Minnesota ITS Safety Plan

Prepared for:

Prepared by:

URS
SEH Inc.
International Idea Institute, Inc.

October 31, 2006
This Minnesota Intelligent Transportation System (ITS) Safety Plan was created through the coordinated efforts of the Minnesota Department of Transportation (Mn/DOT), Department of Public Safety (DPS), and other stakeholders. Its purpose is to develop ITS strategies and initiatives that reduce the number of traffic fatalities and serious injuries on Minnesota roads. It was developed to coordinate with and to support the Minnesota Comprehensive Highway Safety Plan (CHSP) and the Minnesota Statewide Heavy Vehicle Safety Plan (SHVSP) as Minnesota moves Toward Zero Deaths (TZD). Using a systematic data and information driven process, and with the guidance of the State’s safety partners, this ITS Safety Plan identified six ITS Critical Strategies (Implement In-Vehicle Based Safety Systems, Improve First Responder/Law Enforcement Systems, Implement Vehicle Infrastructure Integration (VII) Systems, Improve Infrastructure Systems and Signage, Use Intersection Collision Warning Systems, and Improve Driver Education and Licensing Systems Using ITS), supported by 22 ITS Safety Initiatives. Similar to the other plans, the ITS Safety Plan is a living document, to be updated and improved as new technology and initiatives become available.

Additional information regarding this document may be obtained from: Ray Starr, P.E; Mn/DOT Assistant State Traffic Engineer – ITS, 1500 West County Road B-2, M.S. 725: Roseville, MN 55113: (651) 634-5264, Ray.Starr@dot.state.mn.us

This Minnesota ITS Safety Plan was prepared for the Minnesota Department of Transportation by the URS Team consisting of URS, SEH Inc., and the International Idea Institute Inc.
Executive Summary

This Minnesota Intelligent Transportation System (ITS) Safety Plan is intended to be a companion document to the Minnesota Comprehensive Highway Safety Plan (CHSP), the Toward Zero Deaths (TZD) Program, and the Minnesota Statewide Heavy Vehicle Safety Plan (SHVSP). All three plans and the TZD Program have a common goal (reducing fatal and life changing injuries), share a common ancestry, and have a similar development process (based on outreach to safety partners). Additionally, each plan presents a comprehensive approach and a set of strategies for addressing identified safety needs in their designated areas.

A broad range of dedicated traffic safety stakeholders developed the CHSP, TZD Program, and the SHVSP. With these plans and programs underway, those involved began to focus on ITS technology as another tool to reduce highway fatalities and serious injuries. Many of the same dedicated stakeholders involved in creating the CHSP, TZD Program, and the SHVSP met to begin preparation of a Minnesota ITS Safety Plan, utilizing ITS technology.

The purpose of the Minnesota ITS Safety Plan is to develop ITS strategies and initiatives that reduce the number of vehicle traffic fatalities and serious injuries on Minnesota roadways. The ITS Safety Plan supports other safety programs and provides the Minnesota Department of Transportation (Mn/DOT), and other stakeholders, with a plan for the implementation of ITS safety strategies and initiatives.

Minnesota’s Crash Reduction Goals

The common goal of Minnesota’s safety plans and programs is to reduce fatal and life-changing injury crashes on Minnesota roads. The goal of the CHSP is to reduce the number of traffic fatalities from approximately 650 annually to 500 or fewer by 2008, and the goal of the SHVSP is to reduce annual truck related fatalities to 70 or fewer by 2008. The goal of the ITS Safety Plan is to move Minnesota Toward Zero Deaths by supporting the CHSP and the SHVSP.

Minnesota ITS Safety Plan Development Process

The CHSP, TZD Program, and SHVSP provide excellent foundation programs for identifying opportunities to utilize technology to reduce highway crashes and deaths on Minnesota roadways. These plans were data driven and developed in a coordinated, integrated, and systematic approach to address highway safety problems in Minnesota by focusing on the number of lives lost, as opposed to the fatal crash rate.
Building on the CHSP and SHVSP, an ITS Safety Plan Oversight Committee began researching previous Minnesota and other states’ ITS safety activities, including successes/benefits realized. A national survey was first conducted to solicit input on ITS safety initiatives, challenges, ideas, and successful ITS safety projects. A workshop was then held to review current safety initiatives in Minnesota and continue to identify potential ITS strategies and initiatives. From the data collected through the surveys and workshop, 91 ITS safety “ideas” were collected. The ideas were then sorted, refined, and compiled. Interviews were held with 14 key program leaders in Minnesota for their input on the critical strategies and initiatives identified through the survey and at the workshop. As part of the development process, an effectiveness spreadsheet was then prepared to estimate the potential safety benefits and the implementation costs associated with each ITS initiative.

The Minnesota ITS Safety Plan

The ITS safety planning and development efforts have resulted in completion of this Minnesota ITS Safety Plan containing six ITS Critical Strategies supported by 22 ITS Safety Initiatives. The selected initiatives advance the six ITS Critical Strategies, which are proactive in their approach to reducing the number of fatalities on Minnesota roadways.

**ITS Critical Strategy 1: Implement In-Vehicle Based Safety Systems**

1.1 Require seatbelt ignition interlock on new vehicles
1.2 Require blood alcohol content level ignition interlocks on vehicles driven by repeat drunk driving offenders
1.3 Provide information to equip vehicles with systems that deliver real-time information and warnings to drivers
1.4 Use preemption on vehicle radios to provide real-time information
1.5 Research equipping vehicles with systems to detect driver distractions and provide warnings

**ITS Critical Strategy 2: Improve First Responder/Law Enforcement Systems**

2.1 Coordinate emergency responder databases to allow access to consistent crash information
2.2 Allow law enforcement to retrieve data from onboard vehicle computers
2.3 Develop and provide a uniform, real-time automated crash reporting system
2.4 Implement automated enforcement of red light running at intersections
2.5 Expand quick clearance policies for incidents
2.6 Implement automated enforcement of speed violations

**ITS Critical Strategy 3: Implement Vehicle Infrastructure Integration (VII) Systems**

3.1 Implement improved lane guidance system
3.2 Develop vehicle to vehicle and vehicle to infrastructure communication

**ITS Critical Strategy 4: Improve Infrastructure Systems and Signage**

4.1 Expand work zone safety systems
4.2 Implement variable speed limit signs
4.3 Expand the use of dynamic message signs to provide location based, real-time information to drivers
4.4 Research use of graphics (and text) for dynamic message sign messages
4.5 Expand geographic coverage of the RTMC systems
4.6 Integrate reporting systems across state and local borders

**ITS Critical Strategy 5: Use Intersection Collision Warning Systems**
5.2 Install rural intersection warning and decision support systems

**ITS Critical Strategy 6: Improve Driver Education and Licensing Using ITS**
6.1 Expand graduated driver licensing
6.2 Use driving simulation for teenage and mature driver education

These six strategies coordinate with and support the CHSP’s five Critical Emphasis Areas and 15 Critical Strategies, the 10 Critical Strategies from the SHVSP, along with the American Association of State Highway and Transportation Official’s (AASHTO) 22 emphasis areas. The 22 emphasis areas were identified in AASHTO’s Strategic Highway Safety Plan (SHSP) to highlight where the greatest number of lives can be saved. Additional details for each plan can be found in the following documents:

- Minnesota Comprehensive Highway Safety Plan  
- Minnesota Statewide Heavy Vehicle Safety Plan  
  [http://www.dot.state.mn.us/ofrw/heavy_vehicle.html](http://www.dot.state.mn.us/ofrw/heavy_vehicle.html)
- AASHTO’s Strategic Highway Safety Plan  
  [http://safety.transportation.org/plan.aspx](http://safety.transportation.org/plan.aspx)

Significant effort was devoted to developing an effectiveness spreadsheet for the Minnesota ITS Safety Plan. The effectiveness spreadsheet provides an opportunity to evaluate the potential for each initiative to reduce fatalities and life-changing injuries. To assist in measuring each initiative a benefit/cost ratio was calculated based on implementation costs. It is important to note that the benefits of each initiative are to society and the costs will be incurred by the agencies within the Minnesota safety community.

**Funding and Three-Year ITS Deployment Plan**

As part of this ITS Safety Plan, a Three-Year Deployment Plan was developed to identify strategies and initiatives to implement within three years as well as identify future efforts. A key component of the deployment plan was to determine the resulting reductions in fatalities/injuries and the costs to implement the initiatives. The strategies and initiatives developed for the Minnesota ITS Safety Plan require that many organizations, public and private, form partnerships and cooperate on reducing road fatalities. The full implementation of the Three-Year ITS Deployment Plan will require significant commitment and effort from Minnesota’s safety community.
Funding will be critical to the success of these initiatives. Most require deployment of ITS technology, either on the roadside, or in the vehicle. Fortunately, this was recognized in the Federal Highway Administration (FHWA) transportation funding legislation for the Safe, Accountable, Flexible, Efficient, Transportation Equity Act-Legacy for Users (SAFETEA-LU). Opportunities exist within SAFETEA-LU for increased funding of ITS and safety projects. The Minnesota challenge, which includes federal, state, county, and local agencies, will be to develop the initiatives contained in this ITS Safety Plan into projects that can be funded and implemented. While SAFETEA-LU can supply some funding for project implementation, additional state, county, and local funding commitments will be required, particularly for ongoing operations.

The Challenge

A lot of thought and effort went into developing the Minnesota ITS Safety Plan. Since most of the technology to implement the identified ITS initiatives already exists, the real need is to begin utilizing the technology. With the potential for saving hundreds of lives each year on Minnesota’s roads, the ITS Safety Plan offers a significant challenge to various agencies across the state. The challenge is to commit the resources, staff, and funding necessary to implement the initiatives in this ITS Safety Plan as soon as possible. With over 45% of the fatalities occurring on local roadways, this challenge applies to all transportation organizations. The need is not political, nor can it be easily balanced against other needs, because each life that can be saved is important to Minnesota. Realistically, not every ITS Safety Initiative can be funded and implemented.

This Minnesota ITS Safety Plan is only the beginning; the first step, in developing safer travel for tomorrow.
## Common Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
</tr>
<tr>
<td>CEA</td>
<td>Critical Emphasis Area</td>
</tr>
<tr>
<td>CHSP</td>
<td>Comprehensive Highway Safety Plan</td>
</tr>
<tr>
<td>Clarus</td>
<td>National Surface Transportation Weather Observing and Forecasting System</td>
</tr>
<tr>
<td>DPS</td>
<td>Minnesota Department of Public Safety</td>
</tr>
<tr>
<td>DSRC</td>
<td>Dedicated Short Range Communication</td>
</tr>
<tr>
<td>DMS</td>
<td>Dynamic Message Signs</td>
</tr>
<tr>
<td>Four E’s</td>
<td>Engineering, Education, Enforcement, Emergency Medical Services</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>ITS</td>
<td>Intelligent Transportation Systems</td>
</tr>
<tr>
<td>Mn/DOT</td>
<td>Minnesota Department of Transportation</td>
</tr>
<tr>
<td>NCHRP</td>
<td>National Cooperative Highway Research Program</td>
</tr>
<tr>
<td>SAFETEA-LU</td>
<td>Safe, Accountable, Flexible, Efficient, Transportation Equity Act-Legacy for Users</td>
</tr>
<tr>
<td>SHSP</td>
<td>Strategic Highway Safety Plan</td>
</tr>
<tr>
<td>SHVSP</td>
<td>Statewide Heavy Vehicle Safety Plan</td>
</tr>
<tr>
<td>TZD</td>
<td>Toward Zero Deaths</td>
</tr>
<tr>
<td>VII</td>
<td>Vehicle Infrastructure Integration</td>
</tr>
</tbody>
</table>
Minnesota ITS Safety Plan Participants

Oversight Committee

Eleven key individuals from various departments within the following agencies provided oversight for the development of the Minnesota ITS Safety Plan.

- Minnesota Department of Transportation (Mn/DOT)
- Minnesota Department of Public Safety (DPS)
- Mille Lacs County

Workshop Attendees

Fifty individuals from various departments within the following agencies participated in the Minnesota ITS Safety Plan Workshop.

- Minnesota DPS
- Minnesota Department of Transportation
- University of Minnesota
- Federal Motor Carrier Safety Administration (FMCSA), Minnesota Division
- AAA Minnesota/Iowa
- Federal Highway Administration (FHWA)
- Mille Lacs County
- C3 TransSystems
- Traffic Technologies
- American Traffic Safety Services Association (ATSSA)
- ADDCO
- Minnesota State Patrol
- South Central Minnesota Emergency Management Services (EMS)

Consultant Support

This Minnesota ITS Safety Plan was prepared for the Minnesota Department of Transportation by the URS Team consisting of the following consulting firms.

- URS Corporation
- SEH Inc.
- International Idea Institute Inc.
# Table of Contents

1.0 Background, Purpose, and Goals  
   1.1 Minnesota ITS Leadership  
   1.2 Purpose and Goal  

2.0 Significant Minnesota Highway Safety Programs  
   2.1 Toward Zero Deaths  
   2.2 Minnesota Comprehensive Highway Safety Plan  
   2.3 Minnesota Statewide Heavy Vehicle Safety Plan  

3.0 Nationwide ITS Safety Initiatives  

4.0 Stakeholder Outreach  
   4.1 Agency Surveys  
   4.2 ITS Safety Plan Workshop  
   4.3 Key Minnesota Program Leader Interviews  

5.0 ITS Safety Critical Strategies and Initiatives  
   5.1 Development Methodology  
   5.2 Detail Descriptions of ITS Safety Critical Strategies and Initiatives  
     - ITS Critical Strategy 1: Implement In-Vehicle Based Safety Systems  
     - ITS Critical Strategy 2: Improve First Responder/Law Enforcement Systems  
     - ITS Critical Strategy 3: Implement Vehicle Infrastructure Integration (VII) Systems  
     - ITS Critical Strategy 4: Improve Infrastructure Systems and Signage  
     - ITS Critical Strategy 5: Use Intersection Collision Warning Systems  

6.0 ITS Critical Strategies and Initiatives Effectiveness Spreadsheet  

7.0 Three Year Funding and Deployment Plan  
   7.1 Funding Opportunities  
   7.2 Corridor Applications  
   7.3 Three-Year Deployment Plan  
   7.4 Impact on Reducing Fatalities and Injuries  
   7.5 The Challenge  

8.0 Action Plans  

9.0 Key Conclusions  

Minnesota ITS Safety Plan  
Table of Contents  

October 31, 2006
Tables

Table 1 - Stakeholder Outreach Efforts .............................. 11
Table 2 - Safety Issues and Possible Technology Application from Agency Surveys 12
Table 3 - Workshop ITS Safety Ideas .................................. 15
Table 4 - Minnesota ITS Safety Plan Effectiveness Spreadsheet .................. 51
Table 5 - ITS Safety Plan Three-Year Deployment Plan Overview .............. 58
Table 6 - ITS Safety Plan Critical Strategies and Initiatives Action Plans .......... 64

Figures

Figure 1 - Safety Programs/Plans Relationship .................................. 2
Figure 2 - Survey Recipients .................................................. 12
Figure 3 - Survey Respondents .............................................. 12
Figure 4 - Three-Year Deployment Plan Development Process ............... 56

References

References .............................................................................. 89

Appendices1

Appendix A - Nationwide ITS Safety Efforts – Summary
Appendix B - Minnesota ITS Safety Plan Survey – Template and Results
Appendix C - Minnesota ITS Safety Plan Workshop - Summary
Appendix D - Minnesota Comprehensive Highway Safety Plan Effectiveness Spreadsheet
Appendix E - Minnesota ITS Safety Plan Effectiveness Spreadsheet – Field Descriptions

1 The Appendices are included as a separate document
1.0 Background, Purpose, and Goals

While Minnesota has one of the lowest traffic fatality rates in the nation, that isn’t enough for Minnesota. The vision of moving Toward Zero Deaths, through the application of the Federal Highway Administration’s (FHWA) Four E’s -- engineering, education, enforcement, emergency medical services -- has inspired transportation safety stakeholders to develop partnerships and plans to further reduce the number of fatalities on Minnesota roads.

To address the Minnesota’s traffic safety issues in a coordinated, integrated, and systematic approach, the Minnesota Department of Transportation (Mn/DOT) and the Department of Public Safety (DPS) along with other stakeholders formed a strong safety partnership. They have prepared and are implementing two initiatives; the Toward Zero Deaths Program (TZD) and the Minnesota Comprehensive Highway Safety Plan (CHSP). Both efforts take an interdisciplinary, comprehensive approach to saving lives, and bring together representatives from engineering, enforcement, education, and emergency medical/health services. The national plan to improve roadway safety is the Association of State Highway and Transportation Official’s (AASHTO’s) Strategic Highway Safety Plan (SHSP).

The goal of the Minnesota CHSP is to reduce the number of traffic fatalities to 500 or less per year by 2008, from the current level of approximately 650. This is the first step in moving Toward Zero Deaths. The TZD Program builds partnerships between community groups and state agencies to improve traffic safety in a designated area. Mn/DOT took the lead in developing the CHSP with assistance from DPS, while DPS took the lead in developing the TZD Program with assistance from Mn/DOT.

To address fatal and life-changing heavy vehicle crashes, the Office of Freight & Commercial Vehicle Operations at Mn/DOT and the Commercial Vehicle Enforcement Section of the Minnesota State Patrol partnered to develop the Minnesota Statewide Heavy Vehicle Safety Plan (SHVSP). The SHVSP and CHSP have a similar development process and approach. The goal of the SHVSP is to reduce heavy vehicle related fatalities to fewer than 70 by 2008, to support the CHSP goal of fewer than 500 fatalities statewide by 2008, and to take the initial steps in moving Toward Zero Deaths.

With the CHSP, TZD and SHVSP programs underway, those involved began to focus on Intelligent Transportation Systems (ITS) technology as another tool to reduce highway crashes and deaths. ITS technology encompasses a broad range of wireless and wire line communications-based information and electronic technologies. When integrated with transportation infrastructure, and vehicles themselves, these technologies relieve congestion, improve safety, and enhance productivity. The question for developing this ITS Safety Plan was how could ITS technologies and strategies be added to and support the CHSP Critical Emphasis Areas. An ITS Safety Plan Oversight Committee was identified to provide input and guide moving ITS strategies in Minnesota forward. The Oversight Committee consisted of participation from the following individuals.

- Bernie Arseneau, Mn/DOT
The CHSP is a resource that will continue to develop with strategies that will continue to evolve to help reach the goal of eliminating highway deaths. Similar to the CHSP, the ITS Safety Plan is a living document, to be updated and improved as new technology and initiatives become available and as benefit/cost lessons are learned.

*Figure 1* illustrates the relationship of the various plans that have come together to reduce road fatalities and mutually support each other.

---

**AASHTO – Strategic Highway Safety Plan (SHSP)**
National plan with 22 areas emphasized where the greatest number of lives can be saved

**Minnesota Toward Zero Deaths (TZD) Program**
Multi-agency partnership led by DPS to raise awareness and develop tools to reduce the number of traffic deaths and injuries in Minnesota

**Minnesota Comprehensive Highway Safety Plan (CHSP)**
Mn/DOT led plan, based on SHSP, but focuses on 5 Critical Emphasis Areas (CEA) and aims to reduce traffic fatalities to fewer than 500 by 2008

**Minnesota Statewide Heavy Vehicle Safety Plan (SHVSP)**
State Patrol and Mn/DOT led companion document to CHSP with a goal of reducing annual truck related fatalities to 70 or fewer by 2008 using 10 Critical Strategies

**Minnesota ITS Safety Plan**
Mn/DOT led plan to support the CHSP and TZD goals with 6 Critical ITS Strategies and 22 ITS Initiatives

*Figure 1: Safety Programs/Plans Relationship*
1.1 Minnesota ITS Leadership

Minnesota has been a national leader in developing ITS programs through the Minnesota Guidestar program, the University of Minnesota (U of M) Center for Transportation Studies, and the U of M ITS Institute. Mn/DOT staff have been involved with FHWA in developing advanced ITS programs, including the National Mayday Readiness Initiative, Vehicle Infrastructure Integration (VII), Cooperative Intersection Crash Avoidance Systems (CICAS), and the National Surface Transportation Weather Observing and Forecasting System (Clarus). These programs reflect FHWA’s major initiatives aimed at improving transportation safety, relieving congestion and enhancing productivity.

Vehicle Original Equipment Manufacturers (OEM) have begun to include ITS technologies in their vehicles. Examples of in-vehicle ITS technology, that is currently available, includes adaptive cruise control systems, drive-by-wire throttle, electronic steering, and OnStar®. The public is also becoming more knowledgeable about ITS technology. For example the May 2006 issue of POPULAR SCIENCE describes an ITS equipped autonomous vehicle currently available in the UK.

Not only has Minnesota made safety a priority; so has the U. S. Department of Transportation (USDOT). As part of SAFETEA-LU, additional focus and funding for the prevention of fatalities and life-changing crashes has become available. The next step is to move forward with ITS plans and projects that can take advantage of available funding.

Many of the same dedicated stakeholders involved in creating the CHSP met in early 2006 to begin discussing how ITS can be used to achieve Minnesota’s safety goals. The result of their efforts has been the completion of this Minnesota ITS Safety Plan.

