Minnesota Department of Transportation District 4

Intelligent Transportation Systems (ITS) Scoping Study and Implementation Plan

April 2004
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Executive Summary

As a result of the 1997 Minnesota Department of Transportation (Mn/DOT) Statewide Intelligent Transportation System (ITS) Strategic Plan, the primarily rural districts in the state were instructed to conduct ITS scoping studies. The major goal of these studies was to develop a plan for the implementation of various ITS technologies in each district. The studies offered an opportunity for local stakeholders to identify important transportation problems that could be addressed with advanced communications and other technologies.

Mn/DOT District 4, which includes 12 counties in west-central Minnesota, undertook this study in the summer of 2003. Through a series of meetings and workshops, representatives of Mn/DOT, Minnesota State Patrol, city and county engineering departments, local law enforcement agencies, regional planning agencies, and other local stakeholders worked together to develop a prioritized list of potential ITS projects, and a proposed implementation plan.

The study process followed a logical progression, with strong input from the local stakeholders at every step. First, a review of existing conditions was conducted in order to help the group identify transportation problems and issues. These issues were ranked by the stakeholders, in order to determine which issues were of most concern in the local area. The most important issues included:

- Safety
- Recurring and seasonal congestion
- Construction
- Weather
- Emergency response

Next, a series of possible solutions were identified and prioritized. In general, this exercise indicated which types of solutions were favored for implementation. The favored solutions included:

- Dynamic message signs (DMS)
- Highway – rail crossing safety and alert systems
- Automatic anti-icing systems
- Information dissemination systems
- Work zone safety systems

After identifying the basic types of solutions, the stakeholders developed prioritized lists of locations for each type of ITS solution. Finally, the individual projects were grouped into categories for short, intermediate, and long-term deployment. The results are shown in the table on the following two pages.

This plan should serve as a guide for the deployment of ITS solutions in Mn/DOT District 4. The projects recommended in the plan were selected and prioritized by local transportation stakeholders with specific expertise in transportation issues in the region. Intelligent transportation systems are simply tools that these experts can use to help improve the safety and efficiency of the transportation network in Mn/DOT District 4.
<table>
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<tr>
<th>Project #</th>
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<td>- WB I-94 in Moorhead; EB and WB I-94 in Fergus Falls; EB and WB I-94 in Alexandria; WB USTH 10 in Detroit Lakes</td>
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<td>Portable Traffic Management System [5]</td>
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**Notes:**
[1] Please refer to project descriptions in Section 5.2 for more detailed descriptions
[2] Costs will depend on results of Highway-Rail Crossing Safety System Study (Project 3.1)
[3] May be included with USTH 10 improvement project in 2006 or 2007
[4] Private company could pay for kiosks and charge user fees for public internet access
[5] PTMS may be borrowed from other districts at little or no charge
1.0 Introduction

1.1 Background

The Minnesota Department of Transportation (Mn/DOT) has long been a leader in the deployment of intelligent transportation systems (ITS). ITS simply refers to the use of advanced communications and technologies to improve the safety and efficiency of the transportation systems.

At first, most of the ITS deployments were focused on urban areas, including the Minneapolis / St. Paul metropolitan area in Minnesota. In 1997, Mn/DOT adopted its Statewide ITS Strategic Plan to guide ITS initiatives throughout greater Minnesota. As a result, many of the primarily rural districts in Minnesota were instructed to conduct an ITS Scoping Study, including District 4. The goals of the study include:

- Identify and prioritize ITS needs in District 4 area
- Identify possible ITS solutions
- Determine planning level cost estimates
- Develop a high level staged implementation plan
- Develop high level Turbo Architecture schematics for ITS solutions in accordance with National ITS Standards

District 4 encompasses a large area of west central Minnesota, including the counties of Becker, Big Stone, Clay, Douglas, Grant, Mahnomen, Otter Tail, Pope, Stevens, Swift, Traverse, and Wilkin. The district contains over 3600 lane miles of state and federal highways. The district also borders North Dakota, including the city of Fargo, which have already deployed some ITS projects. Representatives from state, regional, and local agencies in both Minnesota and North Dakota were heavily involved throughout the study. Coordination with agencies both within Minnesota and in North Dakota was an integral step to ensure the most efficient deployment of ITS for District 4.

The Mn/DOT District 4 ITS Scoping Study began in the summer of 2003, and was completed in March of 2004.

1.2 Study Process

Figure 1.1 below illustrates the process that was undertaken to complete the study.
1.3 Goals and Objectives

The goals and objectives for the ITS scoping study were identified early in the process in order to guide the committee through the tasks of prioritizing transportation issues and problems, and determining potential solutions.

*Increase operational efficiency and capacity of the transportation system*
  - Increase operational efficiency
  - Increase speeds and reduce stops
• Reduce operating costs of the infrastructure

**Enhance personal mobility, convenience, and comfort of the transportation system**
• Reduce travel time and cost
• Increase travel time reliability
• Improve safety and personal security

**Improve the safety of the transportation system**
• Reduce number and severity (cost) of accidents
• Reduce injuries and fatalities

**Enhance the communications between transportation and emergency response agencies**
• Increase sharing of incident / congestion information
• Reduce information-gathering costs
• Increase awareness of available information
2.0 Existing Conditions and Transportation Facilities Inventory

This section of the report gives an overview of some of the existing conditions and facilities on the transportation system in the district. This information was presented to the committee members and stakeholders, and was used as a basis to discuss the transportation issues and problems in the district that might be addressed with ITS solutions.

2.1 Traffic Counts / ADT

Mn/DOT has a series of traffic counts throughout District 4. The date of the counts varies by location, from 1999 to 2002. Average Daily Traffic (ADT) counts have been obtained for the following groups:

- Cities Under 5000
- Cities Over 5000
- County Trunk Highways
- General Highways

There are also two statewide maps available. The first shows ADT for major highways in the state from 2002. The second map is a forecast of projected 20-year cumulative Equivalent Single Axle Loads (ESALs).

Finally, there is an additional map of traffic count locations within District 4, which indicates the location and type of counts and counting equipment, such as automatic traffic recorders (ATRs) and weigh-in-motion (WIM) scales.

These counts and maps are available on the resource CD-ROM that is available with this report.

As may be expected, the highest ADTs are found on I-94 near Moorhead, Fergus Falls, and Alexandria; and USTH 10 in Moorhead and Detroit Lakes. Both of these facilities are multi-lane divided highways that run through or near the largest cities in the district. Some of the peak ADT counts in the district include:

(ADT rounded to nearest thousand vehicles)

- 50,000, on I-94 near the Red River bridge connecting Moorhead and Fargo, ND
- 25,000 on USTH 10/75 in Moorhead
- 21,000 on USTH 75 near I-94 in Moorhead
- 18,000 on MNTH 29 in Alexandria
- 14,000 on USTH 10 in Detroit Lakes

2.2 Crash Data

Crash data for a three-year time period from 1999 to 2001 was obtained. The data was contained in two databases: one for intersections, and one for highway segments. The databases contain information about the number and severity of accidents, costs, rank, ADT on the facility, control method at intersections, and the number of injuries and fatalities. Each of these databases
provides information for state and federal highways only, and does not include information for county and local roads, except for intersections of either a state or federal highway with a county highway or local road.

The first database contains information about crashes at intersections from 1999 to 2001. The overall statewide database covers more than 2400 intersections, which includes 124 intersections in District 4. Six of the intersections in District 4 are among the 200 highest crash cost intersections in the state, as ranked by total cost. Those six intersections include:

(total cost and statewide rank in parentheses)
- USTH 10 & MNTH 32 in Hawley ($1,588,000; #31)
- USTH 75 & CSAH 12 / CR 74 in Moorhead ($1,362,000; #58)
- USTH 10 & S Jct USTH 75 in Moorhead ($1,143,000; #92)
- USTH 59 & N Jct MNTH 34 in Detroit Lakes ($1,059,000; #108)
- MNTH 27 & S Jct MNTH 29 in Alexandria ($997,000; #121)
- USTH 10 & 3rd St in Moorhead ($972,000; #124)

An overall examination of the top 20 highest crash cost intersections in District 4 (as ranked by total cost) reveals the following information:

- Five are in/near Moorhead
- Eight are in/near Alexandria (all on MNTH 29)
- Three are in/near Detroit Lakes
- Half are on USTH 10, 59, or 75

Although almost all of the highest crash cost intersections are in or near the three largest cities in the district, the highest cost intersection (USTH 10 and MNTH 32) is in a rural location. Although the crash rate at that intersection is relatively low compared to others on the list, the total cost is high because of a significant number of injuries and fatalities. This should not be surprising, due to the high speeds along USTH 10 at this location. Fortunately, the intersection will be improved with a project to provide an interchange with grade separation.

The second database contains crash data for highway segments from 1999 to 2001. This statewide database covers more than 2600 segments, 316 of which are in District 4. Eight of the segments are among the highest crash cost segments 200 in the state (as ranked by crash cost per mile), and include the following:

(crash cost per mile and statewide rank in parentheses)
- USTH 10 near Red River / border with N.D. in Moorhead ($4,661,215; #27)
- MNTH 210 between Fergus Falls & I-94 ($3,497,143; #45)
- MNTH 29 south of 3rd Ave in Alexandria ($2,954,501; #64)
- MNTH 29 in downtown Alexandria ($2,241,910; #117)
- USTH 75 south of USTH 10 in Moorhead ($2,022,684; #137)
- MNTH 79 near USTH 59 in Elbow Lake ($1,733,333; #178)
- USTH 59 in Detroit Lakes ($1,628,319; #193)

An overall examination of the top 20 highest crash cost highway segments in District 4 (as ranked by cost per mile) reveals the following information:

- Seven are segments of USTH 10
- Three of the worst six are on MNTH 29 in Alexandria
• There are no segments of I-94 in the top 20; the only segment of I-94 ranked in the top 50 is a 3.1 mile segment in Moorhead, which is ranked #25

This data shows that the most dangerous segments are often not the highest speed, highest volume facilities. This also confirms that the section of MNTH 29 through Alexandria has significant crash problems, and should be investigated further.

2.3 Traffic Signals

MnDOT currently controls 55 traffic signals in District 4. Figure 2.1 below lists those intersections, including the location and information about the controller and detector types.
<table>
<thead>
<tr>
<th>CITY</th>
<th>TH</th>
<th>LOCATION</th>
<th>CONTROLLER</th>
<th>CMU</th>
<th>#LS</th>
<th>DET. TYPE</th>
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<td>Main Ave. - ramps</td>
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<td>FT</td>
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</tr>
</tbody>
</table>

Figure 2.1 – Mn/DOT Traffic Signals in District 4

Out of these 55 intersections, 10 are ranked among the 20 highest crash cost intersections in the district. In summary:

Mn/DOT District 4 ITS Scoping Study 9 April 2004
Six are on MNTH 29 in Alexandria
Three are on USTH 10; two in Moorhead and one in Detroit Lakes
One is on USTH 75 in Moorhead

These statistics simply show that there are crash problems at both signalized and unsignalized intersections that need to be addressed. The fact that the stretch of MNTH 29 in Alexandria has significant crash problems at many signalized intersections indicates the need to explore possible ITS solutions, such as an integrated signal system.

2.4 Traveler Information

The main source of information available to travelers in the district is through the Minnesota 511 system. Travelers can access the information by dialing 511, or by visiting the 511 web site at http://511mn.org. Information available through the 511 system includes:

- Critical Incidents
- Road Conditions
- Roadwork and Construction Activities
- Weather
- Commercial Vehicle Permit Requirements and Restrictions

Figure 2.2 below is a screenshot of the 511 website, focused on District 4:
Figure 2.2 – Image of Mn/DOT 511 Traveler Information Web Site
2.5 **Weather Information / RWIS**

Weather information in the district is primarily collected by two systems: the Automated Weather Observing System (AWOS) stations at six airports; and the Road Weather Information System (RWIS) stations at nine roadside locations throughout the district.

The AWOS stations measure and provide the following information:

- Air temperature
- Relative humidity and dew point
- Wind speed and direction
- Precipitation type and intensity
- Visibility

The RWIS stations measure and provide the following information:

- Pavement surface condition
- Surface temperature
- Subsurface temperature
- Air temperature
- Relative humidity and dew point
- Wind speed and direction
- Precipitation type and intensity
- Visibility
- Photo snapshot of current conditions (at some locations)

The web site [http://www.rwis.dot.state.mn.us](http://www.rwis.dot.state.mn.us) may be used to access the information for both the RWIS and AWOS stations. Figure 2.3 below shows an example of the website, focused on available weather information for District 4.
Figure 2.3 – Image of Mn/DOT RWIS Information Web Site
2.6 Transit Systems

The following municipalities, counties, or regions operate transit systems in District 4:

- City of Moorhead (coordinated with Fargo Metro Area Transit)
- City of Benson
- Clay County
- Becker County
- Mahnomen County Heartland Express
- City of Morris
- Grant County
- City of Pelican Rapids
- Rainbow Rider (Douglas, Pope, Stevens, and Traverse County)

Details of the transit systems may be found in the documents “2002 Minnesota Transit Report: A Guidebook to Minnesota’s Public Transportation Network” and “Greater Minnesota Public Transportation Plan”, which can be found on the resource CDROM available with this report.

