are required between transit service providers and enforcement agencies.
ID: S28

Project Title: Transit Scheduling Software Systems

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

ITS Service Area: APTS

Type: Deployment

Description
This project 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 project 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.

Project Champion and Stakeholder
Metro area transit providers, local transit providers

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

Market Package
- APTS02 – Transit Fixed-Route Operations

Interconnect
- Transit Management Centers and Transit Data Archives

Technology Assessment
This project utilizes technology that is readily available.

Project Dependency
This project is not dependent upon any other projects.

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.

Needs and Objectives Addressed
Need: TR15 – Optimize schedule efficiency

Objectives: O-29 – Enhance transit operations efficiency
O-36 – Enhance asset and resource management

Agreement
There are no agreements required for this project.
ID: S29

Project Title: DARTS On-line Reservation for Seniors

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Twin Cities Mobility

ITS Service Area: APTS

Type: Deployment

Description
This project 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.

Project Champion and Stakeholder
DARTS

Project Element
• Transit Information Websites
• Local Transit Management Centers

Market Package
• APTS03 – Demand Response Transit Operations
• ATIS02 – Interactive Traveler Information

Interconnect
• Transit Information Websites and Local Transit Management Centers

Technology Assessment
This project utilizes technology that is readily available.

Project Dependency
This project is not dependent upon any other projects.

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
Objectives: O-28 – Increase transit ridership
            O-29 – Enhance transit operations efficiency
            O-35 – Inform travelers of travel mode options

Agreement
There are no agreements required for this project.
ID: S30

**Project Title:** Expand Real-Time Transit Departure Information

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

**Transportation Policy Area:** Statewide Connections, Twin Cities Mobility

**ITS Service Area:** APTS

**Type:** Deployment

**Description**
The project 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.

**Project Champion and Stakeholder**
Project Champion: Metro Transit
Stakeholders: Metro Area Transit Providers, Local Transit Agencies, Intercity Transit Agencies, Mn/DOT (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

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

**Technology Assessment**
This project utilizes technology that is readily available.
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.

Project Dependency
An Automated Vehicle Location (AVL) system is required to provide necessary data for this project. This project is also depending upon the successful deployment of the real-time bus arrival/departure information system as part of the Urban Partnership Agreement (UPA) Transit Technology Project in the metro area. This project 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
Objectives: O-28 – Increase transit ridership
O-35 – Inform traveler of travel mode options

Agreement
There are no agreements required for this project.
ID: S31

Project Title: Real-Time Transit Transfer Information

Timeframe: Short to Medium Term – Years 0-8

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

ITS Service Area: APTS

Type: Deployment

Description
This project 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.

Project Champion and Stakeholder
Project Champion: Metro Transit
Stakeholders: Metro Area Transit Providers, Local Transit Providers, Intercity Transit Providers, Mn/DOT (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

Market 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 project utilizes technology that is currently available.
Project Dependency
This project may be implemented in coordination with the Project S30 – 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
Objectives: O-28 – Increase transit ridership
O-35 – Inform traveler of travel mode options

Agreement
There are no agreements required for this project.
ID: S32

Project Title: Virtual Weigh Stations

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Infrastructure Preservation, National and Global Connections, Statewide Connections, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: CVO

Type: Deployment

Description
This project 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 stand alone 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT OFCVO
Stakeholders: Minnesota State Patrol

Project Element
- Virtual Weigh Stations
- Commercial Vehicles

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

Interconnect
- Virtual WIM Stations and in-vehicle equipment (Commercial Vehicles)
- Mn/DOT OFCVO and in-vehicle equipment (Commercial Vehicles)

Technology Assessment
This project utilizes current technology already tested and proven through an operational test.

Project Dependency
There are no known project dependencies.

Cost Estimate
Capital costs and operations and maintenance costs have yet to be determined.
**Needs and Objectives Addressed**

**Needs:**
- CF02 – Provide mobile weight enforcement
- CF03 – Target enforcement at locations with history of violations

**Objectives:**
- O-36 – Enhance asset and resource management
- O-38 – Reduce freight movement delays due to inspection
- O-40 – Reduce commercial vehicle size and weight violations

**Agreement**
This project does not require any agreements.
ID: S33

Project Title: RFID Tags for Tracking the Movement of Cargo and Cargo Conditions

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Maintenance and Security

ITS Service Area: CVO

Type: Deployment

Description
This project will install RFID on CVO vehicle license plate to give fleet/freight managers the ability to track carrier and loads (e.g. breech of security) and monitor the location and condition of cargo between states.

Project Champion and Stakeholder
Project Champion: Private Trucking Companies

Project Element
• Commercial Vehicles
• Private Fleet and Freight Management Center
• Intermodal Freight Depots

Market Package
• CVO02 – Freight Administration

Interconnect
• Commercial vehicles and Private Fleet and Freight Management Centers.
• Private Fleet and Freight Management Centers and intermodal freight depots.

Technology Assessment
This project utilizes current technology already deployed.

Project Dependency
There are no known project dependencies.

Cost Estimate
Given the un-defined scope of this project, the per unit cost estimate for re-usable RFID tags ranges between $100 and $400.

Needs and Objectives Addressed
Need: CF15 – Track and manage interstate intermodal freight movements
Objectives
O-20 – Reduce security risks to motorists and travelers
O-21 – Provide security risks to transportation infrastructure
O-22 – Reduce exposure due to Hazmat & homeland security incidents
O-36 – Enhance asset and resource management
O-40 – Reduce commercial vehicle size and weight violations
Agreement
This project does not require any agreements.
ID: S34

**Project Title:** Congestion Reduction in Major Freight Bottlenecks

**Timeframe:** Short Term – Years 1-3

**Transportation Policy Area:** Twin Cities Mobility

**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.


Mn/DOT 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 Mn/DOT RTMC and Private Fleet and Freight Management Centers that provide route plans to Commercial Vehicles approaching the bottleneck areas.

**Project Champion and Stakeholder**
Project Champion: FHWA
Stakeholders: Mn/DOT, 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
Market Package
- CVO01 – Fleet Administration
- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- ATMS04 – Freeway Control
- 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 project utilizes current technology already deployed in the project area.

Project Dependency
There are no known project dependencies.

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
Objectives: O-24 – Reduce congestion and delay
           O-26 – Maintain smooth traffic flow
           O-33 – Keep travelers informed of travel conditions

Agreement
This project requires a Memorandum of Understanding between Mn/DOT, City of Minneapolis, Hennepin County, FHWA, and Metro Transit.
ID: S35

Project Title: Enhance Automated Permit Routing System

Timeframe: Short Term – Years 1-4

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

ITS Service Area: CVO

Type: Deployment

Description
This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT OFCVO
Stakeholders: Minnesota State Patrol

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

Market Package
• CVO01 – Fleet Administration

Interconnect
• Automated Permit Routing System and CARS
• Automated Permit Routing System and Private Fleet and Freight Management Center

Technology Assessment
This project 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.

Project Dependency
There are no known project dependencies.

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
Objectives: O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow
O-33 – Keep travelers informed of travel conditions
O-36 – Enhance asset and resource management
O-40 – Reduce commercial vehicle size and weight violations

**Agreement**
This project does not require any agreements.
ID: S36

**Project Title:** Enhanced Online Permitting, and Tax Features

**Timeframe:** Short Term – Years 2-4

**Transportation Policy Area:** National and Global Connections

**ITS Service Area:** CVO

**Type:** Deployment

**Description**
This enhancement will allow commercial vehicle operators to apply online for credential and permits and to make payments for fees. Currently, the Minnesota CVO Online website provides for electronic permit applications, license renewals, and IRP and IFTA applications. This enhancement will integrate more permitting, credentialing, and tax features into CVO Online to make it a one-stop shopping site.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT OFCVO
Stakeholder: Minnesota State Patrol

**Project Element**
- Minnesota CVO Online
- Minnesota CVIEW
- IFTA Clearinghouse
- IRP Clearinghouse
- MCMIS
- PRISM
- SAFER
- Private Fleet and Freight Management Center
- Motor Carrier Registration System

**Market Package**
- CVO04 – CV Administrative Processes

**Interconnect**
- Minnesota CVO Online and Minnesota CVIEW
- Minnesota CVO Online and Private Fleet and Freight Management Center
- Minnesota CVO Online and Motor Carrier Registration System
- Minnesota CVIEW and IFTA Clearinghouse/IRP Clearinghouse/MCMIS/PRISM/ SAFER

**Technology Assessment**
This project utilizes on-line application and payment technology that is currently being used. A replacement of the current Motor Carrier Information System will need to be deployed and interfaces will need to be implemented for each of the new permit, credential, and tax processing systems that will allow data to be entered from Minnesota CVO Online website.

**Project Dependency**
The current Motor Carrier Information System will be replaced before interfaces with processing systems can be implemented.

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

Needs and Objectives Addressed
Need: CF06 – Provide electronic application, processing, fee collection, issuance and distribution of CVO credentials
Objective: O-37 – Enhance credential automation

Agreement
This project does not require any agreements.
ID: S37

**Project Title:** Emergency Responder Database

**Timeframe:** Short Term – Years 0-4

**Transportation Policy Area:** Traveler Safety, Maintenance and Security

**ITS Service Area:** EM

**Type:** Deployment

**Description**
This project 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 project 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.

**Project Champion and Stakeholder**
Project 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, Mn/DOT

**Project Element**
- 911Dispatch Center
- County Emergency Operations Centers
- Minnesota SEOC
- Minnesota State Patrol Databases
- Minnesota Emergency Responder Database

**Market 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 project 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.

Project Dependency
This project 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 project 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
Objectives: O-4 – Reduce incident clearance time
O-15 – Reduce emergency/incident response time
O-16 – Enhance emergency/incident response effectiveness

Agreement
This coordination of emergency responder databases will require working Memorandums of Understanding between all agencies involved in the project, 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: S38

Project Title: Enhance Dynamic Routing of Emergency Vehicles

Timeframe: Short Term – Years 1-4

Transportation Policy Area: Traveler Safety

ITS Service Area: EM

Type: Deployment

Description
This project 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 project will focus on the metro area by providing all metro area roadway surveillance videos to Mn/DOT FIRST, MSP, and other dispatch centers and emergency responders. FIRST and some dispatchers already use camera feeds from Mn/DOT 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 project will expand this shared video surveillance to areas of greater Minnesota. This project will also provide TOCC roadway surveillance videos to local and regional dispatch centers and emergency responders in greater Minnesota.

Project Champion and Stakeholder
Project Champion: MSP
Stakeholders: MSP, Metro area 911 dispatch centers, local and regional emergency response dispatch centers, local emergency response agencies, Mn/DOT RTMC and TOCCs

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

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

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 project utilizes technology already deployed or soon to be deployed in the project area. This project will require coordination between Mn/DOT 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).

**Project Dependency**
This project 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
- Objectives: O-4 – Reduce incident clearance time
  O-15 – Reduce emergency/incident response time

**Agreement**
This project will require agreements between Mn/DOT and participating local emergency response agencies over transmission and use of video data.
ID: S39

Project Title: Critical Infrastructure Surveillance

Timeframe: Short Term – Years 3-4

Transportation Policy Area: Traveler Safety, Maintenance and Security

ITS Service Area: EM

Type: Deployment

Description
This project 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 project 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 project was identified by the Statewide ITS Strategic Plan (2006).

Project Champion and Stakeholder
Project Champion: Minnesota Homeland Security and Emergency Management
Stakeholders: Mn/DOT, MSP, local emergency management agencies, local emergency response agencies

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

Market 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 Mn/DOT District 1 and Minnesota State Patrol.

Project Dependency
This project is not dependent upon any other projects.

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

**Objectives:**
- O-4 – Reduce incident clearance time
- O-19 – Reduce security risks to transit passengers and transit vehicles
- O-20 – Reduce security risks to motorists and travelers
- O-21 – Reduce security risks to transportation infrastructure
- O-27 – Reduce incident detection and verification time

**Agreement**

There are no agreements require for this project.
ID: S40

**Project Title:** Maintenance Vehicle AVL Equipment

**Timeframe:** Short Term – Years 0-4

**Transportation Policy Area:** Maintenance and Security

**ITS Service Area:** MCM

**Type:** Deployment

**Description**
This project would install 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 would 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 project can be coordinated with Mn/DOT’s involvement in the Maintenance Decision Support System (MDSS) – a project to develop a prototype predictive tool using a variety of weather and maintenance inputs to recommend most effective treatment and timing.

Mn/DOT has equipped AVL technology on maintenance vehicles in different districts throughout the state. This project 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 project was identified in the Minnesota Guidestar Program: Deployment Assessment (2007). This project 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT

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

**Market 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
**Technology Assessment**
This project is an expansion of a current deployment and utilizes technology that has already been deployed and is readily available.

**Project Dependency**
This project could be implemented in conjunction with Project S41 – Roadway Condition and Environmental Sensors on Maintenance Vehicles for Traveler Information.