1.2 Purpose and Goal

The stated purpose of the Minnesota ITS Safety Plan is to develop strategies and initiatives that reduce the number of vehicle traffic crashes, fatalities and serious injuries on Minnesota roadways. The ITS Safety Plan will support other safety programs and provide Mn/DOT, and other stakeholders, with a plan for the implementation of high priority ITS safety strategies and initiatives.

The goal of the ITS Safety Plan is to move Minnesota Toward Zero Deaths by supporting the CHSP with an ITS Safety Plan.
Developers of the ITS Safety Plan realize that ITS technology for both vehicle and road systems is rapidly advancing. Therefore, the ITS Safety Plan must be flexible and nimble to take advantage of new technology and funding developments. Furthermore, not every identified project initiative can be funded and implemented.
2.0 Significant Minnesota Highway Safety Programs

Working together, Minnesota transportation safety stakeholders have developed and implemented a number of important programs and plans to address highway fatalities and to move Minnesota Toward Zero Deaths. Identifying and learning about each plan and program assisted the ITS Safety Plan Oversight Committee in developing this ITS Safety Plan as a companion document to the CHSP building on what has been completed and not duplicating efforts. Together the TZD, CHSP, and SHVSP provide excellent foundation documents for identifying opportunities to use ITS technology to reduce highway crashes and deaths on Minnesota’s roads. Through the development of this plan, the Oversight Committee focused on approaching zero deaths through the use of ITS technology. Application of ITS is key to reducing fatalities on our roads.

The following sections provide a brief summary of each of the plans/programs underway in Minnesota.

2.1 Toward Zero Deaths

Towards Zero Deaths (TZD) is a multi-agency partnership that includes representatives from DPS, Minnesota State Patrol, FHWA, Mn/DOT and the Center for Transportation Studies at the University of Minnesota. The mission of TZD is, "To move Minnesota toward zero deaths on our roads, using Education, Enforcement, Engineering, and Emergency Services.”

Since the 1990s, the Minnesota Departments of Public Safety and Transportation have worked together to find better solutions to the problem of serious injuries and fatal crashes on Minnesota roadways. In 2001, the North Star Safety Workshop brought together experts from many Minnesota research organizations and state agencies - as well as presenters from Washington, Sweden, and Australia - to share information on safety.

The Toward Zero Deaths program developed out of the momentum created by the North Star Safety Workshop. The members of the TZD program team realized that moving toward a goal of zero deaths would require cooperation among state and local agencies.

The goals of the TZD program are as follows:

1. To make Toward Zero Deaths a statewide priority for the administration and the legislature
2. To create partnerships with community groups
3. To strengthen the involvement of other transportation stakeholder groups in order to achieve our collective vision

The only way we are going to approach zero deaths is through the use of ITS technology.
4. To enhance the general public's awareness of the traffic safety problem in Minnesota and what can be done to stop it

5. To implement practical, innovative ideas and best practices developed from research at the University of Minnesota and state agencies

The TZD website, http://www.tzd.state.mn.us/, contains information on how individuals can organize to identify traffic safety problems in their community and participate in finding solutions to those problems. By working together, community groups and government agencies can be successful in making Minnesota's roads safer. A Toward Zero Death Conference is also organized each year by DPS, Mn/DOT and the TZD program. The conference is intended to provide a forum to share information on best practices in the areas of engineering, enforcement, education, and emergency medical/health services, and to identify new approaches for reducing the number of fatalities and life-changing injuries on Minnesota roads.

2.2 Minnesota Comprehensive Highway Safety Plan

The Minnesota Comprehensive Highway Safety Plan (CHSP) was created in response to the fatal crash rate in Minnesota. From a peak in the 1970’s, there have been significant reductions in the number of traffic related fatalities in Minnesota, which led to noticeable decreases in the fatal crash rate. However, after 1980 there has been an increasing trend in the number of traffic fatalities while the trend in the fatal crash rate has flattened. The pattern in Minnesota’s traffic fatalities has paralleled the national trend.

Looking at highway crash statistics and the lack of progress in reducing fatalities in the United States led AASHTO to create the Strategic Highway Safety Plan (SHSP). The SHSP acknowledged the need for the states to look at traffic safety in a new way and identified 22 emphasis areas where the greatest number of lives can be saved. In Minnesota a review of the fatal crash data revealed that some of the key contributing factors -- young drivers, impaired drivers, aggressive drivers, unbelted vehicle occupants, lane departure crashes, and intersection crashes -- are directly related to the original AASHTO 22 emphasis areas.

Since previous approaches to traffic safety were becoming less effective as reducing the number of traffic fatalities, Mn/DOT and DPS created a partnership to address the State’s traffic safety issues in a coordinated, integrated, and systematic approach by preparing and implementing two initiatives; TZD and the Minnesota CHSP.

The goal of the Minnesota CHSP is to reduce the number of traffic fatalities to 500 or less per year by 2008, from the current level of approximately 650 traffic fatalities per year. This is the first step in moving Toward Zero Deaths. Mn/DOT has taken the lead in developing the CHSP programs, while DPS has taken the lead in developing the TZD Program.
From AASHTO’s original 22 emphasis areas, the CHSP partners identified five Critical Emphasis Areas (CEAs) that are most important to Minnesota. They are:

CEA 1 – Reducing Impaired Driving and Increasing Seat Belt Use.
CEA 2 – Improving the Design and Operation of Highway Intersections
CEA 3 – Addressing Young Drivers over Involvement and Curbing Aggressive Driving
CEA 4 – Reducing Head-On and Across-Median Crashes, Keeping Vehicles on the Roadway and Minimizing the Consequences of Leaving the Road
CEA 5 – Increasing Driver Safety Awareness and Improving Information Systems

To support the CEAs, 15 Critical Strategies were identified. Based on a data driven prioritization process, these Critical Strategies have the greatest ability to reduce the number of traffic fatalities and serious injuries in Minnesota. Action Plans were also developed for each of the Critical Strategies. The CHSP Critical Strategies are:

1. Provide adequate law enforcement resources
2. Primary seat belt law
3. Implement automated enforcement
4. Stronger graduated driver licensing system
5. Cost effective lane departure improvements
6. Communication and marketing task force
7. High-level traffic safety panel and legislative action committee
8. Cost effective intersection improvements
9. Roadway maintenance
10. Support the enforcement of traffic safety laws
11. Targeted enforcement
12. Enhance driver education
13. Road safety audits
14. Improve data system
15. Statewide trauma system

2.3 Minnesota Statewide Heavy Vehicle Safety Plan

The Statewide Heavy Vehicle Safety Plan (SHVSP) is a companion document to the CHSP. Both documents have the same goal (reducing fatal and life-changing injury crashes), share a common ancestry and had a similar development process (based on outreach to safety partners). Additionally, both plans present a comprehensive approach and a set of strategies (enforcement, engineering, and education) for addressing the identified safety needs.

The CEAs of the CHSP do not specifically address fatal and life-changing injury crashes involving heavy vehicles because the data driven screening process found that the number of severe truck crashes was not high enough to be in Minnesota’s top five list. In order to focus on fatal and life-changing heavy vehicle crashes, the Office of Freight and Commercial
Vehicle Operations at Mn/DOT and the Commercial Vehicle Enforcement section of the Minnesota State Patrol joined forces to develop the Minnesota SHVSP.

A review of historic crash data from Minnesota found that the total number of truck crashes (about 6,000 annually) and fatal truck crashes (about 75 annually) has remained relatively consistent since the early 1990’s. This data matches the national trend, which AASHTO and FHWA suggest is a call for a new focus on system-wide safety, the use of proven strategies, a better balance between reactive and proactive measures, and better integration among agencies responsible for safety enforcement/engineering/education and finally adoption of an aggressive safety goal. Consistent with these initiatives, the Federal Motor Carrier Safety Administration has established a goal to reduce the number of truck related fatalities by 25%. Minnesota’s Departments of Public Safety and Transportation have endorsed this effort and have adopted a goal of reducing annual truck related fatalities to 70 or fewer by 2008.

Developers of the SHVSP analyzed crash data, input from AASHTO, and the National Cooperative Highway Research Program (NCHRP), and conducted a workshop where input from approximately 50 professionals representing a cross section of safety experts was prioritized. The final result of these efforts is a prioritized list of ten Critical Strategies that address enforcement, engineering, and education issues, including:

1. Law Enforcement and Inspector Resources
2. Cost Effective Road and Roadside Improvements
3. Strengthen Commercial Drivers Licensing
4. Passenger Vehicle Driver Education
5. Four-Cable Median Barrier
6. Automatic Notification of Driver Convictions
7. Demonstration Corridor
8. Work Zones
9. Targeted Enforcement
10. Improve Data Systems.

The greatest challenge facing traffic safety professionals in Minnesota is acknowledging that the effort to reduce fatal and life-changing injuries associated with crashes involving heavy vehicles is tied to implementing the prioritized strategies. The guiding principles suggest that the most effective implementation likely involves doing things differently from what has been done in the past. This includes investing in more enforcement and having the enforcement focused in the corridors with the greatest needs based on truck volumes, speed profiles, number of citations, and number of truck crashes.
3.0 Nationwide ITS Safety Initiatives

The TZD Program, the CHSP, and the SHVSP are important road safety planning documents for Minnesota. However, many significant ITS safety programs have been or are being developed nationwide. To recognize and incorporate the potential of these programs, the ITS Safety Plan Oversight Committee researched these ITS safety activities, including successes/benefits realized. Appendix A - Nationwide ITS Safety Efforts - Summary provides additional information for each of the following identified national ITS safety activities:

- **Intelligent Vehicle Initiative (IVI)**
  IVI aims to accelerate the development and commercialization of vehicle-based driver assistance products that will warn drivers of dangerous situations, recommend actions, and even assume partial control of vehicles to avoid collisions.

- **Vehicle Infrastructure Initiative (VII)**
  The VII vision is that every car manufactured in the U.S. would be equipped with a communications device and a GPS unit so that data could be exchanged with a nationwide, instrumented roadway system.

- **Cooperative Intersection Collision Avoidance Systems (CICAS)**
  CICAS use both vehicle-based and infrastructure-based technologies to help drivers approaching an intersection understand the state of activities within that intersection. The system has the potential to warn drivers about likely violations of traffic control devices and to help them maneuver through cross traffic.

- **Stop Red Light Running Program – Photo Enforcement**
  The “Stop Red Light Running Program” is a nationwide effort to increase driver awareness of the dangers and consequences of running red lights. The aim is to continually reduce the incidents of red light running in order to prevent related crashes, trauma center admissions and fatalities.

- **The Interactive Highway Safety Design Model (IHSDM)**
  IHSDM is a suite of software analysis tools for evaluating safety and operational effects of geometric design decisions on two-lane rural highways. IHSDM is a decision-support tool.

- **Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA-LU)**
  SAFETEA-LU is a major effort at the Federal level to reduce the number of severity of highway-related crashes. The primary purpose of this legislation was to provide for a coordinated national highway safety program through financial assistance to the States to accelerate highway traffic safety programs. With guaranteed funding for highways, highway safety, and public transportation SAFETEA-LU represents the largest surface transportation investment in the U.S. history.

- **Safe Routes to Schools (SRTS)**
  The SRTS program was created by Section 1404 of SAFETEA-LU. It provides funds to the States to substantially improve the ability of primary and middle school students to walk and bicycle to school safely.
Automated Collision Notification (ACN) Field Operational Test (FOT)
The goal of ACN FOT is to design, develop, and field test new technology to automatically detect and characterize potential injury-causing vehicle crashes and then provide 911 dispatchers with information about the crash events.

ITS Safety in Work Zones
Safety in work zones means ITS technologies that provide ways to better monitor and manage traffic through work zones and increase safety for both workers and road users.

Human Centered Systems Laboratories (HCSL) (The HumanFIRST Program)
The HCSL support the testing and evaluation of driver performance through the use of a wide range of testing facilities. The HumanFIRST (Human Factors Interdisciplinary Research in Simulation and Transportation) laboratory provides facilities – including an immersive, virtual-reality simulator environment – and expertise to study the interaction between people and transportation systems.

Advocates for Highway and Auto Safety (AH & AS)
AH &AS is an alliance of consumer health and safety groups to increase public participation such as working with insurance companies and agents to make America’s roads safer.
4.0 Stakeholder Outreach

With a background of Minnesota safety needs (Chapter 2.0: Significant Minnesota Highway Safety Programs) and the results compiled from other ITS safety programs nationwide (Chapter 3.0: Nationwide ITS Safety Initiatives), the ITS Safety Plan Oversight Committee began a three step outreach process to identify potential ITS safety initiatives for Minnesota. The outreach efforts included:

- National and Minnesota Agency Survey
- ITS Safety Plan Workshop
- Interviews with Key Minnesota Program Leaders

Table 1: Stakeholder Outreach Efforts provides an overview of the audience and focus of each outreach activity conducted.

<table>
<thead>
<tr>
<th>Outreach</th>
<th>National and Minnesota Agency Survey</th>
<th>ITS Safety Plan Workshop</th>
<th>Interviews With Key Minnesota Program Leaders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audience</td>
<td>Over 100 National and Minnesota Agencies</td>
<td>50 Minnesota Safety Stakeholders</td>
<td>14 Minnesota Key Program Leaders</td>
</tr>
<tr>
<td>Focus</td>
<td>To identify ITS safety ideas and strategies including: - Safety initiatives - Challenges - Issues - Successful projects</td>
<td>To build upon the survey results by continuing to identify ITS strategies (without consideration of funding constraints).</td>
<td>To review prospective ITS initiatives from the survey and workshop; rate the initiatives for their perceived safety value and potential for implementation; and identify specific initiatives well suited to existing programs.</td>
</tr>
</tbody>
</table>

The following sections provide details on the process and results for conducting the agency surveys, workshop, and interviews.

4.1 Agency Surveys

As part of the ITS Safety Plan development process a stakeholder survey was developed to solicit input on ITS safety initiatives, challenges, project/program ideas, and successful ITS safety projects that have worked in Minnesota and other states. The survey results provided a
foundation for identifying ITS initiatives and strategies at a subsequent workshop. The survey template is included in Appendix B.

The survey was sent to 111 recipients including representatives of FHWA, State DOT’s, Metropolitan Planning Organizations (MPOs), cities and counties, private firms, police/patrol departments, universities, and others (hospitals, public safety organizations, public transportation, etc.).

Forty-seven recipients responded to the survey, which is a 42% return rate. Figure 2: Survey Recipients provides an overview of the backgrounds for those that received the survey. Figure 3: Survey Respondents provides an overview of those responding to the survey.

4.1.1 Survey Results

Following is a summary of the information gathered from the surveys. Complete details of the survey results are included in Appendix B: Minnesota ITS Safety Plan Survey.

The survey provided respondents with the opportunity to indicate ITS or highway safety efforts that they were familiar with or would like to see implemented. Some of the items indicated included AMBER Alert, work zone safety, Toward Zero Death, and dynamic message signs. The full list of efforts noted by recipients is included in Appendix B. Survey respondents also identified specific safety issues and suggested possible technology applications (see Table 2).

<table>
<thead>
<tr>
<th>Safety Concern</th>
<th>Technology Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>- Flashing Beacons</td>
</tr>
<tr>
<td>- Rural Intersections Crash Avoidance</td>
<td>- Automated speed reduction signs (advisory)</td>
</tr>
<tr>
<td></td>
<td>- Crash data/automated crash records system</td>
</tr>
<tr>
<td>Minnesota ITS Safety Plan</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Chapter 4.0</strong>&lt;br&gt;<strong>Roadway Departures in Rural Areas</strong>&lt;br&gt;- Run off Road Collisions&lt;br&gt;- Unintentional Lane Departures&lt;br&gt;- Animal Vehicle Crashes</th>
<th><strong>VII, Mayday (OnStar®) and Next Gen 911</strong>&lt;br&gt;- Deer Warning System&lt;br&gt;- In-vehicle detection/rumble strips or infrastructure warning devices/lane departure warning systems</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Urban</strong>&lt;br&gt;- Urban Intersection Crashes&lt;br&gt;- Red-Light Running&lt;br&gt;- Pedestrian Safety</td>
<td><strong>Active intersection collision warning systems</strong>&lt;br&gt;- Appropriate signal phasing (e.g., exclusive left turns to minimize conflicts)&lt;br&gt;- Photo recognition and other ETC devices&lt;br&gt;- Detection for starting or extending &quot;Walk&quot;</td>
</tr>
<tr>
<td><strong>Incident Management/Emergency Management/Response</strong>&lt;br&gt;- Incident Management&lt;br&gt;- Emergency Management&lt;br&gt;- Slow Response Time&lt;br&gt;- Public Safety Situational Awareness</td>
<td><strong>Real time data and video (CCTV) available to share between multiple agencies and departments instantly</strong>&lt;br&gt;- Variable speed limits&lt;br&gt;- Real-time info on queues and delays&lt;br&gt;- Response coordination, FIRST&lt;br&gt;- Photogrammetry&lt;br&gt;- High bandwidth wireless access to multimedia content</td>
</tr>
<tr>
<td><strong>Speed Enforcement</strong></td>
<td><strong>Radar trailers</strong>&lt;br&gt;- Variable speed limit signs</td>
</tr>
<tr>
<td><strong>Driver’s Education</strong>&lt;br&gt;- New drivers, Older and Younger drivers&lt;br&gt;- Using Child Restrains Properly&lt;br&gt;- More Strict Motorcycle Training&lt;br&gt;- Drivers Distractions</td>
<td><strong>Implement and enforce education standards</strong>&lt;br&gt;- Media campaigns</td>
</tr>
<tr>
<td><strong>Work Zone Safety</strong>&lt;br&gt;- Variable speed limit signs&lt;br&gt;- Computer tools and staff to better plan work and coordinate work zones&lt;br&gt;- Use of technology to monitor traffic performance in the work zone</td>
<td><strong>VII</strong>&lt;br&gt;- Intelligent cruise control&lt;br&gt;- RWIS&lt;br&gt;- DMS&lt;br&gt;- Fog warning sensors&lt;br&gt;- Bridge deicing&lt;br&gt;- MDSS&lt;br&gt;- Low cost in-pavement sensors and image based image detection systems</td>
</tr>
<tr>
<td><strong>Weather</strong>&lt;br&gt;- Weather Related Crashes&lt;br&gt;- Bridge and Pavement Icing</td>
<td></td>
</tr>
</tbody>
</table>
### Minnesota ITS Safety Plan

#### Chapter 4.0

<table>
<thead>
<tr>
<th>Trucks/Rail</th>
<th>Information/Communications</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Truck Crashes and Truck Safety</td>
<td>- Truck over speed warning system and signing</td>
</tr>
<tr>
<td>- Highway Rail Grade Crossings</td>
<td>- Automated truck inspection</td>
</tr>
<tr>
<td></td>
<td>- Automated enforcement on gate violations</td>
</tr>
<tr>
<td></td>
<td>- DMS signs triggered by approaching trains</td>
</tr>
<tr>
<td></td>
<td>- Use graphics enhanced messages for more effective communications to motorists</td>
</tr>
<tr>
<td></td>
<td>- DMS</td>
</tr>
<tr>
<td></td>
<td>- 511</td>
</tr>
<tr>
<td></td>
<td>- Smart Call Boxes</td>
</tr>
<tr>
<td></td>
<td>- Portable Message Boards</td>
</tr>
<tr>
<td></td>
<td>- GPS Vision TM/Total Vision TM</td>
</tr>
<tr>
<td></td>
<td>- ARTIIS TM</td>
</tr>
<tr>
<td></td>
<td>- Impaired/drowsy driver sensors on vehicles</td>
</tr>
<tr>
<td></td>
<td>- VII other vehicle technology</td>
</tr>
<tr>
<td></td>
<td>- Model detour routing/DMS, HAR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drunk, Impaired Driving</th>
<th>Privatized Efforts for Maintenance, Data Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Impaired/drowsy driver sensors on vehicles</td>
<td>- Model detour routing/DMS, HAR</td>
</tr>
<tr>
<td>- VII other vehicle technology</td>
<td></td>
</tr>
</tbody>
</table>

The survey also asked what factors are important to successfully implementing a safety project or program. Funding and coordination with other agencies were the highest ranked by the majority of survey respondents. Respondents also indicated that the most significant challenges to implementing ITS safety projects or programs are the limited resources available for long term operations and lack of ITS awareness among decision makers. A complete list of the success factors and challenges noted is included in Appendix B.

As part of the survey, respondents also provided a list of documents related to developing a safety plan. These documents were used as references as the Minnesota ITS Safety Plan was developed.

### 4.2 ITS Safety Plan Workshop

The second step of the stakeholder outreach was to conduct an ITS Safety Planning Workshop. The workshop was held March 27, 2006 at the Mn/DOT Arden Hills Training Center in Shoreview, Minnesota with 50 participants. The purpose of this workshop was to review current safety initiatives in Minnesota and throughout the nation, and identify ITS
strategies and initiatives to reduce the number of vehicle traffic fatalities and serious injuries on Minnesota roadways.

