



Executive Summary

Minnesota's comprehensive and strategic safety planning process began in 2004, involved a cross-section of state, local and private safety partners and culminated in the Minnesota Comprehensive Highway Safety Plan (CHSP). Since the completion of the Minnesota CHSP in December 2004, coordinated efforts among agencies to elevate and strengthen the emphasis on transportation safety are credited with reducing traffic fatalities from as high as 657 in 2002 to 494 by 2006. Which means Minnesota achieved the transportation safety goal (500 or fewer annual traffic fatalities by 2008) established in the CHSP two years ahead of schedule. Based on this success and the continued commitment of the State's safety partners, a new safety goal has been adopted by the Toward Zero Deaths (TZD) Executive Committee – to reduce the number of highway traffic related fatalities to fewer than 400 by 2010.

After the Minnesota CHSP was completed, the law governing Federal surface transportation programs was signed – known as Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). This legislation made several important changes to the existing Highway Safety Improvement Program. Two of the most important requirements are that each state develop a Strategic Highway Safety Plan (SHSP) and that it be signed by the governor or designated representative.

The purpose of the Minnesota SHSP is to:

- Update the Minnesota CHSP to attain compliance with requirements of SAFETEA-LU.
- Provide an overview and coordination with other safety plans and programs within the state - examples include the TZD program, Statewide Heavy Vehicle Safety Plan, Intelligent Transportation System Safety Plan, Central Safety Fund, and the Highway Safety Plan.
- Review the most recent crash data to confirm the Critical Emphasis Areas (CEAs) as well as document progress towards Minnesota's safety goal.
- Review and update the strategies in the CSHP to reflect new initiatives as well as program advances and achievements.
- Provide Minnesota Department of Transportation (Mn/DOT) Districts and Minnesota county highway departments with technical assistance in prioritization and deployment of safety countermeasures within their jurisdiction by completing a detailed crash analysis in each jurisdiction and with a focus on low-cost strategies that can be deployed proactively.
- Define a process for updating, monitoring and reviewing the Strategic Highway Safety Plan (SHSP) and the priorities established.

The key steps in preparation of the Minnesota SHSP included the following:

- The analysis of Minnesota crash data confirmed that the Critical Emphasis Areas (CEAs) identified in the 2004 CHSP still represent the focus of where Minnesota's safety planning and implementation should be directed – the CEAs represent both Driver Behavior (seat belt usage, impaired driving, aggressive driving and young drivers), Infrastructure (road departure, intersections and head on crashes), Data Information Systems and Driver Safety Awareness. It should be noted that seat belt usage (52%) is the top factor contributing to the



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severity of crashes in Minnesota followed by impaired driving (36%), intersections (33%) and road departures (32%) – crash data from 2001 through 2005 (see **Table ES.1**).

TABLE ES.1
Number of Fatalities in the Critical Emphasis Areas (2001-2005)

Critical Emphasis Areas in the Minnesota SHSP	Fatalities		Minnesota Ranking of AASHTO's 22 Emphasis Areas
Increasing Seat Belt Usage	1,271	52%	1
Reducing Impaired Driving	1,068	36%	2
Improving the Design and Operation of Highway Intersections	1,004	33%	3
Keeping Vehicles on the Roadway (combined with Minimizing the Consequences of Leaving the Road)	965	32%	4
Curbing Aggressive Driving	850	28%	5
Instituting Graduated Licensing for Young Drivers	718	24%	6
Reducing Head-On and Across-Median Crashes	611	20%	7
Increasing Driver Safety Awareness			
Improving Information and Decision Support Systems			

2001-2005: 2,701 fatal crashes; 3,008 fatalities; 2,429 vehicle occupant fatalities