2.7 Activity Centers and Special Events

District 4 includes five cities with a population of 5000 people or greater: Moorhead, Detroit Lakes, Alexandria, Morris, and Fergus Falls. Moorhead is the largest city in the district, with a population of over 32,000. Fargo (N.D.) has a population of over 90,000, and borders Moorhead on the Red River. The Fargo (N.D.) – Moorhead area has numerous special events and festivals, including large events at the Fargo Dome, which draw people from the region in both states.

The entire area is also a significant tourist destination, especially in the summer months. Memorial Day, July 4th, and Labor Day weekends are especially crowded, and can result in significant traffic problems throughout the district. In particular, special events such as WE Fest in Detroit Lakes can draw upwards of 20,000 people per day to an area with a population of less than 10,000. Many of the major transportation issues and problems can be attributed to tourism and special events.

2.8 Railroads

Figure 2.4 below illustrates the railroad lines throughout Minnesota, and the approximate number of trains that run daily across selected segments. The Burlington Northern – Santa Fe (BNSF) line that primarily runs east-and-west across the northern part of District 4 carries up to 45 trains per day in most areas, with greater volumes in the Moorhead area.
Minnesota Train Volumes
(Number of Trains Per Day)
N/W = Number Per Week
1998 to 2000 Counts

- **Minnesota Northern**
- **Canadian Pacific Railroad**
- **Burlington Northern Santa Fe**
- **Otter Tail Valley Railroad**

Figure 2.4 – Railroad Map and Train Volumes
3.0 Related ITS Activities

Minnesota and Mn/DOT have been on forefront of ITS development over the years. In particular, the Twin Cities area has been a leader in the deployment of traffic management and traveler information technologies, such as ramp metering, traffic management centers, and dynamic message signs.

However, not all of the deployment has been focused on the urban areas. Many activities have been proposed or installed in rural areas throughout the state, either as stand-alone components, or as part of statewide initiatives. Examples of ITS activities and deployments in rural areas of Minnesota include:

- 511 Traveler Information (phone and internet-based)
- Road / Weather Information Systems (RWIS)
- Transportation Operations and Communication Centers (TOCC)
- Commercial Vehicle Information Systems and Networks (CVISN)
- Advanced Rural Transportation Information Coordination (ARTIC)
- Automated Road Closure Gates

The overall ITS program in the state is called Minnesota Guidestar. More information is available on the internet at http://www.dot.state.mn.us/guidestar/index.html.
4.0 Problems and Needs Assessment

A major step in any study or planning process is to discover, discuss, and prioritize a list of needs and problems. For a transportation study, issues to consider include crashes and other safety factors, congestion, traveler information needs, transit and commercial vehicle issues, emergency services, etc. The examination of existing conditions and the transportation facilities inventory helped to identify potential needs and issues in the district. However, direct input from transportation stakeholders is the best way to find out about the needs of the transportation system.

On Monday, August 18, 2003, a Stakeholders’ Workshop was held in Detroit Lakes. The primary goals of the workshop were to review the inventory, discuss and prioritize a list of transportation issues, walk through a few scenarios, and to identify any additional problem areas that might be addressed with ITS solutions.

4.1 Prioritization of Transportation Issues

The first group exercise of the workshop allowed the participants to rank general transportation problem areas in the district. A list of 43 categories was provided, which included issues such as recurring congestion on highways, lack of available traveler information, transit service area, emergency response times, and safety. Each participant was asked to pick the ten categories he or she felt were the most important issues in the district, and were given ten small colored stickers. They were also asked to break down their ten selections as follows: the two most critical (red dots), the two next most critical (yellow dots), and six other important issues (green dots). Each category was represented by a piece of paper attached to the wall, and participants were asked to place their dots on the ten categories they felt were most important, following the guidelines.

After the exercise, the sheets on the wall were collected and the results were tabulated. The scores were determined by giving three points for each red dot, two points per yellow dot, and one point per green dot. All 43 categories were then ranked based on highest score. The full results are shown in a table at the end of these meeting minutes. In summary, the issues identified as being the most important included safety, seasonal and recurring congestion, construction, weather, and emergency response time. Figure 4.1 below illustrates the results of the prioritization exercise.
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<thead>
<tr>
<th>Transportation Issue</th>
<th>Score</th>
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<tbody>
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<td>Safety (Hwy)</td>
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<tr>
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<td>Congestion - Seasonal (Hwy)</td>
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<td>Safety (Arterial)</td>
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</tr>
<tr>
<td>Construction Projects (Hwy)</td>
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<td>6</td>
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<tr>
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</tr>
<tr>
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<td>10</td>
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<tr>
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<td>Lack of Weather Condition Information</td>
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</table>

Figure 4.1 – Stakeholders’ Prioritization of Transportation Issues
4.2 Scenarios Exercises

In this exercise, participants were split into three groups. Each group was presented with the same three scenarios: an incident (bus accident) on the interstate, a hazardous weather situation (strong winter storm), and a large special event (WE Fest). Each scenario presented a description of a typical event, and asked questions about how different agencies respond to the events. All groups were asked to go through all three scenarios and answer the questions, but each group was give one scenario for them to focus on. The groups were given an hour to complete the exercise. Afterwards, each group presented their results from one of the scenarios, and members of the other groups were allowed to provide additional comments. The results have been summarized for each scenario, and are attached in the appendix of this report. These findings aided in the process of determining potential ITS solutions and developing a high-level ITS architecture.

4.3 Additional Problem Areas

These issues were discussed after the completion of the Scenarios Exercises.

Railroads: There is a significant amount of train traffic in the district. For example, one busy railroad line in Moorhead sees 67 trains per day. These trains can cause significant queues at grade crossings, and there is often little space for vehicle storage, especially when heavy trucks are present.

Recurring Urban Congestion: There are problems where the urban arterials cross the interstates in the Fargo – Moorhead area. The group would like to see better timed, traffic responsive signals at these locations. Also, they’d like to explore the possibility of using dynamic message signs to provide alternative route information into/from the urban area. The urban area is growing fast, and the Red River and interstates (I-94 and I-29) present additional challenges for traffic flow into and out of the city centers.

Seasonal Congestion: Traffic in the summertime, especially on Friday evening and Sundays, can be heavy due to tourist traffic. USTH 10 is very busy, and it is often hard for traffic (including heavy trucks and farm equipment) to find acceptable gaps to cross. The intersections of USTH 10 with MNTN 32 and MNTN 9 are significantly affected, although Mn/DOT plans to improve the intersection of 10&32 with an interchange in 2006. There is also a general lack of passing opportunities on many highways in the district. Travelers in Minnesota have an expectation be able to travel 60-65 mph on most highways.

Safety: This part of Minnesota can be severely impacted by weather events, and there is a need to inform the public of hazardous weather situations. For example, the state could provide more information on dynamic message signs in key locations. In rural areas, where there is a general lack of congestion, accidents at unsignalized intersections are the key concern. Often, when drivers approach a stop sign in a rural area, there is no cross traffic, and they may become complacent. This region has a significant problem with drivers failing to stop at stop signs, thereby causing accidents, many of which result in severe injuries or fatalities.
5.0 Project Descriptions and Implementation Plan

This chapter begins with a description of the process that was undertaken to select, prioritize and refine potential projects. It also includes the proposed deployment schedule, project descriptions, and discussion of possible funding sources and opportunities for integration with other districts.

5.1 Project Selection

The project selection process consisted of two major steps: the preliminary selection and ranking (at meeting on September 30, 2003); and project development and refining (workshop on December 9, 2003).

The September meeting was used to identify potential projects and determine an initial ranking. There was some discussion of possible locations for different projects, but the major goal was simply to determine which ITS solutions were most appealing to the committee members.

The December workshop offered a chance for the committee to further refine the prioritization, scope, and locations of the projects. The attendees looked at each ITS solution, and tried to determine the best locations for deployment. The locations were then prioritized within each list, to show which specific sites should be looked at for short-term, mid-term, and long-term projects.

The following two sections (5.11 and 5.12) discuss the procedures and results of the project selection process in more detail.

5.1.1 Ranking of Potential ITS Solutions

On September 30, 2003, a meeting of the District 4 ITS Steering Committee was held to begin the project selection process. The meeting included discussion of ITS User Services and Market Packages, including how they related to the transportation issues that were prioritized at the Stakeholders’ Workshop.

The committee was then presented a list of potential ITS solutions. The solutions were described in more detail, and discussed by the committee members. Once this discussion was complete, the members were asked to rank the potential solutions, in an exercise similar to the transportation issues prioritization at the Stakeholders’ Workshop. Sheets of paper were hung on the walls, each one labeled with a potential ITS solution. There were a total of 35 ITS solutions to choose from. Each participant was given 15 colored stickers (5 red, 5 yellow, 5 green), and was asked to rank his or her top 15 projects, in groups of five. The participants voted by placing the colored dots on the sheets corresponding to the solutions he or she would like to see undertaken in the district. The red dots were used for the five most important projects, yellow for numbers six through ten, and green for numbers eleven through fifteen. After the exercise, the results were tabulated (red = 3 points, yellow = 2 points, green = 1 point), and are shown in Figure 5.1 below:
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<tr>
<th>Potential ITS Solution</th>
<th>Score</th>
<th>Rank</th>
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</thead>
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<td>Highway-Rail Crossing Safety Systems</td>
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<td>Information Dissemination System</td>
<td>31</td>
<td>3</td>
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Figure 5.1 – Ranking of Potential ITS Solutions

5.1.2 Project Development Workshop

Based on the prioritization of potential ITS solutions from the September meeting, an initial list of projects was prepared for the committee. This list was derived from the top 15 ITS solutions as prioritized by the committee at the previous meeting.

On December 9, 2003, the committee reconvened to further refine the project list. The two major goals of the meeting were to determine the preferred scope and locations for the projects, and to make any adjustments to the priority order. For example, the initial ranking indicated that automatic anti-icing systems were, in general, a higher priority than integrated signal systems.
This workshop not only gave the committee a second chance to confirm this, but to also rank which specific bridge locations were most important to deploy the anti-icing systems on.

Based on the input from committee members at this meeting and in follow-up contacts, the final project list was developed. These projects, the associated cost estimates, and the proposed deployment strategy are discussed in the following sections.

5.2 Project Descriptions

This section describes the proposed projects in more detail, including potential benefits, and estimated costs for deployment, operations, and maintenance. The projects are listed in order of priority within the immediate, short, or medium term groups. Some projects may occur in multiple terms, and are listed in the first term that they fall under.

Short Term Projects (0-2 Years)

Project 1 - Permanent Dynamic Message Signs (DMS)

Project Description:

DMS provide text messages via a large lighted display, which can be varied in width and height. The text the signs display can be programmed from a remote location using a wireless transmitter or phone line and modem. DMS can have either a permanent or portable installation. Either way, DMS are useful in disseminating traveler information.

Permanent DMS can be mounted as overhead signs or on overpasses. They are normally hard-wired with a power supply and telephone line. Permanent signs are generally used for incident management and for providing traffic information such as travel times. They can also be used as part of an ice, fog, or flood detection system.

In general, for District 4, the permanent signs would be used to provide information about incidents, special events, hazardous weather, and road closures. They would not be used to provide travel times. The signs would likely be controlled by the District 4 TOCC. As part of a separate project, one permanent DMS is being installed on WB I-94 just east of MNTH 336. There is also a permanent DMS for EB traffic on I-94 in Fargo, ND, which will provide traveler information for motorists headed into Moorhead and other locations in Minnesota, as well as Fargo. There is “dark” fiberoptic cable along I-94 that could potentially be used to communicate with the permanent signs along that route.

The following is a prioritized list for future permanent DMS installations:

1. WB I-94 in Moorhead, between 20th St and USTH 75 interchanges
2. EB and WB I-94 in Alexandria
3. EB and WB I-94 in Fergus Falls
4. WB USTH 10 in Detroit Lakes

There are also a few grade separations in the Moorhead area that are subject to flooding. A permanent DMS may be used to warn drivers of a flooding hazard, possibly as part of an
automatic flood warning system. There are also some less costly alternatives, such as using a static sign with flashers that are activated in case of a flood.

**Expected Benefits:** Improved safety for drivers, maintenance, and emergency response workers; improved traveler information; reduction in vehicle delay

**Estimated Deployment Costs:** $40,000 - $80,000 per permanent DMS

**Estimated Annual Operations and Maintenance Costs:** $2,500 per DMS
Figure 5.2 – Map of Existing and Proposed DMS Installations
**Project 2 - Portable Dynamic Message Signs**

**Project Description:**

Portable DMS offer special advantages. They are lower in cost (in terms of installation costs and the fact that a supporting structure is not necessary) and may be shared between agencies. Due to their mobile nature, they may be moved around to various locations as the need arises. Portable DMS can be mounted on a trailer or a vehicle. They can be powered by a battery or by solar power and operated by remote cellular control from a PC or by hand held controller input. They are generally used for special events, work zones, and incident management. They can also be used at a permanent location.

Mn/DOT currently has four portable DMS in the district (stationed in Alexandria, Dilworth, Fergus Falls, and Detroit Lakes. They may update one of the older signs, and would like two more portable DMS. They would often be used to inform drivers that I-94 and/or USTH 10 are closed, typically during severe winter weather. EB USTH 10 between Moorhead and Dilworth would be a great location for a sign for when the highway is closed on the east side of Dilworth.