A complete summary of the Workshop is included as *Appendix C: Minnesota ITS Safety Plan Workshop - Summary*. The summary provides detailed information discussed at the workshop and the full list of strategic ideas identified by participants. The summary was used as a resource for selection of ITS Critical Strategies and ITS Safety Initiatives.

Participants were separated into four breakout groups to discuss ITS safety ideas/solutions and opportunities. The intent of these breakout group discussions was to generate as many potential ITS strategies as possible (assuming that funding is available), identify prospective partners for the strategies identified, and identify potential barriers to those strategies. Although strategies were initially identified without constraints, the one-on-one interviews with key program leaders conducted after the workshop, filtered the strategies based on constraints (see *Section 4.3*).

Each of the four breakout groups were asked to focus on a theme based on the Critical Emphasis Areas identified in the Minnesota CHSP. The themes included:

- **Group A**: Reduce Teenage, Elderly, and Impaired Driver Crashes
- **Group B**: Reduce Run-Off-The-Road and Intersection Crashes
- **Group C**: Reduce Secondary and Congestion Related Crashes
- **Group D**: Improve Crash Data Collection and Emergency Response

Summary reports of the breakout group discussions were presented at the conclusion of the workshop. These summary reports are covered in detail in *Appendix C: Minnesota ITS Safety Plan Workshop - Summary*. After each of the four groups presented their strategies/ideas, each workshop attendee voted on the strategies/ideas they would like to see move forward.

*Table 3: Workshop ITS Safety Ideas*, provides a listing of the ITS Safety Ideas suggested at the workshop based on votes received from highest to lowest.

<table>
<thead>
<tr>
<th>Strategy - Idea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link EMS/Law Enforcement/Fire Databases at Scene to Investigation</td>
</tr>
<tr>
<td>Vehicle “Black Box” Access</td>
</tr>
<tr>
<td>Vehicle Provide Accident Data</td>
</tr>
<tr>
<td>Seatbelt Interlock (can’t start car)</td>
</tr>
<tr>
<td>Run-Off-The-Road - Technologies in Roadway to Indicate Where the Car is in the Lane (Magnets, GPS, Detecting Pavement Markings)</td>
</tr>
<tr>
<td>Route Guidance System to Tell You Where You Are (Program in Hazardous Roadway Locations or Unexpected Curves or Ice on Bridges)</td>
</tr>
<tr>
<td>Uniform/Automated Crash Reporting/Real-Time</td>
</tr>
<tr>
<td>Variable Speed Limits and Integration with Law Enforcement</td>
</tr>
<tr>
<td>Common Standard for Location Information</td>
</tr>
</tbody>
</table>
### Dynamic Merge in Work Zones
- Intoxication Detection – Alcohol Interlock (can’t start car)
- Graduated (Expanded) Licensing Based on Behaviors (Rewards for Safe Drivers)
- Intersection - Decision Support System
- Interactive Intersection Flashers/CMS
- Intersection - Photocop (Portable) – Place at Various Locations to Mail Poor Driver Behavior to the Owner
- Real-Time Feedback to Drivers - Location Based
- Generate Leadership at Local Levels
- Periodic Retesting for Renewing License
- In-vehicle Reporting/Monitors/Cameras for Education
- Intelligent Vehicle Positioning/Event Warning in Car/Vehicle to Vehicle Communication
- Expand Mayday (OnStar) System
- Pictograms on DMS (Congestion Maps)
- Add High Accuracy GPS to Striper
- Increase Density of System
- Data Recorder (Time of Day, Speed, Weaving, etc.)
- Arterial Information System
- Get All Data Elements From Crash to EMS
- Speed “Governor” (Feedback to Driver From Road Real-Time)
- Smart Card that Communicates to Infrastructure to Tailor Warning to Driver Experience/Information Needs
- Run-Off-The-Road - GPS Needs High Accurate Maps
- Detecting Driver Distractions (Both hands on the Steering Wheel)
- Speed Limit Database for All Road (So That Service Providers Can Cut Off Service or Interrupt When a Driver Needs to Slow Down)
- Expanded Use of Lane Control
- Speed Detection/Reporting
- Rumble Strips
- Information to Driver (DMS) of Poor Behavior/Too Fast For Geometrics
- Quick Clearance Policies (Towing, Reconstruction)
- Driver Simulators for Teenagers and Elderly to Provide Objective Feedback
- RFID for Reading Driver Information while Mobile/Ability to Update Card Remotely
- Increase Road Condition Awareness
- ID Cards with Profiles of Driver (Insert into Car to Drive)
- Intersection - In-Car Rumble Strips
- Radio Preemption Using Public Frequency to Provide Information to the Driver Regarding a Work Zone
- Increase Capacity with Added Lanes
- Expand System as Congestion Grows
- Helicopter Accident Clean Up
- Nationalize Driving Laws
- Run-Off-The-Road - Animal Detector
Work Zones – Cell Phones
Data Collector (Black Box) for Time, Speed, Miles
Vehicle Control for Speed or Other Performance Factors
Run-Off-The-Road - Fatigue Prevention (Automated Cell Phone Calls)
Beacons to Flash if There are No Other Cars for a Long Time
Horn Activated if You Are Going Too Fast Into a Work Zone
Beep if You Are Driving Under 70 mph and Not Belted
Better Screening for Drivers
Speed Information System
Technology for Quick Accident Reconstruction
Promote Telecommuting

The workshop participants agreed that this was a comprehensive list of ITS Safety Ideas. Even though some of the strategies did not receive a high number of points, they were considered along with the results from the surveys as the ITS Safety Plan moved forward.

4.3 Key Minnesota Program Leaders Interviews

The third step in stakeholder outreach for the ITS Safety Plan was to conduct interviews with key program leaders and decision makers in Minnesota’s safety community. The Oversight Committee targeted 15 interview candidates based on the organization or program they represent or that individual’s role in roadway safety efforts. Following is a list of the candidates who were able to participate in the interviews.

- Bernie Arseneau, Mn/DOT-Office of Traffic, Security and Operations
- Loren Hill, Mn/DOT-Office of Traffic, Security and Operations
- Ray Star, Mn/DOT-Office of Traffic, Security and Operations
- Kathy Swanson, Minnesota Department of Public Safety-Office of Traffic Safety
- Jim McCarthy, Federal Highway Administration
- Max Donath, ITS Institute, Center for Transportation Studies, University of Minnesota
- Rick West, Otter Tail County and Minnesota Association of County Engineers
- Mark Maloney, City of Shoreview and Minnesota Association of City Engineers
- Mike Robinson, Mn/DOT-District 1
- Tim Held, Minnesota Department of Health
- Mary Hedges, EMS Regulatory Board
- Marthand Nookala, Hennepin County
- Carol Bufton, Minnesota Safety Council
- Bill Jones, USDOT ITS Program

The purpose of the interviews was to:

1) review prospective ITS initiatives;
2) rate the initiatives for their perceived safety value and potential for implementation; and
3) identify specific initiatives well suited to existing programs.

To conduct the interviews, leaders were presented with a list of proposed strategies and project ideas, which were generated from the earlier survey and stakeholder workshop.

The interviews went extremely well with contacts fully engaged and supportive of using ITS to further supplement roadway safety efforts. All were pleased that Mn/DOT and DPS are continuing their collaborative pursuit of reducing crashes on Minnesota roads. An important observation from the interviews is that many of the organizations have similar goals to reduce traffic fatalities. However, they often have different and sometimes competing factors that dictate how to reach those goals. As such, the interview participants expressed support for the Minnesota CHSP and related plans to provide a common foundation for all organizations to build their safety agendas from. Participants frequently commented that having consistent messages and goals, for example, would be particularly helpful when working with the Legislature. Following are additional highlights from the interviews.

- Participants’ strongest interests and highest ratings for safety value were in lane departure prevention and intersection crash avoidance initiatives, particularly because these address some of the most common crash attributes.
- Seatbelt interlocks, emergency response coordination, and variable speed limits were also highly regarded among participants. It should also be noted that enacting a primary seatbelt law and efforts to reduce speed violations were among the highest rated initiatives in Minnesota’s CHSP.
- Several participants commented that the initiatives are well aligned with the USDOT’s nine major ITS initiatives.
- Several initiatives were rated high for their perceived safety value, but significantly lower for the potential to implement them. In many cases, the most common impediment was strong institutional issues related to jurisdiction, enforcement or public perception. An excellent example of this is requiring seatbelt interlocks on vehicles. Although technically this is fairly simple and the safety effectiveness could be very high, institutionally there would likely be legal barriers, vehicle manufacturer opposition, or public resistance.
- Human factor concerns were also noted by interview participants. For example, if vehicles were equipped with systems to detect driver distraction and provide warnings, there was skepticism regarding how effectively this would alert drivers and what their ability to appropriately react to such warnings.
- It was observed that most initiatives are geared toward preventing crashes, while others are focused on improving enforcement, lessening the severity of a crash outcome, or preventing secondary crashes.
- Public education was repeatedly noted as essential to successfully implementing any of the initiatives. Education about the magnitude of the problem with road safety, as well as the benefits of a specific initiative.
- Specific safety funding programs noted by participants for potential implementation of these initiatives included Highway Safety Improvement Program (HSIP), 402 Safety
Funds, Central Safety Fund, Federal ITS earmarks, USDOT demonstration funding, and Area Transportation Partnerships (ATP).

Based on suggestions and comments from the interview participants, the ITS Safety Critical Strategies and Proposed Initiatives were further combined and refined. This step is described in Section 5.0.
5.0 ITS Safety Critical Strategies and Initiatives

5.1 Development Methodology

During the ITS Safety Workshop a total of 50 ITS Safety Strategies/Ideas were developed. These ideas were then combined with ideas collected during the Agency Survey into a total of 91 ITS Safety Ideas. With these 91 ITS Safety Ideas in hand the planning team began the process of identifying, selecting, and prioritizing the ITS Safety Critical Strategies and ITS Safety Initiatives for the ITS Safety Plan.

To accomplish this goal the planning team went through a multi-step process as it formed these 91 “brainstorming ideas” into an easily understood list of Critical Strategies and achievable Project Initiatives. The steps are as follows:

a) Each of the 91 safety ideas had received points during the workshop, and during the surveys. This provided a basis for sorting and ranking the ideas.
b) To sort the “ideas”, they were first linked to the CHSP’s five Critical Emphasis Areas.
c) The next step was to try and link them with the CHSP 15 Critical Strategies, but the technology ideas did not fit logically with these 15 Critical Strategies.
d) Seeking better ways to categorize the technology ideas the team then grouped them by their technology “systems”. Using this process all of the suggested ideas appeared to fit logically into one of the groups and appropriate draft descriptive labels for each group were added. These labels were later refined to become the draft six ITS Safety Critical Strategies.
e) The 91 safety ideas were still rough ideas that needed further definition and to be combined with similar ideas. Grouping similar ideas, along with their workshop point totals, under each ITS Safety Critical Strategies resulted in 22 ITS Safety Project Initiatives. The Project Initiatives were then ranked by their combined points. Several of the “ideas” were general program comments or directions rather than technology appropriate ideas. These were removed from the “ideas” listing and incorporated in the overall plan.
f) At this point the ITS Safety Project Initiatives were short “ideas” developed during the workshop and on surveys. Next, the team added descriptive words that helped further define and clarify these early ideas as potential Project Initiatives.
g) Based on workshop and survey comments, another column providing additional descriptive details for each potential initiative, was added and a draft list of the strategies and proposed initiatives was developed.
h) Also from the Workshop, the Survey, and from team experts the current development and implementation status of each idea was added.
i) Using this preliminary working draft the team then conducted the interviews with Key Program Leaders (as described in Chapter 4.3.).
j) Based on suggestions and comments by these key program leaders and on feedback from the developing Effectiveness Spreadsheet (described in Chapter 6.) the list of
proposed Project Initiatives were further combined and refined resulting in the final selection of six Minnesota ITS Safety Critical Strategies and 22 ITS Safety Initiatives.

k) The six Minnesota ITS Critical Strategies and 22 Initiatives were again reviewed to see that they coordinated with the TZD Program, with the CHSP’s five Critical Emphasis Areas and 15 Critical Strategies along with AASHTO’s 22 emphasis areas and the SHVSP.

The result of this development process was creation of the ITS Safety Critical Strategies and ITS Safety Initiatives identified below and described in the next section.

**ITS Critical Strategy 1: Implement In-Vehicle Based Safety Systems**

1.1 Require seatbelt ignition interlock on new vehicles
1.2 Require blood alcohol content level ignition interlocks on vehicles driven by repeat drunk driving offenders
1.3 Provide information to equip vehicles with systems that deliver real-time information and warnings to drivers
1.4 Use preemption on vehicle radios to provide real-time information
1.5 Research equipping vehicles with systems to detect driver distractions and provide warnings

**ITS Critical Strategy 2: Improve First Responder/Law Enforcement Systems**

2.1 Coordinate emergency responder databases to allow access to consistent crash information
2.2 Allow law enforcement to retrieve data from onboard vehicle computers
2.3 Develop and provide a uniform, real-time automated crash reporting system
2.4 Implement automated enforcement of red light running at intersections
2.5 Expand quick clearance policies for incidents
2.6 Implement automated enforcement of speed violations

**ITS Critical Strategy 3: Implement Vehicle Infrastructure Integration (VII) Systems**

3.1 Implement improved lane guidance system
3.2 Develop vehicle to vehicle and vehicle to infrastructure communication

**ITS Critical Strategy 4: Improve Infrastructure Systems and Signage**

4.1 Expand work zone safety systems
4.2 Implement variable speed limit signs
4.3 Expand the use dynamic message signs to provide location based, real-time information to drivers
4.4 Research use of graphics (and text) for dynamic message sign messages
4.5 Expand geographic coverage of the RTMC systems
4.6 Integrate reporting systems across state and local borders

**ITS Critical Strategy 5: Use Intersection Collision Warning Systems**

5.1 Install rural intersection warning and decision support systems
ITS Critical Strategy 6: Improve Driver Education and Licensing Using ITS

6.1 Expand graduated driver licensing
6.2 Use driving simulation for teenage and mature driver education

5.2 Detail Description of ITS Safety Critical Strategies and Initiatives

ITS Critical Strategy 1: Implement In-Vehicle Based Safety Systems

1.1 Require seatbelt ignition interlock on new vehicles

Description
The premise of this initiative is to expand existing seatbelt interlocks so that a driver would be unable to start a vehicle unless the seatbelt is fully engaged for everyone in the vehicle. Technology is currently available to interlock the ignition with seatbelts. Currently, most new vehicles issue an audible alarm that will continue until everyone in the front seat is buckled.

Background
In-vehicle devices such as safety belt interlocks can be effective at increasing safety belt use among certain populations. A safety belt interlock device prevents the driver from either operating the vehicle or operating entertainment systems such as the radio if the front seat (or other) occupants fail to use their safety belts. Vehicles are currently equipped with various interlocks to achieve other safety purposes. For example, clutch interlocks prevent the starter from operating in a manual transmission vehicle unless the clutch pedal is fully depressed; transmission interlocks used in automatic transmission equipped vehicles prevent the starter from operating unless the transmission is in park or neutral; and brake-shift interlocks prevent vehicles equipped with automatic transmissions from being shifted out of park unless the brake pedal is depressed.

Beginning in the 1960s, the requirement to install lap and shoulder belts in all new passenger vehicles was one of the original federal standards stemming from legislation to improve highway safety. Unfortunately, the availability of seat belts was not enough to cause motorists to use them. In fact, studies indicated that as few as 10 to 15 percent buckled up voluntarily. Near that same time the newly formed National Highway Traffic Safety Administration (NHTSA) began promoting air bags, automatic belt systems, and 60-second flashing light and buzzer warnings to remind motorists to buckle up, but technical and political factors delayed introduction of air bags and automatic seat belts. As an interim measure, NHTSA mandated that all model year 1974 passenger vehicles be equipped with an ignition interlock that prevented the engine from starting if any front-seat occupant was not buckled up. The

---

technology was not widespread for various reasons, including seat belt comfort, sensor accuracy and public acceptance.

Congress quickly enacted legislation prohibiting NHTSA from requiring either ignition interlocks or continuous buzzer warnings for more than eight seconds. NTHSA then implemented a sole requirement of a 4 to 8 second warning light and buzzer that is activated when front seat belts are not fastened at the time of ignition – a standard that is still in effect today.

Current federal law restricts NHTSA’s regulatory scope with regard to new seat belt use technologies, but manufacturers are not prevented from providing them voluntarily. Ford Motor Company introduced on selected model year 2000 vehicles the BeltMinder™, a system of warning chimes and flashing lights that operates intermittently for up to 5 minutes to alert and remind the unbelted to buckle up. Other vehicle manufacturers plan to deploy technologies that go beyond the current 4 to 8 second warning with “enhanced” seat belt reminder systems. No manufacturers are currently developing interlock systems as original equipment, although technologies such as a seat belt shifter lock may soon be available as an aftermarket option in the United States.

The Transportation Research Board (TRB) views seat belt use technology as complimentary to other proven strategies for increasing seat belt use. Such strategies may include enactment of state seat belt laws that enable law enforcement to pull over and cite drivers who are not buckled up and well publicized enforcement programs.

1.2 Require blood alcohol content level ignition interlocks on vehicles driven by repeat drunk driving offenders

Description
This strategy would require a driver’s blood alcohol content level to be checked by an onboard device that is interlocked with the vehicle’s ignition system. The vehicle would not start if the driver’s blood alcohol content were above a preset level. There is technology currently available and several state court systems currently require some form of blood alcohol content level.

Background
As of July 2003, 42 of 50 states including the District of Columbia contained legislation requiring ignition interlock requirements for convicted drunk drivers. However, 31 of the 50 states do not require ignition interlock devices after the first drunk driving offense. Examples of legislation range from requiring ignition interlock devices after 2nd and 3rd offences to requiring them for probationary driving privileges after a first offense. Specifically,
Minnesota requires “If ignition interlock is installed, treatment is completed, and at least half of the sentence is served, then a limited sentence may be obtained.”

New York state legislators are considering requiring ignition interlock devices on all cars and trucks by 2009. Further, SAAB and Volvo models in Sweden are considering whether to bring the technology to the United States. Legislation such as that in New York face tough challenges due to concerns about forcing every driver to pass a blood alcohol test to start a vehicle, irritating non-drinkers, and worrying restaurant industry officials about a stepping back to the Prohibition era. Mothers Against Drunk Driving (MADD) does not currently support requiring devices on all vehicles because it does not think the technology is ready. Presently, MADD recommends requiring devices for anyone convicted of a first drunken-driving offense.

1.3 Provide real-time information to equipped vehicles that deliver warnings to drivers

**Description**
This system could include technology to notify the driver of the posted speed limit, based on the vehicle location. Other notification could include indication of an unsafe area ahead. Also, based on GPS location, vehicles could inform a driver of hazardous roadway locations, alignment changes, upcoming work zones, or bridge surface conditions.

**Background**

Realizing the United States could benefit from foreign technologies in the field of ITS, FHWA, AASHTO, and the National Cooperative Highway Research Program (NCHRP) sent teams to countries where significant advances and innovations have been made in technology, management practices, organizational structure, program delivery, and financing. Following are examples of in-vehicle systems providing real-time information and warnings to drivers.

- Technology under development uses image processing to help the driver recognize infrastructure features, traffic-control devices, and other key environmental elements surrounding the vehicle. For example, a video camera could capture the image of an octagon and the onboard processor in the vehicle could interpret the image to mean an approaching stop sign. The onboard processor then communicates to the driver the proximity of the stop sign as the vehicle approaches the location. Expanding on this scenario, the onboard processor could sense that as the vehicle approaches the location of the stop sign it is not decelerating appropriately for the current speed and road conditions. Other uses of image processing include detection of speed limits, traffic signals, and other traffic-control devices, as well as anomalies that may occur in front of or next to the vehicle. Other examples of opportunities to use image processing for

---

safer driving include pedestrian and hazard detection. Hazards could include disabled vehicles, construction work zones, and obstructions in the roadway.

- The European Union (EU) has in place an eSafety Initiative that will allow a motorist to either automatically or manually communicate with a Public Service Answering Point (PSAP) when an incident occurs. The PSAP notifies the appropriate emergency service for response. PSAP personnel will also assist the reporting vehicle operator in addressing immediate needs to the scene of the incident. The GPS component of the eCall initiative will allow emergency response resources to go to the precise location of the incident without wasting minutes searching for the caller. The EU has adopted a plan to equip all new cars in Europe with eCall as soon as 2009.

- The EU has taken digital mapping and onboard navigation systems and developed the SafeMap initiative. This effort entails public-sector agencies and private-sector firms to combine these technologies to bring a higher level of service to the driver. SafeMap focuses on the following six features:
  - Speed limit assistance
  - Curve warning
  - Intersection warning
  - Overtake assistance
  - Hazardous area warning
  - Crash spot warning

It was noted that onboard navigation systems can provide safety benefits, especially when integrated with digital mapping and other features. However, current processing ability of these onboard navigation devices is not adequate to handle the significant processing needs when analyzing video images.