**Cost Estimate**
Total project 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
**Objectives:** O-36 – Enhance asset and resource management
O-39 – Enhance garage operations efficiency

**Agreement**
There are no agreements required for this project.
ID: S41

Project Title: Roadway Condition and Environmental Sensors on Maintenance Vehicles for Traveler Information

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Traveler Safety

ITS Service Area: MCM

Type: Deployment

Description
Mn/DOT currently has 80 maintenance vehicles equipped with sensors to collect pavement and environmental conditions. This project will equip an 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.

Project Champion and Stakeholder
Mn/DOT

Project Element
- Maintenance and Construction Vehicle Equipment
- Maintenance and Construction Management Center
- RWIS Central Control System
- CARS
- Clarus Weather System

Market Package
- MC03 – Road Weather Data Collection
- MC04 – Weather Information Processing and Distribution
- ATIS01 – Broadcast Traveler Information

Interconnect
- Maintenance and Construction Vehicle Equipment and Maintenance and Construction Management Center
- Maintenance and Construction vehicle Equipment and RWIS Central Control System
- RWIS Central Control System and Maintenance and Construction Management Center
- RWIS Central Control System and CARS
- RWIS Central Control System and Clarus Database

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

Project Dependency
This project could be implemented in conjunction with Project S40 – Maintenance Vehicle AVL Equipment.

**Cost Estimate**
The cost for road and air temperature sensors is estimated at $7,000 per vehicle. The annual O&M cost is estimated at $800 per vehicle.

**Needs and Objectives Addressed**
Need: WZ04 – Provide automated monitoring of road weather conditions
Objectives: O-1 – Reduce crashes due to road weather conditions
O-33 – Keep travelers informed of travel conditions

**Agreement**
There are no agreements required for this project.
ID: S42

Project Title: Expand Maintenance and Decision Support System (MDSS) Deployment

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Traveler Safety, Maintenance and Security

ITS Service Area: MCM

Type: Deployment

Description
The Maintenance Decision Support System (MDSS) serves Mn/DOT 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 project will expand the use of MDSS throughout Mn/DOT districts as the system evolves into a statewide deployment. The deployment of MDSS could be in coordination with the Maintenance Vehicle AVL Equipment project which will deploy AVL equipment on additional 900 Mn/DOT maintenance vehicles statewide.

Project Champion and Stakeholder
Mn/DOT

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

Market Package
- MC06 – Winter Maintenance

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 Mn/DOT Districts 2 (Bemidji), 4 (Detroit Lakes), 6 (Rochester), 7 (Mankato), and 8 (Marshall) and is being implemented statewide.

Project Dependency
This project could be coordinated with S40 - Maintenance Vehicle AVL Equipment project.

Cost Estimate
The cost for MDSS deployment is to be determined. Mn/DOT 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
Objectives: O-1 – Reduce crashes due to road weather conditions
O-36 – Enhance asset and resource management

Agreement
Interagency agreements between district offices may be required to ensure consistent operation and maintenance of equipment.
ID: S43

**Project Title:** Dynamic Speed in Work Zones to Advise Drivers

**Timeframe:** Short Term – Years 0-4

**Transportation Policy Area:** Traveler Safety, Statewide Connections, Twin Cities Mobility

**ITS Service Area:** MCM, ATMS

**Type:** Deployment

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

The purpose of the project 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT (Construction), Local Agencies

**Project Element**
- Dynamic Message Sign Roadside Equipment
- Speed Monitoring Roadside Equipment

**Market Package**
- ATMS19 – Speed Monitoring

**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.

**Project Dependency**
This project is not dependent upon any other projects.

**Cost Estimate**
Based on unit cost estimates for portable speed monitoring systems, capital costs for this project range from $5,000 to $15,000 for each project location. The duration of the application will also have impact of the overall project cost.

**Needs and Objectives Addressed**

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

**Objectives:**
O-1 – Reduce crashes due to road weather conditions
O-2 – Reduce crashes due to unexpected congestion
O-3 – Reduce secondary crashes
O-8 – Reduce crashes due to roadways/geomeric restrictions
O-11 – Reduce speed differential
O-26 – Maintain smooth traffic flow

Agreement
This project does not require any agreements.
ID: S44

Project Title: CCTV Cameras at RWIS Sites

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Traveler Safety

ITS Service Area: MCM, ATMS, ATIS

Type: Deployment

Description
This project 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. Mn/DOT, NWS and local agencies use RWIS and AWOS 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 project was identified in the Statewide ITS Strategic Plan (2006).

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, University of Minnesota Duluth

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

Market 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
- RWIS Central Control System and CARS

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

Project Dependency
This project is not dependent upon any other projects.

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

Objectives:
- O-1 – Reduce crashes due to road weather conditions
- O-33 – Keep travelers informed of travel conditions

Agreement
If RWIS images are shared with other agencies, an agreement between those agencies and Mn/DOT on the use of the image data will need to be signed.
ID: S45

Project Title: Expand Automated Flagging System for Work Zones

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Traveler Safety

ITS Service Area: MCM

Type: Deployment

Description
This project 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. Mn/DOT 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Counties, Cities, Private Contractors

Project Element
• Maintenance and Construction Vehicle Equipment
• Intelligent Work Zone System Roadside Equipment

Market 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 project is an expansion of a current application and utilizes technology already deployed and readily available.

Project Dependency
This project is not dependent upon any other projects.

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

Needs and Objectives Addressed
**Needs:**
WZ05 – Warn travelers about trucks entering/exiting work zones
WZ14 – Provide automated flagging for stationary work zones

**Objectives:**
O-24 – Reduce congestion and delay
O-25 – Enhance safety of personnel in work zones

**Agreement**
There are no agreements required for this project.
ID: S46

**Project Title:** Portable Queue Detection and Stopped Traffic Advisory

**Timeframe:** Short Term – Years 0-4

**Transportation Policy Area:** Traveler Safety, Statewide Connections, Twin Cities Mobility

**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 project can also be integrated with Vehicle Infrastructure Integration (VII) systems in the future, when roadside VII equipment is deployed.

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

**Project Champion and Stakeholder**
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Local Agencies

**Project Element**
- Intelligent Work Zone System Roadside Equipment

**Market 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 project 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.

**Project Dependency**
This project is not dependent upon any other projects.
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
Objectives: O-11 – Reduce speed differential
O-24 – Reduce congestion and delay

Agreement
There are no agreements required for this project.
ID: S47

**Project Title:** Expand Roadway Automated Treatment System Deployment

**Timeframe:** Short Term – Years 0-4

**Transportation Policy Area:** Traveler Safety, Energy and the Environment

**ITS Service Area:** MCM

**Type:** Deployment

**Description**
Automated roadway treatment systems have been deployed in the metro area and in Mn/DOT 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 project 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 Mn/DOT, Hennepin County, City of Moorhead, and City of East Grand Forks, have planned to deploy such systems.

**Project Champion and Stakeholder**
Mn/DOT (District Maintenance), Local Agencies

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

**Market 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 project is an expansion of a current application and utilizes current technology already deployed.

**Project Dependency**
This project is not dependent upon any other projects.

**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.

**Needs and Objectives Addressed**
Need: WZ07 – Provide roadway automated treatment with stationary units

Objectives: O-1 – Reduce crashes due to road weather conditions
O-44 – Reduce environmental impacts of de-icing material use

Agreement
There are no agreements required for this project.
ID: S48

Project Title: Expand Dynamic Late Merge System Deployment

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

ITS Service Area: MCM

Type: Deployment

Description
This project 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.

Project Champion and Stakeholder
Mn/DOT (Construction, District Traffic), Local Agencies

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

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

Project Dependency
This project is not dependent upon any other projects.

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

Objectives: O-24 – Reduce congestion and delay
            O-26 – Maintain smooth traffic flow

Agreement

Interagency agreements between district offices may be required to ensure consistent operation and maintenance of equipment.
ID: S49

**Project Title:** GIS Mapping Enhancement

**Timeframe:** Short Term – Years 0-4

**Transportation Policy Area:** Infrastructure Preservation, Maintenance and Security

**ITS Service Area:** MCM

**Type:** Deployment

**Description**
This project 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Local Agencies

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

**Market 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 project utilizes technology that is currently available from technology vendors.

**Project Dependency**
This project is not dependent upon any other projects.

**Cost Estimate**
TBD.

**Needs and Objectives Addressed**

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

Objectives: O-36 – Enhance asset and resource management
O-42 – Enhance investment decision making
Agreement
This project does not require any agreements.
ID: S50

Project Title: Enhanced Data Entry and Integration of Work Zone Information

Timeframe: Short Term – Years 0-4

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

ITS Service Area: MCM

Type: Deployment

Description
This project will expand the capability of entering work zone data via web-enabled cell phones. This capability currently exists in Mn/DOT District 7 and will be expanded to other Mn/DOT districts. This project will also improve the level of detail of the reporting system and simplify the data entry system. The result of this project 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.).

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, MSP, Local Agencies

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

Market Package
- MC08 – Work Zone Management

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

Technology Assessment
This project utilizes technology that is currently deployed.

Project Dependency
This project is not dependent upon any other projects.

Cost Estimate
The cost for this project is estimated around $50,000. The annual O&M cost is estimated at $5,000.

Needs and Objectives Addressed
Need: WZ11 – Provide work zone information to travelers
Objectives: O-24 – Reduce congestion and delay
O-33 – Keep travelers informed of travel conditions

Agreement
Interagency agreements between district offices may be required to ensure consistent data entry of work zone information.
ID: S51

**Project Title:** Expand IWZ Deployment to Greater Minnesota

**Timeframe:** Short Term – Years 0-4

**Transportation Policy Area:** Statewide Connections, Twin Cities Mobility

**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.

**Project Champion and Stakeholder**
Mn/DOT, Local Agencies

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

**Market 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 project utilizes technology that is currently deployed.

**Project Dependency**
This project is not dependent upon any other projects.

**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

**Objectives:**
- O-24 – Reduce congestion and delay
- O-33 – Keep travelers informed of travel conditions

**Agreement**
This project does not require any agreements.
ID: S52

**Project Title:** Work Zone Intrusion Alarm System

**Timeframe:** Short Term – Years 2-4

**Transportation Policy Area:** Traveler Safety

**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 Mn/DOT District 3. Upon successful demonstration of the pilot, additional Work Zone Intrusion Alarm System units will be procured and used in work zones.

**Project Champion and Stakeholder**
Mn/DOT (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 project is an expansion of a current system that is being tested. Commercial, off-the-shelf systems are also available from private vendors.

**Project Dependency**
This project depends upon the result of the pilot project that is currently being conducted in Mn/DOT 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

**Objective:** O-25 – Enhance safety of personnel in work zones

**Agreement**
There are no agreements required for this project.
ID: S53

**Project Title:** Bridge Inspection / Structural Monitoring Roadside Equipment

**Transportation Policy Area:** Infrastructure Preservation, Maintenance and Security

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

**ITS Service Area:** MCM

**Type:** Deployment

**Description**
This project 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 Mn/DOT 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.

**Project Champion and Stakeholder**
Mn/DOT

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

**Market 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.

**Project Dependency**
This project may be dependent upon results of initial testing on the Minneapolis I-35W Bridge.
Cost Estimate
TBD

Needs and Objectives Addressed
Need: WZ13 – Provide cameras/ sensors on bridges to assist for inspection and continual monitoring
Objective: O-36 – Enhance asset and resource management

Agreement
This project does not require any agreements.
4.4 Medium and Long Term Projects

ID: M01

Project Title: Provide Information on Alternate Routes and Detours Due to Roadwork

Timeframe: Medium Term – Years 5-6

Transportation Policy Area: Traveler Safety, Statewide Connections, Twin Cities Mobility

ITS Service Area: ATIS, MCM

Type: Deployment

Project Concept
This project 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.

Mn/DOT RTMC will provide information on recommended alternate routes and detours in the metro area on the Mn/DOT website and through, the 511 telephone system, and Mn/DOT operated DMS alongside roadways. This project will require Mn/DOT, 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. A Mn/DOT study on Vehicle Infrastructure Integration (VII) will be started in FY09, and the results might have implications on this project.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Counties, Cities

Project Dependency
This project is not dependent upon any other projects. However, the results of the VII project may support this project.

Needs and Objectives Addressed

Need: TI05 – Provide information on roadway construction and maintenance activities

Objectives:
- O-8 – Reduce crashes due to roadway/geometric restrictions
- O-24 – Reduce congestion and delay
- O-26 – Maintain smooth traffic flow
- O-33 – Keep travelers informed of travel conditions

Market Package
- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- MC08 – Maintenance and Construction Vehicle Maintenance
ID: M02

**Project Title:** CARS Integration Across State Borders

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety, Maintenance and Security, National and Global Connections, Statewide Connections

**ITS Service Area:** ATIS

**Type:** Deployment

**Project Concept**
The focus of this project will be to integrate the Minnesota Condition and Acquisition Reporting System (CARS) with neighboring state reporting systems similar to CARS. The benefits to this project 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 project is identified by the Statewide ITS Strategic Plan (2006) and the ITS Safety Plan Initiative.