- Following the confirmation of the CEA's, the safety partners reviewed the 15 Critical Strategies that were identified in the Minnesota CHSP. It was concluded that implementation of these strategies still represented the best opportunity to reduce the number of severe crashes, with two modifications. The first includes a suite of intersection improvements to better address that intersection crashes in the Minneapolis/St. Paul Metropolitan area account for more than twice as many severe crashes as any other emphasis area. The second is an effort to integrate the Critical Strategies in the Minnesota CHSP with strategies in the numerous strategic safety plans prepared by Minnesota's agencies. Additional strategies were also identified to address any gaps in these plans, especially strategies to improve emergency response times.
- The Mn/DOT is responsible for preparation of this SHSP and will continue to be the agency responsible for periodic review and update. However, an effort will be made to add structure in order to provide assistance with both implementation and coordination between agencies and traffic safety advocacy groups in future planning efforts. In order to do so, Mn/DOT will work with the members of the TZD program including the program's co-leader, the Minnesota Department of Public Safety.
- The 2004 CHSP was based on an analysis of statewide crash data. Following the release of the Plan, questions arose about whether the data and the resulting recommended safety strategies were representative of actual conditions in each Mn/DOT District. In response, a detailed review of fatal and serious injury crash records was performed using the following steps:



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1. Analyze and review crash data by Mn/DOT District.
2. Disaggregate the subset of serious crashes in each District by road system – State Highways vs. Local Roads.
3. For the State Trunk Highways, further disaggregate the crash data by location (rural vs. urban) and facility type (freeway, expressway, multi-lane and 2-lane conventional).
4. For the local roads, further disaggregate the crash data by the counties that make up the District. Note: An analysis similar to what was performed for the State Trunk Highways could not be completed because the necessary roadway information is not available for the local road system.
5. For the lowest levels of disaggregation, identify the primary contributing factors for fatal and serious injury crashes.
6. Map from the contributing factors to cost-effective safety strategies.

The results of this analysis (see **Table ES.2** for a summary or Appendix IV for greater detail) led to a general conclusion and a series of specific recommendations for implementation directed at both Greater Minnesota Districts and the Metro District. First, new implementation guidance recognizes that crash densities in rural areas are typically less than one-half of the densities on comparable urban facilities. This guidance suggests that safety programs in Mn/DOT's Greater Minnesota Districts and counties would be most effective if they focused on proactively deploying low cost intersection and road departure strategies broadly across their systems while programs in urban areas would be most effective if they focused on reactively deploying higher cost intersection treatments. Furthermore, there is a need to direct safety resources to the seven Greater Minnesota Districts and to the local road system because fatal and serious injury crashes are over represented in these areas. The implementation recommendations include:

TABLE ES.2
Summary of ATP/District Analysis

	Greater Minnesota Districts/ATPs				Metro District/ATP			
	Annual Fatal Crashes	Crash Density ⁺	Percent Lane Departure	Percent Intersection	Annual Fatal Crashes	Crash Density ⁺	Percent Lane Departure	Percent Intersection
Rural								
State	170	1	52%	34%	34	7	35%	24%
Local	143	0.3*	63%	31%	21	2*	50%	33%
Urban								
State	16	7	31%	44%	36	32	58%	33%
Local	16	4*	41%	53%	71	12*	36%	56%

Based on 2004-2005 fatal crash records.

⁺ Crash Density = Total Crashes ÷ Miles of Road ÷ Years of Crash Data

* Estimated crash densities for local roads.



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Greater Minnesota Districts

- Establish a goal to spend at least 70% of the safety investment on low cost proactive strategies (in response to low crash densities).
- Invest in rural roads (90% of the fatalities occur on roads classified as rural)
- Invest in two-lane facilities (67% of the fatalities).
- Invest in low cost and proven strategies that can be widely deployed across the system.
- Develop a process to aid implementation of safety projects on the local road system.
- Focus investments in improving the edges of roadways (paved shoulders, safety wedge, rumble strips/stripes).
- Build partnerships with law enforcement to address alcohol-related, speeding-related and unbelted vehicle occupant fatalities and injuries.

Metro District

- Establish a goal to spend 70% of the safety investment on reactive strategies at identified high crash locations. (Currently, Metro District's safety program is almost exclusively reactive.)
- Invest in freeway and multi-lane facilities (70% of the fatalities).
- Continue investing in safety projects on the local road system.
- Focus investments in road edges and median barriers on freeway facilities and intersection improvements on multi-lane arterials.
- Build partnerships with law enforcement to address serious crashes related to speeding and red-light running.