1.4 Use Preemption on vehicle radios to provide real-time information

**Description**
Real-time information related to road emergencies could be delivered to drivers by preempting radio broadcasts or through Radio Data Systems (RDS) messages.

**Background**
Real-time information to a driver could be obtained by turning their radio to a specified station. 8Radio Data System (RDS) is now standard on many vehicle modes and enables a radio listener to scan for a particular type of program -- for example, current affairs, science, or popular music -- without having to constantly manipulate the tuning dial. A listener who is traveling or commuting in a vehicle can arrange to have special traffic bulletins break into programs automatically, even if the traffic information is broadcast by a station other than the one the listener is tuned to at the moment. In fringe areas, where reception of a particular station is marginal, RDS allows the receiver to automatically tune to a stronger station if there is any such station running the same program at the same time. An RDS receiver can also be

---

set to display brief text messages from broadcasters, and to periodically re-set the car clock to show the exact time. Additionally, RDS can enhance driving safety, because it lets the driver pay attention to the road instead of to the radio controls.

9 The USDOT ITS Standards has incorporated operating rules for efficiently defining textual strings for advanced traveler information systems (ATIS) messages. Specifically, SAE J2540-1 RDS Phrase list defines textual messages for expressing phrases commonly used to convey traffic incident information over limited bandwidth RDS sub-carrier transmission media, but is also used over other media and applications. This standard provides the formatting rules used to facilitate the conveyance of information strings between ATIS data transmitters and data receivers.

1.5 Research equipping vehicles with systems to detect driver distractions and provide warnings

Description
A driver would receive an audible (i.e., beeping) or tactile (i.e., seat vibration) alert as a warning if distraction or unresponsiveness are detected. The University of Minnesota has previously developed technology and conducted research in this area

Background
10, 11 Traditional vehicle safety systems have largely been passive and focused on occupant protection. One of the more standard vehicle safety systems today is electronic stability control (ESC) system. ESC systems were introduced in the mid 1990s in Europe and have increased to approximately 35 percent of new cars sold. In Japan the application rate is approximately 15 percent. In the U.S., the adoption of safety technology has been much slower with 10 percent of new cars sold in 2004 with ESC. Studies in Europe, Japan and the United States have shown significant reductions in serious crashes and fatalities when vehicles are equipped with ESC. Now that ESC is in place on many vehicles, this technology has become the baseline for expansion of “Active Safety” functions to further reduce crashes. As noted below, the next generation of vehicles will have anticipatory qualities that enable them to provide operating recommendations and active support to the driver.

- Adaptive Cruise Control (ACC) is available on cars today and both radar-based and infrared based systems are in use. ACC uses sensors to monitor and maintain a set speed and distance to the vehicle in front. In the event traffic slows, the ACC equipped vehicle will automatically reduce speed or an audible alarm will sound. Acura, Lexus, Mercedes and Cadillac models have crash avoidance systems tied in with ACC.

Active Passive Integration Approach (APIA) involves cross-linking of today’s varied and primarily stand-alone chassis control units. Additional and enhanced functionality will be achieved by connecting existing equipment (i.e. steering, brakes) electronically. In short, vehicles will have electronic reflexes, with each step enabling the next. An example of this technology might be a scenario with a vehicle equipped with APIA technology is closing in on another vehicle very rapidly. The APIA vehicle senses a closing velocity and makes needed adjustments consisting of a distance warning, then feedback from the gas pedal. The driver then brakes avoiding the collision. In a more aggressive scenario where a crash is imminent, the distance warning would activate as would the gas pedal feedback. The brake system would then pre-charge; the sunroof and windows would automatically close; the seat belt pre-tension device would activate; the airbags would be readied for deployment; and the seats would readjust to place occupants in safer positions for the impending crash. The objective of this safety initiative is made up of three components:

- **Avoidance**: Things that can keep the driver from getting into trouble.
- **Control**: Maintaining control when trouble is imminent.
- **Protection**: Protecting occupants when the first two components fail to protect the driver and/or occupants.

### ITS Critical Strategy 2: Improve First Responder/Law Enforcement Systems

#### 2.1 Coordinate emergency responder databases to allow access to consistent crash information

**Description**

Coordinate emergency responder databases to allow each entity to enter and access information about a crash through an online database. Such coordination would allow the seamless sharing of consistent information on crash and victim details to facilitate better response and care.

**Background**

On-the-scene incident data, road condition or other data may be routed through a single dispatch center or system for processing. The center acts on the information request by dispatching the proper emergency personnel to a traffic incident. Road and weather conditions data may also be uploaded to a central source and disseminated via various means from the center.

For example, police vehicles can act as an information provider for other emergency personnel. In-vehicle digital cameras, pen-based notebook computers and in-vehicle printers are in most police vehicles for crime scene and accident data collection. This also allows input and downloading to a central database for immediate availability to other vehicles responding.

---

to the scene, including emergency management personnel. Information is typically sent via radio frequency to a center and then transmitted along fiber to the in-house dispatch system.

In Dane County, Wisconsin, local emergency response agencies implemented an Interagency Dispatch and Reporting Coordination system by providing incident data and other information before other emergency vehicles, such as fire trucks and ambulances, arrive at the scene. Through this system law enforcement officers transmit incident data via in-car personal computers to a central dispatching database which is then distributed to other emergency responders (i.e. hospitals, fire stations, etc.) over a fiber-optic network. The system has enhanced response time and the preparedness of emergency crews responding to incidents. As noted below, benefits of a coordinated system expand beyond emergency management services:

- Enables emergency responders to be properly prepared for an incident scene before they get to the scene. This decreases response time and increases preparedness of emergency crews.
- Enables State agencies, such as engineering and public safety, to research statistics on incidents for sections of roads. These agencies can mitigate any safety problems relating to roadway design or maintenance.
- Travelers and commuters do not have to search through separate sources to get their road, weather and traffic information. They can visit one source that will supply them with their weather information.

For a coordinated emergency dispatch system to work, a high level of coordination and cooperation is needed by all participants involved. Public and private participants may have to form an official partnership to gain cooperation between sides.

2.2 Allow law enforcement to retrieve data from onboard vehicle computers

Description
Ideally, law enforcement would access this data to determine vehicle speed, deceleration, time of incident, etc. This type of information is currently available on newer model vehicles and Minnesota law enforcement is able to access the data with a warrant.

Background
13 According to NHTSA, about 15 percent of vehicles -- or about 30 million cars and trucks -- have “black boxes” or Event Data Recorders (EDRs). About 65 to 90 percent of 2004 cars and trucks have them, according to NHTSA.

14 An EDR is original equipment that detects a collision event and determines if the air bags should deploy or if restraint systems should activate. This technology has progressed beyond

---

the novelty stage for insurers interested in using objective vehicle information in the evaluation of claims. When properly analyzed, EDR data has been shown to be useful in addressing numerous questions or issues relative to an investigation and/or evaluation of a claim such as:

- Was the driver speeding?
- Was the driver wearing a seat belt?
- What was the required stopping distance at the recorded speeds?
- What was the actual stopping distance?
- Did braking occur early or late in the accident sequence?
- How severe was the impact?

The benefits of quickly and objectively addressing these types of questions are self-evident. Even when the data is not favorable to an insurer, significant investigation and legal costs can be avoided.

Despite operational benefits, critics see negatives to the use of information about motorists derived from devices such as EDRs. Noting that many drivers are unaware that their actions are being recorded, they say rights to privacy could be violated in the absence of regulations governing how the data can be used and interpreted. The Consumers Union and the Electronic Privacy Information Center (EPIC) have raised their concerns in filings to NHTSA. In a June 2004 announcement, NHTSA proposed requiring manufacturers to include information about EDRs in owners' manuals for cars equipped with the technology. Although the federal traffic agency continues to gather feedback on its latest set of EDR recommendations, it is too early to say how the input will shape the agency's final ruling, a representative said. For now, NHTSA has left it up to the courts to decide whether to admit the data as evidence.

A few states are joining the debate. A California law that went into effect in July 2004 requires manufacturers to provide customers with information on black boxes in cars and states that the data cannot be obtained without a court order or the owner's permission. In North Dakota, a bill has been submitted that would require automakers to disclose the presence of the boxes in new car owners' manuals and require dealers to disclose information about them in purchase contracts. The bill would give control of data collected by EDRs to vehicle owners, stating that the data can be downloaded by someone other than the vehicle owner only if it is being used for safety research or diagnosing problems, or if it is court-ordered or needed for crash reconstruction or investigation by law enforcement. The bill would also prevent data from being used in court, unless ordered by the court or allowed by participants in the proceedings.

---

2.3 Develop and provide a uniform, real-time automated crash notification system

**Description**
Provide common location information and communication standards to assist emergency responders in quickly and efficiently locating crash or other road safety related incidents.

**Background**
The USDOT, ITS Standards Program has developed and published the SAE J2266 Location Referencing Message Specification (LRMS) standard. LRMS describes a set of standard interfaces for the transmission of location references among different components of ITS. The LRMS facilitates the movement of ITS data containing the attribute of location; typically, but not always, on a transportation network. LRMS interfaces define standard meanings (semantics) for the content of location reference messages, and standard, public domain formats (syntax) for the presentation of location references to application software. LRMS interfaces will provide a common language for the expression of location among the different components of an integrated transportation system. Since different kinds of location referencing methods must be supported for ITS applications, a variety of location referencing data concepts are provided within the LRMS.

SAE J2266 LRMS, describes seventeen profiles. Profiles are defined for commonly cited location referencing methods and for particular application communities that have unique requirements. For example, the Grid Profile contains a built-in compression scheme, and thus provides an efficient mechanism for transmission of location information over bandwidth constrained media. An ITS location reference may use a single profile, or several profiles. The seventeen profiles described are:

- **Address Profile** - address information that uniquely describes a location, such as a postal code, structure number (e.g., houses), street direction, street side, etc.
- **Area Location Profile** - references an area such as a town, city, state, county, or region.
- **Chain Profile** - references sequences of links with distinct start and end nodes, direction, and name, such as a jurisdictional boundary (e.g., county line, town line, or state line).
- **Cross Streets Profile** - specifies a link along a street or road by names and/or coordinates of bounding intersections with other streets. Note that this profile supersedes SAE 1746, the ISP-Vehicle Location Referencing Standard.
- **Geographic Coordinate Profile** - references coordinate-based points, links, or polar coordinates.
- **Geometry Profile** - referencing for geometric (geometric coordinate-based) objects including nodes, points, links, chains, transitions, areas, and polygons.
- **Grid Profile** - similar to the Geometry profile, but includes a built-in compression scheme intended for use in bandwidth constrained situations.
- **Group Location Profile** - references a group (set) of locations; used if the same information applies to all locations within the group.
2.4 Implement automated enforcement of red light running at intersections

Description
Identify signalized intersections where there have been higher than average crash rates and deploy portable or permanent photo/surveillance systems that automatically mail citations to drivers running red lights.

Background
This technique is used in many locations worldwide to monitor red light running, speed and aggressive driving. However, FHWA and NHTSA support a comprehensive approach to intersection safety to prevent red light running. This approach incorporates engineering, education, and enforcement countermeasures to prevent red light running and improve intersection safety. Based on this approach, FHWA and NHTSA in January 2005, published operational guidelines to address red light running in the United States. 16 The purpose of the guidelines is to assist jurisdictions who are considering the implementation of red light camera systems and help them avoid inconsistent or incorrect application of such systems. Questions have been raised regarding the contracting, design, implementation, operation of red light camera systems, and the legality and intent of photo enforcement systems. In a broader perspective, for continued use of red light camera systems and other technologies to improve transportation operations and safety, it is vital these technologies are perceived as accurate and reliable and are applied fairly.

From an educational perspective, it is very important that a well-designed public information and education campaign is developed to assist motorists and the public in understanding the safety issues inherent to red light running. The education campaign should provide information and data that defines the red light running problem, explains why red light running is dangerous, and identifies the actions that are currently being undertaken to reduce the incidence of red light running. One of the key messages for the red light running education campaign should be fatality and injury consequences and resulting emotional and economic toll of red light running. The emotional toll of red light running to crash victims and their families is quite obvious; however, the indirect economic costs associated with red light running related crashes in terms of lost productivity, higher insurance premiums, and medical cost, while significant, are often not understood.

It is recommended that an ongoing educational program should be designed to reduce red light running, in general, and be delivered in a way so as to communicate the seriousness of the violation and the effectiveness of the countermeasures being employed. Further, ongoing public information and education programs should use various media, such as: posters, mailings, hand-outs, public service announcements on radio and television, warning notices, billboards, warning signs, press releases, slogans, and bumper stickers. State or local agencies should monitor the effectiveness of educational programs and modify them to maximize effectiveness. A red light running education campaign supported by targeted enforcement is a very effective tool. Red light running campaigns should be dovetailed with other traffic safety education and enforcement programs, such as speeding and other forms of aggressive driving.

In summary, a well-designed public information and education campaign, perhaps one that includes mailing an educational notice to a driver that entered the intersection unsafely on major road, will assist motorists and the general public in understanding the safety issues inherent to red light running. It will provide information and data that explain what red light running is, why red light running is dangerous, and what actions are currently being undertaken to reduce the incidence of red light running.

2.5 Expand quick clearance policies for incidents

Description
Quick clearance policies have strong effects on traffic safety and minimize incident related congestion. Studies indicate that good traffic incident management lead by quick clearance actions can reduce delay nationally by 170 million hours annually.

Background
In general, quick clearance legislation authorizes the removal of driver-occupied disabled or wrecked vehicles from travel lanes in addition to the authority to tow those vehicles without

regard to drivers being present at the incident site. There are four categories of quick clearance legislation:

- Driver stop law
- Driver removal law
- Authority removal law
- Authority tow law

In an NCHRP study, a comprehensive survey questionnaire was sent to transportation and related agencies in all 50 states. Approximately 52 percent of surveyed jurisdictions maintain a driver removal law. Within these jurisdictions, an information campaign to inform and educate motorists about existing quick clearance laws are in place to encourage drivers to change their behavior when involved in traffic incidents. Summaries of quick clearance policy strategies based on the survey questionnaire are noted below:

- Include private towing companies as a primary quick clearance stakeholder.
- Implement quick clearance policies and procedures in rural areas.
- Develop quick clearance initiatives for handling traffic incidents on arterials.
- Work with other incident management stakeholders to develop open roads policies.
- Maintain multiple rotational lists or towing licenses for different classes of towing and recovery.
- Institute an automatic tow program in areas having ITS infrastructure for traffic monitoring.
- Enact laws to protect the rights of commercial towing companies authorized to remove disabled or wrecked vehicles in designated areas.
- Explore the idea of having private towing companies charge by the pound (vehicle weight plus factors) as a means of charging for services rendered.
- Develop prequalification guidelines for private towing company inclusion on a rotational list.

Many states hold harmless from liability first responders attempting to clear interstate highways of disabled vehicles and spilled cargo. However, Minnesota does not hold harmless first responders, which impedes their ability to clear vehicles involved in accidents and vehicles carrying cargo. Legislative strategies pertaining to quick clearance to achieve a compromise or consensus about legal liability protection for first responders have proven to be successful in other states that have adopted quick clearance legislation.

---

2.6 Implement automated enforcement of speed violations

**Description**
Photo enforcement for speeding can be deployed reactively at locations where there is a history of crashes with excessive speed as a contributing factor or in work zones.

**Background**

Speeding is one of the major contributing factors in motor vehicle crashes and has a dramatic effect on the severity and injury risk of crashes. Automated camera technology has emerged as a potentially powerful tool to cost-effectively improve speed enforcement. When used as a supplement to the efforts of live officers, automated speed enforcement systems have proven to be very effective. In addition, they allow police officers to focus on other enforcement priorities.

In a basic automated enforcement system, a vehicle triggers a camera at the point at which the vehicle is in violation of the law. A photograph is produced, or a license plate number is digitally recorded, and the violator is issued a ticket, usually through the mail. For speeding, the violation is detected by radar.

While red light enforcement is the most common application of automated enforcement technologies, a number of cities around the United States, including several in California, use speed cameras. Examples of the range of applications for speed cameras can be found in Washington DC, which operates a photo radar program on the Beltway, and San Jose, California, which limits its speed camera enforcement to residential streets. Not all automated enforcement programs are successful. In California, several red light camera programs have been cancelled due to contractor disputes, financing problems and lack of public support.

---

3.1 Implement improved lane guidance systems

**Description**
Provide lane guidance to drivers/vehicles through the use of magnetic, GPS and pavement markings.

**Background**

There is limited route guidance technology currently in use. However, in the future it is anticipated that route guidance technology will provide greater mobility benefits as VII technology improves. An example is dynamic route guidance, which is currently deployed to a limited extent. However, this current technology would be more effective with probe data

---

from VII-equipped vehicles. Current discussions regarding the deployment of VII include a path from current autonomous adaptive cruise control (ACC) systems to full automation with mobility benefits at each stage of the deployment. The technology to accomplish full automation without limitation is well on its way to fruition. However, there are unknown policy and human factor issues that will need to be resolved. Some of these issues include:

- Will drivers understand the limitations of the systems?
- What performance standards would be appropriate?
- Will drivers understand feedback and be able to respond appropriately?

The lane guidance concepts currently under development are expected to be available by 2011 and are summarized below.

- Assisted Lateral Control: This component provides lateral control of vehicle movement, allowing the vehicle to track the lane with greater precision and reliability than would otherwise be possible.
- Longitudinal Control/Control Adaptive Cruise Control: Vehicles communicate with each other and with the infrastructure to control time gaps between vehicles.
- Full Assistance with Driver Vigilance: Longitudinal and lateral controls are available in a dedicated lane with full assistance possible within that lane. It is anticipated this service will improve throughput, depending upon the time gap and speed chosen.
- Gap Creation: With VII enabled longitudinal control (adaptive cruise control), it should be possible for a car on the merge area or ramp to send a message to cars on the main road requesting that a safe gap for merging be created.
- Individualized Traffic Flow Encouragement: This service is used to send traffic flow advice messages to individual vehicles with the purpose of smoothing overall traffic flow and improving mobility. An example of a message might be “please accelerate briskly, the traffic jam is ending” or “stop tailgating”.
- Intelligent Speed and Advisory Control: This system provides the speed limit directly to the vehicle and will provide variable speed limits in work zones and school zones, as well as during inclement weather.
- Intersection Reservation: This component will allow cars to send information directly to the traffic signal, to allow the signal to adjust to demand, and to allow the signal to send back messages regulating speed.
- Enhanced Work Zone Operation: This component uses probe data to collect accurate information on work zone speed and throughput. This could be used to send speed advisories and warnings to individual vehicles.

### 3.2 Develop vehicle to vehicle and vehicle to infrastructure communication

**Description**

This initiative encompasses the national vision for VII. VII will build on the availability of advanced vehicle safety systems developed under the Intelligent Vehicle Initiative (IVI) and
on the results of related research and operational tests. It is also supported by radio spectrum at 5.9 GHz specifically allocated for digital short range communications (DSRC).

**Background**

Since the early 1990s, applications such as intersection collision avoidance could best be accomplished through vehicle-infrastructure and vehicle-vehicle communication. Within the last two years, this concept has been under intense exploration as part of the USDOT’s Vehicle Infrastructure Integration (VII) major initiative. Additionally, VII will enable the deployment of a variety of applications that support private interests, including those of vehicle manufacturers.

At ITS America’s 2004 Annual Meeting in San Antonio, the USDOT formally announced its “major initiatives” program approach, and the VII initiative was one of the nine new programs. By then, the “VII Working Group” was showing signs of stable organization. The group had held several meetings and conference calls, had developed a clear vision, and were working on specific use cases (applications) on which to focus. Organized subcommittees were working on key issue areas, and the group had begun to engage senior executives from the states and the automotive manufacturers.

The aim of the VII initiative is to deploy and enable a communications infrastructure that supports vehicle-to-infrastructure, as well as vehicle-to-vehicle communications. Version 1.1 of the VII Architecture and Functional Requirements (dated July 20, 2005) is already available and was outlined at a public meeting in late July 2005. This high level architecture, based upon DSRC, describes the functional requirements of the proposed system, which is further divided into 4 elements (the vehicle, roadside infrastructure, and a network for each of public and private uses). The development of the VII Architecture, which is fundamentally similar to the development of the National ITS Architecture, provides a logical framework defining not only the flow of data, but also the location and ownership of the VII data, to meet the requirements of more than 70 use cases.

Although DSRC is the basis, for specific VII safety applications, DSRC is simply one of several communications technologies being investigated for the delivery of VII applications. There are several wireless technologies that could provide the vehicle-to-infrastructure link, while other wireline or wireless technologies could extend the communications link from the roadside infrastructure to a traffic management center or a data content provider. Potential benefits of VII are many, and as noted below there are many applications:

- Traffic flow through signals could be made more efficient, through the use of probe data that would allow more frequent or improved re-timing of the signal, and/or dynamic control of the signal based on real time traffic counts or queues at the intersection.

---

Re-routing of traffic due to construction, accidents, or planned special events could be made more efficient based on the knowledge of real-time freeway traffic as well as real-time traffic conditions on arterials.