**Expected Benefits:** Improved safety for drivers, maintenance, and emergency response workers; improved traveler information; reduction in vehicle delay

**Estimated Deployment Costs:** $25,000 per portable DMS

**Estimated Annual Operations and Maintenance Costs:** $2500 per DMS

---

**Project 3.1 - Highway-Rail Crossing Safety System Study**

**Project 3.2 - Highway-Rail Crossing Safety System Deployment**

**Project Description:**

This project would consist of two phases: study and deployment. A detailed study of preferred technologies and potential locations should be performed first. Deployment of the equipment would occur based on the results of the study.

The main east-west BNSF line that parallels USTH 10 through Detroit Lakes and Moorhead has 60-70 trains per day. All crossings that are not gated could be candidates for “low cost active warning” or other safety systems. Most of the locations with crossings of State Trunk Highways are already grade-separated or have other safety systems, so the focus would primarily be on crossings with county roads or city streets.

A variety of technologies have been deployed and tested to detect approaching trains and to provide real-time information. This information can be used to reduce the potential for vehicle-train collisions and to reduce the delay experienced by emergency and transit vehicles at...
crossings. For example, pilot studies have equipped school buses with receivers and display devices capable of announcing the presence of a train by picking up a signal sent out by the intersection. Similar reception devices are considered solutions for emergency vehicles and dispatch centers so they may be alerted to the approaching trains and make provisions for finding crossing points at bridges or underpasses in order to avoid the at-grade crossings.

There are two types of traditional warning systems for rail crossings either passive (e.g., the crossbuck sign) or active warning systems (e.g., flashing lights and gates). These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces can be performed and detected abnormalities reported to both highway and railroad officials.

An example of a project that is currently being deployed in Minnesota is the Mn/DOT Low-Cost Active Warning for Low-Volume Highway/Rail Intersections Test Project, which is being administered by Mn/DOT’s Office of Traffic, Security, and Operations (OTSO). This project is designed to reduce costs for active warning systems at low volume intersections. The system was installed at thirty low-volume crossings on the TC&W corridor between the Twin Cities and South Dakota. Crossings are located in the following counties: Carver, Chippewa, McLeod, and Renville counties. The system uses GPS receivers mounted on trains to continuously monitor the location of trains. A wireless transmitter on each train sends signal to activate the warning systems that include flashing lights at railroad crossing sign as well as a second set of flashers on signs or VMS in advance of intersection at some intersections. However, BNSF has expressed some concerns about the practicality of installing transmitters on their nationwide fleet of locomotives, which are not captive to the area. These and other concerns would need to be addressed in the study phase of this project.

**Expected Benefits:** Advanced warning for drivers; reduction in train – vehicle collisions; “Low Cost Active Warning System” could be deployed at crossings that currently have no or passive warning systems, at a considerable cost savings versus traditional active warning systems

**Estimated Deployment Cost per Unit:** $100,000 - $150,000 for a traditional active warning system, approximately $20,000 - $25,000 for the Low Cost Active Warning System

**Estimated Annual Operations and Maintenance Costs:** $10,000 - $15,000 for traditional; $2000 - $2500 for low cost

**Project 4 - Automatic Anti-Icing Systems**

**Project Description:**

These systems involve the use of spray nozzles mounted either on the bridge wall or pavement to distribute a supply of chemicals to the pavement surface. The system can be activated manually through a remote call up system, or automatically using pavement sensors and/or an RWIS station. This allows the pavement to be treated immediately after detection of ice, or it can be
used to pre-treat the pavement before icing is expected. The preferred anti-icing chemical to be used is potassium acetate.

An anti-icing system is currently being installed on MNTH 336, on the bridge that crosses both the railroad tracks and USTH 10, east of Dilworth. This system covers two two-lane bridges (1200’ and 1500’ long), at a cost of approximately $350,000. Another system is planned for the I-94 bridges over the Red River (ND / MN border) in 2005. This system will cover two bridges of three lanes each (1500’ and 2100’ long) and is estimated to cost $1.1 million to $1.5 million.

The following is a prioritized list for future automatic anti-icing system installations in District 4. These locations were chosen and prioritized by members of the steering committee and other stakeholders, based on local knowledge of where many icing problems occur. Note that a couple of these sites are at locations where major improvement projects are already planned, and the anti-icing systems may be included in the overall improvement project. The state would realize significant cost savings by installing these systems during construction of the new bridges, as opposed to retrofitting existing bridges.

1. I-94 over railroad tracks near County Hwy 87 in Alexandria
2. I-94 over railroad tracks north of Barnesville
3. USTH 59 over railroad tracks just north of USTH 10 in Detroit Lakes (may be deployed with improvement project funds)
4. USTH 10 over railroad tracks between Perham and New York Mills
5. USTH 10 over County Hwy 67 in New York Mills
6. Interchange of USTH 10 and MNTH 32 (may be deployed with improvement project funds)

Expected Benefits: More efficient use of de-icing chemicals; 24-hour-a-day operation; can be operated proactively; can be linked to a RWIS system

Estimated Deployment Cost: The cost varies greatly depending on location, area of coverage, and installation of additional technologies (RWIS station, cameras, etc). In addition to the two systems installed or planned in Moorhead area that were discussed earlier, there are a couple of other examples of anti-icing systems in Minnesota or North Dakota. An anti-icing system in Hillsboro, ND cost $170,000 for two bridges, each of which was two-lanes and 2300’ feet in length. The cost also included one RWIS station. In 1999, Mn/DOT installed an automatic anti-icing system on the 1950’ long, eight-lane bridge carrying I-35W over the Mississippi River, for approximately $620,000. According to the USDOT, the range of deployment costs is $25,000 to approximately $500,000.

For the purposes of this study, the assumed deployment cost will be $300,000 per installation. However, this cost will vary depending on the size of the bridges, the installation of any additional technologies, and whether or not the system is installed on a new bridge or as a retrofit to an existing bridge. For example, the bridge carrying I-94 over the railroad tracks north of Barnesville is significantly smaller than the bridge on MNTH 336, whose anti-icing system cost $350,000. However, that system did not include any cameras. The systems on I-94 may benefit from the installation of cameras to monitor weather, pavement, and traffic conditions. Thus, the estimate of $300,000 may still be appropriate, despite the significantly smaller coverage area on the bridge.
Estimated Annual Operations and Maintenance Costs: The cost varies greatly, depending on the length of the span and the coverage area. The pump and control hardware may need to be replaced every five years at a cost of approximately $3500. According to the USDOT, the annual O&M cost may range from $2000 to $30,000. For the purposes of this study, the assumed operations and maintenance cost will be $10,000 per year per installation.
Figure 5.3 – Map of Existing and Proposed Automatic Anti-Icing System Installations
Project 5 - Speed Reduction System

Project Description:

The goal of these systems is to improve work crew safety and reduce collisions between the motoring public and maintenance and construction vehicles. The biggest problem in the district with respect to work zones is with vehicle accidents, not worker safety, although that is always a major concern. The committee has found that “fines doubled in work zone” signs, followed by speed display boards have worked very well. Mn/DOT has previously purchased five speed display signs. The district would like additional signs to use for work zones. Portable Highway Advisory Radio (HAR) systems may also be considered to improve safety in work zones, but are not included in this project.

The speed display signs are units that can be trailer-mounted for easy portability. The unit consists of radar to detect vehicle speeds, and an LED board to display the vehicle speeds. Generally, the units also have a static speed limit sign to reinforce the law to the drivers. The unit can be programmed so that when a vehicle exceeds the speed limit, the LED display can use a different color, or flash to help make the driver aware that they are speeding.

Expected Benefits: Improved worker and driver safety in work zones; increased compliance with work zone speed limits

Estimated Deployment Costs: Speed display boards (radar included) are approximately $4000 - $11,000. Other equipment TBD.

Estimated Annual Operations and Maintenance Costs: $400 - $1100 per unit

Project 6 - Integrated Signal Systems

Project Description:

The two main concerns raised that relate to the timing of signal systems in District 4 are:

- Delay caused by trains at rail crossings that result in congestion and in vehicles queuing back through intersections due to lack of adequate storage.
- Congestion due to poor signal coordination at interchanges

Many signals in operation today are controlled by time-of-day cycle timing. A cycle-timed system is one where the amount of time given to any particular direction is changed based upon a preprogrammed timing plan entered into the signal's memory. In order to change the cycle pattern, someone has to go out to the signal and manually change it. Today, integrated signal systems have been successfully installed throughout the U.S. An integrated signal system allows an agency to coordinate surface street traffic flow along a roadway by controlling the signal timing at individual signal controllers. Data collected through surveillance components can be analyzed and signal timings automatically changed.
Highway rail intersection equipment can also be interconnected with adjacent signalized intersections to provide local control that can be adapted to highway-rail intersection activities. An example of a system currently deployed in District 4 is the Moorhead Area Integrated Train Detection and Traffic Control System. This system allows for special signal timing plans to be selected when trains are approaching or present and provides travelers and dispatchers with information on the train movements. However, at the time of this report, the Moorhead Area Integrated Train Detection and Traffic Control system is not in operation. There are a number of equipment issues, mostly associated with outdated traffic controllers. As these are upgraded, most likely as part of installing advanced preemption, the system could be put back in operation. Alternatively, the system could be abandoned if the advanced preemption and signal plan coordination resolve the issues.

Candidate corridors for integrated signal systems in the district include Main Ave., USTH 10 and USTH 75 in Moorhead, MNTH 29 in Alexandria, and USTH 10 in Detroit Lakes. Coordination with highway-rail crossings is especially important on Main Ave. in Moorhead.

This project involves the purchase and installation of the necessary equipment (detectors, controller cards, communications, etc) to achieve an integrated signal system for a corridor or area. It also includes analysis of existing signal timing plans, plus the development of new timing plans when appropriate.

Expected Benefits: Improved signal coordination; signal timing can more easily be changed to adapt to traffic conditions; reduction in vehicle delay

Estimated Deployment Costs: $30,000 per intersection; however, this cost may vary greatly, depending on the need to upgrade existing equipment and install new equipment. Some overall cost savings may be realized if this equipment is installed along with traffic signal pre-emption equipment.

Estimated Annual Operations and Maintenance Costs: $1000 per intersection

Project 7 – Improvements to Dissemination of Information to Agency Partners

Project Description:

There are already a number of information systems available, including Mn/CARS, 511, RWIS, and others. The major problems are that people either often don’t know what information is available or where to obtain it. Simply marketing what is available may be an effective solution. A web-based, “pull-type” system could provide a “one-stop shopping” center, with links to available information. The system could also be setup to allow agencies to post additional information for other agencies in the district to see.

The objective of this project is to provide a low cost information access system to be used by emergency management, highway maintenance and MnDOT personnel. Information available through this system could include:

- Road Weather and Pavement Condition Information
- Maintenance and Construction Activity Information
- Real Time Incident Information
- Rail Schedule Information

**Expected Benefits:** Improved access to valuable information for safety and maintenance agencies

**Estimated Deployment Costs:** Minimal – if hosted on an agency’s existing web site, the deployment cost would simply be the labor to develop the web page(s); estimated to be less than $5000

**Estimated Annual Operations and Maintenance Costs:** Minimal
Intermediate Term Projects (3-5 Years)

**Project 3.2 - Highway-Rail Crossing Safety System Deployment**
Please refer to the project description under Short Term Projects for more information.

**Project 4 - Automatic Anti-Icing Systems**
This project would involve the installation of an anti-icing system at an additional location. Please refer to the project description under Short Term Projects for more information.

**Project 6 - Integrated Signal Systems**
This would consist of the installation of an integrated signal system for USTH 10 in Moorhead. However, this project may be included with the USTH 10 improvement project in 2006 or 2007. Please refer to the project description under Short Term Projects for more information.

**Project 8 - Incident Management / Alternate Route Plan**

**Project Description:**

The purpose of an incident management plan is to determine the best way to respond to incidents to reduce the impacts to the transportation network and increase safety for travelers. Incident management plans generally include an examination of the:

- Coordination between agencies including the DOT, law enforcement and other first responders, maintenance agencies, tow operators
- Communications and exchange of information
- Best alternate routes and strategy for their use

The Fargo-Moorhead area was identified by the committee as the best candidate for creating an incident management / alternate route plan as a result of this study.

**Expected Benefits:** Improved coordination and emergency response between agencies; well-defined alternate / detour routes

**Estimated Deployment Costs:** $120,000

**Estimated Annual Operations and Maintenance Costs:** Minimal – occasional meetings to update plans / alternate routes
**Project 9 - Traffic Signal Pre-emption for Emergency Vehicles**

**Project Description:**

Traffic signals can disrupt the progress of emergency vehicles by causing them to slow or stop. Since other vehicles in cross traffic often have the right of way when the emergency vehicle reaches the intersection, hazardous situations often occur. Traffic Signal Pre-emption involves switching the appropriate signal at a signalized intersection to green to grant an approaching emergency vehicle right-of-way regardless of the normal signal-phasing pattern.