**Project Champion and Stakeholder**
*Project Champion:* Mn/DOT
*Stakeholders:* Mn/DOT, Neighboring States (North Dakota, South Dakota, Iowa, and Wisconsin)

**Project Dependency**
There are no project dependencies.

**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

**Objectives:**
- O-1 – Reduce crashes due to roadway weather conditions
- O-2 – Reduce crashes due to unexpected congestion
- O-3 – Reduce secondary crashes
- O-8 – Reduce crashes due to roadway/geometric restrictions
- O-22 - Reduce exposure due to Hazmat & homeland security incidents
- O-24 – Reduce congestion and delay
- O-26 – Maintain smooth traffic flow
- O-33 – Keep travelers informed of travel conditions
- O-35 – Keep travelers informed of travel mode options
- O-36 – Enhance asset and resource management
- O-41 – Enhance planning and better data
- O-42 – Enhance investment decision making

**Market Package**
- ATIS06 – Transportation Operations Data Sharing
ID: M03

**Project Title:** ITS Communications Interstate Connectivity

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety, Maintenance and Security, National and Global Connections, Statewide Connections

**ITS Service Area:** ATIS

**Type:** Deployment

**Project Concept**
This focus of this project will be to implement communications connectivity to adjacent states that support ITS deployments. This project 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 Mn/DOT and neighboring state agencies. This project is identified by the Statewide ITS Strategic Plan (2006).

**Project Champion and Stakeholder**
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Neighboring States (North Dakota and Wisconsin)

**Project Dependency**
This project depends on planned deployment of a National ATIS Network or standards.

**Needs and Objectives Addressed**

**Need:** TI02 – Provide traveler information across state borders

**Objectives:**
- O-1 – Reduce crashes due to roadway weather conditions
- O-2 – Reduce crashes due to unexpected congestion
- O-3 – Reduce secondary crashes
- O-8 – Reduce crashes due to roadway/geometric restrictions
- O-22 – Reduce exposure due to Hazmat & homeland security incidents
- O-24 – Reduce congestion and delay
- O-26 – Maintain smooth traffic flow
- O-33 – Keep travelers informed of travel conditions
- O-35 – Keep travelers informed of travel mode options

**Market Package**
- ATIS06 – Transportation Operations Data Sharing
ID: M04

Project Title: CARS RWIS Data Addition

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Statewide Connections

ITS Service Area: ATIS

Type: Deployment

Project Concept
This project will focus on adding weather-related information data from RWIS stations to the Minnesota Condition Acquisition and Reporting Systems (CARS). This 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 project 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 project is identified by the Statewide ITS Strategic Plan (2006).

Project Champion and Stakeholder
Project Champion: Mn/DOT

Project Dependency
There are no project dependencies.

Needs and Objectives Addressed
Need: TI04 – Provide current and forecast road and weather conditions information
Objectives: O-1 – Reduce crashes due to road weather conditions
          O-33 – Keep travelers informed of travel conditions

Market Package
- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- ATMS06 – Traffic Information Dissemination
ID: M05

Project Title: Seasonal Road Weight Restrictions via WiFi/Kiosks at Rest Areas

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Statewide Connections

ITS Service Area: ATIS

Type: Deployment

Project Concept
This project will provide a link to information on seasonal road weight restrictions from wireless internet / kiosks at rest areas. This will allow truck drivers, especially owner/operated ones that do not use dispatchers, to view updated information and let them choose their route accordingly.

Project Champion and Stakeholder
Project Champion: Mn/DOT

Project Dependency
This project is dependent upon Project S05 – Rest Area Internet Access.

Needs and Objectives Addressed
Need: TI08 – Provide information on seasonal road weight restrictions
Objectives: O-24 – Reduce congestion and delay
          O-26 – Maintain smooth traffic flow
          O-33 – Keep travelers informed of travel conditions

Market Package
- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- ATMS06 – Traffic Information Dissemination
ID: M06

Project Title: Congestion Information Expanded to Selected Greater Minnesota Locations

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Statewide Connections

ITS Service Area: ATIS

Type: Deployment

Project Concept
This project will expand the incident and congestion information that is available on non-Mn/DOT roadways outside of the metro area and make it available through the 511 website and telephone information service. Mn/DOT 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. Mn/DOT and local agencies will enable increasing the coverage of Mn/DOT’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 Mn/DOT will also provide travelers with up-to-date incident information.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Local Agencies

Project Dependency
This project 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
Need: TI14 – Expand traveler information coverage in Greater Minnesota
Objectives: O-1 – Reduce crashes due to roadway weather conditions
O-2 – Reduce crashes due to unexpected congestion
O-3 – Reduce secondary crashes
O-8 – Reduce crashes due to roadway/geometric restrictions
O-22 – Reduce exposure due to Hazmat & homeland security incidents
O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow
O-33 – Keep travelers informed of travel conditions
O-35 – Keep travelers informed of travel mode options

Market Package
- ATIS01 – Broadcast Traveler Information
ID: M07

Project Title: Traffic Flow Maps for Key Arterials

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Statewide Connections, Twin Cities Mobility

ITS Service Area: ATIS

Type: Deployment

Project Concept
Mn/DOT 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 Mn/DOT 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT

Project Dependency
This project is dependent upon the deployment of roadway sensors / traffic detectors on key signalized arterial roadway segments.

Needs and Objectives Addressed
Need: TI17 – Provide travel time or traffic flow maps for major signalized intersections
Objectives: O-2 – Reduce crashes due to unexpected congestion
O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow
O-33 – Keep travelers informed of travel conditions

Market Package
- ATIS01 – Broadcast Traveler Information
- ATMS06 – Traffic Information Dissemination
ID: M08

Project Title: Seasonal and Recreational Traveler Information

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Security, Statewide Connections

ITS Service Area: ATIS

Type: Deployment

Project Concept
This project 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 project will alert travelers to seasonal and recreational traffic information that may affect their travel behavior and reduce traffic congestion. This project is identified by the Statewide ITS Strategic Plan (2006).

Project Champion and Stakeholder
Project Champion: Mn/DOT

Project Dependency
This project 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

Objectives:  
O-1 – Reduce crashes due to road weather conditions  
O-2 – Reduce crashes due to unexpected congestion  
O-3 – Reduce secondary crashes  
O-24 – Reduce congestion and delay  
O-26 – Maintain smooth traffic flow  
O-30 – Increase carpoolers

Market Package
- ATIS01 – Broadcast Traveler Information
- ATMS06 – Traffic Information Dissemination
ID: M09

Project Title: Enhanced Traveler Information for Transit and Other Modes

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

ITS Service Area: ATIS

Type: Deployment

Project Concept
This project will enhance the provision of traveler information through the Mn/DOT 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 Mn/DOT 511 system.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Metro Area Transit Providers, Local Transit Providers

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TI19 – Provide different alternatives to travelers for the most appropriate route/mode/time of travel

Objectives: O-2 – Reduce crashes due to unexpected congestion
               O-24 – Reduce congestion and delay
               O-26 – Maintain smooth traffic flow
               O-33 – Keep travelers informed of travel conditions
               O-35 – Keep travelers informed of travel mode options

Market Package
- ATIS01 – Broadcast Traveler Information
- ATIS05 – ISP Based Trip Planning and Route Guidance
- APTS08 – Transit Traveler Information
ID: M10

Project Title: Traveler Service Information on 511

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

ITS Service Area: ATIS

Type: Deployment

Project Concept
This project will provide users of the Mn/DOT 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Private Service Providers

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TI20 – Provide traveler service information for reservations and advanced payment for traveler services
Objectives: O-26 – Maintain smooth traffic flow
            O-33 – Keep travelers informed of travel conditions

Market Package
• ATIS05 – ISP Based Trip Planning and Route Guidance
• ATSI07 – Yellow Pages and Reservations
ID: M11

**Project Title:** Congestion and Closure Information for Transit Dispatchers and Operators

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Twin Cities Mobility

**ITS Service Area:** ATIS

**Type:** Deployment

**Project Concept**
This project will provide real-time traffic congestion/roadway closure information to Metro Transit dispatchers and bus operators. Traveler information currently collected and disseminated by the Mn/DOT 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 project could also be expanded to serve suburban transit providers with traffic congestion/roadway closure information. This project could be an extension of the Short Term project titled, “Transit CAD/AVL Integration with RTMC”. This project was identified in the Statewide ITS Strategic Plan (2006).

**Project Champion and Stakeholder**
Project Champion: Metro Transit
Stakeholders: Metro Area Transit Providers, Mn/DOT

**Project Dependency**
This project is dependent on integration of transit CAD/AVL data with the RTMC.

**Needs and Objectives Addressed**
**Need:** TI21 – Make real-time transportation operations data available to other transportation operators

**Objectives:**
- O-33 – Keep travelers informed of travel conditions
- O-36 – Enhance asset and resource management
- O-41 – Enhance planning and better data
- O-42 – Enhance investment decision making

**Market Package**
- ATIS06 – Transportation Operations Data Sharing
ID: M12

Project Title: Automated Data Interface between Local Public Safety CAD Systems and CARS

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Statewide Connections

ITS Service Area: ATIS, ATMS

Type: Deployment

Project Concept
This project will provide an automated data interface between CARS and local public safety CAD systems. This project 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 project will also implement a data quality and consistency verification system as part of this effort. Mn/DOT CARS will automatically incorporate data from local public safety agencies' CAD systems, increasing the timeliness and accuracy of information in CARS.

Project Champion and Stakeholder
Mn/DOT, Local Agencies

Project Dependency
This project is not dependent upon any other projects.

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

Objectives:
- O-2 – Reduce crashes due to unexpected congestion
- O-3 – Reduce secondary crashes
- O-22 – Reduce exposure due to Hazmat & homeland security incidents
- O-24 – Reduce delay and congestion
- O-26 – Maintain smooth traffic flow
- O-33 – Keep travelers informed of travel conditions
- O-36 – Enhance asset and resource management
- O-41 – Enhance planning with better data
- O-42 – Enhance investment decision making

Market Package
- ATMS06 – Traffic Information Dissemination
- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- ATIS06 – Transportation Operations Data Sharing
ID: M13

Project Title: CVO Online Database and CARS Database Enhancement

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

ITS Service Area: ATIS, CVO

Type: Deployment

Project Concept
This project will automate the data entry into CVO Online to allow for the provision of real time data. Mn/DOT 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TI09 – Provide information on CVO permit restrictions
Objectives:
- O-24 – Reduce congestion and delay
- O-26 – Maintain smooth traffic flow
- O-33 – Keep travelers informed of travel conditions

Market Package
- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- CVO01 – Fleet Administration
ID: M14

Project Title: Traffic Flow Maps for Key Corridors

Timeframe: Medium to Long Term – Years 5 and beyond

Transportation Policy Area: Traveler Safety, Statewide Connections, Twin Cities Mobility

ITS Service Area: ATIS

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, MSP, Local Agencies

Project Dependency
This project 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

Objectives:
O-2 – Reduce crashes due to unexpected congestion
O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow
O-33 – Keep travelers informed of travel conditions

Market Package
• ATIS01 – Broadcast Traveler Information
ID: M15

Project Title: 511 Expansion to Local Roads

Timeframe: Medium to Long Term – Year 5 and Beyond

Transportation Policy Area: Traveler Safety, Statewide Connections, Twin Cities Mobility

ITS Service Area: ATIS

Type: Deployment

Project Concept
This project 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, Mn/DOT will expand coverage of the traffic flow map to include those additional roadways within the Metro area and in Greater Minnesota as well. This project will require the establishment of real-time or near real-time data sharing between Mn/DOT and local agencies on road conditions. This project is identified in the Statewide ITS Strategic Plan (2006).

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Local Agencies

Project Dependency
Availability of real-time information depends on instrumentation of local roads.

Needs and Objectives Addressed
Need:  
TI22 – Include information on local roads in 511

Objectives: 
O-1 – Reduce crashes due to roadway weather conditions
O-2 – Reduce crashes due to unexpected congestion
O-3 – Reduce secondary crashes
O-8 – Reduce crashes due to roadway/geometric restrictions
O-22 - Reduce exposure due to Hazmat & homeland security incidents
O-24 – Reduce congestion and delay
O-33 – Keep travelers informed of travel conditions
O-35 – Keep travelers informed of travel mode options

Market Package
- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
**ID: M16**

**Project Title:** Instrument Local Roads

**Timeframe:** Medium to Long Term – Year 5 and Beyond

**Transportation Policy Area:** Traveler Safety, Statewide Connections, Twin Cities Mobility

**ITS Service Area:** ATIS

**Type:** Deployment

**Project Concept**
This project 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 Mn/DOT Condition Acquisition and Reporting System (CARS) for dissemination to the public through the Minnesota 511 Telephone Information Service and Traveler Information Website.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Local Agencies

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

**Need:**

**Objectives:**
- O-1 – Reduce crashes due to roadway weather conditions
- O-2 – Reduce crashes due to unexpected congestion
- O-3 – Reduce secondary crashes
- O-8 – Reduce crashes due to roadway/geometric restrictions
- O-22 - Reduce exposure due to Hazmat & homeland security incidents
- O-24 – Reduce congestion and delay
- O-33 – Keep travelers informed of travel conditions
- O-35 – Keep travelers informed of travel mode options

**Market Package**
- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
- ATMS01 – Network Surveillance
ID: M17

**Project Title:** Priced Dynamic Shoulder Lanes Expansion

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Twin Cities Mobility

**ITS Service Area:** ATMS

**Type:** Deployment

**Project Concept**
This project will combine the dynamic toll pricing application in effect along I-394 with dynamic lane control technology in effect along I-94 near the Lowry Hill tunnel to create Priced Dynamic Shoulder Lanes (PDSLs). Mn/DOT RTMC is currently deploying PDSLs along I-35W between downtown Minneapolis and the 46th St. S. interchange, which are expected to be operational by September 2009 through the Urban Partnership Agreement between the U.S. Department of Transportation (USDOT), Mn/DOT, and the Metropolitan Council of the Twin Cities. This project will focus on expanding the deployment of PDSLs to other corridors, namely I-94 between downtown Minneapolis and Highway 280.