Defect and Warranty information can be transmitted to/from the vehicles from the moment they roll off the assembly line to the last moment that vehicle is driven. This can improve the speed with which problems are repaired, enhance the ability to notify drivers of potential problems, and even help diagnose recurring problems that can be fixed sooner in the manufacturing process.

Transit and fleet vehicles could exchange real-time schedule information with a dispatch center, as well as with waiting passengers or waiting customers.

Curve Speed Warning and Lane Departure Warning are currently being done with sensors on the vehicle only, but could be improved with high quality maps made possible by a significant increase in vehicle probe data.

The ability to transmit dynamic signage directly into the vehicle (known as in-vehicle signing) can improve the driver’s awareness of work zones and prevent accidents, or even provide variable speed limits to smooth out congestion.

Detection of roadway hazards such as potholes, road weather problems, or even sight distance and design problems can all be potentially identified by vehicle sensors and shared with managers of the roadway faster than is possible today.

### ITS Critical Strategy 4: Improve Infrastructure Systems and Signage

#### 4.1 Expand work zone safety systems

**Description**

Currently being done in Minnesota, safety systems could include deploying dynamic late merge systems, which consist of detection, dynamic message signing and software for automation closures.

**Background**

22 The Minnesota Department of Transportation (Mn/DOT) has been extensively involved with dynamic late merge systems (DLMS) since 2003. During the summer of 2003 an evaluation of DLMS was conducted on US 10 in Anoka, MN. That evaluation underscored the five potential benefits:

- Shortened queue lengths before the work zone.
- Increased traffic capacity through the work zone.
- Reduced aggressive driving.
- Decreased number of work zone related incidents.
- Reduced travel times.

---

During the summer and fall of 2004 Mn/DOT conducted a second round of work zone deployments at four locations in the Twin Cities metro area. The second evaluation of these locations used the five potential benefits above as measures of effectiveness and reviewed further information on the system background from other states including Maryland, Michigan, and Kansas that have deployed DLMS.

Based on the DLMS evaluations conducted in 2003 and 2004 it was recommended that Mn/DOT develop a single guidance document or language used in a work order contract using what was learned in the previous evaluations.

From a National perspective, FHWA has partnered with AASHTO to encourage the implementation of work zone ITS through an AASHTO Technology Implementation Group project. This effort led to a workshop in September 2005, in St. Louis, Missouri, that was attended by representatives from nearly half of the State departments of transportation. It was noted at the workshop that ITS technologies often are:

- Effective work zone management and operations are employed in and around work zones.
- Have a safety or mobility focus but often support both.
- Portable and temporary in most cases, and may be leased or purchased.

Work zone ITS technologies typically include input devices, such as cameras; automated analysis of data; and output devices, such as dynamic messages signs, Web sites, or highway advisory radio. FHWA continues to use workshops to increase the use of innovative technologies and practices.

### 4.2 Implement variable speed limit signs

**Description**
Variable speed limit (VSL) systems provide real-time information on appropriate speed for current conditions based on traffic flow, traffic speed, weather and other inputs and integration with law enforcement.

**Background**
VSL signage is chiefly employed to manage variable conditions on freeways and major arterial routes. VSL products operate successfully in several countries, including the United States, under different environments. Many sizes are available with a range of LED display options. Free-standing, overhead or portal-mounted options are available. The system is highly effective for:

- Congestion management

---

Peak traffic flow control
Adverse weather driving conditions (e.g. rain, snow, wind, ice, fog)
Incident management

One of the primary issues encountered by transportation agencies in regard to VSLs is meshing operating practices and enforcement. In cases where there have been judicial challenges to VSL, if not in place, it has been necessary to incorporate and delegate a statute from the legislature to an administrative agency.

Following are a series of suggestions to address VSL enforcement issues. These suggestions apply primarily for a system which would consist of lower speed limits, posted by CMS, and based on changes in the traffic conditions (i.e., a crash or weather conditions).

- The statutory purpose should be stated as allowing changes in the speed limit to protect the public safety.
- The law should require that alteration of a speed limit must be based upon engineering and traffic investigations that show a need for a variable speed limit due to particular circumstances.
- The statute must require posting for the new limit to be effective.
- The statute should require posting of advance warning that the legal speed limit is changing ahead.
- The law would require posting of advance warning that the legal speed limit is changing ahead.
- The law might include a prohibition on set up of radar, photo-enforcement technology, or other electronic detection enforcement within a specific distance of posting of the new limit.
- The law should provide broad discretion to the administrative agency for enactment of regulations and for sub-delegation of decision making power.
- Either the laws or regulations should provide for the admission of certain evidence by affidavit.

In summary, where there is delegation of authority to an agency with appropriate limitations, and the agency acts within those limitations, established speed limits may be enforced without worry that they will be subject to challenge.

---

4.3 Expand the use of dynamic message signs to provide location based, real-time information to drivers

Description
Dynamic message signs (DMS) are being increasingly used to provide motorists with incident, construction and travel time information. This initiative would explore the use of DMS for additional real-time information and instruction.

Background
Providing drivers with real-time, high-quality traveler information is becoming increasingly important as congestion continues to grow in cities across the United States. Studies have shown not only that congestion is increasing, but that travel time reliability also is a growing problem. Many drivers find themselves stuck in traffic with little information about the cause or the extent of the delay.

Driver frustration is compounded when DMS provide little to no information. DMS are among the most visible elements of ITS deployment and provide the opportunity to communicate en-route information to drivers.

Nationwide, more than 4,500 DMS are installed and operated by nearly 100 agencies. The cost of the DMS hardware alone is more than $330 million. Usually, these signs are installed to support a state or metropolitan area with traffic congestion, significant delays due to traffic incidents or spot-specific problems (such as weather conditions), or to provide general traveler information. However, the traveler information provided by these signs is often vague or of little value to drivers, or signs are left blank even though traffic conditions are deteriorating. The result is a transportation resource that is underutilized and a traveling public who questions the value of the investment.

Key points to the use of real-time DMS are:

- Accuracy is very important to travel time messaging.
- Deployment of DMS should be prior to key decision points where commuters can decide to take alternate routes.
- Understanding the commuting patterns in the region when planning locations for DMS deployment is important.
- Using DMS for travel time messaging increases their visibility and helps justify the deployment.

Some metropolitan areas now provide time-based information, specifically, travel time messages. Travel time messages are displayed in at least 17 metropolitan areas across the United States, including the Twin Cities. Travelers are reacting positively to the messages. Time-based messages allow people to make choices-to have more control over their travel. Although no quantitative studies have been done, informal Web surveys and comments...
received by agencies show that travel time messages help people decide when to take an alternate route and provide a level of comfort when traveling.

Given the large public-sector investment in DMS, traffic surveillance and supporting communications, DMS should be used more effectively, especially in areas that regularly experience traffic congestion or variability. The FHWA recommended practice is that travel time information be the default information available to motorists throughout the day in these areas.

FHWA also recommends that no new DMS be installed in major metropolitan areas or along heavily traveled routes unless the operating agency has the capability to display travel time messages. This is not to say that other messages are not effective or necessary. In cities posting travel time messages, traffic incident, construction and special event messages often override travel time messages. However, travel time messages should be the default message when no other critical information needs to be displayed.

4.4 Research use of graphics (and text) for dynamic message sign messages

Description
As new DMS are deployed, graphic related messaging capabilities would be added. Alone or combined with text, graphics would show information in different formats to enhance driver understanding.

Background
DMS with graphic capabilities are being used in Europe. The DMS will message text with scaleable sign dimensions and pictograms, such as symbols and traffic signs. The list of messages generated could include: alert and incident messages, park and ride recommendations, travel times for public transportation, environmental conditions, or special events.

Studies in the United States have shown positive effectiveness of shape and color for regulatory, warning, guide, tourist oriented direction, recreational, and cultural interest areas are well established for static signs. Graphics in the form of interstate and state highway shields were introduced many years ago and were well received by the motoring public. Several symbols were introduced into the highway signing system with the previous edition of the Manual on Uniform Traffic Control Devices (MUTCD). Research indicates that drivers understand many of the symbols, but some symbols were met with limited understanding. Some of the latter symbols have been removed in later editions of the MUTCD. One advantage of good graphics/symbols is that information may be read and understood quicker.

and farther upstream of the sign in comparison to text messages. Symbols may also be helpful to those motorists with poor reading skills.

Research has also shown that motorists exhibited a strong preference for having the route marker displayed (i.e., interstate shield) on the DMS in comparison to the written version. Studies completed in Europe to evaluate the following symbols that might be used on portable DMS: accident, congestion, advance flagger, lane reduction transition, two-way traffic arrows. The results showed that less than 50 percent of the motorists tested were able to correctly interpret the accident symbol that is used in Europe at distances of 570 ft or more. Subject comprehension of the European congestion symbol was virtually nonexistent. Also, potentially dangerous meanings were frequently associated with the symbol. The most common potentially dangerous meaning involved the motorists believing the symbol indicated three lanes ahead, one for each vehicle displayed in the picture. Similarly, potentially dangerous interpretations were found for the advance flagger symbol. The lane reduction transition symbol was found to be illegible from distances of 570 ft and greater, and was understood by only 80 percent of the motorists when the symbol was viewed at 1400 ft. Although two-way traffic arrows were understood better than the other symbols tested, more than 10 percent had potentially dangerous interpretations.

The current day typical DMS (with three or four lines of text) is not capable of displaying graphics and symbols that would be beneficial to drivers. It is possible to show symbols on full matrix DMS, but this has to be done by compromising the required size of letters used in the message full message.

The shape and color requirements in the MUTCD (2000) suggest that the common types of symbols for regulation and warning cannot be used on current types of DMS used by traffic management centers. Presently, stadium and arena type full-matrix, full-color signs, on which high resolution graphics and symbols are possible, are economically “out of reach” and not practical for most transportation agencies. However, technology is rapidly changing, and research relative to graphics and symbols is advised in order to prepare for the arrival of the newer technologies.

4.5 Expand geographic coverage of the RTMC systems

Description
The Regional Transportation Management Center (RTMC) integrates Mn/DOT's Metro District Maintenance Dispatch and Office of Traffic, Security, and Operations with the Minnesota Department of Public Safety's State Patrol Dispatch into a unified communications center. The integration provides the communications and computer infrastructure necessary for coordinated transportation management on metro freeways during normal commuting periods, as well as during special events and major incidents.
Background
Each year, freeway volumes in the Twin Cities grow by about four percent. The goal of the RTMC is to provide motorists with a faster and safer trip on metro-area freeways by using cutting-edge technology, progressive programs, and real time information delivery systems. Mn/DOT will continue to expand the RTMC’s reach geographically as funding opportunities become available.

4.6 Integrate reporting systems across state and local borders

Description
Provide the ability for reporting systems to share information across state borders. Reporting systems are available now and integration across state borders has been explored through the North/West Passage transportation pooled fund study.

Background
The passage of SAFETEA-LU has generated increased emphasis on reporting systems and the information they gather. Section 1201 of the federal legislation calls for USDOT to establish a real-time system management information program to provide, in all States, the capability to monitor, in real-time, the traffic and travel conditions of the major highways of the United States and to share that information to improve the security of the surface transportation system, to address congestion problems, to support improved response to weather events and surface transportation incidents, and to facilitate national and regional highway traveler information.

Minnesota’s reporting system, the Condition Acquisition and Reporting System (CARS), has been operational since 2000. Since that time, Mn/DOT has explored various opportunities to share its information with other states and information service providers. Most recently, Minnesota has bee involved with eight other states in the North/West Passage Corridor. Interstates 90 and 94 between Wisconsin and Washington function as major corridors for commercial and recreational travel. Idaho, Minnesota, Montana, North Dakota, South Dakota, Washington, Wisconsin and Wyoming are predominantly rural and face similar transportation issues related to traffic management, traveler information and commercial vehicle operations. Recognizing the value of coordinated, cross-border collaboration for ITS deployment to address these issues, the group formed an FHWA transportation pooled fund.

The primary purpose of the North/West Passage vision is to influence ongoing standards development; operate database systems that can transmit and receive multiple data streams; and use effective methods for sharing, coordinating and integrating traveler information across state borders.

Mn/DOT and the Minnesota State Patrol (MSP) are implementing a network of nine Transportation Operation and Communication Centers (TOCCs). The goal of these centers is to establish an integrated statewide communication and transportation operations network serving rural Minnesota.
The TOCCs are regional centers for 24-hour incident and emergency response, multi-agency dispatching and fleet management, interagency communications, collection and dissemination of road conditions. TOCCs are located at Virginia, Baxter, Thief River Falls, Detroit Lakes, St. Cloud, Duluth, Marshall, Mankato and Rochester.

The TOCCs are being built around a framework of proactive interagency cooperation, updated facilities and technologies, and enhanced voice and data communications. The end result will be to improve Mn/DOT and MSP operational effectiveness and the overall safety and efficiency of the transportation system in Minnesota.

**ITS Critical Strategy 5: Use Intersection Collision Warning Systems**

**5.1 Install rural intersection warning and decision support systems**

**Description**
Provide drivers on the rural roadways with information indicating when entry into the intersection is safe.

**Background**
On a national level, intersection warning and decision support systems are being addressed by Cooperative Intersection Collision Avoidance Systems (CICAS). This ITS major initiative uses both vehicle-based and infrastructure-based technologies to help drivers approaching an intersection understand the state of activities within that intersection. CICAS consists of:

- Vehicle-based technologies and systems—sensors, processors, and driver interfaces within each vehicle.
- Infrastructure-based technologies and systems—roadside sensors and processors to detect vehicles and identify hazards and signal systems, messaging signs, and/or other interfaces to communicate various warnings to drivers.
- Communications systems—dedicated short-range communications (DSRC) to communicate warnings and data between the infrastructure and equipped vehicles.

The CICAS initiative builds on research and operational tests previously conducted under the USDOT’s Intelligent Vehicle Initiative. It is being closely coordinated with the Vehicle Infrastructure Integration and the Intelligent Vehicle-Based Safety Systems initiatives. A CICAS initiative working group is being formed from partnerships with automotive manufacturers, State and local departments of transportation and university research centers throughout the United States.

---

Minnesota ITS Safety Plan

Minnesota is focusing on lateral direction crashes where minor roads intersect major arterials, particularly in rural areas. Minnesota is currently demonstrating an infrastructure-based rural intersection collision avoidance system and is leading an eight-state, pooled fund demonstration to note the differences in application across varying geographies and driving characteristics.

### ITS Critical Strategy 6: Improve Driver Education and licensing Using ITS

#### 6.1 Expand graduated driver licensing

**Description**

New drivers are rewarded for safe driving under graduated driver licensing programs. Currently, a limited graduated driver licensing program exists in Minnesota. However, using technology such as in-vehicle monitoring could be added to enhance the program to reward safe drivers.

**Background**

The graduated driver's license (GDL) law in Minnesota became effective on January 1, 1999. It compliments the existing driver's license program by introducing a provisional license stage for young drivers. This multi-tiered program, designed to ease young novice drivers into the driving environment, provides for additional parental/legal guardian involvement. It also emphasizes the importance of a good driving record. A few GDL facts:

- The GDL law provides for three phases of licensing for persons less than 18 years of age: Phase I-Instruction Permit Phase II-Provisional License Phase III-Full License.
- The law increases the parent's/legal guardian's involvement in their teen's driving experience.
- A person who fails the driving test four times must complete a minimum of six hours of behind-the-wheel instruction with a licensed instructor before taking the road test again. (A valid instruction permit is required.)
- An applicant who is age 18 and who has not been previously licensed, must hold an instruction permit for six months before taking a road test. Applicants who are 19 or older must hold an instruction permit for three months before taking a road test.
- There is a $3.50 credit toward the fee for a full license for a provisional license holder who has no violations on his/her driving record.

The University of Minnesota, Center for Transportation Studies has been extensively involved with research in regard to driver performance and behaviors. Specifically, a possible approach to mitigate the incidence of teenage driver crashes and fatalities is through the use of

---

29 Minnesota Department of Public Safety. “Graduated License”
http://www.dps.state.mn.us/dvs/DriverLicense/Graduated%20DL/grad_license.htm
30 University of Minnesota, Center for Transportation Studies. “In-Vehicle Driver Assistance for Teenagers”
in-vehicle technology. The Teen Driver Support System (TDSS) aims to address five primary contributing factors associated with the majority of teen fatal crashes:

- Speeding
- Seatbelt use
- Alcohol impairment
- Driver inattention/distraction
- Driver inexperience

This will be implemented using a combination of what are called forcing, feedback, and/or reporting functions. Forcing functions will be in the form of ignition interlocks to enforce seatbelt compliance and sober driving. A feedback function will provide real time tutoring and warnings about illegal or unsafe speeds. A reporting function will record vehicle information for parents to review and supervise (and enforce) teen driver performance.

An evaluation of past and present commercially available in-vehicle systems has identified a number of deficiencies; these systems are too passive and do not offer the best possible technological solution. Validation of the TDSS will be accomplished over a three-phase program. The first phase of the project (design and development of a prototype TDSS system) is underway with funding from the ITS Institute. A speed-limit feedback and reporting system has been developed for demonstration. The system correlates the location (using GPS) of the vehicle to a digital road map and the road's corresponding speed limit. If the driver's current speed exceeds the road's posted limit, an audible warning is used to notify the driver, and details (time, location, speed, etc.) of the infraction are recorded for later review. Testing of the speed-limit notification system is currently underway.

A future component of the system will include curve-speed feedback. The system will compare the driver's current speed to an advisory speed based on the road geometry, and a warning tone will be used to notify the driver that their current speed may be unsafe for an upcoming curve. This type of system will be especially useful at night on rural highways, where sudden changes in road curvature may not be recognized in time by drivers who are distracted and/or unfamiliar with the road.

Alcohol interlock systems are also commercially available and can be integrated into the system. Considering the cost, the alcohol interlock component would be reserved for teen drivers with preexisting alcohol-related convictions. Seatbelt interlocks, which were briefly required by NHTSA in 1973, are no longer commercially available. Therefore, a method of integrating a low-cost seatbelt interlock is being explored. An outline has been drafted for two additional phases:

1) The design and evaluation of human interfaces for the selected feedback and reporting systems used to modify driving behavior (which will be based on a population of teenagers using a driving simulator).
2) A subsequent multi-vehicle field operational test to evaluate the benefits of a TDSS. The goal of this program is to develop and validate a new support system that can be
used by teen drivers, parents, the insurance industry and government (through public policy, graduated licensing, etc.) to effect significant improvements in the near future.

If successful, the results of this work could lead to a system that would eventually be marketed to parents of teen drivers, or could be adopted as of part future GDL programs.

6.2 Use driving simulation for teenage and mature driver education

Description
Individuals would be asked to participate in driving simulation to see the effects of driving too fast, tailgating, reaction time, etc. This technology has been available for many years. However, political support will be needed to proceed at a state level.

Background
Studies have found that many traditional driver-education programs go only so far; providing teens with information and instruction, but stopping short of addressing the underlying attitudes that influence how teens drive. Driving simulation technology has been available for many years and continues to makes advancements. For example, there are successful programs in several states supported by dedicated and disciplined research. DriveSafety is a program that defines teen driving problems, identifies solutions and then tests those solutions for real results. It is focused on a multi method training approach to solving teen driving problems including psychology, simulation and driver’s education. DriveSafety is applying a systemic approach to solving the teen driving problem by listening to and educating teens, parents, educators, industry and government. DriveSafety believes that before a solution is introduced into the market that it should be rigorously researched and proven to provide results.

DriveSafety is the funding source behind the Simulation Training and Assessment Research (STAR) Laboratory located on the campus of Kansas State University. The STAR lab is one of the only laboratories in the world dedicated solely to the research of teen driving safety. This lab is responsible for the research behind the attitudinal awareness tool TeenDASH™ for Safety. This revolutionary online survey and classroom curriculum is the result of over 2 years of research and continues to be rigorously tested to determine if it will ultimately make a difference in the reduction of crashes, deaths and injuries among teens. However, there is still speculation regarding:

- How effective are driving simulators for training teen drivers and assessing their driving performance?
- Does simulator training make teens safe drivers, and has there been any reduction in traffic crashes, injuries, and fatalities among teens that can be attributed to this training?

6.0 ITS Critical Strategies and Initiatives Effectiveness Spreadsheet

Selection of the Minnesota ITS Safety Critical Strategies and Initiatives through the survey, workshop, and interviews brought the ideas of many experts in traffic technology, safety, engineering, and law enforcement into a clearer focus. The next step was to develop an effectiveness spreadsheet. The goal of the effectiveness spreadsheet is to assess the factors that could help determine the potential of each project initiative to reduce crashes, save lives and minimize injury severity in a way the demonstrates a positive benefit/cost ratio.

The ITS Safety Plan Effectiveness Spreadsheet included at the end of this section (see Table 4) is based off of the Minnesota CHSP Effectiveness Spreadsheet (see Appendix D). Since a considerable amount of work and research was used to develop this spreadsheet, the ITS Safety Plan used, where applicable, data presented in the CHSP spreadsheet in order to not duplicate efforts. For example, the CHSP used 2002 Crash Data to support many assumptions, so the ITS Safety Plan spreadsheet was also based off the same data for consistency.