Fargo uses a strobe-operated system for pre-emption. Some ambulances in Moorhead may already have the appropriate equipment, but police and fire department vehicles do not. This project would involve deploying pre-emption equipment at the 23 signalized intersections controlled by MnDOT in Moorhead, as well as emitters for 20 emergency vehicles.

**Expected Benefits:** Decreased response / travel time for emergency vehicles; improved safety for patients, emergency workers, and drivers

**Estimated Deployment Costs:** Approximately $4,000+ per intersection (controller card and detectors are approximately $4000; additional cost for wiring varies); $750-$1000 per emitter for vehicles. Estimating $5000 per intersection (with wiring and installation) for 23 intersections in Moorhead, and emitters at $1000 each for 20 vehicles, the cost is $135,000. Some overall cost savings may be realized if this equipment is installed along with integrated signal system equipment.

**Estimated Annual Operations and Maintenance Costs:** $500 per intersection, $100 per emitter

**Project 10 - Cameras for Road Weather Information System (RWIS) Stations**

**Project Description:**

Road Weather Information Systems detect and communicate weather and/pavement condition information. The majority of the nine existing RWIS stations in the district do not have cameras. Two have black-and-white cameras. The committee would like to see the installation of high-quality color cameras at the stations, especially those that work in conjunction with automatic anti-icing systems.

**Expected Benefits:** Ability to visually verify weather and road conditions at the RWIS stations

**Estimated Deployment Costs:** Approximately $25,000 per camera, plus possible costs to upgrade communications.

**Estimated Annual Operations and Maintenance Costs:** $1000 per camera
**Project 11 – Enhanced Reference Signs**

**Project Description:**

This project would involve the installation of enhanced reference signs along I-94 in District 4. The signs are used to aid motorists and emergency response personnel in determining the exact location of incidents. The signs generally display the route number, shield, direction, and milepost number, and are typically spaced 0.1 to 0.5 miles apart.

**Expected Benefits:** Improved response time for law enforcement and emergency vehicles

**Estimated Deployment Costs:** $75 for sign and $45 for post. I-94 in District 4 runs for 115 miles. If installed every 0.2 miles, the total cost would be $138,000.

**Estimated Annual Operations and Maintenance Costs:** $1380
Long Term Projects (6-10 years)

Project 4 - Automatic Anti-Icing Systems
This project would involve the installation of an anti-icing system at an additional location. Please refer to the project description under Short Term Projects for more information.

Project 6 - Integrated Signal Systems
This would consist of the installation of integrated signal systems for USTH 75 in Moorhead, USTH 10 in Detroit Lakes, and MNTH 29 in Alexandria. Please refer to the project description under Short Term Projects for more information.

Project 12 - Interactive Kiosks

Project Description:
Interactive kiosks can be used to provide travelers with information about special events, parking, tourist info, road conditions, and weather. The kiosks could also be used for public internet access, either for free or for a small fee to help cover operations costs. This project would include the purchase of two kiosks to be installed in the Moorhead area. The kiosks could be placed in shopping malls, traveler / tourist information centers, grocery stores, etc.

Expected Benefits: Increased availability of traveler information

Estimated Deployment Costs: ~$5,500 for kiosk, $50 connection fee/phone cost. Assuming installation of two kiosks, the total cost would be approximately $11,000.

Estimated Annual Operations and Maintenance Costs: $1100 (approximately $50/month for connection + $500 annual maintenance)

The deployment, operations and maintenance costs of these kiosks may potentially be shifted to a private partner, who would provide the system and pay for the communications. In return, they would be able to collect fees from users accessing the system for external internet use.

Project 13 – Portable Traffic Management System

Project Description:
This project involves the purchase of a portable traffic management system. These trailer-mounted units can be used during construction and maintenance activities, special events, or major incidents. Since they are portable, they can be used in almost any location for any period of time.

The units are designed to gather and monitor traffic data, manage traffic flow, and provide information to drivers. The units may include equipment such as sensors, wireless
communications, video cameras, dynamic message signs, and vehicle speed radar. Communications with the system can be achieved through a variety of transmission options.

There may be opportunities to utilize existing PTMS units in other districts, resulting in significant cost savings compared to purchasing a new unit.

**Expected Benefits:** Improved safety for travelers and workers; increased availability of traveler information; additional source of information for traffic management

**Estimated Deployment Costs:** $90,000 for new purchase – includes structure, tower, camera, DMS, and trailer.

**Estimated Annual Operations and Maintenance Costs:** $9000
5.3 Deployment Strategy

After presenting the final list of proposed ITS deployments, it is important to discuss general strategies for implementing the solutions.

Perhaps the most important strategy is to educate partners on the benefits of ITS technologies and concepts. ITS solutions are not replacements for building and maintaining roads and transit systems. They are simply tools that can be used to enhance the operations and safety of these transportation systems. The State of Minnesota has been a leader in the development of ITS, and it is vitally important to continue to demonstrate the benefits of ITS to elected officials, community leaders, and the general public. It is also crucial to educate employees in Mn/DOT and local transportation agencies. This study offered an opportunity to begin the education process, but the key will be to continue to reach out to stakeholders within and outside of Mn/DOT. If an administrator, planner, or engineer is not aware of an ITS solution that may be appropriate for a particular problem, it will be difficult to mainstream ITS into the traditional improvement process.

In general, there are two methods to deploy ITS technologies. Either install ITS equipment during new construction or rehabilitation projects, or retrofit the systems onto existing infrastructure. The second method is more common, but the first method should be advocated whenever possible. Including ITS solutions with traditional improvement projects not only results in cost savings compared to retrofitting, but it also helps promote the notion of ITS as “another tool in the toolbox” of transportation planning. This report identifies some deployments that be may be good candidates for installation as part of a larger improvement project. Reference sections 5.2 and 5.4 for further information on this strategy and other potential funding sources.

The major reason why potential ITS solutions need to be prioritized is for deploying the systems within appropriate budgets and schedules. Thus, after the general solutions and specific locations were identified and prioritized, the next step was to separate the projects into short, intermediate, and long-term deployment schedules. This not only allows the stakeholders to confirm their priorities for ITS deployment, but also offers a chance to promote a reasonable schedule and cost information to decision-makers. The proposed projects, schedule, and cost estimates presented are intended to provide a starting point for early deployment of ITS in District 4. The district and other transportation stakeholders should continue to promote, research, and discuss these tools, and make adjustments to the scope and schedule of ITS projects as they see fit for their needs.

Figure 5.4 below shows the proposed deployment schedule and estimated costs for the projects. The schedule is divided into short term (0-2 years), intermediate term (3-5 years), and long term (6-10 years).
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<td>- I-94 bridge over RR tracks near County Highway 87 in Alexandria</td>
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<td>Integrated Signal System for Main Avenue in Moorhead (8 intersections)</td>
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<td>$8,000</td>
</tr>
<tr>
<td>6</td>
<td>Improvements to Dissemination of Information to Agency Partners</td>
<td>$5,000</td>
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</tr>
<tr>
<td>7</td>
<td>Subtotal (Short Term)</td>
<td>$995,000</td>
<td>$39,500</td>
</tr>
<tr>
<td><strong>Intermediate Term (3-5 Years)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Anti-Icing System</td>
<td>$300,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>4</td>
<td>- I-94 bridge over RR tracks north of Barnesville</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Integrated Signal System for USTH 10 in Moorhead (7 intersections)</td>
<td>$210,000</td>
<td>$7,000</td>
</tr>
<tr>
<td>8</td>
<td>Incident Management/Alternate Route Plan</td>
<td>$120,000</td>
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<tr>
<td>9</td>
<td>Traffic Signal Preemption for Emergency Vehicles in Moorhead</td>
<td>$135,000</td>
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<td>10</td>
<td>Addition of Cameras to Existing RWIS Stations (9 locations)</td>
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<td>Enhanced Reference Signs along I-94</td>
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<td><strong>Long Term (6-10 Years)</strong></td>
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<td>Anti-Icing System</td>
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<td>4</td>
<td>- USTH 10 bridge over RR tracks between Perham and New York Mills</td>
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</tr>
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<td>6</td>
<td>Integrated Signal System for USTH 75 in Moorhead (7 intersections)</td>
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<td>Integrated Signal System for USTH 10 in Detroit Lakes (3 intersections)</td>
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<td>Integrated Signal System for MNTH 29 in Alexandria (15 intersections)</td>
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<td>12</td>
<td>Interactive Kiosks in Moorhead (2 units) [4]</td>
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</tr>
<tr>
<td>13</td>
<td>Portable Traffic Management System [5]</td>
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<td>$9,000</td>
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</table>

Notes:
[1] Please refer to project descriptions in Section 5.2 for more detailed descriptions
[2] Costs will depend on results of Highway-Rail Crossing Safety System Study (Project 3.1)
[3] May be included with USTH 10 improvement project in 2006 or 2007
[4] Private company could pay for kiosks and charge user fees for public internet access
[5] PTMS may be borrowed from other districts at little or no charge

**Figure 5.4 – Summary of Proposed Deployment Schedule and Estimated Costs**
5.4 Potential Funding Sources

The State of Minnesota currently has some funding available for ITS projects in the primarily rural districts of Mn/DOT, but the exact amount available to District 4 is not yet known. Therefore, this section may help to identify other ways to fund the projects recommended in this study.

One of the best ways to get many of these projects deployed is for them to be included as parts of larger improvement projects. For instance, an anti-icing system may be installed on a new or renovated bridge during construction, using improvement project funds. An example in District 4 is the reconstruction of the USTH 59 bridge over railroad tracks in Detroit Lakes, just north of the intersection with USTH 10. That project is currently scheduled for 2006. Installing an anti-icing system during construction of the bridge would save a significant amount of money versus retrofitting an existing bridge. Another candidate for deploying ITS equipment as part of a regular improvement project would be installing integrated signal systems during reconstruction of an urban arterial. USTH 10 in Moorhead is scheduled for an improvement project in 2006 or 2007, and may offer an opportunity for efficient deployment of an integrated signal system.

The cost of deploying interactive kiosks might be offset by allowing a private company to purchase, install, and maintain them. Mn/DOT would provide traveler information for free, but the private company could also charge user fees for general public internet access. Additional costs may be offset through advertisements on the kiosks.

There may also be opportunities to borrow certain ITS equipment from other districts in Mn/DOT, or to purchase them at little cost. In particular, other districts have portable traffic management system (PTMS) units that may be available for use by District 4.

Finally, Mn/DOT should be encouraged to pursue additional state and federal funding for ITS projects. Mn/DOT should continue to showcase their role in the use of advanced technologies to improve the safety and efficiency of our nation’s transportation system. Information for stakeholders looking to secure federal funds for ITS projects, and information regarding current congressional requests for ITS funds are available by contacting Mn/DOT’s Office of Government Affairs, or by visiting: http://www.dot.state.mn.us/govrel/.

5.5 Integration Opportunities

There may be a number of opportunities for integration with adjacent districts in Mn/DOT. These opportunities may be in the form of information sharing, joint ITS activities, joint purchasing of equipment, or coordinated support for regional or statewide ITS initiatives.

The ultimate goal of ITS integration between the districts should be the sharing of information collected within each district. Information to be shared may include weather and pavement conditions, traffic volumes, truck volumes and classifications, traveler information, construction and maintenance activities, transit operations, and emergency response. One possible solution would be to integrate the TOCCs operating or being developed in each district. This would allow other districts to view information collected by a district through their existing ITS equipment and other information sources, if the TOCC has “virtual traffic operations” capabilities and is used for
that purpose. At a minimum, integration of the TOCCs would allow for sharing of emergency operations and response information between the districts.

District 4 may also benefit from working with adjacent districts on joint ITS projects. In particular, Mn/DOT District 2 (based in Bemidji) is interested in pursuing a couple of projects with District 4. District 2 would also like to install cameras at existing RWIS stations (refer to District 4 Project 10.0). They also expressed an interest in purchasing cameras for certain locations without RWIS stations, such as key bridges. The two districts may be able to realize significant cost savings and other efficiencies if they pursue a joint project to purchase and install these cameras. The benefits would be expanded if the districts were able to share the video with adjacent districts, possibly through integration of the TOCCs.

District 2 is also interested in acquiring a Weigh-in-Motion (WIM) or WIM + Class Type system to gather information about the numbers and types of commercial vehicles that use the highway system in the area. Mn/DOT has previously invested in some WIM installations. However, there were some problems with the equipment, such as rusting on some steel plates. The district would like to invest in a smaller-scale system that can weigh, count and classify trucks. Both District 4 and District 2 would benefit from being able to share this type of information with each other.
6.0 ITS Architecture

6.1 Overview of ITS Architecture

The National ITS Architecture provides a common framework for planning, defining, and integrating intelligent transportation systems. It is a mature product that reflects the contributions of a broad cross-section of the ITS community (transportation practitioners, systems engineers, system developers, technology specialists, consultants, etc.). The architecture defines:

- The functions (e.g., gather traffic information or request a route) that are required for ITS
- The physical entities or subsystems where these functions reside (e.g., the field or the vehicle).
- The information flows and data flows that connect these functions and physical subsystems together into an integrated system.

The development of the National ITS Architecture was led by the Federal Highway Administration (FHWA) of the United States Department of Transportation (USDOT). ITS architectures are designed to promote and ensure that equipment and components of individual ITS installations are compatible with and can be integrated with other ITS installations. This approach maximizes the benefits and efficiency of ITS solutions.