Mn/DOT 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT

**Project Dependency**
There are no project dependencies.

**Needs and Objectives Addressed**

**Needs:**
- TM07 – Provide lane and shoulder control
- TM20 – Operate dynamic shoulders

**Objectives:**
- O-24 – Reduce congestion and delay
- O-26 – Provide smooth traffic flow
- O-30 – Increase carpoolers
- O-31 – Increase throughput of roadways

**Market Package**
- ATMS04 – Freeway Control
ID: M18

Project Title: Automated Red Light Running Enforcement

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project will focus on deploying automated intersection surveillance systems that enforce red-light running violations. Automated systems reduce the need for law enforcement vehicles to be physically present at intersections to enforce violations. Systems will generate fine revenue for local law enforcement communities and also decrease red-light running violations over time as drivers adjust their behavior due to system operation. This project is identified in the Statewide ITS Strategic Plan (2006).

Project Champion and Stakeholder
Project Champion: Mn/DOT

Project Dependency
This project 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.

Needs and Objectives Addressed
Need: TM02 – Implement red-light running technology
Objectives: O-5 – Reduce crashes due to red-light running
O-10 – Reduce crashes at intersections
O-16 – Enhance emergency/incident response effectiveness

Market Package
• ATMS01 – Network Surveillance
• ATMS03 – Surface Street Control
ID: M19

**Project Title:** Expand CCTV Surveillance at High Incident Locations

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety, Maintenance and Security, Statewide Connections, Twin Cities Mobility

**ITS Service Area:** ATMS

**Type:** Deployment

**Project Concept**
This project 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 project 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, MSP, Local Agencies

**Project Dependency**
There are no project dependencies.

**Needs and Objectives Addressed**

**Need:** TM04 – Provide cameras at locations with high incidents and areas of high importance for incident identification and verification

**Objectives:**
- O-4 – Reduce incident clearance time
- O-15 – Reduce emergency/incident response time
- O-16 – Enhance emergency/incident response effectiveness
- O-21 – Reduce security risks to transportation infrastructure
- O-24 – Reduce congestion and delay
- O-26 – Maintain smooth traffic flow
- O-27 – Reduce incident detection and verification time

**Market Package**
- ATMS01 – Network Surveillance
- ATMS08 – Traffic Incident Management System
ID: M20

Project Title: ITS and Communications Coordination and Information Sharing

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Twin Cities Mobility

ITS Service Area: ATMS, EM

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: MSP, Local Law Enforcement Agencies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed

Needs:  
- TM12 – Reduce clearance time for primary crashes
- TM22 – Provide system-coordinated response to incidents

Objectives:  
- O-4 – Reduce incident clearance time
- O-15 – Reduce emergency/incident response time
- O-16 – Enhance emergency/incident response effectiveness
- O-26 – Maintain smooth traffic flow
- O-27 – Reduce incident detection and verification time

Market Package
- ATMS08 – Traffic Incident Management System
- EM01 – Emergency Call-Taking and Dispatch
- EM02 – Emergency Routing
ID: M21

Project Title: Maintenance and CVO Alternate Route Database Development

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Statewide Connections, Twin Cities Mobility

ITS Service Area: ATMS

Type: Deployment

Project Concept
Develop maintenance/CVO database incorporating roadway capacity, restrictions, construction information, and additional information to be used in recommending alternate routes.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Local Agencies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM16 – Identify alternate routes
Objectives: O-1 – Reduce crashes due to road weather conditions
O-2 – Reduce crashes due to unexpected congestion
O-4 – Reduce incident clearance time
O-22 – Reduce exposure due to Hazmat & homeland security incidents
O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow

Market Package
- ATMS08 – Traffic Incident Management System
- EM09 – Evacuation and Reentry Management
- EM10 – Disaster Traveler Information
ID: M22

**Project Title:** Emergency Management Alternate Route Database Development

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety, Maintenance and Security, Statewide Connections, Twin Cities Mobility

**ITS Service Area:** ATMS

**Type:** Deployment

**Project Concept**
Develop emergency management database identifying roadways that are closed or congested due to incidents, emergencies, evacuations or planned events.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT  
Stakeholders: MSP, Local EM Agencies

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

**Need:** TM16 – Identify alternate routes

**Objectives:**
- O-1 – Reduce crashes due to road weather conditions
- O-2 – Reduce crashes due to unexpected congestion
- O-4 – Reduce incident clearance time
- O-22 – Reduce exposure due to Hazmat & homeland security incidents
- O-24 – Reduce congestion and delay
- O-26 – Maintain smooth traffic flow

**Market Package**
- ATMS08 – Traffic Incident Management System
- EM09 – Evacuation and Reentry Management
- EM10 – Disaster Traveler Information
ID: M23

Project Title: ATMS for Major Event Management

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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 project deployment have yet to be determined. This project is identified by the Statewide ITS Strategic Plan (2006).

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Local Agencies, MSP, Event Organizers

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM17 – Provide travel information on special events
Objectives: O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow

Market Package
• ATMS06 – Traffic Information Dissemination
• ATIS01 – Broadcast Traveler Information
ID: M24

**Project Title:** CCTV External Surveillance on Metro Transit Vehicles

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Maintenance and Security, Twin Cities Mobility

**ITS Service Area:** ATMS

**Type:** Deployment

**Project Concept**
This project will allow Metro Transit vehicles to transmit roof-mounted traffic surveillance camera images of surrounding arterial traffic conditions to the Mn/DOT RTMC and Metro Transit Control Center. Camera images will provide the RTMC and Transit Control Center with additional information to manage traffic congestion. This project was identified by the Minnesota Guidestar ITS Strategic Plan (2006).

**Project Champion and Stakeholder**
Project Champion: Metro Transit  
Stakeholder: Mn/DOT

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**
**Need:** TM25 – Operate CCTV cameras  
**Objectives:**  
O-21 – Reduce security risks to transportation infrastructure  
O-24 – Reduce congestion and delay  
O-26 – Maintain smooth traffic flow  
O-27 – Reduce incident detection and verification time

**Market Package**
- ATMS01 – Network Surveillance
ID: M25

**Project Title:** Emergency Vehicle Strategic Deployment

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety, Maintenance and Security

**ITS Service Area:** ATMS

**Type:** Deployment

**Project Concept**
This project will utilize and convert available crash location information in developing an operational guide used by Mn/DOT and emergency/incident response agencies to strategically deploy emergency vehicles at high-risk accident locations along the roadway. This project is identified by the Statewide ITS Strategic Plan (2006).

**Project Champion and Stakeholder**
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, MSP, Local Agencies

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

**Need:** TM22 – Provide system-coordinated response to incidents

**Objectives:**
- O-4 – Reduce incident clearance time
- O-15 – Reduce emergency/incident response time
- O-16 – Enhance emergency/incident response effectiveness
- O-27 – Reduce incident detection and verification time

**Market Package**
- ATMS08 – Traffic Incident Management System
ID: M26

Project Title: Expand Greater Minnesota Population Center Ramp Meter Deployment

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Transportation Security, Statewide Connections

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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 Mn/DOT RTMC.

Project Champion and Stakeholder
Project Champion: Mn/DOT

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM23 – Operate Ramp Meters
Objectives:
O-2 – Reduce crashes due to unexpected congestion
O-3 – Reduce secondary crashes
O-11 – Reduce speed differential
O-24 – Reduce congestion and delay
O-26 – Provide smooth traffic flow
O-31 – Increase throughput of roadways

Market Package
• ATMS04 – Freeway Control
ID: M27

Project Title: Vehicle Occupancy Monitoring/ Enforcement System

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Twin Cities Mobility

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, MSP

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM27 – Provide HOV bypass lanes at ramp meter locations
Objectives: O-24 – Reduce congestion and delay
O-26 – Provide smooth traffic flow
O-30 – Increase carpoolers

Market Package
• ATMS05 – HOV Lane Management
ID: M28

Project Title: Active Flashing Signals and Gates at Highway/Railroad Intersections

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Local Agencies, Railroad Companies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM28 – Provide railroad flashing light signals and gates
Objective: O-9 – Reduce crashes at railroad crossings

Market Package
• ATMS13 – Standard Railroad Grade Crossing
• ATMS14 – Advanced Railroad Grade Crossing
ID: M29

Project Title: Automated/Remote Operated Gate Systems

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Maintenance and Security

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project will deploy automated/remote control gate systems at rural locations experiencing unsafe driving conditions. This system will include CCTVs to assure safe operation.

Project Champion and Stakeholder
Project Champion: Mn/DOT

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM29 – Provide automated/remote control gate systems
Objectives: O-1 – Reduce crashes due to road weather conditions
O-2 – Reduce crashes due to unexpected congestion
O-16 – Enhance emergency/incident response effectiveness
O-22 – Reduce exposure due to Hazmat & homeland security incidents
O-24 – Reduce congestion and delay

Market Package
• ATMS21 – Roadway Closure Management
ID: M30

Project Title: Integrated Payment System for MnPASS, Transit and Parking

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Twin Cities Mobility

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: City of Minneapolis, Metro Transit, Private Parking Operators

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM30 – Provide simple and integrated electronic payment systems
Objective: O-34 – Enhance parking facility services and management

Market Package
- ATMS10 – Electronic Toll Collection
- ATMS16 – Parking Facility Management
- APTS04 – Electronic Fare Payment
ID: M31

Project Title: Additional Air Quality Sensors at Strategic Locations

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Energy and the Environment

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: Federal Agencies, MPCA
Stakeholders: Mn/DOT, Local Agencies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM31 – Monitor and collect air quality data
Objective: O-43 – Enhance compliance of air quality standards

Market Package
- ATMS11 – Emissions Monitoring and Management
ID: M32

Project Title: Curve Speed Warning Systems

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Local Agencies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM32 – Provide curve speed warnings
Objectives: O-1 – Reduce crashes due to road weather conditions
            O-8 – Reduce crashes due to roadway/geometric restrictions
            O-33 – Keep travelers informed of travel conditions

Market Package
• ATMS19 – Speed Monitoring
ID: M33

Project Title: Intersection Warning and Decision Support Systems

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project will install rural intersection warning and decision support systems 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 project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Local Agencies

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

Needs and Objectives Addressed
Need: TM33 – Provide intersection collision avoidance systems
Objectives: O-8 – Reduce crashes due to roadway/geometric restrictions
O-9 – Reduce crashes at railroad crossings

Market Package
- AVSS05 – Intersection Safety Warning
- AVSS10 – Intersection Collision Avoidance
ID: M34

Project Title: Flood Warning Systems

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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 project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Local Agencies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM34 – Provide roadway flood warnings
Objectives: O-1 – Reduce crashes due to road weather conditions
O-33 – Keep travelers informed of travel conditions

Market Package
• ATMS06 – Traffic Information Dissemination
• MC12 – Infrastructure Monitoring
ID: M35

Project Title: Overheight Detection/Warning Systems

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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 Mn/DOT 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 Mn/DOT District 7 TOCC.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Local Agencies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM35 – Provide vehicle overheight detection/warning systems
Objectives: O-8 – Reduce crashes due to roadway/geometric restrictions
O-33 – Keep travelers informed of travel conditions

Market Package
- ATMS06 – Traffic Information Dissemination
- EM05 – Transportation Infrastructure Protection
ID: M36

Project Title: Signal Phase Transition Systems

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project will implement signal phase transition (i.e. sufficient yellow and all-red signal phases) at intersections with high crash rates throughout the state.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Local Agencies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM37 – Provide safe signal phase transition
Objectives: O-5 – Reduce crashes due to red-light running
O-10 – Reduce crashes at intersections
O-14 – Reduce violation of traffic laws

Market Package
• ATMS03 – Surface Street Control
ID: M37

**Project Title:** TIGER Corridor Expansion

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Statewide Connections

**ITS Service Area:** ATMS

**Type:** Deployment

**Project Concept**
This project 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 project 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 project 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT

**Project Dependency**
This project 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

**Objectives:**
- O-24 – Reduce congestion and delay
- O-26 – Provide smooth traffic flow
- O-27 – Reduce incident detection and verification time
- O-28 – Increase transit ridership
- O-31 – Increase throughput of roadways