The effectiveness spreadsheet estimates the number of traffic fatalities and serious injuries prevented given a specified level of deployment for an ITS Critical Strategy. The spreadsheet also identifies the benefit/cost ratio for each ITS strategy based on an estimated implementation cost. It is important to note that the best information available was used to determine the values included in the effectiveness spreadsheet. However, Mn/DOT and DPS realize that other agencies and organizations may be aware of or have more information that can improve the effectiveness values. Such information would be welcome for future versions of the spreadsheet.

The first column in the spreadsheet lists each ITS Safety Initiative under the six ITS Safety Critical Strategies. The second column (Minnesota CHSP CEA) indicates how each ITS initiative relates to the five Critical Emphasis Areas identified in the CHSP. The five CHSP CEA’s are as follows:

- Minnesota CHSP CEA 1 – Reducing Impaired Driving and Increasing Seat Belt Use
- Minnesota CHSP CEA 2 – Improving the Design and Operations of Highway Intersections
- Minnesota CHSP CEA 3 – Addressing Young Drivers Over Involvement and Curbing Aggressive Driving
- Minnesota CHSP CEA 4 – Reducing Head-On and Across-Median Crashes, Keeping Vehicles on the Roadway and Minimizing the Consequences of Leaving the Road
- Minnesota CHSP CEA 5 – Increasing Driver Safety Awareness and Improving Information Systems
The spreadsheet is then divided into three categories: Given Values, Input Values, and Output Values. The following information provides details of how each value was estimated in the spreadsheet. Additional details for each cell included in the effectiveness spreadsheet are included in Appendix E.

Given Values

- **Related Crashes Fatal**
  The number of fatal crashes from the 2002 Crash Facts that are potentially correctable by the action listed under the ITS Critical Strategy. The cell comments contain the number of fatalities (i.e., lives lost) that resulted from the fatal crashes.

- **Related Crashes Serious Injury**
  The number of serious injury crashes from the 2002 Crash Facts that are potentially correctable by the action listed under the ITS Critical Strategy. The cell comments contain the number of serious injuries that resulted from the crashes.

- **Effectiveness Fatal**
  The effectiveness of the listed ITS initiative at reducing the number of fatal crashes. The effectiveness may be listed as a percentage (i.e. prevent 50% of related crashes for every mile treated) or as an absolute number (i.e. prevent 1 crash for every program developed). The source for the effectiveness is presented in the cell comments.

- **Effectiveness Serious Injury**
  The effectiveness of the listed ITS initiative at reducing the number of serious injury crashes. The effectiveness may be listed as a percentage (i.e. prevent 50% of related crashes for every mile treated) or as an absolute number (i.e. prevent 1 crash for every program developed). The source for the effectiveness is presented in the cell comments.

- **Color Coding**
  The effectiveness values (effectiveness fatal and serious injury) were color coded based on level of confidence.
  
  Green Proven (Initiatives that have been rigorously tested and the results are considered to be very reliable)
  
  Yellow Tried (Initiatives that are often widely accepted, but quality experiments and evaluation may be not have been performed to document the safety benefit)
  
  Red Experimental (Initiatives that have little or no research available to document their effectiveness)

- **Effectiveness Unit**
  The effectiveness unit was selected based on the most likely fashion of deployment.

Input Values

- **Interest Rate**
  The interest rate used to amortize the implementation costs into an annual value over the life of the project. The default interest rate selected was the current interest rate used by Mn/DOT in benefit-cost analysis when the Minnesota CHSP was developed.
- **Deployment**
  The level of deployment for each strategy. One was specifically used as the level of deployment so initiatives could be compared for order of magnitude.

- **Unit Cost**
  Represents an estimate of the implementation cost (i.e. salary, construction cost, related maintenance, etc.) for the life of the project. The original values are general estimates that may be refined if and when more detailed information is available.

- **Service Life**
  The estimated life of the project related to the unit cost.

**Output Values**

- **Annual Crash Prevention Fatalities**
  The estimated number of fatalities and the effectiveness for fatal crashes. Most values are computed using the effectiveness for fatal crashes (column 1), effectiveness (column 3), and deployment (column 5). However, some strategies also included a constant value when calculating crash prevention. This constant value represents crash density (crash per mile, crash per intersection, etc.) that was determined using the entire state trunk highway system. Even though this constant is based on the state highway system, it is a conservative value because crashes were averaged across the entire system. Therefore it is also likely relevant for use on local roadways.

- **Annual Crash Prevention Serious Injuries**
  The estimated number of serious injuries prevented using the amount of deployment and the effectiveness for serious injury crash. Most values are computed using the effectiveness for serious injuries (column 2), effectiveness (column 4), and deployment (column 5). However, some strategies also included a constant value when calculating crash prevention. This constant value represents crash density (crash per mile, crash per intersection, etc.) that was determined using the entire state trunk highway system. Even though this constant is based on the state highway system, it is a conservative value because crashes were averaged across the entire system. Therefore it is also likely relevant for use on local roadways.

- **Initial Cost**
  The initial cost for implementation based upon the unit cost and the amount of deployment. The cost has not been converted into a yearly cost.

- **BC Ratio**
  Annual benefit divided by the annualized cost. The annual benefit is computed as $3.4 million for each fatal crash prevented and $270,000 for each serious injury crash prevented (Note: Benefit computed on crashes prevented and not on fatalities and injuries prevented.)

The last column in the spreadsheet identifies a champion for each ITS initiative.

The best information available was used to determine the information included in each cell, however Mn/DOT and DPS realize that other agencies and organizations may be aware or have more information that can improve the effectiveness values.
### Table 4: Minnesota ITS Safety Plan Effectiveness Spreadsheet

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
<th>Estimated Initial Investment</th>
<th>Annualized Cost</th>
<th>Annual Benefit</th>
<th>BC Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ITS Critical Strategy #1: Implement In-Vehicle Based Safety Systems</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Require seatbelt ignition interlocks on new vehicles</td>
<td>$131.4800</td>
<td>$50,000</td>
<td>$1,813</td>
<td>&gt; 100</td>
</tr>
<tr>
<td>1.2</td>
<td>Require blood alcohol content level ignition interlocks on vehicles driven by impaired/seat belt drivers</td>
<td>$110</td>
<td>$50,000</td>
<td>$1,813</td>
<td>&gt; 100</td>
</tr>
<tr>
<td>1.3</td>
<td>Provide real-time information to vehicles that deliver warnings to drivers</td>
<td>$26,3100</td>
<td>$50,000</td>
<td>$1,813</td>
<td>&gt; 100</td>
</tr>
<tr>
<td>1.4</td>
<td>Use preemption on vehicle radios to provide real-time information</td>
<td>$26,3100</td>
<td>$50,000</td>
<td>$1,813</td>
<td>&gt; 100</td>
</tr>
<tr>
<td>1.5</td>
<td>Research equipping vehicles with systems to detect driver distractions and provide warnings</td>
<td>$333,194</td>
<td>$1,000,000</td>
<td>$333,194</td>
<td>&gt; 100</td>
</tr>
<tr>
<td><strong>ITS Critical Strategy #2: First Responder/Law Enforcement Systems</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Coordinate emergency responder databases to allow access to consistent crash information</td>
<td>$8,387,189</td>
<td>$43,500,000</td>
<td>$130,351,000</td>
<td>15.5417</td>
</tr>
<tr>
<td>2.2</td>
<td>Allow law enforcement to retrieve data from onboard vehicle computers</td>
<td>$130,351,000</td>
<td>$43,500,000</td>
<td>$130,351,000</td>
<td>15.5417</td>
</tr>
<tr>
<td>2.3</td>
<td>Develop and provide a uniform, real-time automated crash notification system</td>
<td>$11,050</td>
<td>$125,000</td>
<td>$277,883,000</td>
<td>100</td>
</tr>
<tr>
<td>2.4</td>
<td>Implement automated enforcement of red light running at intersections</td>
<td>$9,640</td>
<td>$50,000</td>
<td>$9,951</td>
<td>&gt; 100</td>
</tr>
<tr>
<td>2.5</td>
<td>Expand thoroughness and quality of incidents</td>
<td>$277,883,000</td>
<td>$125,000</td>
<td>$3,927,800</td>
<td>&gt; 100</td>
</tr>
<tr>
<td>2.6</td>
<td>Implement automated enforcement of speed violations</td>
<td>$277,883,000</td>
<td>$125,000</td>
<td>$3,927,800</td>
<td>&gt; 100</td>
</tr>
<tr>
<td><strong>ITS Critical Strategy #3: Implement Vehicle Infrastructure Integration (VII) Systems</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Implement improved lane guidance system</td>
<td>$1,494</td>
<td>$1,000</td>
<td>$1,494</td>
<td>&gt; 100</td>
</tr>
<tr>
<td>3.2</td>
<td>Develop vehicle to vehicle and vehicle to infrastructure communication system</td>
<td>$1,494</td>
<td>$1,000</td>
<td>$1,494</td>
<td>&gt; 100</td>
</tr>
<tr>
<td><strong>ITS Critical Strategy #4: Improve Infrastructure Systems and Signage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Expand work zone safety systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>Implement variable speed limit signs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>Expand the use of dynamic message signs to provide location-based, real-time information to drivers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td>Research use of graphics (and text) for dynamic message sign messages</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.6</td>
<td>Integrate reporting systems across state and local borders</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ITS Critical Strategy #5: Use Intersection Collision Warning Systems</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>Install intersection warning and detection support systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ITS Critical Strategy #6: Driver Education and Licensing Using ITS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td>Expand graduated driver licensing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.2</td>
<td>Use driving simulation for teenage and mature driver education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Details and descriptions of how each cell was determined is included in Appendix E.
7.0 Three-Year Funding and Deployment Plan

The Three-Year Funding and Deployment Plan is built around the ITS Safety Plan goal of moving Minnesota Toward Zero Deaths by supporting the CHSP. This Three-Year Funding and Deployment Plan has identified the highest priority strategies and initiatives to implement in years one through three of the program as well as future efforts. Since most of the ITS Safety Plan Initiatives require deployment of ITS technology, either on the road infrastructure or within the vehicle, adequate funding will be critical to the success of the plan.

Using the Minnesota ITS Safety Plan Effectiveness Spreadsheet, one could quickly select initiatives with the highest benefit/cost ratio. However, there are many interrelated factors that must also be considered when selecting initiatives to implement during the next three years including:

- Users perception of the need and value of the initiative
- Anticipated reduction in fatalities
- Ease of implementation
- Technology maturity and success in other applications
- Installation costs and ongoing maintenance costs
- Funding availability – source of funding
- Usefulness – will it be accepted and used by the general public
- Early success possibilities
- Political implications
- Legal issues
- Agencies sponsorship, cooperation, and commitments
- Who will champion the initiative, public or private
- Work load of the agency/champion

In the final analysis there are two key factors to the success of each ITS Safety Initiative.

1) **Who will champion the initiative?** A very committed person/organization, who understands the need and value of an initiative, can overcome many barriers and issues such as those listed above resulting in successfully completing an initiative. Without a committed champion and their supporters, most initiatives have little chance of success. To help assure the success of these ITS Safety Initiatives, each one has a designated champion as indicated in the ITS Safety Plan Effectiveness Spreadsheet, who is committed to the success of the initiative.

It should be noted that of the ITS Safety Plan Oversight Committee membership, six key individuals are or have retired, changed jobs, or retired but are continuing to work, which provides a hole for consistency.
2) **How will the initiative be funded?** Funding of the initiative, for both installation and maintenance, must come from a reliable source either public or private or most of the initiatives cannot be successful. Various funding opportunities are discussed below.

### 7.1 Funding Opportunities

This section of the plan does not include a detailed funding program for each initiative. Funding of ITS Safety Initiatives is not simply a matter of preparing funding requests and being handed the funds to implement an initiative. Most initiatives will require the identification of a funding source, plus justification, and documentation. That is an important role for each identified champion. Identification of a funding source can be a challenge because of the many different, often overlapping programs available, and the varying requirements for each of them. Funding opportunities are continually changing as new federal and state programs are announced. Many sources of funds also must be balanced against other needs, for example, which is more important a pavement overlay for a deteriorating section of road, or deploying a DMS?

The following sections provide a general listing of funding opportunities, to establish that funding opportunities are available, but each opportunity requires a dedicated effort to apply them.

**State Transportation Improvement Projects (STIP)**
Projects in the STIP are generally developed by Mn/DOT Districts, with about 25% of the projects developed by Regional Development Commissions and counties. Funding includes federal funds, state funds, and local funds.

**CHSP Central Safety Fund**
The CHSP Central Safety Fund was established by the Mn/DOT Office of Traffic, Security and Operations and DPS Office of Traffic Safety in 2005 to provide funding for state, county, and local agency safety projects. In its first year there grants will be made to assist counties in conducting road safety audits and for paying the costs of constructing safety projects or funding activities to reduce the number of fatal and severe crashes on local roads.

**Minnesota Guidestar**
Minnesota Guidestar is the state's ITS program. Its mission is to research, test, and deploy advanced transportation technology to save lives, time, and money.

Many projects in the Guidestar program are funded by previous ITS earmarks, ITS state matching funds, and regular federal highway funding. Guidestar generally doesn’t fund ITS implementation projects. The Guidestar program focuses mainly on innovative ideas and programs to develop demonstration projects and studies as well as deployments that are statewide in nature.
SAFETEA-LU
In the early years of ITS, most of the federal funding for these programs was through earmarked programs. SAFETEA-LU, the new transportation bill, has essentially eliminated ITS earmarked funding. Today, ITS funding is available through many other federal funding categories. This is both an advantage for ITS, by opening additional funding opportunities, and a problem because ITS must compete with bridge, pavement, and other funding needs. In addition many of these programs require state and local match funds.

Several SAFETEA-LU categories bare special mention and attention as potential funding sources. These include:

- National Strategy to Reduce Congestion on America’s Transportation Network, announced by U.S. Secretary of Transportation Norman Mineta in May of 2006. Among other things it calls for more widespread deployment of new technologies and practices that end traffic tie ups, and designates and funds new “corridors of the future”.
- Opportunities exist within the nine FHWA ITS Initiatives including Vehicle Infrastructure Integration (VII) Integrated Corridor, Clarus, and Cooperative Intersection Collision Avoidance Systems.
- HSIP (Highway Safety Improvement Program): The program authorizes a new core Federal-aid funding program beginning in FY 2006 to achieve a significant reduction in traffic fatalities and serious injuries on all public roads. SAFETEA-LU funding for integration of ITS planning projects is to be included in the normal STIP planning process. ITS will become another element in the STIP planning process. This will require development of ITS specifications to make it easier to prepare ITS proposals.

Project Amendments and Addendums Embedded in Traditional Construction Projects
Often it is possible to add an ITS Safety Initiative as part of the scope of a planned transportation construction project, or an ongoing project. This allows for early implementation of many of the safety initiatives without waiting for statewide or federal funding programs to develop.

Earmark Funding
On the federal level, earmarked ITS funding is no longer available as part of the SAFETEA-LU or other programs. On the state level, earmarks are unlikely at this time, but the value of lives saved could be a convincing argument for special funding. Funds remaining from previous earmarks are available until expended or retracted by the USDOT.

Public Private Partnerships
Minnesota has a rich history of developing public-private partnerships for ITS technology programs. Several of the ITS Safety initiatives provide an opportunity to work with vehicle manufacturers for joint development and deployment of ITS safety
technologies. These public-private partnerships require that all parties realize that the long-term goal of the private partner is to create a return on their investment. The need to make a profit will influence their perception of the need for their involvement in an initiative.

**Homeland Security, Public Safety and Other Special Funding Opportunities**

As part of the programs for public safety and homeland security, various organizations sometimes have transportation safety related funding opportunities available.

**Research Funding**

The Center for Transportation Studies ITS Institute at the University of Minnesota received increased funding in SAFTEA-LU which can be used to fund ITS research projects.

The Minnesota challenge for Federal, State, County and Local agencies will be to develop the initiatives contained in the ITS Safety Plan into projects that can be funded and implemented. Another challenge is to seek and utilize funding opportunities when they become available.

### 7.2 Corridor Applications

Minnesota’s TZD program has led the way in developing cooperative projects to reduce traffic fatalities using Education, Enforcement, Engineering, and Emergency Services. The TZD program selected three corridors to focus attention on. These corridors are:

**Wright County:** Highway 55 is one of the most traveled two-lane roadways in the state of Minnesota. The 55 Corridor, stretching from Buffalo through Wright County to Medina (Hennepin County) was identified as a major area of concern.

**US 52:** A four-lane, divided highway, US 52 stretches from the Twin Cities to the Iowa border and is a regular transportation link for a wide variety of drivers—including commuters, business travelers, and rural residents.

**Mille Lacs and Isanti Counties:** The 65/95 Corridor is actually two state highways which intersect in the city of Cambridge. Minnesota 95 is a two-lane highway between Cambridge and Princeton, while Minnesota 65 is a four-lane divided highway linking Cambridge and Isanti, so the corridor spans both Mille Lacs and Isanti Counties.

Since these corridors have already been selected in the TZD program as corridors on which to focus attention, the ITS Safety Plan will also support these corridors with ITS Safety Initiatives. The TZD corridors will provide special opportunities for comparison studies and future analysis of the success of various ITS Safety efforts.
The ITS Safety Plan is a statewide plan for implementation of high priority ITS Safety strategies and initiatives. Therefore projects selected for implementation within a corridor must also be applicable beyond the corridor.

7.3 Three-Year Deployment Plan

Developing a three-year deployment plan that addresses the funding and other variables mentioned above is a significant challenge. To accomplish this the ITS Safety Plan Oversight Committee followed a logical path shown in Figure 4 and described in Chapters 2.0 – 6.0 of this plan.

The result of these efforts has been to define the 22 ITS Safety Initiatives so that they can be developed and implemented on a case-by-case basis. With all the variables involved it is recognized that some initiatives will move faster, and will be more successful than others. Some will be easier to implement, because of their size, outside support, and early success capabilities. Some may never be completed, however they can be used to set an example for future initiatives.

In establishing the Three-Year Deployment Plan all of the various factors were taken into consideration by the Oversight Committee including cost/benefit determinations from the Effectiveness Spreadsheet. The final determination relies on the judgment of the Oversight Committee as a whole. Finally this is a flexible Three-Year Deployment plan. As funding or other opportunities change, the plan is designed to take advantage of those opportunities. For example if special funding opportunities develop, that would provide for early deployment of a third year project the first year, that could become an overriding factor in moving forward early for that particular project or for a portion of that project. Initiatives may be developed in sections or segments as appropriate.

Table 5: ITS Safety Plan Three-Year Deployment Overview - provides an overview of the ITS Safety Three-Year ITS Safety Deployment Plan. As described above the key word for this
plan is flexibility. Flexibility to manage programs most effectively, to seek and utilize special opportunities, and to implement as many of the initiatives as rapidly as possible to save as many lives as possible.

In developing the 3-Year Deployment Plan the following descriptions are applicable to the Year column:

- **Underway Initiatives** are those that are already being implemented, whole or in part. Underway does not mean completed, and additional work to complete the Initiative may be required.

- **Year 1 Initiatives** are those on which the start of development is anticipated in the first year after this plan is adopted. Completion dates will be established during Initiative development.

- **Year 2 Initiatives** are those on which the start of development is anticipated in the second year after this plan is adopted. Completion dates will be established during Initiative development.

- **Year 3 Initiatives** are those on which the start of development is anticipated in the third year after this plan is adopted. Completion dates will be established during Initiative development.

- **Future Initiatives** are those on which the start of development is not anticipated at this time. The initiative might require legislation, outside support not currently available, special funding or there are other issues.

It was noted by the ITS Safety Oversight Committee that ITS technology to implement most of the initiatives already exists. The challenge is to find programs and opportunities to implement the technology.

It was noted by the ITS Safety Development team that technology to implement most of the Initiatives already exists. The challenge is to find programs and opportunities to implement the technology.