An ITS architecture has two layers: a physical layer, and a logical layer. The logical architecture defines what needs to be done; specifically, the processes and data flows necessary to provide a particular service. The physical architecture provides a structural framework for the processes and data flows, and defines the physical entities and architecture flows necessary to support an integrated intelligent transportation system. It is generally easier to understand the architecture through the description of user services and market packages.

6.2 User Services and Market Packages

User services document what Intelligent Transportation Systems should do from the user's perspective. A broad range of users are considered, including the traveling public as well as many different types of system operators. User services, including the corresponding user service requirements, form the basis for the National ITS Architecture development effort. The initial user services were jointly defined by USDOT and ITS America with significant stakeholder input and documented in the National Program Plan. The concept of user services allows system or project definition to begin by establishing the high level services that will be provided to address identified problems and needs. New or updated user services have been and will continue to be satisfied by the National ITS Architecture over time.

The market packages provide an accessible, service-oriented perspective to the National ITS Architecture. They are tailored to fit, separately or in combination, real world transportation problems and needs. Market packages collect together one or more equipment packages that must work together to deliver a given transportation service and the architecture flows that connect them and other important external systems. In other words, they identify the pieces of the physical architecture that are required to implement a particular transportation service.
An initial list of market packages was created to identify those that would potentially apply to the district. As the study progressed, and the potential projects were identified, many of these market packages no longer applied. Figure 6.1 below lists the market packages that were initially identified as potentially applying to ITS projects in District 4.
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<tr>
<th>User Services Bundle</th>
<th>User Services</th>
<th>Market Packages</th>
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<tr>
<td>Travel and Transportation Management</td>
<td>Pre-trip Travel Information</td>
<td>Broadcast Traveler Information (ATIS1)</td>
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<td>Interactive Traveler Information (ATIS2)</td>
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<td>Probe Surveillance (ATMS02)</td>
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<td>Highway Rail Intersection</td>
<td>Surface Street Control (ATMS03)</td>
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<td>Freeway Control (ATMS04)</td>
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<tr>
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<td>Incident Management System (ATMS08)</td>
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<td>Traffic Forecast and Demand Management (ATMS09)</td>
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<td>Virtual TMC and Smart Probe Data (ATMS12)</td>
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<td>Standard Railroad Grade Crossing (ATMS13)</td>
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<tr>
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<td>Advanced Railroad Grade Crossing (ATMS14)</td>
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<tr>
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<td></td>
<td>Railroad Operations Coordination (ATMS15)</td>
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<td>Speed Monitoring (ATMS19)</td>
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<td>En-route Driver Information</td>
<td>Interactive Traveler Information (ATIS2)</td>
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<td>Traveler Services Information</td>
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<td>Public Transportation Management</td>
<td>Transit Vehicle Tracking (APTS1)</td>
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<td>Transit Fixed-Route Operations (APTS2)</td>
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<td>Personalized Public Transit</td>
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<td>Transit Traveler Information (APTS8)</td>
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<td>Commercial Vehicle Management</td>
<td>Weigh-In-Motion (CVO06)</td>
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<td>Electronic Clearance</td>
<td>Roadside CVO Safety (CVO07)</td>
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<td>Automated Roadside Safety Inspection</td>
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<td>Emergency Management</td>
<td>Emergency Notification and Personal Security</td>
<td>Emergency Response (EM01)</td>
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<td>Emergency Vehicle Management</td>
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<td>Mayday Support (EM03)</td>
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<td>Roadway Service Patrols (EM04)</td>
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<td>Disaster Traveler Information (EM10)</td>
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<td>Archived Data Function</td>
<td>ITS Data Mart (AD1)</td>
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<td>ITS Data Warehouse (AD2)</td>
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<td></td>
<td>Weather Information Processing and Distribution (MC04)</td>
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<td>Roadway Automated Treatment (MC05)</td>
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<td>Roadway Maintenance and Construction (MC07)</td>
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<td>Work Zone Safety Monitoring (MC09)</td>
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<tr>
<td></td>
<td></td>
<td>Maintenance and Construction Activity Coordination (MC10)</td>
</tr>
</tbody>
</table>

**Figure 6.1 – User Services and Market Packages Potentially Applicable to District 4**
The market packages that were determined to still apply after the project selection process are described in the following sections.

**Interactive Traveler Information (ATIS2)**

This market package provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. The traveler can obtain current information regarding traffic conditions, roadway maintenance and construction, transit services, ride share/ride match, parking management, detours and pricing information. A range of two-way wide-area wireless and fixed-point to fixed-point communications systems may be used to support the required data communications between the traveler and Information Service Provider. A variety of interactive devices may be used by the traveler to access information prior to a trip or en route including phone via a 511-like portal, kiosk, Personal Digital Assistant, personal computer, and a variety of in-vehicle devices. This market package also allows value-added resellers to collect transportation information that can be aggregated and be available to their personal devices or remote traveler systems to better inform their customers of transportation conditions. Successful deployment of this market package relies on availability of real-time transportation data from roadway instrumentation, transit, probe vehicles or other means. A traveler may also input personal preferences and identification information via a "traveler card" that can convey information to the system about the traveler as well as receive updates from the system so the card can be updated over time.

**Network Surveillance (ATMS01)**

This market package includes traffic detectors, other surveillance equipment, the supporting field equipment, and fixed-point to fixed-point communications to transmit the collected data back to the Traffic Management Subsystem. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Subsystem). The data generated by this market package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Information Service Provider Subsystem.

**Surface Street Control (ATMS03)**

This market package provides the central control and monitoring equipment, communication links, and the signal control equipment that support local surface street control and/or arterial traffic management. A range of traffic signal control systems are represented by this market package ranging from fixed-schedule control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. Additionally, general advisory and traffic control information can be provided to the driver while en route. This market package is generally an intra-jurisdictional package that does not rely on real-time communications between separate control systems to achieve area-wide traffic signal coordination. Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would be
represented by this package. This market package is consistent with typical urban traffic signal control systems.

**Freeway Control (ATMS04)**

This market package provides the communications and roadside equipment to support ramp control, lane controls, and interchange control for freeways. Coordination and integration of ramp meters are included as part of this market package. This package is consistent with typical urban traffic freeway control systems. This package incorporates the instrumentation included in the Network Surveillance Market Package to support freeway monitoring and adaptive strategies as an option.

This market package also includes the capability to utilize surveillance information for detection of incidents. Typically, the processing would be performed at a traffic management center; however, developments might allow for point detection with roadway equipment. For example, a CCTV might include the capability to detect an incident based upon image changes. Additionally, this market package allows general advisory and traffic control information to be provided to the driver while en route.

**Traffic Information Dissemination (ATMS06)**

This market package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, incident information, and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), Transit Management, Emergency Management, and Information Service Providers. A link to the Maintenance and Construction Management subsystem allows real time information on road/bridge closures due to maintenance and construction activities to be disseminated.

**Virtual TMC and Smart Probe Data (ATMS12)**

(note: The TOCCs can be used as a Virtual TMC if the correct software is installed. This study recommends use of the TOCCs for Virtual TMC functions, although it does not use smart probes.)

This market package provides for special requirements of rural road systems. Instead of a central TMC, the traffic management is distributed over a very wide area (e.g., a whole state or collection of states). Each locality has the capability of accessing available information for assessment of road conditions. The package uses vehicles as smart probes that are capable of measuring road conditions and providing this information to the roadway for relay to the Traffic Management Subsystem and potentially direct relay to following vehicles (i.e., the automated road signing
equipment is capable of autonomous operation). In-vehicle signing is used to inform drivers of detected road conditions.

**Standard Railroad Grade Crossing (ATMS 13)**

This market package manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Both passive (e.g., the crossbuck sign) and active warning systems (e.g., flashing lights and gates) are supported. (Note that passive systems exercise only the single interface between the roadway subsystem and the driver in the architecture definition.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported to both highway and railroad officials through wayside interfaces and interfaces to the traffic management subsystem.

**Advanced Railroad Grade Crossing (ATMS14)**

This market package manages highway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This market package includes all capabilities from the Standard Railroad Grade Crossing Market Package and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems supported by this market package include positive barrier systems that preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment which detects, or communicates with the approaching train. In this market package, the wayside equipment provides additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This market package also includes additional detection capabilities that enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.

**Railroad Operations Coordination (ATMS15)**

This market package provides an additional level of strategic coordination between freight rail operations and traffic management centers. Rail operations provides train schedules, maintenance schedules, and any other forecast events that will result in highway-rail intersection (HRI) closures. This information is used to develop forecast HRI closure times and durations that may be used in advanced traffic control strategies or to enhance the quality of traveler information.

**Speed Monitoring (ATMS19)**
This market package monitors the speeds of vehicles traveling through a roadway system. If the speed is determined to be excessive, roadside equipment can suggest a safe driving speed. Environmental conditions may be monitored and factored into the safe speed advisories that are provided to the motorist. This service can also support notifications to an enforcement agency to enforce the speed limit on a roadway system.

**Weigh-in-Motion (CVO06)**

This market package provides for high speed weigh-in-motion with or without Automated Vehicle Identification (AVI) capabilities. This market package provides the roadside equipment that could be used as a stand-alone system or to augment the Electronic Clearance (CVO03) market package.

**Disaster Traveler Information (EM10)**

This market package uses ITS to provide disaster-related traveler information to the general public, including evacuation and reentry information and other information concerning the operation of the transportation system during a disaster. This market package collects information from multiple sources including traffic, transit, public safety, emergency management, shelter provider, and travel service provider organizations. The collected information is processed and the public is provided with real-time disaster and evacuation information using ITS traveler information systems.

A disaster will stress the surface transportation system since it may damage transportation facilities at the same time that it places unique demands on these facilities to support public evacuation and provide access for emergency responders. Similarly, a disaster may interrupt or degrade the operation of many traveler information systems at the same time that safety-critical information must be provided to the traveling public. This market package keeps the public informed in these scenarios, using all available means to provide information about the disaster area including damage to the transportation system, detours and closures in effect, special traffic restrictions and allowances, special transit schedules, and real-time information on traffic conditions and transit system performance in and around the disaster.

This market package also provides emergency information to assist the public with evacuations when necessary. Information on mandatory and voluntary evacuation zones, evacuation times, and instructions are provided. Available evacuation routes and destinations and current and anticipated travel conditions along those routes are provided so evacuees are prepared and know their destination and preferred evacuation route. Information on available transit services and traveler services (shelters, medical services, hotels, restaurants, gas stations, etc.) is also provided. In addition to general evacuation information, this market package provides specific evacuation trip planning information that is tailored for the evacuee based on origin, selected destination, and evacuee-specified evacuation requirements and route parameters.

This market package augments the ATIS market packages that provide traveler information on a day-to-day basis for the surface transportation system. This market package provides focus on the special requirements for traveler information dissemination in disaster situations.
Road Weather Data Collection (MC03)

This market package collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway (or guideway in the case of transit related rail systems). In addition to fixed sensor stations at the roadside, sensing of the roadway environment can also occur from sensor systems located on Maintenance and Construction Vehicles and on-board sensors provided by auto manufacturers. The collected environmental data is used by the Weather Information Processing and Distribution Market Package to process the information and make decisions on operations.

Weather Information Processing and Distribution (MC04)

This market package processes and distributes the environmental information collected from the Road Weather Data Collection market package. This market package uses the environmental data to detect environmental hazards such as icy road conditions, high winds, dense fog, etc. so system operators and decision support systems can make decision on corrective actions to take. The continuing updates of road condition information and current temperatures can be used by system operators to more effectively deploy road maintenance resources, issue general traveler advisories, issue location specific warnings to drivers using the Traffic Information Dissemination market package, and aid operators in scheduling work activity.

Roadway Automated Treatment (MC05)

This market package automatically treats a roadway section based on environmental or atmospheric conditions. Treatments include fog dispersion, anti-icing chemicals, etc. The market package includes the environmental sensors that detect adverse conditions, the automated treatment system itself, and driver information systems (e.g., dynamic message signs) that warn drivers when the treatment system is activated.

Winter Maintenance (MC06)

This market package supports winter road maintenance including snow plow operations, roadway treatments (e.g., salt spraying and other anti-icing material applications), and other snow and ice control activities. This package monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities, determine the appropriate snow and ice control response, and track and manage response operations.

Roadway Maintenance and Construction (MC07)

This market package supports numerous services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Maintenance services would include landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment on the roadway (e.g., signs, traffic controllers, traffic detectors, dynamic message
signs, traffic signals, CCTV, etc.). Environmental conditions information is also received from various weather sources to aid in scheduling maintenance and construction activities.

**Work Zone Management (MC08)**

This market package directs activity in work zones, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., ISP, traffic management, other maintenance and construction centers) for better coordination management. Work zone speeds and delays are provided to the motorist prior to the work zones.