**Market Package**
- ATMS01 – Network Surveillance
- ATMS03 – Surface Street Control
- ATMS04 – Freeway Control
- ATMS05 – HOV Lane Management
- ATMS07 – Regional Traffic Management
- ATMS10 – Electronic Toll Collection
- ATMS18 – Reversible Lane Management
ID: M38

Project Title: Additional Installation of HRI Monitoring Equipment

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project will allow Mn/DOT 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Local Agencies, Railroad Companies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM38 – Provide health monitoring of rail crossings
Objective: O-9 – Reduce crashes at railroad crossings

Market Package
- ATMS13 – Standard Railroad Grade Crossing
- ATMS14 – Advanced Railroad Grade Crossing
ID: M39

Project Title: Queue Length at Ramps, Incident and Work Zones

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Statewide Connections

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Local Agencies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed

Need: TM39 – Monitor queue length at ramps, incidents, and work zones

Objectives:
- O-2 – Reduce crashes due to unexpected congestion
- O-11 – Reduce speed differential
- O-16 – Enhance emergency/incident response effectiveness
- O-24 – Reduce congestion and delay
- O-25 – Enhance safety of workers
- O-26 – Provide smooth traffic flow

Market Package
- ATMS01 – Network Surveillance
- MC08 – Work Zone Management
ID: M40

Project Title: Expand Total Stations and Photogrammetry Deployment

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: MSP
Stakeholders: Local Law Enforcement Agencies

Project Dependency
This project is not dependent upon any other projects

Needs and Objectives Addressed
Need: TM41 – Improve incident investigation capabilities
Objectives: O-14 – Reduce violation of traffic laws
O-16 – Enhance emergency/incident response effectiveness
O-17 – Safeguard public safety personnel while they are at roadway incidents and emergencies

Market Package
• ATMS08 – Traffic Incident Management System
ID: M41

Project Title: Snowplow Maintenance Activity Alerts Using DMS

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Project Concept
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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Local Agencies

Project Dependency
This project is not dependent upon any other projects

Needs and Objectives Addressed
Need: TM43 – Notify travelers of snowplow operations and cleanup using DMS
Objectives:
O-1 – Reduce crashes due to road weather conditions
O-12 – Reduce crashes due to driver errors and limitations
O-26 – Maintain smooth traffic flow
O-33 – Keep travelers informed of travel conditions

Market Package
- ATMS06 – Traffic Information Dissemination
- MC06 – Winter Maintenance
ID: M42

**Project Title:** Detectors for Speed Data Collection at High Incident Locations

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** ATMS

**Type:** Deployment

**Project Concept**
This project will install speed detection systems at locations with history of high incidents and incidents with high speeds. The purpose of the project 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT
Stakeholders: Local Agencies

**Project Dependency**
This project is not dependent upon any other projects

**Needs and Objectives Addressed**

**Need:** TM42 – Use roadside data collectors to determine locations with high incident of speeding

**Objectives:**
- O-11 – Reduce speed differential
- O-14 – Reduce violation of traffic laws
- O-41 – Enhance planning with better data

**Market Packages**
- ATMS01 – Network Surveillance
- ATMS19 – Speed Monitoring
ID: M43

Project Title: Electronic Fare Payment Systems

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Statewide Connections, Twin Cities Mobility

ITS Service Area: APTS

Type: Deployment

Project Concept
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.

Project Champion and Stakeholder
Project Champion: Transit Agencies

Project Dependency
This project is dependent upon a study of electronic fare card parking and paratransit.

Needs and Objectives Addressed
Need: TR03 – Provide simple fare payment systems
Objective: O-29 – Enhance transit operations efficiency

Market Package
- APTS04 – Transit Fare Collection Management
ID: M44

Project Title: Transit Agencies Smart Card for Employee Management

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: APTS

Type: Deployment

Project Concept
The project 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.

Project Champion and Stakeholder
Project Champion: Stakeholders: Transit Agencies

Project Dependency
This project could build upon a similar deployment by the Duluth Transit Agency.

Needs and Objectives Addressed
Need: TR05 – Manage transit fleet and personnel operations
Objectives:
O-19 - Reduce security risks to transit passengers and transit vehicle operators
O-29 - Enhance transit operations efficiency
O-36 - Enhance asset and resource management

Market Package
• APTS01 – Transit Vehicle Tracking
• APTS02 – Transit Fixed-Route Operations
• APTS04 – Transit Fare Collection Management
ID: M45

**Project Title:** St. Cloud MTC Transit Vehicle Security Technologies

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Maintenance and Security

**ITS Service Area:** APTS

**Type:** Operational Test

**Project Concept**
This project 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. These projects are identified by the Statewide ITS Strategic Plan (2006).

**Project Champion and Stakeholder**
Project Champion: St. Cloud MTC

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

**Need:** TR06 – Provide surveillance and enforcement on transit vehicles and transit facilities

**Objectives:**
- O-19 – Reduce security risks to transit passengers and transit vehicle operators
- O-21 – Reduce security risks to transportation infrastructure

**Market Package**
- APTS05 – Transit Security
ID: M46

Project Title: Expand Electronic Fare Collection Technologies

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Maintenance and Security, Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: APTS

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: Local Transit Agencies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TR07 – Provide electronic fare payment card
Objectives: O-24 – Reduce congestion and delay
O-29 – Enhance transit operations efficiency

Market Package
- APTS04 – Transit Fare Collection Management
ID: M47

Project Title: Wireless Transmission of Metro Transit Vehicle Diagnostic Data

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Maintenance and Security

ITS Service Area: APTS

Type: Operational Test

Project Concept
This project 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 project 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 project was identified by the Minnesota Guidestar ITS Strategic Plan (2006).

Project Champion and Stakeholder
Project Champion: Metro Transit

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TR08 – Support vehicle diagnostics and maintenance
Objectives: O-36 – Enhance asset and resource management
O-39 – Enhance garage operations efficiency

Market Package
• APTS06 – Transit Fleet Management
ID: M48

**Project Title:** Transit Vehicle Lateral Safety Detection and Warning Systems

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety

**ITS Service Area:** APTS

**Type:** Deployment

**Project Concept**
This project 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 project can be used by additional transit agencies in future deployments of lateral safety detection and warning systems.

**Project Champion and Stakeholder**
Project Champion: Transit Agencies

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

**Need:** TR13 – Provide collision avoidance assistance for transit vehicles

**Objectives:**
- O-7 – Reduce lane departure crashes
- O-12 – Reduce crashes due to driver errors and limitations

**Market Package**
- AVSS03 – Longitudinal Safety Warning
- AVSS04 – Lateral Safety Warning
**ID:** M49

**Project Title:** Coordinate Scheduling, Historical Route Data and Transit Movements

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** APTS

**Type:** Deployment

**Project Concept**
The project 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.

**Project Champion and Stakeholder**
Project Champion: Transit Agencies

**Project Dependency**
This project is dependent upon S25 – Data Analysis Tools for Transit Route Performance.

**Needs and Objectives Addressed**

**Need:** TR15 – Optimize schedule efficiency

**Objectives:**
- O-29 - Enhance transit operations efficiency
- O-36 - Enhance asset and resource management

**Market Package**
- APTS02 - Transit Fixed-Route Operations
ID: M50

**Project Title:** Enhance Carpool and Vanpool Ridematching System.

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** APTS

**Type:** Deployment

**Project Concept**
The project 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 MN with city, county, and regional transit providers as needed.

**Project Champion and Stakeholder**
Project Champion: Transit Agencies

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

- **Need:** TR16 – Provide information on ridesharing opportunities
- **Objective:** O-30 - Increase carpoolers

**Market Package**
- APTS08 - Transit Traveler Information
- ATIS08 – Dynamic Ridesharing
ID: M51

Project Title: Transit Signal Priority along Arterials

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: APTS

Type: Deployment

Project Concept
Based on the success of Transit Signal Priority (TSP) deployment for the Urban Partnership Agreement Transit Technologies Projects, this project will focus on expanding TSP deployment to key signalized intersection along other transit corridors.

Project Champion and Stakeholder
Project Champion: Metro Transit

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TR17 – Coordinate transit vehicle movements with traffic control devices
Objectives: O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow
O-28 – Increase transit ridership
O-29 – Enhance transit operations efficiency

Market Package
• APTS08 - Transit Traveler Information
ID: M52

Project Title: Pedestrian and Bicycle Detection with Advance Warning for Drivers

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety

ITS Service Area: APTS

Type: Deployment

Project Concept
This project 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 project will deploy the system at areas with high pedestrian accident rates.

Project Champion and Stakeholder
Project Champion: Transit Agencies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TR18 – Install pedestrian detection/warning system to reduce incidents
Objectives: O-12 – Reduce crashes due to driver errors and limitations
O-13 – Reduce crashes involving pedestrians or non-motorized vehicles

Market Package
- AVSS03 – Longitudinal Safety Warning
ID: M53

**Project Title:** NexTrip Enhancements

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** APTS

**Type:** Deployment

**Project Concept**
This project will add rail mode information (commuter, light rail) to Metro Transit NexTrip system and integrate St. Cloud transit information into NexTrip.

**Project Champion and Stakeholder**
Project Champion: Metro Transit, St. Cloud MTC

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**
Need: TR20 – Provide real-time transfer information to travelers en route
Objective: O-35 – Inform traveler of travel mode options

**Market Package**
- APTS08 - Transit Traveler Information
ID: M54

Project Title: Transit Agency On-line Reservation Integration with Fleet Scheduling Systems

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: APTS

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: Metro Area Transit Providers
Stakeholders: Local Area Transit Providers, Intercity Transit Providers

Project Dependency
This project is similar to the project of DARTS On-line Reservation for Seniors.

Needs and Objectives Addressed

Need: TR21 – Provide on-line reservation system for demand-responsive transit

Objectives:
O-28 – Increase transit ridership
O-29 – Enhance transit operations efficiency
O-35 – Inform traveler of travel mode options

Market Package
• APTS03 - Demand Response Transit Operations
• ATIS02 - Interactive Traveler Information
ID: M55

Project Title: Queue Jump Systems at Bottlenecks

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: APTS

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: Transit Agencies
Stakeholders: Mn/DOT, Local Agencies

Project Dependency
This project is not dependent upon any other projects but could support Transit Signal Priority along Arterials project.

Needs and Objectives Addressed
Need: TR19 – Provide queue jumping
Objectives: O-24 – Reduce congestion and delay
O-29 – Enhance transit operations efficiency

Market Packages
• APTS09 - Transit Signal Priority
ID: M56

**Project Title:** Expand Metro Area Transit Management Systems to Greater Minnesota

**Timeframe:** Medium to Long Term – Year 5 and Beyond

**Transportation Policy Area:** Maintenance and Security, Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility, Energy and Environment

**ITS Service Area:** APTS

**Type:** Deployment

**Project Concept**
This project 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.

**Project Champion and Stakeholder**
Project Champion:
Stakeholders: Transit Agencies

**Project Dependency**
There are no project dependencies.

**Needs and Objectives Addressed**

**Needs:**
- TR05 – Manage transit fleet and personnel operations
- TI14 – Expand traveler information coverage in Greater Minnesota

**Objectives:**
- O-19 – Reduce security risks to transit passengers and transit vehicle operators
- O-22 – Reduce exposure to Hazmat & homeland security incidents
- O-24 – Reduce congestion and delay
- O-26 – Maintain smooth traffic flow
- O-29 – Enhance transit operations efficiency
- O-33 – Keep travelers informed of travel conditions
- O-35 – Keep travelers informed of travel mode options
- O-36 – Enhance asset and resource management

**Market Package**
- APTS01 – Transit Vehicle Tracking
- APTS04 – Transit Fare Collection Management
- ATIS01 – Broadcast Traveler Information
ID: M57

**Project Title:** Surveillance Video Integration

**Timeframe:** Medium to Long Term – Year 5 and Beyond

**Transportation Policy Area:** Maintenance and Security

**ITS Service Area:** APTS

**Type:** Deployment

**Project Concept**
This project 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.

**Project Champion and Stakeholder**
Project Champion: Transit Agencies
Stakeholders: Local Agencies, Local Law Enforcement and Emergency Agencies

**Project Dependency**
This project 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**

<table>
<thead>
<tr>
<th>Need</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR06 – Provide surveillance and enforcement on transit vehicles and transit facilities</td>
<td>O-19 – Reduce security risks to transit passengers and transit vehicle operators</td>
</tr>
<tr>
<td></td>
<td>O-21 – Reduce security risks to transportation infrastructure</td>
</tr>
</tbody>
</table>

**Market Package**
- APTS05 – Transit Security
ID: M58

Project Title: CVO Database Enhancement

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Infrastructure Preservation, Maintenance and Security, Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: CVO

Type: Deployment

Description
This project will implement ways to improve efficiency of using multiple databases 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. Mn/DOT and MSP currently use databases such as PRISM and SAFER to query vehicle or operator safety issues.

Project Champion and Stakeholder
Project Champion: Mn/DOT OFCVO
Stakeholders: Minnesota State Patrol

Project Dependency
There are no known project dependencies.