Most of the ITS Safety Initiatives listed require cooperative efforts of more than one public agency or private entity for their success. It’s anticipated the agencies and entities involved will need to create partnerships to fully develop the Initiative. With Minnesota’s history of Public/Private partnerships through the Guidestar and other programs Minnesota has a head start on other states in actively pursuing the ITS Safety Initiatives shown in Table 5.
Table 5: ITS Safety Plan Three-Year Deployment Plan Overview

<table>
<thead>
<tr>
<th>ITS Critical Strategies and Initiatives</th>
<th>Description</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1  Require seatbelt ignition interlocks on new vehicles</td>
<td>The premise of this initiative is to expand existing seatbelt interlocks so that a driver would be unable to start a vehicle unless the seatbelt is fully engaged for everyone in the vehicle. Technology is currently available to interlock the ignition with seatbelts. Currently, most new vehicles issue an audible alarm that will continue until everyone in the front seat is buckled.</td>
<td>Future</td>
</tr>
<tr>
<td>1.2  Require blood alcohol content level ignition interlocks on vehicles driven by repeat drunk driving offenders</td>
<td>This strategy would require a driver’s blood alcohol content level to be checked by an onboard device that is interlocked with the vehicle’s ignition system. The vehicle would not start if the driver’s blood alcohol content were above a preset level. There is technology currently available and several state court systems currently require some form of blood alcohol content level ignition interlock.</td>
<td>Year 3</td>
</tr>
<tr>
<td>1.3  Provide real-time information to equipped vehicles that deliver warnings to drivers</td>
<td>This system could include technology to notify a driver, based on their location of the posted speed limit. Other notification could include indication of an unsafe area ahead, such as hazardous roadway locations, alignment changes, upcoming work zones, or bridge surface conditions.</td>
<td>Year 2</td>
</tr>
<tr>
<td>1.4  Use preemption on vehicle radios to provide real-time information</td>
<td>Real-time information related to road emergencies could be delivered to drivers by preempting radio broadcasts or through Radio Data Systems (RDS) messages.</td>
<td>Year 3</td>
</tr>
<tr>
<td>1.5  Research equipping vehicles with systems to detect driver distractions and provide warnings</td>
<td>A driver would receive an audible (i.e., beeping) or tactile (i.e., seat vibration) alert as a warning if distraction or unresponsiveness are detected. The University of Minnesota has previously developed technology and conducted research in this area.</td>
<td>Underway</td>
</tr>
</tbody>
</table>
Minnesota ITS Safety Plan

<table>
<thead>
<tr>
<th>ITS Critical Strategies and Initiatives</th>
<th>Description</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Coordinate emergency responder databases to allow access to consistent crash information</td>
<td>Coordinate emergency responder databases to allow each entity to enter and access information about a crash through an online database. Such coordination would allow the seamless sharing of consistent information on crash and victim details to facilitate better response and care.</td>
<td>Year 1</td>
</tr>
<tr>
<td>2.2 Allow law enforcement to retrieve data from onboard vehicle computers</td>
<td>Ideally, law enforcement would access this data to determine vehicle speed, deceleration, time of incident, etc. This type of information is currently available on newer model vehicles and Minnesota law enforcement is able to access the data with a warrant.</td>
<td>Year 1</td>
</tr>
<tr>
<td>2.3 Develop and provide a uniform, real-time automated crash notification system</td>
<td>This system would provide immediate notification of a crash to emergency responders and provide access to driver, passenger and vehicle information. This would reduce emergency response time and, ultimately, improve crash fatality and injury rates through faster and more targeted care. This could be viewed as a continuation of the previous Mayday projects conducted in Minnesota.</td>
<td>Underway</td>
</tr>
<tr>
<td>2.4 Implement automated enforcement of red light running at intersections</td>
<td>Identify signalized intersections where there have been higher than average crash rates and deploy portable or permanent photo/surveillance systems that automatically mail citations to drivers running red lights.</td>
<td>Year 1</td>
</tr>
<tr>
<td>2.5 Expand quick clearance policies for incidents</td>
<td>Quick clearance policies have strong effects on traffic safety and minimize incident related congestion. Studies indicate that good traffic incident management lead by quick clearance actions can reduce delay nationally by 170 million hours annually.</td>
<td>Underway</td>
</tr>
<tr>
<td>2.6 Implement automated enforcement of speed violations</td>
<td>Photo enforcement for speeding can be deployed reactively at locations where there is a history of crashes with excessive speed as a contributing factor or in work zones.</td>
<td>Future</td>
</tr>
</tbody>
</table>
### ITS Critical Strategies and Initiatives

<table>
<thead>
<tr>
<th>ITS CS 3</th>
<th>ITS CS 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3.1 Implement improved lane guidance system</strong></td>
<td><strong>4.1 Expand work zone safety systems</strong></td>
</tr>
<tr>
<td>Description: Provide lane guidance to drivers/vehicles through the use of magnetic, GPS and pavement markings.</td>
<td>Currently being done in Minnesota, safety systems could include deploying dynamic late merge systems, which consist of detection, dynamic message signing and software for automation.</td>
</tr>
<tr>
<td>Year: Year 2</td>
<td>Year: Year 1</td>
</tr>
</tbody>
</table>

| **3.2 Develop vehicle to vehicle and vehicle to infrastructure communication** | **4.2 Implement variable speed limit signs** |
| Description: This initiative encompasses the national vision for VII. VII will build on the availability of advanced vehicle safety systems developed under the Intelligent Vehicle Initiative (IVI) and on the results of related research and operational tests. It is also supported by radio spectrum at 5.9 GHz specifically allocated for digital short range communications (DSRC). | Variable speed limit (VSL) systems provide real-time information on appropriate speed for current conditions based on traffic flow, traffic speed, weather and other inputs and integration with law enforcement. |
| Year: Year 1 | Year: Year 1 |

| **4.3 Expand the use of dynamic message signs to provide location based, real-time information to drivers** | **4.3 Expand the use of dynamic message signs to provide location based, real-time information to drivers** |
| Description: Dynamic message signs (DMS) are being increasingly used to provide motorists with incident, construction and travel time information. This initiative would explore the use of DMS for additional real-time information and instruction. | Dynamic message signs (DMS) are being increasingly used to provide motorists with incident, construction and travel time information. This initiative would explore the use of DMS for additional real-time information and instruction. |
| Year: Underway | Year: Underway |

| **4.4 Research use of graphics (and text) for dynamic message sign messages** | **4.5 Expand geographic coverage of the RTMC systems** |
| Description: As new dynamic message signs (DMS) are deployed, graphic related messaging capabilities would be added. Alone or combined with text, graphics would show information in different formats to enhance driver understanding. | The Regional Transportation Management Center (RTMC) integrates Mn/DOT's Metro District Maintenance Dispatch and Office of Traffic, Safety, Security, and Operations with the Minnesota Department of Public Safety's State Patrol Dispatch into a unified communications center. The integration provides the communications and computer infrastructure necessary for coordinated transportation management on metro freeways during normal commuting periods, as well as during special events and major incidents. |
| Year: Year 3 | Year: Underway |

| **4.6 Integrate reporting systems across state and local borders** | **4.6 Integrate reporting systems across state and local borders** |
| Description: Provide the ability for reporting systems to share information across state borders. Reporting systems are available now and integration across state borders has been explored through the North/West Passage transportation pooled fund study. | Provide the ability for reporting systems to share information across state borders. Reporting systems are available now and integration across state borders has been explored through the North/West Passage transportation pooled fund study. |
| Year: Underway | Year: Underway |
## Minnesota ITS Safety Plan

<table>
<thead>
<tr>
<th>ITS Critical Strategies and Initiatives</th>
<th>Description</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITS CS 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1 Install rural intersection warning and decision support systems</td>
<td>Provide drivers on the rural roadways with information indicating when entry into the intersection is safe.</td>
<td>Year 2</td>
</tr>
<tr>
<td>ITS CS 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1 Expand graduated driver licensing</td>
<td>New drivers are rewarded for safe driving under graduated driver licensing programs. Currently, a limited graduated driver licensing program exists in Minnesota. However, using technology such as in-vehicle monitoring could be added to enhance the program to reward safe drivers.</td>
<td>Year 2</td>
</tr>
<tr>
<td>6.2 Use driving simulation for teenage and mature driver education</td>
<td>Individuals would be asked to participate in driving simulation to see the effects of driving too fast, tailgating, reaction time, etc. This technology has been available for many years. However, political support will be needed to proceed at a state level.</td>
<td>Year 3</td>
</tr>
</tbody>
</table>
7.4 Impact on Reducing Fatalities and Injuries

The ITS Safety Plan Effectiveness Spreadsheet is an attempt to quantify the potential for reducing fatalities and injuries for each ITS Safety Strategy and Initiative that is implemented. Many of the initiatives have a potential of implementation by a road segment, county or district, and many of them will work concurrently to reduce fatalities. Thus there are many overlapping factors involved in understanding the impact of each ITS Safety Strategy and Initiative in reducing fatalities. The Effectiveness Spreadsheet however, remains as the best tool to use as a baseline and for studying the impact of the various strategies and initiatives.

7.5 The Challenge

A lot of thought and effort went into developing the Minnesota ITS Safety Plan. Since most of the technology to implement the Initiatives already exists the real need is to begin to utilize the technology as soon as possible. With the potential for saving hundreds of lives each year on Minnesota’s roads the ITS Safety Plan offers a significant challenge to various agencies across the state. The challenge is to commit the resources, staff, and funding necessary to implement the Initiatives in the ITS Safety Plan as soon as possible. And since over 45% of the fatalities occur on local roadways this challenge applies to all transportation organizations. The need is not political, nor can it be easily balanced against other needs, because each life that can be saved is important to Minnesota.

Realistically not every project initiative can be funded and implemented. However, there is a direct link between the number of complete or partial initiatives that are fully developed and the number of lives saved.
8.0 ITS Safety Critical Strategies and Initiatives Action Plans

After the three-year deployment plan was developed (see Section 7.0), the next step was to identify critical information to move the 22 ITS Initiatives forward in Minnesota. Table 6 presents the champion needed to move the project forward, legal/legislative issues, funding options, institutional issues, partners/stakeholders, and specific Minnesota actions. The table is intended to identify preliminary suggestions for moving each initiative forward by the Minnesota safety community.

*Champion:* Person or organization that understands the need and value of the initiative and can identify relevant issues and overcome barriers.

*Legal/Legislative Issues:* Existing or proposed laws or statutes that specifically prohibit or support the initiative.

*Funding Options:* Federal, state and local programs as well as private sector and universities identified as potential funding sources for the initiative.

*Institutional Issues:* Internal (within one organization) or external (across multiple organizations) issues regarding ownership, public perception or political impacts of the initiative.

*Partners/Stakeholders:* Parties that may be affected by or may support the initiative.

*Minnesota Actions:* Potential next steps that Minnesota’s safety community may take to move the initiative forward.
### Table 6: ITS Safety Plan Critical Strategies and Initiatives Action Plans

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Description</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Require seatbelt ignition interlocks on new vehicles</td>
<td>The premise of this initiative is to expand existing seatbelt interlocks so that a driver would be unable to start a vehicle unless the seatbelt is fully engaged for everyone in the vehicle. Technology is currently available to interlock the ignition with seatbelts. Currently, most new vehicles issue an audible alarm that will continue until everyone in the front seat is buckled.</td>
<td>Future</td>
</tr>
</tbody>
</table>

Critical information to move this initiative forward in Minnesota includes:

**Champion:** Mn/DOT State Traffic Engineer – Bernie Arseneau

**Legal/Legislative Issues:**
- National legislation may be required to allow the National Highway Traffic Safety Administration (NHTSA) to require auto manufacturers to install the advanced seatbelt/ignition interlock

**Funding Options:**
- Federal funding – ITS, Highway Safety Improvement Program, Minnesota NHTSA Funding

**Institutional Issues:**
- Human factors implications; drivers may find unsafe ways around the interlock
- Coordination with the automotive industry will be required to implement the advanced interlock

**Partners/Stakeholders:**
1. Automotive industry
2. Minnesota Department of Public Safety
3. Minnesota Safety Council
4. Minnesota Department of Health

**Minnesota Actions:**
1. Identify current efforts by NHTSA related to this subject
2. Determine if Minnesota stakeholder interest is strong enough to influence national movement

See Chapter 5.0 – page 22 for additional information on ITS Initiative 1.1.
1.2 Require blood alcohol content level ignition interlocks on vehicles driven by repeat drunk driving offenders

This strategy would require a driver’s blood alcohol content level to be checked by an onboard device that is interlocked with the vehicle’s ignition system. The vehicle would not start if the driver’s blood alcohol content were above a preset level. There is technology currently available and several state court systems currently require some form of blood alcohol content level ignition interlock.

Year 3

Critical information to move this initiative forward in Minnesota includes:

**Champion:** DPS Office of Traffic Safety – Kathy Swanson

**Legal/Legislative Issues:**
- Minnesota legislation would be required to allow this initiative to be implemented

**Funding Options:**
- Minnesota NHTSA Funding

**Institutional Issues:**
- Human factors implications; drivers may find ways around the interlock
- Coordination with the judicial system will be required to ensure that the interlock is consistently applied as a penalty

**Partners/Stakeholders:**
- Judicial system
- Law enforcement community
- Emergency medical services community
- Emergency Medical Services Regulatory Board (EMSRB)
- DPS – Driver & Vehicle Services Division

**Minnesota Actions:**
1. Gather additional information on the effectiveness of the interlock at deterring drunk driving
2. Gather additional information on the implementation and use of the interlock in other states
3. Develop a legislative proposal in coordination with partners/stakeholders

*See Chapter 5.0 – page 23 for additional information on ITS Initiative 1.2.*
1.3 Provide real-time information to equipped vehicles that deliver warnings to drivers

This system could include technology to notify a driver, based on their location of the posted speed limit. Other notification could include indication of an unsafe area ahead, such as hazardous roadway locations, alignment changes, upcoming work zones, or bridge surface conditions.

**Critical information to move this initiative forward in Minnesota includes:**

**Champion:** Mn/DOT State Traffic Engineer – Bernie Arseneau

**Legal/Legislative Issues:**
- None at this time

**Funding Options:**
- Federal funding – ITS

**Institutional Issues:**
- Human factors implications; careful design will be necessary to avoid driver distraction or confusion from the additional feedback
- Accurate roadway characteristics and daily conditions will be necessary to make information reliable; maintaining information to specific levels of accuracy or quality will have staffing implications
- Providing information on all, most or some public roads will have to be decided as this will impact city, county and state staff
- Delivery of information will be dependent upon the automotive industry and information service providers

**Partners/Stakeholders:**
- Automotive industry
- Information service providers (i.e., Traffic.com, OnStar, etc.)
- Minnesota Department of Public Safety-State Patrol
- City transportation agencies
- County transportation agencies

**Minnesota Actions:**
1. Identify what type of information may be provided (i.e., speed limits, road conditions, etc.)
2. Assess the quality (i.e., consistency, accuracy, reliability, etc.) of information that may be provided
3. Determine if information will be provided for all, most or some public roads
4. Propose the delivery of information to the automotive industry and information service providers to gauge their interest

See Chapter 5.0 – page 24 for additional information on ITS Initiative 1.3.
1.4 Use preemption on vehicle radios to provide real-time information

Real-time information related to road emergencies could be delivered to drivers by preempts to radio broadcasts or through Radio Data Systems (RDS) messages.

| Critical information to move this initiative forward in Minnesota includes: |
| Champion: Mn/DOT State Traffic Engineer – Bernie Arseneau |
| Legal/Legislative Issues: |
| • There may be implications to public service announcement (PSA) requirements for radio broadcasters |
| • If existing emergency broadcast preemption is used as the delivery method for this preemption, there may be some implications to current rules governing emergency broadcasts |
| Funding Options: |
| • Federal funding – ITS, Highway Safety Improvement Program |
| Institutional Issues: |
| • Delivery of information will be dependent upon radio broadcasters |
| • Radio broadcasters may interpret this as a loss in air time that could impact their advertising, programming and revenue |
| • Accurate information will be necessary to ensure reliability; maintaining information accuracy or quality will have staffing implications |
| • Providing information on all, most or some public roads will have to be decided as this will impact city, county and state staff |
| Partners/Stakeholders: |
| • Radio broadcasters |
| • Federal Communications Commission |
| • City and county transportation agencies |
| Minnesota Actions: |
| 1. Explore the parameters of existing PSA requirements for radio broadcasters |
| 2. Gather information regarding preemption delivery methods used in other countries |
| 3. Identify what type of information may be provided (i.e., road conditions, work zone information, etc.) |
| 4. Assess the quality (i.e., consistency, accuracy, reliability, etc.) of information that may be provided |
| 5. Determine if and when information will be provided for all, most or some public roads |
| 6. Propose the delivery of information to radio broadcasters to gauge their interest |

See Chapter 5.0 – page 25 for additional information on ITS Initiative 1.4
### 1.5 Research equipping vehicles with systems to detect driver distractions and provide warnings

A driver would receive an audible (i.e., beeping) or tactile (i.e., seat vibration) alert as a warning if distraction or unresponsiveness are detected. The University of Minnesota has previously developed technology and conducted research in this area.

<table>
<thead>
<tr>
<th>Underway</th>
</tr>
</thead>
</table>

Critical information to move this initiative forward in Minnesota includes:

**Champion:** Mn/DOT State Traffic Engineer – Bernie Arseneau

**Legal/Legislative Issues:**
- None at this time

**Funding Options:**
- University research funding
- Federal funding – ITS

**Institutional Issues:**
- Human factors implications; careful design will be necessary to ensure appropriate detection and then driver understanding and response
- There will need to be close coordination with the automotive industry as technology would need to be integrated with vehicle equipment

**Partners/Stakeholders:**
- Automotive industry
- University research facilities; particularly the University of Minnesota because of their previous research and development efforts
- Private sector vendors

**Minnesota Actions:**
1. Work with universities to identify opportunities for research; beginning with the University of Minnesota and their previous work in this area
2. Identify current practices in the commercial vehicle auto industry to understand what may be used today

*See Chapter 5.0 – page 26 for additional information on ITS Initiative 1.5*
2.1 Coordinate emergency responder databases to allow access to consistent crash information

<table>
<thead>
<tr>
<th>Critical information to move this initiative forward in Minnesota includes:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Champion:</strong> Emergency Medical Services Regulatory Board (EMSRB) – Mary Hedges</td>
</tr>
</tbody>
</table>

**Legal/Legislative Issues:**
- There may be data privacy implications regarding the transfer of personal or health related information for victims as governed by the Health Insurance Portability and Accountability Act of 1996 (HIPAA)
- The Minnesota Department of Health has previously encountered legislative issues regarding the accessibility of personal records

**Funding Options:**
- Because the Minnesota Department of Health or EMSRB have only been peripherally involved in the ITS Safety Plan process, it would be presumptuous to identify funding options without their further input

**Institutional Issues:**
- This could be a further evolution of Minnesota State Ambulance Reporting System (MNSTAR). A web-based, statewide data system called that went online on April 1, 2003, MNSTAR gives Minnesota's 256 agencies the flexibility to collect their own data.

**Partners/Stakeholders:**
- Law enforcement community
- Emergency medical services community
- EMSRB, or Minnesota Department of Health
- Minnesota Department of Public Safety-Traffic Safety and DVS

**Minnesota Actions:**
1. Evaluate the possibility of this being an evolution of MNSTAR
2. Identify if there are any similar or related activities going on in other parts of the country
3. Better understand the authority of the EMSRB and Minnesota Department of Health in relation to coordinating this initiative

*See Chapter 5.0 – page 27 for additional information on ITS Initiative 2.1*
2.2 Allow law enforcement to retrieve data from onboard vehicle computers

Ideally, law enforcement would access this data to determine vehicle speed, deceleration, time of incident, etc. This type of information is currently available on newer model vehicles and Minnesota law enforcement is able to access the data with a warrant.

Critical information to move this initiative forward in Minnesota includes:

**Champion:** Minnesota State Patrol – Mark Dunaski

**Legal/Legislative Issues:**
- There may be data privacy implications regarding the use of this information for prosecution

**Funding Options:**
- Not applicable at this time

**Institutional Issues:**
- The public and the automotive industry may raise data privacy concerns regarding access to this type of information

**Partners/Stakeholders:**
- Law enforcement community

**Minnesota Actions:**
1. Monitor future legislation that could potentially restrict or expand this initiative

See Chapter 5.0 – page 28 for additional information on ITS Initiative 2.2
## 2.3 Develop and provide a uniform, real-time automated crash notification system

This system would provide immediate notification of a crash to emergency responders and provide access to driver, passenger and vehicle information. This would reduce emergency response time and, ultimately, improve crash fatality and injury rates through faster and more targeted care. This could be viewed as a continuation of the previous Mayday projects conducted in Minnesota.

### Underway

<table>
<thead>
<tr>
<th>Critical information to move this initiative forward in Minnesota includes:</th>
</tr>
</thead>
</table>

**Champion:** Mn/DOT State Traffic Engineer – Bernie Arseneau

**Legal/Legislative Issues:**

- None at this time

**Funding Options:**

- Federal funding – ITS, Highway Safety Improvement Program, Minnesota NHTSA Funding

**Institutional Issues:**

- The public may raise data privacy concerns regarding access to this type of information

**Partners/Stakeholders:**

- Law enforcement community
- Minnesota Department of Health
- Private Sector
- EMS

**Minnesota Actions:**

1. Monitor future legislation that could potentially restrict or expand this initiative
2. Monitor implementation of a statewide trauma system

*See Chapter 5.0 – page 30 for additional information on ITS Initiative 2.3*
| 2.4 Implement automated enforcement of red light running at intersections | Identify signalized intersections where there have been higher than average crash rates and deploy portable or permanent photo/surveillance systems that automatically mail citations to drivers running red lights. | Year 1 |

Critical information to move this initiative forward in Minnesota includes:

**Champion:** Minnesota State Patrol – Mark Dunaski

**Legal/Legislative Issues:**
- There are legal restrictions on the issuance of citations when an officer is not physically present to witness the violation

**Funding Options:**
- Federal funding – Highway Safety Improvement Program, Minnesota NHTSA Funding
- State funding – Central Safety Fund

**Institutional Issues:**
- Some members of the public have been resistant to this approach to enforcing traffic violations under the auspices of privacy and accuracy of the technology

**Partners/Stakeholders:**
- Law enforcement community
- Judicial system
- Minnesota Department of Public Safety-Traffic Safety
- Mn/DOT

**Minnesota Actions:**
1. Explore where the City of Minneapolis is at with their red light running (Stop on Red) program
2. Determine how Minneapolis red light running experience may effect future efforts to pursue automated enforcement and/or be implemented in other jurisdictions

*See Chapter 5.0 – page 31 for additional information on ITS Initiative 2.4*
## Minnesota ITS Safety Plan

**Chapter 8.0**

### 2.5 Expand quick clearance policies for incidents

Quick clearance policies have strong effects on traffic safety and minimize incident related congestion. Studies indicate that good traffic incident management lead by quick clearance actions can reduce delay nationally by 170 million hours annually.