### 6.3 Transportation Issues and User Services

As described in section 4.1, transportation issues in the district were prioritized by the committee. Using the top 20 issues from the prioritized list, a table was developed to map these issues to the appropriate user services. From these user services, it was possible to start identifying the potential market packages (described in section 6.2) and possible ITS solutions. The table mapping the transportation issues to the user services is shown as follows in Figure 6.2:
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Figure 6.2 – Transportation Issues Mapped to User Services
6.4 Overall System Architecture

The system and project architectures developed for this study were based on the approved Minnesota statewide ITS architecture. Starting with the statewide architecture, information that did not apply to the proposed projects in District 4 was removed, and new information was added as necessary. **The official architecture for this study is contained in a file for use with Turbo Architecture. This file is included on the resource CD available with this report.**

This section presents the overall, top-level ITS system architecture for the projects recommended in this scoping study. Two different methods to present this information are the “sausage diagram” and the “interconnect diagram”.

The “sausage diagram” shown in Figure 6.3 indicates the different ITS subsystems that are used for the projects, as well as the possible types of communications between the subsystems. The subsystems highlighted in white are the potentially active subsystems for one or more proposed projects. This diagram is shown on the following page. For example, the diagram shows that the Remote Traveler Support subsystem may be linked to the Traffic Management subsystem via wireline communications.

The “interconnect diagram” shown in Figure 6.4 is a more detailed view of the architecture. This diagram indicates the potential systems and agencies involved in one or more of the ITS projects, as well as the possible communications links between them. This diagram is shown following the “sausage diagram”. For example, the interconnect diagram shows that the traveler information kiosk may be connected to the TOCC, 511, Mn/CARS, and RWIS.

Together, these two diagrams give a basic overview of how the various ITS components may work together. When each project is undertaken, a more detailed physical and logical architecture will need to be developed to show the relationship and information flows between the appropriate systems and agencies.
Figure 6.3 – Overall ITS System Architecture “Sausage Diagram” for District 4
Figure 6.4 – Overall ITS System Architecture “Interconnect Diagram” for District 4
6.5 Project Architectures

Now that the overall system architecture has been presented, it is important to look at each project individually. The system architecture is used to help ensure that the individual ITS components can be integrated and share information. The project architectures should be consistent with the system architecture, as each project is considered a piece of the overall ITS system.

For each of the projects recommended through this study, the basic project ITS architecture is shown in the following pages in Figure 6.5. The project architectures simply indicate the potential types, sources, and recipients of information flows between systems. For more detailed descriptions of the projects, please refer to section 5.2 of this document. Note that in the diagrams, RS stands for roadway subsystem. In general, any ITS field equipment would fall into this subsystem.

**Project 1 - Permanent Dynamic Message Signs (DMS)**

![Diagram of Permanent DMS architecture]

**Project 2 - Portable Dynamic Message Signs**

![Diagram of Portable DMS architecture]
Project 3 - Highway-Rail Crossing Safety System

![Diagram of Project 3]

Project 4 - Automatic Anti-Icing Systems

![Diagram of Project 4]

Project 5 - Speed Reduction System

This project as proposed consists of stand-alone units with no requirements for external communications to other systems, and thus does not require an ITS project architecture.

Project 6 - Integrated Signal Systems

![Diagram of Project 6]
Project 7 – Improvements to Dissemination of Information to Agency Partners

- Mn/DOT
  - Weather/Roadway Condition Information
- Mn State Patrol
  - Emergency Response
- Mn/DOT D-4
  - Roadway Maintenance
- Event Promoter
  - Events
- Mn/DOT D-4
  - Mn/CARS
- Mn/DOT
  - 5-1-1 Traveler Information Center
- Agency Partner
  - Agency Partner
- TOCC
  - Traffic Operation Server

Project 8 - Incident Management / Alternate Route Plan

This project consists of a study and the creation of a plan, and does not require an ITS project architecture.

Project 9 - Traffic Signal Pre-emption for Emergency Vehicles

- Vehicle
  - Emergency Response Vehicles
- RS
  - Traffic Signals
  - Control data
- TOCC
  - Traffic Operation / Coordination Server
  - System parameters
  - Control data
**Project 10 - Cameras for Road Weather Information System (RWIS) Stations**

![Diagram of project 10]

**Project 11 – Enhanced Reference Signs**

This project consists of the installation of static signs, with no additional equipment or communications needs. Thus, it does not require an ITS project architecture.

**Project 12 - Interactive Kiosks**

![Diagram of project 12]

**Project 13 – Portable Traffic Management System**

![Diagram of project 13]

**Figure 6.5 – Basic ITS Project Architectures**
Appendix

- Description of Data Flows from ITS System Architecture
- Agendas and Meeting Minutes from 6/25/03 Kickoff Meeting, 8/18/03 Stakeholders’ Workshop, and 9/30/03 Steering Committee Meeting
- Results from Scenarios Exercise at Stakeholders’ Workshop (Incident, Special Event, Hazardous Weather Conditions)

Resource CD

Items included on the Resource CD include:

- Final Report with Appendix
- Turbo Architecture file
- Description of Data Flows from ITS System Architecture
- Agendas, PowerPoint presentation slides, and Meeting Minutes from 6/25/03 Kickoff Meeting, 8/18/03 Stakeholders’ Workshop, and 9/30/03 Steering Committee Meeting
- Results from Scenarios Exercise at Stakeholders’ Workshop (Incident, Special Event, Hazardous Weather Conditions)
- Maps of Traffic Volumes / AADT Data
- District 4 Signal Systems Inventory
- Database of Transit Providers in District 4
- “Greater Minnesota Public Transportation Plan”
- Database of Rail Accidents (statewide and D4)
- Maps of Minnesota Railroad Lines and Volumes
- Mn/DOT Organization Chart
- Databases of Crash Data for Intersections and Highway Segments (statewide and D4)
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Mn/DOT District 4 ITS Scoping Study

April 2004
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Destination: TOCC
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Destination: TOCC
Destination: Local Traffic Engineering Agencies
Destination: Local Traffic Engineering Agencies
Destination: RWIS Roadside Equipment
Destination: Local Roadway Maintenance Agencies
Destination: Local Roadway Maintenance Agencies
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In Regional Architecture

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In Regional Architecture

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In Regional Architecture

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Source: Local Roadway Maintenance Agencies  
FlowName: equipment maintenance status  
Destination: 5-1-1 Traveler Information Center  
Status: Existing  
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Source: Local Roadway Maintenance Agencies  
FlowName: equipment maintenance status  
Destination: Local Traffic Engineering Agencies  
Status: Existing  
In Regional Architecture

Source: Local Roadway Maintenance Agencies  
FlowName: event confirmation  
Destination: TOCC  
Status: Existing  
In Regional Architecture

Source: Local Emergency Management Agencies  
FlowName: event information  
Destination: Event Promoters  
Status: Existing  
In Regional Architecture

Source: Event Promoters  
FlowName: event information request  
Destination: 5-1-1 Traveler Information Center  
Status: Existing  
In Regional Architecture

Source: 5-1-1 Traveler Information Center  
FlowName: event plans  
Destination: Event Promoters  
Status: Existing  
In Regional Architecture

Source: Event Promoters  
FlowName: event plans  
Destination: 5-1-1 Traveler Information Center  
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Source: Event Promoters  
FlowName: event plans  
Destination: Local Emergency Management Agencies  
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In Regional Architecture

Source: Event Promoters  
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Destination: Local Traffic Engineering Agencies  
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Source: Event Promoters  
FlowName: event plans  
Destination: Minnesota State Patrol  
Status: Existing  
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Source: Broadcast Information Providers  
FlowName: fault reports*  
Destination: 5-1-1 Traveler Information Center  
Status: Existing  
In Regional Architecture

Source: Local Signal Center Roadside Equipment  
FlowName: fault reports*  
Destination: Local Signal Center  
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Destination: Local Traffic Engineering Agencies

FlowName: maint and constr resource response
Status: Existing
Source: Local Roadway Maintenance Agencies
Destination: Road Weather Information Center

FlowName: maint and constr resource response
Status: Existing
Source: Local Roadway Maintenance Agencies
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FlowName: maint and constr vehicle conditions
Status: In Regional Architecture
Source: Local Roadway Maintenance Equipment
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FlowName: maint and constr vehicle operational data
Status: In Regional Architecture
Source: Local Roadway Maintenance Equipment
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FlowName: maint and constr work plans
Status: In Regional Architecture
Source: Local Roadway Maintenance Agencies
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Status: In Regional Architecture
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FlowName: media information request
Status: In Regional Architecture
Source: Broadcast Information Providers
Destination: 5-1-1 Traveler Information Center

FlowName: media information request
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Source: Broadcast Information Providers
Destination: Local Emergency Management Agencies

FlowName: media information request
Status: In Regional Architecture
Source: Broadcast Information Providers
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FlowName: remote surveillance control
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FlowName: remote surveillance control
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FlowName: remote surveillance control
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FlowName: request fare and price information
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Destination: Local Traffic Engineering Agencies

FlowName: request for right-of-way
Status: Existing
Source: 5-1-1 Traveler Information Center
Destination: Local Signal Center

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Status: Existing
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FlowName: request for road network conditions
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Source: TOCC Roadside Equipment
Destination: Local Traffic Engineering Agencies

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Destination: Local Roadway Maintenance Agencies

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Source: Inter-Jurisdictional MnCARS
FlowName: request for road network conditions
Destination: Road Weather Information Center
Status: Existing In Regional Architecture

Source: Inter-Jurisdictional MnCARS
FlowName: request for road network conditions
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Source: TOCC
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Source: Road Weather Information Center
FlowName: road network conditions
Destination: Inter-Jurisdictional MnCARS
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Source: Local Roadway Maintenance Agencies
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Source: Local Roadway Maintenance Equipment
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Source: Local Signal Center Roadside Equipment
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Source: TOCC
Status: Existing
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Source: Local Roadway Maintenance Equipment
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Source: Local Signal Center Roadside Equipment
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Source: Local Traffic Engineering Agencies
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Source: Local Traffic Engineering Agencies
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Source: Road Weather Information Center
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Source: TOCC
FlowName: traffic archive data
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Source: TOCC
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FlowName: traffic control coordination
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FlowName: traffic images
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FlowName: traffic sensor control
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Destination: Inter-Jurisdictional MnCARS

FlowName: traveler archive data
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Source: Inter-Jurisdictional MnCARS  
FlowName: traveler archive data  
Destination: 5-1-1 Traveler Information Center  
Status: Existing  
In Regional Architecture

Source: Inter-Jurisdictional MnCARS  
FlowName: traveler archive data  
Destination: Road Weather Information Center  
Status: Existing  
In Regional Architecture

Source: Road Weather Information Center  
FlowName: traveler archive data  
Destination: 5-1-1 Traveler Information Center  
Status: Existing  
In Regional Architecture

Source: Road Weather Information Center  
FlowName: traveler archive data  
Destination: Inter-Jurisdictional MnCARS  
Status: Existing  
In Regional Architecture

Source: TOCC  
FlowName: traveler archive data  
Destination: 5-1-1 Traveler Information Center  
Status: Existing  
In Regional Architecture

Source: TOCC  
FlowName: traveler archive data  
Destination: Inter-Jurisdictional MnCARS  
Status: Existing  
In Regional Architecture

Source: TOCC  
FlowName: traveler information for media  
Destination: Minnesota State Patrol  
Status: Existing  
In Regional Architecture

Source: 5-1-1 Traveler Information Center  
FlowName: vehicle location  
Destination: Broadcast Information Providers  
Status: Existing  
In Regional Architecture

Source: Local Emergency Management Vehicle  
FlowName: video surveillance control  
Destination: Local Roadway Maintenance Equipment  
Status: Existing  
In Regional Architecture

Source: Local Roadway Maintenance Agencies  
FlowName: video surveillance control  
Destination: Local Traffic Engineering Agencies  
Status: Existing  
In Regional Architecture

Source: Local Roadway Maintenance Agencies  
FlowName: video surveillance control  
Destination: RWIS Roadside Equipment  
Status: Existing  
In Regional Architecture

Source: Local Roadway Maintenance Agencies  
FlowName: video surveillance control  
Destination: TOCC Roadside Equipment  
Status: Existing  
In Regional Architecture

Source: Local Traffic Engineering Agencies  
FlowName: video surveillance control  
Destination: TOCC Roadside Equipment  
Status: Existing  
In Regional Architecture

Source: TOCC  
FlowName: weather information  
Destination: Local Traffic Engineering Agencies  
Status: Existing  
In Regional Architecture

Source: National Weather Service  
FlowName: weather information  
Destination: Inter-Jurisdictional MnCARS  
Status: Existing  
In Regional Architecture

Source: National Weather Service  
FlowName: work zone information  
Destination: TOCC  
Status: Existing  
In Regional Architecture

Source: Local Roadway Maintenance Agencies  
FlowName: work zone information  
Destination: Broadcast Information Providers  
Status: Existing  
In Regional Architecture

Source: Local Roadway Maintenance Agencies  
FlowName: work zone information  
Destination: Inter-Jurisdictional MnCARS  
Status: Existing  
In Regional Architecture

Source: Local Roadway Maintenance Agencies  
FlowName: work zone information  
Destination: Local Traffic Engineering Agencies  
Status: Existing  
In Regional Architecture

Source: Local Roadway Maintenance Agencies  
FlowName: work zone information  
Destination: Local Emergency Management Agencies  
Status: Existing  
In Regional Architecture
Source: Local Roadway Maintenance Agencies  
FlowName: work zone status