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

Objectives: O-6 – Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system
O-20 – Reduce security risks to motorists and travelers
O-21 – Reduce security risks to transportation infrastructure
O-22 – Reduce exposure due to Hazmat & homeland security incidents
O-23 – Enhance tracking and monitoring of sensitive Hazmat shipments
O-36 – Enhance asset and resource management
O-38 – Reduce freight movement delays due to inspection
O-40 – Reduce commercial vehicle size and weight violations

Market Package
• CVO04 – CV Administrative Processes
• CVO07 – Roadside CVO Safety
• AD01 – ITS Data Mart
ID: M59

Project Title: Work Zone Restriction Information Automation

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Infrastructure Preservation, Maintenance and Security, Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: CVO

Type: Deployment

Description
This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Local Agencies

Project Dependency
This project could be built upon Project S35: Enhance Automated Permit Routing System.

Needs and Objectives Addressed
Need: CF13 – Provide size and weight restrictions due to work zones
Objectives:
  O-6 – Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system
  O-24 – Reduce congestion and delay
  O-26 – Maintain smooth traffic flow
  O-33 – Keep travelers informed of travel conditions
  O-36 – Enhance asset and resource management
  O-40 – Reduce commercial vehicle size and weight violations

Market Package
  • CVO01 – Fleet Administration
ID: M60

Project Title: ATIS for CVO

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: CVO

Type: Deployment

Description
This project 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 project was identified by the Statewide ITS Strategic Plan (2006).

Project Champion and Stakeholder
Project Champion: Private Trucking Companies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed

Need: CF14 – Direct commercial vehicle operators to the quickest route/time of travel
Objectives: O-24 – Reduce congestion and delay
O-26 – Maintain smooth traffic flow
O-33 – Keep travelers informed of travel conditions

Market Package
- CVO01 – Fleet Administration
- ATIS01 – Broadcast Traveler Information
- ATIS02 – Interactive Traveler Information
ID: M61

Project Title: Commercial Vehicles as Probes

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: CVO

Type: Deployment

Description
This project will utilize private fleet management vehicle GPS systems to provide Mn/DOT with anonymous probe traffic data. This data would provide Mn/DOT with more accurate information on travel conditions on metro area freeways. Mn/DOT will need to develop a partnership with private trucking companies.

Project Champion and Stakeholder
Project Champion: Mn/DOT OFCVO
Stakeholders: Private Trucking Companies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: CF16 – Track commercial fleet
Objectives: O-6 – Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system
O-21 – Reduce security risks to transportation infrastructure
O-22 – Reduce exposure due to Hazmat & homeland security incidents
O-23 – Enhance tracking and monitoring of sensitive Hazmat shipments
O-36 – Enhance asset and resource management
O-40 – Reduce commercial vehicle size and weight violations

Market Package
- CVO01 – Fleet Administration
ID: M62

Project Title: RFID Tags for Identification of HAZMAT Materials

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Maintenance and Security, Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: CVO

Type: Deployment

Description
This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Law Enforcement and Emergency Management Agencies

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: CF17 – Manage HAZMAT Incidents
Objectives: O-6 – Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system
O-15 – Reduce emergency/incident response time
O-16 – Enhance emergency/incident response effectiveness
O-22 – Reduce exposure due to Hazmat & homeland security incidents
O-26 – Maintain smooth traffic flow
O-36 – Enhance asset and resource management

Market Package
- CVO01 – Fleet Administration
ID: M63

Project Title: Multi-State OS/OW Permitting System

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Infrastructure Preservation, Maintenance and Security, National and Global Connections, Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: CVO

Type: Deployment

Description
This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Neighboring States

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: CF18 – Provide multi-state oversize/overweight permitting
Objectives: O-36 – Enhance asset and resource management
O-37 – Enhance credential process automation
O-40 – Reduce commercial vehicle size and weight violations

Market Package
• CVO04 – CV Administrative Processes
ID: M64

**Project Title:** Enhanced Crash Database

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety, Infrastructure Preservation, Maintenance and Security, Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** CVO

**Type:** Deployment

**Description**
This project 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 project will provide MSP and local law enforcement the ability to collect and enter more detailed data regarding crashes involving commercial vehicles into crash databases.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT
Stakeholders: MSP

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

**Need:** CF19 – Improve quality and accessibility of commercial vehicle-related crash data

**Objectives:**
- O-6 – Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system
- O-41 – Enhance planning with better data
- O-42 – Enhance investment decision making

**Market Package**
- AD01 – ITS Data Mart
- AD02 – ITS Data Warehouse
ID: M65

**Project Title:** Enhance Commercial Vehicle Shipment Performance

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Infrastructure Preservation, Maintenance and Security, National and Global Connections, Statewide Connections

**ITS Service Area:** CVO

**Type:** Deployment

**Description**
This project will improve the timeliness and accuracy of shipment information to provide better data for commercial vehicle shipment performance analysis. This project will also provide new types of freight shipment data for new analysis and planning. Mn/DOT Office of Commercial Vehicle Operations (OFCVO) currently obtains information on freight movement and analyzes it to develop strategies and performance measures for Mn/DOT’s role in improving or augmenting freight movement.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT OFCVO

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

**Need:** CF20 – Measure historic commercial vehicle shipment performance

**Objectives:**
- O-36 – Enhance asset and resource management
- O-41 – Enhance planning with better data
- O-42 – Enhance investment decision making

**Market Package**
- CVO01 – Fleet Administration
ID: M66

Project Title: Evacuation/Reentry Real-time Information ITS Systems

Timeframe: Medium Term – Years 5-7

Transportation Policy Area: Maintenance and Security, Statewide Connections, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: EM

Type: Deployment

Project Concept
This project will develop systems to recommend alternate routes based on real-time traffic information and historic travel information. This project 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.

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, MSP, Minnesota DPS, Local Emergency Management Agencies

Project Dependency
This project is dependent upon Project M47 – Wireless Transmission of Metro Transit Vehicle Diagnostic Data to provide real-time traffic and evacuation information.

Needs and Objectives Addressed
Need: E09 – Provide emergency/evacuation and reentry information
Objectives:
- O-22 – Reduce exposure to Hazmat and homeland security incidents
- O-24 – Reduce congestion and delay
- O-26 – Maintain smooth traffic

Market Package
- EM10 – Disaster Traveler Information
ID: M67

**Project Title:** Enhanced Automated and Manual In-Vehicle Notification Assistance

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety, Maintenance and Security, Twin Cities Mobility

**ITS Service Area:** EM

**Type:** Deployment

**Project Concept**
This project 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 project is identified by the Minnesota ITS Safety Plan (2006).

**Project Champion and Stakeholder**
Project Champion: Minnesota State Patrol
Stakeholders: PSAPs, First Responders, Mn/DOT, Local Agencies

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

<table>
<thead>
<tr>
<th>Need</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>E03</td>
<td>O-15 – Reduce emergency/incident response time</td>
</tr>
<tr>
<td></td>
<td>O-16 – Enhance emergency/incident response effectiveness</td>
</tr>
</tbody>
</table>

**Market Package**
- EM03 – Mayday and Alarms Support
ID: M68

Project Title: AVL Systems for Local Responders

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Maintenance and Security, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: EM

Type: Deployment

Project Concept
This project 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.

Project Champion and Stakeholder
Project Champion: Local Emergency Management Agencies

Project Dependency
There are no project dependencies.

Needs and Objectives Addressed
Need: E06 – Provide AVL to emergency vehicles
Objectives:
- O-4 – Reduce incident clearance time
- O-15 – Reduce incident/emergency response time
- O-36 – Enhance asset and resource management

Market Package
- EM01 – Emergency Call-Taking and Dispatch
- EM02 – Emergency Routing
ID: M69

Project Title: Expand Deployment of Mobile Data Computers

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Maintenance and Security, Twin Cities Mobility

ITS Service Area: EM

Type: Deployment

Project Concept
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.

Project Champion and Stakeholder
Project Champion: Minnesota State Patrol
Stakeholders: Minnesota State Patrol, Local Emergency Response Agencies, Mn/DOT

Project Dependency
There are no project dependencies.

Needs and Objectives Addressed

Need: E08 – Provide mobile data computers in emergency vehicles to provide real-time information

Objectives:
O-4 – Reduce incident clearance time
O-16 – Enhance emergency/incident response effectiveness
O-27 – Reduce incident detection and verification time

Market Package
- EM01 – Emergency Call-Taking and Dispatch
- EM02 – Emergency Routing
ID: M70

**Project Title:** Remote Posting of AMBER Alerts on DMS

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety, Maintenance and Security

**ITS Service Area:** EM

**Type:** Deployment

**Project Concept**
This project will provide Mn/DOT 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT TOCCs

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

**Need:** E10 – Provide ability to remotely post AMBER alert information on DMS

**Objectives:**
- O-16 – Enhance emergency/incident response effectiveness
- O-20 – Reduce security risks to motorists and travelers

**Market Package**
- EM06 – Wide Area Alert
ID: M71

**Project Title:** Wireless Digital Feeds Between MSP and Local EM Responders

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety, Maintenance and Security, Twin Cities Mobility

**ITS Service Area:** EM

**Type:** Deployment

**Project Concept**
This project 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.

**Project Champion and Stakeholder**
Project Champion: MSP
Stakeholders: MSP, Local Emergency Management Agencies, Mn/DOT

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

**Need:** E11 – Provide wireless digital feed between patrol and emergency responder vehicles and dispatch centers

**Objectives:**
- O-4 – Reduce incident clearance time
- O-16 – Enhance emergency/incident response effectiveness
- O-27 – Reduce incident detection and verification time

**Market Package**
- EM01 – Emergency Call-Taking and Dispatch
- EM02 – Emergency Routing
ID: M72

Project Title: Automated Field Reporting Systems for MSP and Local Law Enforcement

Timeframe: Medium Term – Years 5-8

Transportation Policy Area: Traveler Safety, Maintenance and Security, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: EM

Type: Deployment

Project Concept
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.

Project Champion and Stakeholder
Project Champion: MSP
Stakeholders: MSP, Local Law Enforcement Agencies

Project Dependency
This project is dependent upon the Rapid Incident Clearance Project that is currently underway.

Needs and Objectives Addressed

Need: E12 – Implement automated field reporting system
Objectives:
  O-4 – Reduce incident clearance time
  O-17 – Safeguard public safety personnel while they are at roadway incidents and emergencies

Market Package
- AD01 – ITS Data Mart
ID: M73

**Project Title:** DVR to Review Central Images during an Incident

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety, Maintenance and Security, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** EM

**Type:** Deployment

**Project Concept**
Integrate 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT
Stakeholders: MSP

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**
Need: E13 – Provide Real-time Digital Video Recordings (DVR)
Objective: O-16 – Enhance emergency/incident response effectiveness

**Market Package**
- EM01 – Emergency Call-Taking and Dispatch
- EM02 – Emergency Routing
- AD01 – ITS Data Mart
ID: M74

**Project Title:** Incorporate Road Construction Data in CAD Systems

**Timeframe:** Medium Term – Years 7-8

**Transportation Policy Area:** Traveler Safety, Maintenance and Security, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** EM

**Type:** Deployment

**Project Concept**
Enhance CAD systems to incorporate current construction and evacuation traffic management routing information into GIS maps. This project 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT
Stakeholders: Mn/DOT, Minnesota State Patrol, Local Emergency Management Agencies

**Project Dependency**
The real-time evacuation traffic management data component is dependent on Project M66: Evacuation/ Reentry Real-time Information ITS Systems project.

**Needs and Objectives Addressed**
Need: E07 – Enhance GIS capabilities
Objective: O-16 – Enhance emergency response effectiveness

**Market Package**
- EM02 – Emergency Routing
ID: M75

**Project Title:** County Public Works AVL Equipment

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Maintenance and Security, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility, Energy and Environment

**ITS Service Area:** MCM

**Type:** Deployment

**Project Concept**
This project will install Automated Vehicle Locator (AVL) devices in county-level maintenance vehicles in order to fully maximize available resources during snowfall and icy conditions. Local agencies can take advantage of lessons learned from Mn/DOT which is in the process of expanding the deployment of AVL systems on their maintenance vehicles throughout the state.

**Project Champion and Stakeholder**
Project Champion: Local Agencies

**Project Dependency**
This project may be dependent upon the completion of statewide deployment of AVL technology on Mn/DOT maintenance vehicles.