<table>
<thead>
<tr>
<th>Critical information to move this initiative forward in Minnesota includes:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Champion:</strong> Mn/DOT State Traffic Engineer – Bernie Arseneau</td>
</tr>
</tbody>
</table>

**Legal/Legislative Issues:**
- None at this time

**Funding Options:**
- Not applicable at this time

**Institutional Issues:**
- There may be jurisdictional or “turf” issues among fire, law enforcement, EMS and transportation staff related to quick clearance for incidents
- Coordination with private tow truck or heavy equipment operators will be required

**Partners/Stakeholders:**
- Law enforcement community
- Fire community
- EMS community
- Towing companies
- Heavy equipment operators
- Minnesota Department of Public Safety- State Patrol

**Minnesota Actions:**
1. Review existing Traffic Incident Management Operational Guidelines to understand the current policy related to quick clearance
2. Explore recent discussions among the Incident Management Coordination Team to determine the strengths/weaknesses of the current policy

*See Chapter 5.0 – page 32 for additional information on ITS Initiative 2.5*
2.6 Implement automated enforcement of speed violations

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photo enforcement for speeding can be deployed reactively at locations where there is a history of crashes with excessive speed as a contributing factor or in work zones.</td>
<td></td>
</tr>
</tbody>
</table>

Critical information to move this initiative forward in Minnesota includes:

**Champion:** Minnesota State Patrol – Mark Dunaski

**Legal/Legislative Issues:**
- There are legal restrictions on the issuance of citations when an officer is not physically present to witness the violation

**Funding Options:**
- Federal funding – Highway Safety Improvement Program, Minnesota NHTSA Funding
- State funding – Central Safety Fund

**Institutional Issues:**
- Some of the public has been resistant to this approach to enforcing traffic violations under the auspices of privacy and accuracy of the technology

**Partners/Stakeholders:**
- Law enforcement community
- Judicial system
- Minnesota Department of Public Safety-Traffic Safety
- Mn/DOT

**Minnesota Actions:**
1. Explore existing legal restrictions and determine how to address them in a way that allows for a limited evaluation of automated enforcement of speed violations
2. Complete a limited evaluation of automated enforcement for speed violations

*See Chapter 5.0 – page 34 for additional information on ITS Initiative 2.6*
### 3.1 Implement improved lane guidance system

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide lane guidance to drivers/vehicles through the use of magnetic, GPS and pavement markings.</td>
<td>Year 2</td>
</tr>
</tbody>
</table>

Critical information to move this initiative forward in Minnesota includes:

**Champion:** Mn/DOT Division Director – Rick Arnebeck

**Legal/Legislative Issues:**
- None at this time

**Funding Options:**
- University research funding
- Federal funding – ITS
- State funding – Central Safety Fund

**Institutional Issues:**
- This initiative should be closely coordinated with national VII efforts
- There may be considerable infrastructure cost associated with implementing this initiative
- Coordination with the automotive industry will be necessary for this initiative to determine how road infrastructure will integrate with vehicles

**Partners/Stakeholders:**
- Automotive industry
- University research facilities; particularly the University of Minnesota

**Minnesota Actions:**
1. Explore current directions being taken for the national VII initiative
2. Determine if and how Minnesota will attempt to secure federal funding related to the national VII initiative
3. Discuss technical approach options with the University of Minnesota

See Chapter 5.0 – page 34 for additional information on ITS Initiative 3.1
This initiative encompasses the national vision for VII. VII will build on the availability of advanced vehicle safety systems developed under the Intelligent Vehicle Initiative (IVI) and on the results of related research and operational tests. It is also supported by radio spectrum at 5.9 GHz specifically allocated for digital short range communications (DSRC).

### Critical information to move this initiative forward in Minnesota includes:

**Champion:** Mn/DOT Division Director – Rick Arnebeck

**Legal/Legislative Issues:**
- None at this time

**Funding Options:**
- Federal funding – ITS
- Automotive industry

**Institutional Issues:**
- The public may be resistant to this initiative under the auspices of privacy and reliability of the technology
- There will be driver education challenges regarding the appropriate use of the new technology
- Roadside infrastructure deployment will be costly and may be challenging for public agencies to manage

**Partners/Stakeholders:**
- USDOT
- AASHTO
- Automotive industry

**Minnesota Actions:**
1. Consider application to USDOT to be a VII demonstration state
2. Maintain leadership in the national initiative through Mn/DOT Commissioner
3. Monitor the progress of Mn/DOT’s Ford vehicle probe operational test (using State Patrol vehicles as probes to identify travel times)

*See Chapter 5.0 – page 35 for additional information on ITS Initiative 3.2*
Currently being done in Minnesota, safety systems could include deploying dynamic late merge systems, which consist of detection, dynamic message signing and software for automation.

### Year 1

#### Champion: Mn/DOT State Traffic Engineer – Bernie Arseneau/State Construction Engineer – Gary Thompson

#### Legal/Legislative Issues:
- None at this time related to dynamic late merge systems

#### Funding Options:
- State funding – Central Safety Fund
- Construction project special provisions

#### Institutional Issues:
- Could consider the possibility of using automated enforcement in work zones similar to what Europe is practicing
- The public may be resistant to this initiative if automated enforcement is used at the technical approach under the auspices of privacy and reliability of the technology

#### Partners/Stakeholders:
- Work Zone Safety Committee
- Law enforcement community

#### Minnesota Actions:
1. Explore the use of automated enforcement in work zones as a potential safety system
2. Identify the current state of practice/policy in Minnesota for dynamic late merge through the Work Zone Safety Committee

*See Chapter 5.0 – page 37 for additional information on ITS Initiative 4.1*
| 4.2 Implement variable speed limit signs | Variable speed limit (VSL) systems provide real-time information on appropriate speed for current conditions based on traffic flow, traffic speed, weather and other inputs and integration with law enforcement. | Year 1 |

Critical information to move this initiative forward in Minnesota includes:

**Champion:** Mn/DOT State Traffic Engineer – Bernie Arseneau

**Legal/Legislative Issues:**
- There may be enforcement issues regarding the use of a variable speed limit sign as an advisory or regulatory limit
- There may be liability issues with modifying the speed to address changing road conditions

**Funding Options:**
- State funding – Central Safety Fund

**Institutional Issues:**
- Public education will be necessary to explain how drivers should react to the variable speed limits

**Partners/Stakeholders:**
- AAA
- Minnesota Trucking Association
- Minnesota State Patrol
- Minnesota Supreme Court
- Law enforcement community

**Minnesota Actions:**
1. Clarify if variable speed limits can be regulatory and enforced as such
2. Conduct an operational test and detailed evaluation of the effectiveness of variable speed limits in Minnesota

See Chapter 5.0 – page 38 for additional information on ITS Initiative 4.2
| 4.3 | Expand the use of dynamic message signs to provide location based, real-time information to drivers | Dynamic message signs (DMS) are being increasingly used to provide motorists with incident, construction and travel time information. This initiative would explore the use of DMS for additional real-time information and instruction. | Underway |

Critical information to move this initiative forward in Minnesota includes:

**Champion:** Mn/DOT State Traffic Engineer – Bernie Arseneau

**Legal/Legislative Issues:**
- None at this time

**Funding Options:**
- Federal funding – ITS
- State funding – Central Safety Fund

**Institutional Issues:**
- None at this time

**Partners/Stakeholders:**
- Minnesota State Patrol
- Law enforcement community

**Minnesota Actions:**
1. Identify potential locations for expanded DMS, including high-volume rural roads and metro area freeways

See Chapter 5.0 – page 40 for additional information on ITS Initiative 4.3
<table>
<thead>
<tr>
<th>ITS CS 4: Improve Infrastructure Systems and Signage</th>
<th></th>
<th></th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.4 Research use of graphics (and text) for dynamic message sign messages</strong></td>
<td>As new dynamic message signs (DMS) are deployed, graphic related messaging capabilities would be added. Alone or combined with text, graphics would show information in different formats to enhance driver understanding.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Critical information to move this initiative forward in Minnesota includes:

**Champion:** Mn/DOT State Traffic Engineer – Bernie Arseneau

**Legal/Legislative Issues:**
- None at this time

**Funding Options:**
- Federal funding – ITS
- State funding – Central Safety Fund
- University of Minnesota research funding

**Institutional Issues:**
- Current practice does not allow for the use of graphics in DMS messages, so this would need to be discussed among the Traffic Engineering Organization (TEO)-Signing Committee

**Partners/Stakeholders:**
- TEO
- University research facilities; particularly the University of Minnesota

**Minnesota Actions:**
1. Determine if a human factors research project would be appropriate to identify the effectiveness of using graphics on DMS

*See Chapter 5.0 – page 41 for additional information on ITS Initiative 4.4*
## 4.5 Expand geographic coverage of the RTMC systems

The Regional Transportation Management Center (RTMC) integrates Mn/DOT's Metro District Maintenance Dispatch and Office of Traffic, Security, and Operations with the Minnesota Department of Public Safety's State Patrol Dispatch into a unified communications center. The integration provides the communications and computer infrastructure necessary for coordinated transportation management on metro freeways during normal commuting periods, as well as during special events and major incidents.

Critical information to move this initiative forward in Minnesota includes:

**Champion:** Mn/DOT State Traffic Engineer – Bernie Arseneau

**Legal/Legislative Issues:**
- None at this time

**Funding Options:**
- Federal funding – ITS
- State funding – Central Safety Fund

**Institutional Issues:**
- There may be staffing limitations that could limit the level of monitoring/response that would be needed for expanded RTMC coverage

**Partners/Stakeholders:**
- Minnesota State Patrol
- KBEM
- Information service providers (i.e., Traffic.com)

**Minnesota Actions:**
1. Evaluate current expansion plans and available funding to identify gaps

See Chapter 5.0 – page 42 for additional information on ITS Initiative 4.5
## 4.6 Integrate reporting systems across state and local borders

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide the ability for reporting systems to share information across state borders. Reporting systems are available now and integration across state borders has been explored through the North/West Passage transportation pooled fund study.</td>
<td></td>
</tr>
</tbody>
</table>

Critical information to move this initiative forward in Minnesota includes:

### Champion:
Mn/DOT State Traffic Engineer – Bernie Arseneau

### Legal/Legislative Issues:
- None at this time

### Funding Options:
- Federal funding – ITS, State Planning and Research (SP&R)

### Institutional Issues:
- Working with other states may lead to varying levels of data quality, communication cost sharing, etc.
- It will be challenging to utilize ITS standards that are still evolving

### Partners/Stakeholders:
1. Bordering states
2. North/West Passage Transportation Pooled Fund Study
3. USDOT
4. Condition Acquisition and Reporting System (CARS) Transportation Pooled Fund Study

### Minnesota Actions:
1. Continue participation in transportation pooled fund studies related to this initiative
2. Monitor results of USDOT request for information on section 1201 of SAFETEA-LU regarding a real-time system management information program
3. Monitor Wisconsin’s development of a reporting system

See Chapter 5.0 – page 43 for additional information on ITS Initiative 4.6
### 5.1 Install rural intersection warning and decision support systems

| Provide drivers on the rural roadways with information indicating when entry into the intersection is safe. |

#### Critical information to move this initiative forward in Minnesota includes:

**Champion:** Mn/DOT Assistant State Traffic Engineer/ITS – Ray Starr

**Legal/Legislative Issues:**
- None at this time

**Funding Options:**
- Federal funding – ITS

**Institutional Issues:**
- Human factors implications; careful design will be necessary to avoid driver confusion from the additional feedback

**Partners/Stakeholders:**
- University of Minnesota
- USDOT
- City transportation agencies
- County transportation agencies

**Minnesota Actions:**
1. Execute the Cooperative Intersection Collision Avoidance Systems (CICAS) research project funded by the USDOT

*See Chapter 5.0 – page 44 for additional information on ITS Initiative 42*
New drivers are rewarded for safe driving under graduated driver licensing programs. Currently, a limited graduated driver licensing program exists in Minnesota. However, using technology such as in-vehicle monitoring could be added to enhance the program to reward safe drivers.

### Year 2

<table>
<thead>
<tr>
<th>Critical information to move this initiative forward in Minnesota includes:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Champion:</strong> DPS – Pat McCormack</td>
</tr>
<tr>
<td><strong>Legal/Legislative Issues:</strong></td>
</tr>
<tr>
<td>• Existing graduated driver licensing laws should be reviewed to ensure that they allow for additional restrictions and monitoring of teenage drivers</td>
</tr>
<tr>
<td><strong>Funding Options:</strong></td>
</tr>
<tr>
<td>• Federal funding – Highway Safety Improvement Program, Minnesota NHTSA Funding</td>
</tr>
<tr>
<td>• State funding – Central Safety Fund</td>
</tr>
<tr>
<td><strong>Institutional Issues:</strong></td>
</tr>
<tr>
<td>• There may be privacy issues associated with in-vehicle monitoring</td>
</tr>
<tr>
<td>• There may be public resistance to further restricting the driving privileges of teenage drivers</td>
</tr>
<tr>
<td><strong>Partners/Stakeholders:</strong></td>
</tr>
<tr>
<td>• Mn/DOT</td>
</tr>
<tr>
<td>• Private and public driver education providers</td>
</tr>
<tr>
<td>• University research facilities; particularly the University of Minnesota based on previous work in this area with the Teen Driver Support System</td>
</tr>
<tr>
<td><strong>Minnesota Actions:</strong></td>
</tr>
<tr>
<td>1. Review existing graduated driver licensing laws to ensure that they allow for additional restrictions and monitoring of teenage drivers</td>
</tr>
<tr>
<td>2. Evaluate technology options for in-vehicle monitoring (i.e., camera, on-board vehicle systems)</td>
</tr>
<tr>
<td>3. Determine the status and potential application of the University of Minnesota’s Teen Driver Support System program</td>
</tr>
</tbody>
</table>

*See Chapter 5.0 – page 45 for additional information on ITS Initiative 6.1*
### Chapter 8.0

#### 6.2 Use driving simulation for teenage and older driver education

Individuals would be asked to participate in driving simulation to see the effects of driving too fast, tailgating, reaction time, etc. This technology has been available for many years. However, political support will be needed to proceed at a state level.

<table>
<thead>
<tr>
<th>Year 3</th>
</tr>
</thead>
</table>

Critical information to move this initiative forward in Minnesota includes:

**Champion:** DPS – Driver & Vehicle Services – Pat McCormack

**Legal/Legislative Issues:**
- Driving regulations may need to be evaluated to determine if they allow for further evaluation of older and/or new teenaged drivers

**Funding Options:**
- Federal funding – Highway Safety Improvement Program, Minnesota NHTSA Funding

**Institutional Issues:**
- There may be older driver resistance to this additional evaluation of their driving skills and privileges.

**Partners/Stakeholders:**
- Mn/DOT
- Private & public driver education providers – those offering new driver education and defensive driving courses
- University research facilities; particularly the University of Minnesota based on previous work with the Teen Driver Support System program and work with simulation for human factors research

**Minnesota Actions:**
1. Review driving regulations to determine if they allow for further evaluation of older and new teenaged drivers
2. Evaluate current simulation technology to determine effectiveness, potential application and cost parameters

See Chapter 5.0 – page 47 for additional information on ITS Initiative 6.2
9.0 Key Conclusions

This Minnesota ITS Safety Plan is an important first step toward developing safer travel in Minnesota. When implemented the plan’s 6 ITS Safety Strategies supported by 22 ITS Safety Initiatives listed below will have a significant impact on Minnesota’s goal of reducing traffic fatalities and serious injuries on its roadways. Furthermore this plan does not stand-alone, it was developed to support other safety programs including TZD, the CHSP, and the SHVP by providing Mn/DOT, and other stakeholders, a statewide plan for the implementation of high priority ITS Safety strategies and initiatives. Use of ITS technology is critical as Minnesota works to meet the goals of TZD and to the success of the CHSP, and SHVSP in Minnesota.

Minnesota’s ITS Critical Safety Strategies and Initiatives

ITS Critical Strategy 1: Implement In-Vehicle Based Safety Systems
   1.1 Require seatbelt ignition interlock on new vehicles
   1.2 Require blood alcohol content level ignition interlocks on vehicles driven by repeat drunk driving offenders
   1.3 Provide information to equip vehicles with systems that deliver real-time information and warnings to drivers
   1.4 Use preemption on vehicle radios to provide real-time information
   1.5 Research equipping vehicles with systems to detect driver distractions and provide warnings

ITS Critical Strategy 2: Improve First Responder/Law Enforcement Systems
   2.1 Coordinate emergency responder databases to allow access to consistent crash information
   2.2 Allow law enforcement to retrieve data from onboard vehicle computers
   2.3 Develop and provide a uniform, real-time automated crash reporting system
   2.4 Implement automated enforcement of red light running at intersections
   2.5 Expand quick clearance policies for incidents
   2.6 Implement automated enforcement of speed violations

ITS Critical Strategy 3: Implement Vehicle Infrastructure Integration (VII) Systems
   3.1 Implement improved lane guidance system
   3.2 Develop vehicle to vehicle and vehicle to infrastructure communication

ITS Critical Strategy 4: Improve Infrastructure Systems and Signage
   4.1 Expand work zone safety systems
   4.2 Implement variable speed limit signs
   4.3 Expand the use of dynamic message signs to provide location based, real-time information to drivers
   4.4 Research use of graphics (and text) for dynamic message sign messages
   4.5 Expand geographic coverage of the RTMC systems
   4.6 Integrate reporting systems across state and local borders
Minnesota ITS Safety Plan

Chapter 9.0

Minnesota ITS Safety Plan

ITS Critical Strategy 5: Use Intersection Collision Warning Systems
5.1 Install rural intersection warning and decision support systems

ITS Critical Strategy 6: Improve Driver Education and Licensing Using ITS
6.1 Expand graduated driver licensing
6.2 Use driving simulation for teenage and mature driver education

Many new opportunities using ITS to improve safety are currently being developed at all levels of government and by private industry. These ITS technologies and applications will fundamentally change how we drive our vehicles, while dramatically reducing roadway fatalities. This three-year plan is a major opening step toward implementation of ITS safety technologies and for safer travel in Minnesota.

Most of the 22 ITS Safety Initiatives included in the plan require cooperative efforts from more than one public agency and/or private industry for their success. Public agencies do not build cars, but they can help make the cars and roadways safer. It’s anticipated the agencies and industries involved will create working partnerships to fully develop the 22 initiatives. With its history of Public/Private partnerships, through the Guidestar and other programs, Minnesota has a head start on other states in actively pursuing the 22 ITS Safety Initiatives.

In the final analysis the three key factors to the success of ITS Safety in Minnesota are:

Determining Minnesota transportation safety needs and how can we meet them using ITS? This ITS Safety Plan has identified Minnesota transportation safety needs and provides a comprehensive statewide plan with 22 initiatives to meet these needs using ITS technologies (Table 5).

Who will champion the initiative? A very committed person/organization, who understands the need and value of an initiative can overcome many barriers, solve problems and champion a successful initiative. To help assure the success of these ITS Safety Initiatives, each initiative has a designated champion, who is committed to the success of the initiative. Adequate staffing at champion agencies for development of the initiatives TO SAVE MINNESOTA LIVES is critical to the success of the Minnesota ITS Safety Plan.

How will the initiative be funded? Funding of each initiative, for installation, operation, and maintenance, must come from reliable sources either public or private or most of the initiatives will have limited success. Various funding opportunities are discussed in Chapter 7; however incorporating ITS Safety Initiatives into programs such as the Mn/DOT STIP will be critical to the long-term success of the plan.
To complete the Minnesota ITS Safety Plan significant effort was devoted to developing an effectiveness spreadsheet (Appendix E). The effectiveness spreadsheet provides an opportunity to measure the potential for reducing fatalities and life changing injuries of each initiative in the plan. To assist in measuring each initiative a benefit/cost ratio was calculated based on implementation costs. It is important to note that the benefits of each initiative are to society and the costs will be incurred by the agencies within the Minnesota safety community.

The Minnesota ITS Safety Plan is consistent with the TZD, CHSP, and SHVSP in that it focuses on reducing fatalities on Minnesota road systems. As we make progress on reducing fatalities our next step is focusing on reducing personal injury and property damage crashes. This plan is a living document that will need to be modified, updated, and improved as more data and technology becomes available.
References

8. *POPULAR SCIENCE MAGAZINE*, May, 2006 article “WHAT’S NEW AUTO TECH” describing autonomous vehicle