Destination: Local Traffic Engineering Agencies  
Status: Existing  
In Regional Architecture

Source: Local Roadway Maintenance Equipment  
FlowName: work zone warning status

Destination: Local Roadway Maintenance Agencies  
Status: Existing  
In Regional Architecture

Source: Local Roadway Maintenance Equipment  

Destination: Local Roadway Maintenance Agencies
AGENDA

MN/DOT D4 ITS Scoping Study for Developing Early Deployment Plan

ITS Steering Committee Meeting

Wednesday, June 25, 2003, 1:00 PM – 3:00 PM

Location:
Transportation District 4
1000 Highway 10 West
Conference Room B109/110
Detroit Lakes, MN 56501

1. Welcome and Introductions – Tom Swenson, Mn/DOT District 4
2. Project Introduction – Connie Li, TranSmart
3. Introduction to Rural ITS – Bridget Barrett, TranSmart
4. Statewide TOCC Effort – Tom Peters, Mn/DOT TOCC
5. Discussion of District 4 area existing conditions and problems
6. Discussion of Stakeholder Workshop Preliminary Agenda
7. Wrap-up and schedule next Steering Committee Meeting
AGENDA

MN/DOT D4 ITS Scoping Study for Developing Early Deployment Plan

ITS Stakeholders Workshop

Monday, August 18, 2003, 11:00 AM – 3:00 PM

Location:
Transportation District 4
1000 Highway 10 West
Conference Room B109/110
Detroit Lakes, MN 56501

1. (11:00) Welcome and Introductions – Tom Swenson, Mn/DOT District 4
2. (11:05) Quick Overview of Project – Tom Swenson, Mn/DOT District 4
3. (11:10) Introduction to ITS – TranSmart
4. (11:25) Overview of District 4 Inventory – TranSmart
5. (11:45) Introduction of Ranking Exercise – TranSmart
6. (12:00) Lunch / Ranking Exercise – All
7. (12:45) Scenarios Group Exercise – All
8. (1:45) Break
9. (1:55) Reports from Scenarios Group Exercise - All
10. (2:15) Discussion of Additional Problem Areas - All
11. (2:35) Results of Ranking Exercise - TranSmart
12. (2:50) Wrap-up and Next Steps
Meeting Minutes

MN/DOT D4 ITS Scoping Study for Developing Early Deployment Plan

ITS Stakeholders Workshop

Monday, August 18, 2003, 11:00 AM – 3:00 PM

Location:
Transportation District 4
1000 Highway 10 West
Conference Room B109/110
Detroit Lakes, MN 56501

Attendees:

<table>
<thead>
<tr>
<th>Name</th>
<th>Agency</th>
<th>Work Phone</th>
<th>E-mail Address</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

Welcome and Introductions

Tom Swenson of Mn/DOT welcomed the group. The attendees then introduced themselves and indicated the agency that they were representing. The group represented a broad cross-section of stakeholders, including representatives from Minnesota and North Dakota DOTs, regional planning, city and county engineering, law enforcement, and transportation research organizations.

Quick Overview of Project
Tom Swenson gave a brief overview of the Scoping Study, and provided an opportunity for initial questions. A majority of the attendees of the workshop were at the kickoff meeting, so most were already familiar with the project.

**Introduction to ITS**

TranSmart Technologies presented a brief slide show to give participants an idea of what Intelligent Transportation Systems are, and some types of projects that may be applicable to District 4. A short video was also shown that demonstrated some ITS deployments around the country, including a Mayday system in Colorado, and the Minnesota Guidestar system.

**Overview of District 4 Inventory**

TranSmart provided an overview of the preliminary results of the District 4 transportation systems and facilities inventory. The inventory includes information such as traffic volumes and ADTs, accident data, traffic signals controlled by Mn/DOT, activity centers and special events in the area, transit systems, and available traveler and weather information. This information will be used to help determine transportation problems and possible solutions, including potential ITS projects.

**Ranking Exercise**

The first group exercise of the workshop allowed the participants to rank general transportation problem areas in the district. A list of 43 categories was provided, which included issues such as recurring congestion on highways, lack of available traveler information, transit service area, emergency response times, and safety. Each participant was asked to pick the ten categories he or she felt were the most important issues in the district, and were given ten small colored stickers. They were also asked to break down their ten selections as follows: the two most critical (red dots), the two next most critical (yellow dots), and six other important issues (green dots). Each category was represented by a piece of paper attached to the wall, and participants were asked to place their dots on the ten categories they felt were most important, following the guidelines.

After the exercise, TranSmart collected the sheets from the wall, and tabulated the results. The scores were determined by giving three points for each red dot, two points per yellow dot, and one point per green dot. All 43 categories were then ranked based on highest score. The full results are shown in a table at the end of these meeting minutes. In summary, the issues identified as being the most important included safety, seasonal and recurring congestion, construction, weather, and emergency response time.

**Scenarios Group Exercises**

In this exercise, participants were split into three groups. Each group was presented with the same three scenarios: an incident (bus accident) on the interstate, a hazardous weather situation (strong winter storm), and a large special event (WE Fest). Each scenario presented a description of a typical event, and asked questions about how different agencies respond to the events. All groups were asked to go through all three scenarios and answer the questions, but each group was given one scenario for them to focus on. The groups were given an hour to complete the exercise. Afterwards, each group presented their results from one of the scenarios, and members of the other groups were allowed to provide additional comments. The results have been summarized for each scenario, and will be sent out with these meeting minutes as separate attachments. The
results can also be requested by contacting TranSmart Technologies. These findings will aid in the process of determining potential ITS solutions and developing a high-level ITS architecture.

**Discussion of Additional Problem Areas**

After the group exercises, the participants were provided an opportunity to discuss other concerns, problems, and issues with the transportation system in the District 4 area, including categories from the ranking exercise. A few of the issues that were raised are discussed below:

- **Railroads:** There is a significant amount of train traffic in the district. For example, one busy railroad line in Moorhead sees 67 trains per day. These trains can cause significant queues at grade crossings, and there is often little space for vehicle storage, especially when heavy trucks are present.

- **Recurring Urban Congestion:** There are problems where the urban arterials cross the interstates in the Fargo – Moorhead area. The group would like to see better timed, traffic responsive signals at these locations. Also, they’d like to explore the possibility of using dynamic message signs to provide alternative route information into/from the urban area. The urban area is growing fast, and the Red River and interstates (I-94 and I-29) present additional challenges for traffic flow into and out of the city centers.

- **Seasonal Congestion:** Traffic in the summertime, especially on Friday evening and Sundays, can be heavy due to tourist traffic. USTH 10 is very busy, and it is often hard for traffic (including heavy trucks and farm equipment) to find acceptable gaps to cross. The intersections of USTH 10 with MNTH 32 and MNTH 9 are significantly affected, although Mn/DOT plans to improve the intersection of 10&32 with an interchange in 2009. There is also a general lack of passing opportunities on many highways in the district. Travelers in Minnesota have an expectation be able to travel 60-65 mph on most highways.

- **Safety:** This part of Minnesota can be severely impacted by weather events, and there is a need to inform the public of hazardous weather situations. For example, the state could provide more information on dynamic message signs in key locations. In rural areas, where there is a general lack of congestion, accidents at unsignalized intersections are the key concern. Often, when drivers approach a stop sign in a rural area, there is no cross traffic, and they may become complacent. This region has a significant problem with drivers failing to stop at stop signs, thereby causing accidents, many of which result in severe injuries or fatalities.

**Next Steps**

The next meeting of the Steering Committee will be held on Tuesday, September 30th, from 12:00 noon to 3:00 PM, in room B109 of the Mn/DOT District 4 office in Detroit Lakes. An agenda will be sent out prior to the meeting. One of the goals of the meeting will be to discuss and rank potential ITS projects.

The workshop adjourned at 3:00 PM.

Minutes prepared by TranSmart Technologies. Please contact Seth Johnson at (608) 273-4740x16 or sjohnson@trafficonline.com with any questions or comments.
District 4 ITS Stakeholder Meeting
Hazardous Weather Scenario Exercise

Scenario: A strong winter storm is forecasted to hit West Central Minnesota within the next few hours. The storm is predicted to include heavy snowfall and winds resulting in blowing snow. Icing on bridges including the I-94 bridge over the Red River is expected.

- How would you get current information about weather and road conditions including pavement temperature and the presence of ice? What kinds of information are currently available to you?
  - Radio, TV, news media
  - 511
  - RWIS
  - National Weather Service
  - Radar and weather reports from internet
  - Reports from Highway Patrol and maintenance crews

- What problems do you have currently getting weather and road condition information? Are there types of information you do not have access to that would be helpful?
  - 511 doesn’t work well (problems with voice recognition)
  - Counties don’t have access to same info as Mn/DOT
  - Want more RWIS info
  - Flood information before it happens (predictions)

- Who would you communicate with while preparing for and dealing with the storm either within your own agency or at another agency (Mn/DOT, law enforcement, transit)? Who would you provide information to and how would you do it?
  - Mn/DOT maintenance
  - Law enforcement / State Patrol
  - Public
  - Media
  - Communications could be improved. Perhaps post some information on a web site.

- Who do you think would need information about the storm including information about road conditions, incidents, and closures? Are there any agencies that you do not provide
information to that you think you should? Is there information that would be helpful to you that you do not currently receive?

- Schools
- Traveling public, media
- State Patrol / law enforcement
- MnDOT and local highway maintenance agencies
- Commercial vehicle operators
- Transit agencies
- Info about what roads are closed

- What kinds of information would you currently provide to travelers and how would you provide it (media, variable message sign, etc.) both prior to and during the storm?

  - Road conditions (ice, snow covered, etc.)
  - Blockages / road closures
  - Visibilities
  - Road work
  - Media
  - 511
  - Permanent and portable DMS
  - Weather kiosks at rest areas
  - Info only available for Minnesota Trunk Highways

- What kinds of information would you want to provide to the public and what do you think would be the best way to provide it?

  - Info on county and local roads
  - More weather and road condition information
  - Provide direct access to Mn/DOT info for counties, municipalities, and public
  - Radar screens at rest areas
  - DMS at advanced locations
  - 511

- Who is responsible for applying salt or other deicing chemicals? How is it determined how much deicing material to apply and where to apply it?

  - Mn/DOT maintenance
  - Based on experience
  - Bare pavement policy
  - RWIS
  - Statewide program for chemical applications
• How is communication with maintenance vehicles handled currently? What type of communication is used (radio, cell phone, etc.), and what type of information is exchanged? Is this information currently provided to any other agencies?
  o 2-way radios and cell phones
  o AVLs on snowplows yet?
  o Road conditions information and maintenance status is exchanged
  o North Dakota can dial into 2-way radio system

• What types of problems in dealing with winter maintenance have you encountered? What do you think could be done to improve things?
  o Few or no backup trucks available
  o Trouble handling major events; some private snow-plow operators need to be hired
  o Getting salt from vendors
  o Trucks getting stuck or getting in accidents
  o Poor visibility
  o Better communications between agencies (need Memorandum of Understanding)
  o Automatic vehicle location (AVL) / GPS
  o Crash avoidance technologies
  o Counties need access to more information
  o Real-time information
Scenario Description: Its around 4:00 PM on a Tuesday afternoon and an accident has just occurred on I-94. A school bus has sideswiped another vehicle while attempting to change lanes, veered out of its lane colliding with another vehicle, and overturned, coming to rest in the center lane of the freeway.

Incident Detection

- How would the incident normally be detected?
  - School bus radio
  - Cell phone / 911

- How would the exact location of the incident be determined?
  - Description from caller
  - Name of road, cross streets
  - Distance from reference points, exits, or landmarks
  - Verification from emergency responders

- Are there any problems currently with detecting and locating incidents? What do you think could be done to improve this?
  - Unfamiliar users don’t know where they are or give poor descriptions
  - Victim may be unable to call due to injury or lack of cell phone, and there may be no witnesses or other drivers in the area.
  - Problem determining in which county incident is located
  - May be multiple accidents in same area, but that can’t be seen from one location. Need to verify response to each.
  - Milepost education / enhanced reference markers
  - Mayday systems
  - AVL in transit and maintenance vehicles
  - Determining location of cell phones through GPS, triangulation, etc.
  - Incident detection systems
  - CCTV only good if there are other detection methods (eg, loop detectors)
Emergency Response

- Who would be the first to respond to the incident? What other agencies might be called to respond?
  - Nearest law enforcement
  - Other law enforcement (police, sheriff, state patrol)
  - Fire department / EMS
  - Maintenance (for traffic control and cleanup)
  - Tow truck operators
  - HAZMAT when necessary

- How would this be determined and coordinated between agencies?
  - Phone calls
  - Joint dispatch in urban areas
  - State Patrol dispatch in rural areas
  - Emergency Operations Plan (EOP) guidance
  - EMS plans

- How would the different agencies responding to the incident communicate with each other?
  - Phone calls
  - On-the-scene coordination
  - Radios
  - Central dispatch

- Are there any problems currently with communicating with other emergency response agencies? What do you think could be done to improve this?
  - Can’t always communicate by radio
  - Phone calls don’t always work well
  - Use common frequencies for radios
  - Coordinated central dispatch
Communications and Information Exchange between Agencies

- Which agencies or organizations do you think would need information about this incident (Mn/DOT, law enforcement agencies, etc.), and what kinds of information (lane closures, injuries, etc.) do you think they would need?