**Needs and Objectives Addressed**

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

**Objectives:**
- O-36 – Enhance asset and resource management
- O-39 – Enhance garage operations efficiency

**Market Package**
- MC01 – Maintenance and Construction Vehicle and Equipment Tracking
- MC06 – Winter Maintenance
ID: M76

**Project Title:** Graphical-Based Construction Scheduling Tool

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Maintenance and Security, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** MCM

**Type:** Deployment

**Project Concept**
This project will develop a dynamic graphical-based tool for communication of construction and maintenance activity within and between multiple maintenance agencies. Mn/DOT will need to investigate staffing requirements for data entry into the dynamic scheduling tool. Mn/DOT 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

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

**Objectives:**
- O-24 – Reduce congestion and delay
- O-41 – Enhance planning with better data

**Market Package**
- MC10 – Maintenance and Construction Activity Coordination
ID: M77

**Project Title:** Portable Work Zone Dynamic Speed Display Signs

**Timeframe:** Medium Term – Years 5-8

**Transportation Policy Area:** Traveler Safety, Maintenance and Security, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** MCM

**Type:** Deployment

**Project Concept**
This project 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 project 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

*Need: WZ15 – Provide dynamic speed display*

*Objectives: O-11 – Reduce speed differential*

*O-26 – Maintain smooth traffic flow*

**Market Package**
- MC08 – Work Zone Management
- ATMS19 – Speed Monitoring
ID: L01

**Project Title:** Route-specific Weather Information

**Timeframe:** Long Term – Year 9 and Beyond

**Transportation Policy Area:** Traveler Safety, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** ATIS

**Type:** Deployment

**Project Concept**
This project 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT

**Project Dependency**
There are no project dependencies.

**Needs and Objectives Addressed**

*Need:* TI04 – Provide current and forecast road and weather conditions information

*Objectives:*  O-1 – Reduce crashes due to road weather conditions  
O-33 – Keep travelers informed of travel conditions

**Market Package**
- ATIS02 – Interactive Traveler Information
- MC04 – Weather Information Processing and Distribution
ID: L02

**Project Title:** Use Agency Vehicles as Data Probes

**Timeframe:** Long Term – Years 9 and beyond

**Transportation Policy Area:** Traveler Safety, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** ATMS

**Type:** Deployment

**Project Concept**
This project 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 Mn/DOT Condition Acquisition and Reporting System (CARS) for dissemination to the public through the Minnesota 511 Telephone Information Service and Traveler Information Website. This project would increase detection coverage in Greater Minnesota.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT
Stakeholders: Local EM Agencies

**Project Dependency**
This project may support the implementation of the Medium Term project titled, “Congestion Information Expanded to Selected Greater Minnesota Locations.”

**Needs and Objectives Addressed**

<table>
<thead>
<tr>
<th>Need</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI14</td>
<td>O-1 – Reduce crashes due to roadway weather conditions &lt;br&gt; O-2 – Reduce crashes due to unexpected congestion &lt;br&gt; O-3 – Reduce secondary crashes &lt;br&gt; O-8 – Reduce crashes due to roadway/geometric restrictions &lt;br&gt; O-22 - Reduce exposure due to Hazmat &amp; homeland security incidents &lt;br&gt; O-24 – Reduce congestion and delay &lt;br&gt; O-26 – Maintain smooth traffic flow &lt;br&gt; O-33 – Keep travelers informed of travel conditions &lt;br&gt; O-35 – Keep travelers informed of travel mode options</td>
</tr>
</tbody>
</table>

**Market Package**
- ATMS02 – Traffic Probe Surveillance
ID: L03

Project Title: Automated Speed Enforcement

Timeframe: Long Term – Year 9 and Beyond

Transportation Policy Area: Traveler Safety

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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 project is identified by the Minnesota Guidestar ITS Strategic Plan (2006) and Deployment Assessment (2007).

Project Champion and Stakeholder
Project Champion: Mn/DOT
Stakeholders: MSP, Local Law Enforcement Agencies

Project Dependency
This project 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

Objectives: O-11 – Reduce speed differential
           O-18 – Reduce speed violations
           O-26 – Maintain smooth traffic flow

Market Package
- ATMS19 – Speed Monitoring
ID: L04

Project Title: Contraflow Lanes

Timeframe: Long Term – Years 9 and Beyond

Transportation Policy Area: Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: ATMS

Type: Deployment

Project Concept
This project 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. Mn/DOT will focus on developing and deploying a moveable barrier system, which will also require signage and other traffic control devices. This project is identified by the Minnesota Guidestar ITS Deployment Assessment (2007).

Project Champion and Stakeholder
Project Champion: Mn/DOT

Project Dependency
This project is dependent upon corridor studies to determine project location and upon the development and deployment of a moveable barrier system.

Needs and Objectives Addressed
Need: TM11 – Operate reversible lanes
Objectives: O-24 – Reduce congestion and delay
            O-26 – Provide smooth traffic flow
            O-30 – Increase carpoolers
            O-31 – Increase throughput of roadways

Market Package
• ATMS18 – Reversible Lane Management
ID: L05

**Project Title:** In-Pavement LEDs

**Timeframe:** Long Term – Year 9 and Beyond

**Transportation Policy Area:** Traveler Safety, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** ATMS

**Type:** Deployment

**Project Concept**
This project 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 Mn/DOT 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT

**Project Dependency**
This project is dependent upon additional testing of in-pavement LED roadway lighting techniques.

**Needs and Objectives Addressed**
- **Need:** TM19 – Operate in-pavement dynamic lane markings
- **Objectives:**
  - O-24 – Reduce congestion and delay
  - O-26 – Maintain smooth traffic flow

**Market Package**
- ATMS04 – Freeway Control
ID: L06

**Project Title:** Transit Vehicle Communications to Emergency Response Centers

**Timeframe:** Long Term – Year 9 and Beyond

**Transportation Policy Area:** Traveler Safety, Maintenance and Security, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** ATMS, EM

**Type:** Deployment

**Project Concept**
This project will equip bus fleets with communications systems to allow bus drivers to connect directly with emergency-response command centers during emergency situations.

**Project Champion and Stakeholder**
Project Champion: Metro Transit
Stakeholders: Local agencies, MSP, Minnesota Homeland Security and Emergency Management

**Project Dependency**
This project is not dependent upon any other projects.

**Needs and Objectives Addressed**

- **Need:** TM22 – Provide system-coordinated response to incidents
- **Objectives:**
  - O-4 – Reduce incident clearance time
  - O-15 – Reduce emergency/incident response time
  - O-16 – Enhance emergency/incident response effectiveness
  - O-27 – Reduce incident detection and verification time

**Market Package**
- ATMS08 – Traffic Incident Management System
- EM08 – Disaster Response and Recovery
ID: L07

Project Title: Expand HOT Lane Deployment in Metro Area

Timeframe: Long Term – Years 9 and Beyond

Transportation Policy Area: Twin Cities Mobility, Energy and Environment

ITS Service Area: ATMS

Type: Deployment

Project Concept
The objective of this project 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. Other areas for HOT lane deployment will be examined by Mn/DOT in future studies.

Project Champion and Stakeholder
Project Champion: Mn/DOT

Project Dependency
This project is not dependent upon any other projects.

Needs and Objectives Addressed
Need: TM26 – Operate MnPASS HOT Lanes
Objectives: O-24 – Reduce congestion and delay
O-26 – Provide smooth traffic flow
O-30 – Increase carpoolers
O-31 – Increase throughput of roadways

Market Package
- ATMS05 – HOV Lane Management
- ATMS10 – Electronic Toll Collection
- ATMS18 – Reversible Lane Management
ID: L08

**Project Title:** Enhanced Speed Monitoring Equipment

**Timeframe:** Long Term – Years 9 and Beyond

**Transportation Policy Area:** Traveler Safety, Maintenance and Security, Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

**ITS Service Area:** ATMS

**Type:** Deployment

**Project Concept**
This project 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.

**Project Champion and Stakeholder**
Project Champion: Mn/DOT
Stakeholders: MSP, Local Law Enforcement Agencies

**Project Dependency**
This project may be dependent upon Project S48 – Portable Queue Detection and Stopped Traffic Advisory.

**Needs and Objectives Addressed**
**Need:** TM40 – Monitor queue length at ramps, incidents, and work zones

**Objectives:**
- O-2 – Reduce crashes due to unexpected congestion
- O-11 – Reduce speed differential
- O-16 – Enhance emergency/incident response effectiveness
- O-24 – Reduce congestion and delay
- O-25 – Enhance safety of workers
- O-26 – Provide smooth traffic flow

**Market Package**
- ATMS19 – Speed Monitoring
- MC08 – Work Zone Management
ID: L09

Project Title: On-Board Enunciator and AVL Integration

Timeframe: Long Term – Years 9 and Beyond

Transportation Policy Area: Twin Cities Mobility, Greater Minnesota Metropolitan and Regional Mobility

ITS Service Area: APTS

Type: Deployment

Project Concept
The project 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.

Project Champion and Stakeholder
Project Champion: Transit Agencies

Project Dependency
This project is dependent upon the expansion of metro area APTS transit management systems (i.e. AVL technology) to transit agencies in Greater Minnesota.

Needs and Objectives Addressed
Need: TR10 – Provide on-board automated enunciators
Objective: O-35 – Inform traveler of travel mode options

Market Package
• APTS08 – Transit Traveler Information
Appendix A
Minnesota Statewide Regional ITS Architecture Development Process

Step 1: Get Started
The Minnesota Statewide Regional ITS Architecture process begins with a focus on relevant stakeholders ranging from transportation policy decision makers, to transportation planning, to project development. Based on the scope of the regions, in this case statewide, the relevant stakeholders and one or more champions are identified. Additionally, the personnel that will be involved are identified and the overall development effort is planned. The steps to getting started are:

1. **Identify Need** – Assess the need for the architecture and identify regional architecture boundaries. This step is complete. The Minnesota ITS Regional Architecture was developed in Minnesota in the late 1990s and was updated in 2001. As part of the planning and ITS architecture update:
   - It is necessary to determine if ITS technologies are being implemented.
   - Determine needs and services to develop ITS projects in the region.
   - Continue to build awareness statewide of the benefits of a regional ITS architecture through outreach and education. Focus on the benefits of ITS rather than the rule/policy.

   The most important reason in developing and updating Minnesota ITS Regional Architecture is that it can help to efficiently plan for and implement more effective ITS systems. It is important to have a regional architecture that complies with a federal rule or policy. However, the ultimate goal is to develop a regional architecture that can be used statewide to guide ITS implementation, and to help ensure the statewide ITS needs are integrated with statewide transportation programs (i.e. Statewide Transportation Plan, STIP, local and regional long range transportation plans, ITS Strategic Plan and other ITS documents etc.).

2. **Define Scope** – What is the general scope of the ITS architecture?
   - Review the geographic area. What cities, counties, or other special areas need to be included that was not previously part of the regional architecture.
   - Identify the timeframe the statewide architecture will address. The Minnesota ITS Planning and Architecture Updated has identified projects to be implemented over the next 0 to 4 years (short-term), 5 to 8 years (medium-term) and over 8 years (long-term).

   Information and feedback to define the scope was actively solicited from stakeholders through out the development of the Minnesota Planning and ITS Architecture Update.

3. **Identify Stakeholders** – This task identifies and engages relevant stakeholders that own or operate ITS systems, as well as other agencies that have an interest in regional transportation issues.
   - Provide educational materials that provide examples of successful ITS projects, benefits of ITS systems and ITS architecture.
   - Use working groups already in place to engage potential stakeholders and obtain feedback to identify new stakeholders.
   - Identify additional stakeholders from referrals by stakeholders already participating in the process.
To continue momentum and to keep open channels of communication, schedule ongoing meetings and/or provide a consistent mechanism of communication to/from agencies responsible for the overall transportation program. Existing examples include Minnesota Guidestar, ITS MN which sponsors many activities and events related to ITS. NCITE and ITS MN have an organized ITS Technical Committee which meets every other month with various interested stakeholders to cover ITS related topics.

4. **Identify Champions** – The key to this task is to identify one or more key persons to lead the regional ITS architecture development. In the case of Minnesota’s ITS architecture, Mn/DOT with the support of Minnesota Guidestar, has championed ITS architecture development and continues to do so. However, another key objective of this task is to continue to obtain broad-based buy in and support from stakeholders. As new ITS programs and projects are identified the following are recommended characteristics of a “program or project champion”:

- Champion must be a stakeholder, so they have a vested interest.
- If the program or project is more complex and, for example, crosses jurisdictional boundaries more on champion may be identified.
- Have an understanding of the subject (Minnesota Statewide Regional ITS Architecture) and have familiarity of the National ITS Architecture.
- Knowledge of local ITS systems and projects.
- Have high level access to resources to gain support for various regional or cross jurisdictional efforts.

**Step 2: Gather Data**
An inventory of existing and planned ITS elements supports development of interface requirements and information exchanges with ITS elements as required in FHWA Rule 940 and FTA National ITS Architecture Policy. Minnesota has a developed an ITS inventory as required by the FHWA rule. Most recently and, as part of the Minnesota ITS Planning and Regional Architecture Update the following was completed.

1. **Define Inventory** – Review of the existing Minnesota ITS Architecture inventory, as well as locating data that may have been documented since the previous ITS architecture update completed in 2001.
   - Updated and collected inventory data is included in an updated ITS inventory list per FHWA requirements.
   - The existing and revised ITS inventory was reviewed with relevant stakeholders and as necessary additional collected inventory information was obtained from the stakeholders.
   - Each ITS element is documented, at a high level, by associated organization(s), status (e.g. existing or planned), and a brief description for each element in the ITS inventory.
   - Each ITS element is mapped to the National ITS Architecture subsystems and terminators and use the National ITS Architecture to help map identify gaps and identify additional inventory to fill the gaps.

2. **Determine Needs and Services** – This step identifies regional needs and ITS services that are documented in ITS strategic plan, other ITS planning and deployment documents, long-range plans and other transportation planning documents. This information is most effectively collected from key stakeholders associated and
responsible for operation, maintenance and uses of the transportation system. Since 2006, at numerous stakeholder forums, Mn/DOT has met with and collected data from stakeholders around Minnesota to identify ITS needs and services to be planned, demonstrated and deployed into short, medium and long-range projects. Key activities related to this task include:

- Review regional needs and ITS services that may be documented in various transportation documents.
- Collect needs from stakeholders relevant to the overall transportation system.
- Document regional needs and services.
- Identify projects based on the needs and services collected from documents and stakeholder feedback.
- Tie in associated services with each element in the ITS inventory.

In summary, this step requires input from stakeholders, planning studies (e.g. transportation plans, ITS deployment plans, etc.). Review of the 20-Year Statewide Transportation Plan, long-range transportation plans, congestion management plans, safety plans etc. should be reviewed as part of this step.

3. Develop Operational Concept – This step identifies current and future stakeholder roles and responsibilities in the implementation and operation of regional ITS elements. As part of this step buy-in and verification of roles/responsibilities, laying the groundwork for interagency coordination, and future agency agreements is important. The overall process for this step follows:

- Gather existing documents that identify responsibilities in multi-agency scenarios (e.g. Incident Management Plans).
- Develop relevant operational scenarios that require cooperation among a broad array of stakeholders.
- Set up a meeting/workshop where stakeholders can walk through prepared scenarios and identify current roles and opportunities for cooperation/integration in the future.
- Document each stakeholder’s current and future responsibilities for each scenario.
- Key findings should be identified into the high level Operational Concept.

In short, the Operational Concept document for the region will provide an overview how ITS services are provided and identifies the roles and responsibilities of relevant stakeholders.

4. Define Functional Requirements – The objective of this task is to develop a high level description of the required functionality for each ITS element in the inventory. The process includes the following:

- Determination of the level of functional requirements specification that is appropriate for the region.
- Identify ITS elements that require functional requirements definition.
- Build on ITS service and operational concepts to define functional requirements, focusing on those with regional implications.
- Use the National ITS Architecture (subsystems, market packages equipment packages and functional requirements) to support the functional requirements development.
It is important to have stakeholder participation in the functional requirements development so as to accurately define the stakeholders support of the requirements that will be put on their ITS elements.

**Step 3: Define Interfaces**
This step provides detailed task descriptions pertaining to “Identifying Interconnect” and “Defining Information Flows”. Each task provides detailed process procedures, relevant resources and tools for guidance and a general description of associated outputs.

1. **Identify Interconnect** – This process identifies and documents the existing and associated procedure and ensures each interface agrees with the connections that are identified. This process will provide an accurate list of existing and planned interconnects to the region. The summary process is as follows:
   - Review existing connections between ITS elements.
   - Based on the inventory, needs and services, operational concept, and functional requirements, identify inventory elements that will exchange information.
   - Consider whether existing person-to-person connections may evolve into automated interfaces between ITS elements.
   - Document high level status for each connection, including existing and planned.
   - Connections should be reviewed with stakeholders to ensure there is agreement with the identified interfaces for their ITS elements.

2. **Define Information Flows** – This task involves identifying the information to be exchanged between elements and verifies stakeholders responsible for providing and using the information agree with the identified information exchanges.
   - Based on interconnected decisions made by stakeholders and the services, operational concept, functional requirements created in the previous step, define actual information content (i.e. information flows) exchanged on the interface.
   - Provide documentation of the high level status for each information flow, existing and planned.
   - Use the National ITS Architecture to identify potential information to be exchanged.
   - Identify supporting information flows that are not defined in the National ITS Architecture, but important to the region.

**Step 4: Implementation**
This step utilizes the regional ITS framework to define additional projects to bridge identified gaps between the Minnesota Statewide Regional ITS Architecture and regional ITS implementation. A series of staged projects, enabling agency agreements, and supporting ITS standards will support progressive, efficient implementation of ITS in the region. The following process tasks are outlined below:

1. **Define Project Sequencing** – This task identifies and creates a sequence of projects based on regional needs and project readiness. Key activities include:
   - Gather existing project sequence information from documented implementation plans.
   - Define ITS projects for the region in terms of the regional ITS architecture including defining short term projects and locations.
   - Identify project dependencies between ITS projects based on the inventory, functional requirements, and interfaces. Identify projects that that must be implemented before other projects can begin.
• Develop an efficient project sequencing process that stakeholders agree with and takes the feasibility, benefits and dependencies into account.

As with the other steps, project sequencing should take into account stakeholder input as well as review of existing planning documents. Focus should be on short, medium and long term planning decisions.

2. Develop List of Agency Agreements – Review and research each agency’s records to determine if there agreements in place that can or should be amended to include specific ITS operations. If an agency agreement needs to be created the following is recommended:
• When possible, use existing standard agreements for operations, integration, funding etc.
• Evaluate what kind of agreement is needed (e.g. handshake agreement, MOU, interagency agreements etc.) and build consensus with each of the stakeholders involved.

Typically, agreements take time to execute so it is imperative to build consensus early with simple agreements such as MOUs while final agreements are being developed.

3. Identify ITS Standards – Identification of ITS standards that support interfaces in the regional ITS architecture are often not understood by stakeholders involved, and therefore educating stakeholders of ITS standards as it relates to implementation of an ITS project is important. A summary of this task process is as follows:
• Using information flows identified in Step 3, identify relevant ITS standards for the region.
• Assess the ITS standard maturity and develop agreements for use of interim standards when determined necessary.
• Identify other regional and/or statewide standards that might apply.

As previously noted, it is important to educate stakeholders on the importance of ITS standards, especially with respect to cost, risk, and interoperability issues both within the region and when connecting with other ITS architecture regions. Also, work with stakeholders to build regional commitment to consider and deploy ITS standards-conformant system interfaces.

Step 5: Use the Regional ITS Architecture
Use of the regional ITS architecture is a culmination of the previous steps and as briefly outlined below this step shows how incorporate and support ITS services in transportation planning, support programming, budgeting capital planning, and support project implementation.

1. Support Transportation Planning – Fully incorporate ITS elements into the region’s transportation and planning programming processes, and support ITS projects that fully consider the integration opportunities defined in the regional ITS architecture.
• Long Range Planning: The Minnesota Statewide Regional ITS Architecture supports long range planning efforts by promoting increased stakeholder participation and promoting system and inter-jurisdictional integration.
• ITS Strategic Planning: Outputs of the Minnesota Statewide Regional ITS Architecture serve as the basis for ITS planning, with additional effort required to...
define issues such as funding, system management and operation, and regional technology choices.

- Other Planning Activities: The Minnesota Statewide Regional ITS Architecture supports other planning activities such as congestions management, safety planning, freight planning, security planning and operations planning.


- Transportation Improvement Programming: The Minnesota Statewide Regional ITS Architecture supports the selection of projects identified in programming/budgeting documents through its projects definition and sequencing recommendations.
- Capital Planning/Budgeting: Projects from the Minnesota Statewide Regional ITS Architecture will require agency funds to be injected into the capital planning/budget process.

3. Support Project Implementation

- The Minnesota Statewide Regional ITS Architecture supports key system engineering analysis activities.

In summary, the Minnesota Statewide Regional ITS Architecture fully incorporates ITS elements into regional, statewide, agency plans and programs/budgets. Programming documents and capital plans identify efficient sequences that reflect ITS project dependency and sequencing recommendations.

Step 6: Maintain the Regional Architecture

This step provides an overview of responsibilities and procedures to be considered as the Minnesota Statewide Regional ITS Architecture is used and maintained over time. As noted below development and implementation procedures and responsibilities need to be in place to maintain the regional ITS architecture:

- Determine who will be responsible for architecture maintenance. What group or individuals will be responsible for maintaining the architecture? Who will support the effort, and who will have oversight for the maintenance effort?
- What outputs/documents will be maintained? Will only the database be maintained or will graphic representations be maintained as well?
- Define the change management process.
  - How will changes be introduced and who will introduce the changes?
  - Who will evaluate the changes for inclusion?
  - What group will review the change recommendations and make the decisions on what changes are accepted and which are not?
- Develop an Architecture Maintenance Plan. This plan will document the process and provide a framework for the architecture maintenance activity.
- Maintain the architecture plan. Identify, analyze, approve, incorporate, and communicate changes to the ITS architecture. Refine the Maintenance Plan over time so that it continues to accurately reflect the regions architecture maintenance process.
Appendix B
Minnesota Statewide Regional ITS Architecture
and Systems Engineering Checklist for ITS Projects
FHWA Final Rule 940 and FTA National ITS Architecture Policy

For all ITS projects or projects with an ITS component, an Architecture Compliance Checklist must be completed and submitted with the Environmental Document. For questions regarding the completion of this checklist contact Rashmi Brewer, P.E. - Mn/DOT Office of Traffic, Safety and Technology at 651-234-7063 or e-mail at Rashmi.Brewer@dot.state.mn.us.

SECTION 1 - Project Information

1.1 CONTACT PERSON (e.g. PROJECT MANAGER)
Name: _______________ Title: ___________ Agency: ___________
Signature: _______________ Date: ___________
Telephone: _______________ Email: ___________

1.2 PROJECT TITLE

1.3 PROJECT NUMBER
1.3A Federal Project Number: ___________
1.3B State/Local Project Number: ___________

1.4 PROJECT LOCATION AND DESCRIPTION OF PROPOSED WORK

1.5 NEEDS ASSESSMENT
Please describe the problem statement, goals and objectives of the project.

How were these needs identified? (Check appropriate box(es))
☐ Internal Assessment ☐ Stakeholder Involvement ☐ Regional ITS Architecture
☐ Other ITS Planning or Technical Documents ☐ Technical Reviews or other studies
If other documentation was used as a reference, please identify it here:

1.6 NATURE OF WORK (Check appropriate box(es))
☐ Scoping ☐ Design ☐ Software/Integration ☐ Construction ☐ Operations & Management
☐ Evaluations ☐ Planning ☐ Equipment Replacement ☐ Research & Development
☐ Others (Please Specify)
1.7 RELATIONSHIP TO OTHER PROJECTS AND PHASES

Please list any construction and tied projects.

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SECTION 2 – Regional Architecture Assessment

2.1 PORTIONS OF REGIONAL ARCHITECTURE BEING IMPLEMENTED

- Archived Data Management (AD)
- Public Transportation (APTS – Advanced Public Transportation Systems)
- Traveler Information (ATIS – Advanced Traveler Information Systems)
- Traffic Management (ATMS – Advanced Traffic Management Systems)
- Vehicle Safety (AVSS – Advanced Vehicle Safety Systems)
- Commercial Vehicle Operations (CVO)
- Emergency Management (EM)
- Maintenance & Construction Management (MCM)

2.2 INVENTORY ELEMENTS IN MINNESOTA STATEWIDE REGIONAL ARCHITECTURE INCLUDED BY THIS PROJECT (Refer to Sections 4.3 and 4.4 of Volume 9 document for a list of projects included in the architecture)

Project is included in the Minnesota Statewide Regional ITS Architecture: □ Yes  □ No
If “No”, please list ITS elements included in this project.

2.3 INTERFACE IMPACTS (I.E. DATA EXCHANGES) DUE TO PROJECT

Turbo Architecture – “Market Package Report” □ Attached
Turbo Architecture – “Interconnect and Flow Diagrams/Reports” □ Attached
2.4 DOES THE DESIGN INCORPORATE NATIONAL ITS STANDARDS?

☐ No  ☐ Yes

If "Yes", please specify what ITS Standards are being used:

Turbo Architecture - “Standards Report” ☐ Attached
Information on ITS Standards can be found at http://www.standards.its.dot.gov/default.asp.

2.5 CHANGES RECOMMENDED TO MINNESOTA STATEWIDE REGIONAL ARCHITECTURE

☐ No  ☐ Yes

If “Yes”, please specify and provide detail:

SECTION 3 - Project Matrix

3.1 PROJECT MATRIX - DOCUMENTATION

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SECTION 4 - Procurement

4.1 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:
 SECTION 5 - Operations and Management

5.1 STAFFING AND RESOURCES NEEDED FOR OPERATIONS AND MANAGEMENT

5.2 ESTIMATED ANNUAL OPERATIONS AND MANAGEMENT COSTS

 SECTION 6 - Schedule

6.1 EXPECTED PROJECT COMPLETION DATE

 SECTION 7 - Agreements

7.1 IS AN INTERAGENCY AGREEMENT NEEDED FOR THIS PROJECT?
☐ Existing  ☐ To be Developed  ☐ No
Please describe: (Agency name, agreement number, and nature of contract)

 SECTION 8 - Approval

APPROVAL

Name: _______________  Title: ___________  Agency: ___________
Signature: ____________  Date: ___________
Telephone: ____________  Email: ___________