<table>
<thead>
<tr>
<th>Agency</th>
<th>Type of Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mn/DOT maintenance</td>
<td>Location, lane closures and traffic control needs, crash severity of incident, damage to infrastructure, clean-up needs</td>
</tr>
<tr>
<td>Law enforcement</td>
<td>Location, severity of incident, lane closures and traffic control needs, number and severity of injuries</td>
</tr>
<tr>
<td>EMS / Fire</td>
<td>Location, severity of incident, number and severity of injuries, location to transport the injured</td>
</tr>
<tr>
<td>Media / public</td>
<td>Location of incident, traffic problems, general information from law enforcement</td>
</tr>
<tr>
<td>Tow truck operators</td>
<td>Location of incident, number and size of vehicles to be cleared</td>
</tr>
</tbody>
</table>

- Does your agency currently receive or provide any of this information to other agencies? How is the information received or provided?
  - Communication between law enforcement, Fire / EMS, and Mn/DOT
  - Phone calls, radios, dispatch

- Is there any additional information about incidents like the one described that you think your agency should receive and what would be the best way to receive it?
  - More communications between agencies needed
  - HAZMAT information and training
  - Road closures
Traveler Information

- What information about the incident would be provided to travelers (lane closures, location, etc)? How currently would this information be provided (media, variable message signs)?
  
  o Location, lane closures, general info
  
  o Media
    o 511
    o Portable DMS

- Have you experienced difficulties with providing drivers with the information they need during an incident like the one described? How do you think that information could be better provided to travelers?
  
  o Difficult to provide timely traffic info, especially for short-term incidents
  
  o Need more information about traffic backups and chain reaction events

  o Coordinated permanent and portable DMS (portable DMS could be mounted on law enforcement vehicle)
Scenario Description: The WE Fest was recently held in Detroit Lakes. This festival and other events held during the summer bring a huge influx of tourists into the area resulting in increased traffic congestion and other transportation problems.

- What types of traffic problems were encountered during WE Fest, and other events this year and in past years (congestion, increased incidents, etc.)?
  - Increased traffic congestion – trailers, campers
  - Increased incidents – drinking minors, onlookers
  - Increased congestion in Detroit Lakes

- How are these traffic problems currently dealt with during WE Fest?
  - Signs
  - Traffic control / law enforcement
  - Pedestrian underpass
  - Temporary one-way streets
  - Advertising / publicity
  - Shuttle buses

- What ideas do you have for improving the way these problems are handled in the future?
  - Dynamic message signs (DMS)
  - Highway advisory radio (HAR)
  - Information on 511 system
  - More information on ticket for event

- How is traveler information provided to tourists coming into the area for WE Fest prior to their trip? What kinds of information are provided?
  - Info printed on tickets
  - Brochures
  - Newspaper advertising
• How is information provided to travelers once they have arrived in the area for WE Fest? What kind of information is provided (directions, location of parking, availability of parking)?
  
  o Signage for parking, entrances, campgrounds, shuttle areas

• What other types of events, holidays or tourist attractions result in similar traffic problems in the area?
  
  o Steam Threshers Reunion in Rollag (Labor Day weekend)
  o Spirit Fest Midwest (late July) and 10,000 Lakes Fest (July 4th weekend) at Soo Pass Ranch in Detroit Lakes (same location as WE Fest)
  o 4th of July
  o Detroit Lakes Water Carnival (mid July)
  o Memorial Day and Labor Day weekends
  o Concerts and events at Fargo Dome

• Are there particular highway locations that are most affected by WE Fest and other events?
  
  o USTH 59, including intersections with CR22, CSAH 6, USTH 10, Willow St
  o USTH 10
  o For Steam Threshers, intersection of USTH 10 and MNTH 32 is affected
AGENDA

MN/DOT D4 ITS Scoping Study for Developing Early Deployment Plan

ITS Steering Committee Meeting

Tuesday, September 30, 2003, 12:00 PM – 3:00 PM

Location:

Transportation District 4
1000 Highway 10 West
Conference Room B109/110
Detroit Lakes, MN 56501

1. Welcome and Introductions – Tom Swenson, Mn/DOT District 4
2. Summary of Results From Stakeholders Workshop – TranSmart
3. Discussion of Project Goals and Objectives - All
4. Overview of ITS User Services and Market Packages - TranSmart
5. Overview of Potential ITS Solutions for District 4 - TranSmart
6. Solutions Ranking Exercise - All
7. Discussion of Results from Ranking Exercise - All
8. Wrap-up and Schedule Next Steering Committee Meeting (Conference Call) - All
Meeting Minutes

MN/DOT D4 ITS Scoping Study for Developing Early Deployment Plan

ITS Steering Committee Meeting

Tuesday, September 30, 2003, 12:00 PM – 3:00 PM

Location

Transportation District 4
1000 Highway 10 West
Conference Room B109/110
Detroit Lakes, MN 56501

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<td><a href="mailto:tmgordo@co.becker.mn.us">tmgordo@co.becker.mn.us</a></td>
</tr>
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<td>Bruce Hentges</td>
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<td><a href="mailto:sjohnson@trafficonline.com">sjohnson@trafficonline.com</a></td>
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<td><a href="mailto:llandstr@state.nd.us">llandstr@state.nd.us</a></td>
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<td>Rick Lane</td>
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<td>701-241-1529</td>
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<td><a href="mailto:bradley.monson@dot.state.mn.us">bradley.monson@dot.state.mn.us</a></td>
</tr>
<tr>
<td>Dayle Peterson</td>
<td>Minnesota State Patrol</td>
<td>218-846-0784</td>
<td><a href="mailto:dayle.a.peterso@state.mn.us">dayle.a.peterso@state.mn.us</a></td>
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<tr>
<td>Dennis Redig</td>
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<td>218-847-1575</td>
<td><a href="mailto:dennis.redig@dot.state.mn.us">dennis.redig@dot.state.mn.us</a></td>
</tr>
<tr>
<td>Tom Swenson</td>
<td>Mn/DOT – D4</td>
<td>218-847-1523</td>
<td><a href="mailto:thomas.swenson@dot.state.mn.us">thomas.swenson@dot.state.mn.us</a></td>
</tr>
<tr>
<td>Brad Wentz</td>
<td>Becker Co.</td>
<td>218-847-4463</td>
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<tr>
<td>Bob Zimmerman</td>
<td>City of Moorhead</td>
<td>218-299-5393</td>
<td><a href="mailto:bob.zimmerman@ci.moorhead.mn.us">bob.zimmerman@ci.moorhead.mn.us</a></td>
</tr>
</tbody>
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Handouts

1. Agenda
2. Printouts of Presentation Slides
3. Stakeholder Meeting Ranking of Transportation Issues
4. ITS Development Goals and Objectives
5. National Architecture User Services & Market Packages
6. User Services & Market Packages (Applicable to District 4)
7. User Services Mapped to Transportation Issues
8. List of Potential ITS Solutions
9. Meeting Minutes from Stakeholders Workshop
Welcome and Introductions

Tom Swenson of Mn/DOT welcomed the group. The attendees then introduced themselves and indicated which agency they represented. Most of the individuals had also attended the stakeholder workshop and/or kickoff meeting, but there were a couple of new attendees.

Summary of Results from Stakeholders’ Workshop

TranSmart presented a brief overview of the results of the Stakeholders’ Workshop, which was held on Monday, August 18th, 2003 at the District 4 office in Detroit Lakes. Refer to Handout #3 for the results of the Transportation Issues Ranking Exercise. TranSmart also reviewed the results of the Scenarios Exercises and the discussion of additional problem areas. Please refer to the meeting minutes from the Stakeholders Workshop (handout #9) for further information.

Discussion of Project Goals and Objectives

TranSmart presented a list of general ITS goals and objectives (see Handout #4). The list of goals was developed by the USDOT ITS Program, but should be tailored to meet the needs of District 4. The group reviewed these goals and objectives, but made no decisions on adopting and/or changing them. A specific list of goals and objectives is necessary in order to evaluate the effectiveness of the study and future ITS projects that will be implemented as a result. The group was asked to keep this in mind, and the topic will be raised again at a future meeting.

Overview of ITS User Services and Market Packages

TranSmart presented a brief description of ITS User Services and Market Packages. The term “user service” is used to document what ITS components should do from the user perspective. A “market package” is essentially an integrated collection of ITS components and technologies that can be used to help provide one or more user services. Handout #5 shows a complete list of User Services and Market Packages, while Handout #6 shows a revised list of items that may be applicable to District 4. Handout #7 displays a table of user services mapped to the top transportation issues in District 4 as determined at the stakeholders’ workshop. This table offers a quick glance at what problem areas in the district may be addressed with ITS solutions.

Overview of Potential ITS Solutions for District 4

After reviewing the general areas that ITS solutions might be used in District 4, TranSmart presented an overview of specific technologies and potential projects for the district. Handout #8 is a list of the potential projects, while the presentation slides (Handout #2) provide more detailed information about each technology.

Solutions Ranking Exercise

This exercise was similar to ones performed at the Stakeholders’ Workshop. Sheets of paper were hung on the walls, each one labeled with a potential ITS solution. There were a total of 35 ITS solutions to choose from. Each participant was given 15 colored stickers (5 red, 5 yellow, 5 green), and was asked to rank his or her top 15 projects, in groups of five. The participants voted by placing the colored dots on the sheets corresponding to the solutions he or she would like to see undertaken in the district. The red dots were used for the five most important projects, yellow for numbers six through ten, and green for numbers eleven through fifteen. After the exercise,
the results were tabulated (red = 3 points, yellow = 2 points, green = 1 point), and are shown in
the following table:

<table>
<thead>
<tr>
<th>ITS Solution</th>
<th>Score</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Message Signs</td>
<td>34</td>
<td>1</td>
</tr>
<tr>
<td>Highway-Rail Crossing Safety Systems</td>
<td>32</td>
<td>2</td>
</tr>
<tr>
<td>Automatic Anti-Icing Systems</td>
<td>31</td>
<td>3</td>
</tr>
<tr>
<td>Information Dissemination System</td>
<td>31</td>
<td>3</td>
</tr>
<tr>
<td>Work Zone Safety Systems</td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td>Highway-Rail Alert Systems</td>
<td>25</td>
<td>6</td>
</tr>
<tr>
<td>Integrated Signal Systems</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td>Incident Management/Alternate Route Plan</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td>Traveler Information on the Internet</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>Traffic Signal Preemption for Emergency Vehicles</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>AVL/Computer Aided Dispatching System</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>Portable Traffic Management System</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>Mayday Systems</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Road Weather Information System (RWIS)</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Interactive Kiosks</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Enhanced Reference Signs</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>CVO Mobile Scales Information Database</td>
<td>8</td>
<td>17</td>
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<tr>
<td>Smart Plows/Agency Vehicle Monitoring</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Highway Advisory Radio (HAR)</td>
<td>7</td>
<td>19</td>
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<tr>
<td>Closed Circuit Television (CCTV)</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Vehicle Detection</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Automatic Vehicle Location (AVL) for Transit</td>
<td>6</td>
<td>20</td>
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<tr>
<td>Vehicles</td>
<td></td>
<td></td>
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<tr>
<td>Advanced Scheduling / Dispatch System for</td>
<td></td>
<td></td>
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<tr>
<td>Paratransit</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Automated Visibility Warning System</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Ride-sharing Database</td>
<td>5</td>
<td>25</td>
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<tr>
<td>Overheight Detection and Warning System</td>
<td>5</td>
<td>25</td>
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<tr>
<td>Freeway Gates</td>
<td>5</td>
<td>25</td>
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<td>Roadway Service Patrols</td>
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<td>25</td>
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<tr>
<td>Traveler Information via Faxes</td>
<td>4</td>
<td>29</td>
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<tr>
<td>Speed Warning Systems</td>
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<td>29</td>
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<td>Transit Vehicle Traffic Signal Priority</td>
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<td>29</td>
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<td>Traffic Cable Television Channel</td>
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<td>32</td>
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<tr>
<td>Animal Warning Systems</td>
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<td>33</td>
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<tr>
<td>Intersection Collision Warning</td>
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<td>34</td>
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<tr>
<td>Route Diversion Systems</td>
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<td>34</td>
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</table>

The results are only intended to provide a starting point for considering potential projects. As the
study continues and more input is received, new solutions may be added, the rankings may
change, and specific applications and locations will be discussed. Any members of the committee
who were not present at the meeting are welcome to provide their general input and/or rank their
top 15 projects. TranSmart will modify the results if more votes are received. Contact Seth
Johnson at TranSmart if you would like to add your votes.

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Next Steps

The next Steering Committee meeting will be a conference call in either late-November or early-December. TranSmart will coordinate with Tom Swenson and Marc Briese to set up the date, time, and phone number. The general purpose of the meeting will be to further discuss potential ITS solutions, including specific projects and locations. An announcement will be made as soon as the date and time for the meeting are determined, and an agenda will be sent out prior to the conference call.

The meeting adjourned at 3:00 PM.

Minutes prepared by TranSmart Technologies. Please contact Seth Johnson at (608) 273-4740x16 or sjohnson@trafficonline.com with any questions or comments.