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Common Acronyms

- AASHTO – American Association of State Highway and Transportation Officials
- CEA – Critical Emphasis Area
- CHSP – Comprehensive Highway Safety Plan
- CSF – Central Safety Fund
- DPS – Minnesota Department of Public Safety
- EMS – Emergency Medical Services
- FHWA – Federal Highway Administration
- HSIP – Highway Safety Improvement Program
- ITS – Intelligent Transportation Systems
- MDH – Minnesota Department of Health
- Mn/DOT – Minnesota Department of Transportation
- NCHRP – National Cooperative Highway Research Program
- NHTSA – National Highway Traffic Safety Administration
- SAFETEA-LU – Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
- SHSP – Strategic Highway Safety Plan
- SHVSP – Statewide Heavy Vehicle Safety Plan
- SRTS – Safer Routes to School
- TRCC – Traffic Records Coordinating Committee
- TSIS – Traffic Safety Information Systems
- TZD – Toward Zero Deaths



1. Background & Purpose

The initial Minnesota Comprehensive Highway Safety Plan (CHSP) was finalized December 31, 2004. Led by the Minnesota Department of Transportation (Mn/DOT) and Minnesota Department of Public Safety (DPS), the Minnesota CHSP represents a statewide, multi-disciplinary partnership of agencies and safety advocacy groups to actively reduce the number of traffic fatalities and life threatening injuries on Minnesota roadways and streets. The Plan presented a comprehensive, systematic, data driven, and stakeholder-involved process to accomplish this objective. It also established as the statewide safety goal to reduce the number of traffic fatalities to 500 or fewer by 2008, from a then average of 650 fatalities per year.

The purpose of this Update to the Minnesota CHSP is to:

- Attain compliance with requirements of the most recent Federal transportation authorization legislation -- Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) -- which was passed after the CHSP was written.
- Provide an overview and coordination with other safety plans and programs within the state - examples include the Toward Zero Deaths program, Statewide Heavy Vehicle Safety Plan, Intelligent Transportation System Safety Plan, Central Safety Fund, and the Highway Safety Plan.
- Review the most recent crash data to confirm the Critical Emphasis Areas (CEAs) and Critical Strategies as well as document progress towards Minnesota's safety goal.
- Provide Mn/DOT Districts and Minnesota county highway departments with technical assistance in prioritization and deployment of safety countermeasures within their jurisdiction by completing a detailed crash analysis in each jurisdiction and with a focus on low-cost strategies that can be deployed proactively.
- Define a process for updating, monitoring and reviewing the Strategic Highway Safety Plan (SHSP) and the priorities established.

The Minnesota SHSP is an evolution of the original Minnesota CHSP, providing supplementary information and greater coordination among agencies.

NOTE: The updated Minnesota CHSP has also been renamed to the Minnesota SHSP, consistent with SAFETEA-LU. References to the "Minnesota CHSP" are the original plan developed in 2004 while "Minnesota SHSP" refers to the current and updated plan.

1.1 SAFETEA-LU

SAFETEA-LU was signed into law in August 2005, governing Federal surface transportation programs for 2005-2009. This legislation made several key changes to the existing Highway Safety Improvement Program. One of the most important of which requires each state to develop a Strategic Highway Safety Plan which will be signed by the Governor or other responsible authority. After the development process is approved by the Federal Highway Administration (FHWA) Division Office, states may flex up to 10% of portions of the Highway Safety Improvement Program (HSIP) funds to education, enforcement or emergency medical services (EMS) strategies. In order to flex any funds to the other safety Es, the State

transportation agency must first certify that all needs related to railway-highway crossing and infrastructure safety related to HSIP projects are first being met. Other key provisions within SAFETEA-LU include:

- Focus deployment of countermeasures to reduce the most serious crashes, instead of reactive deployment based on all crashes.
- Require states to submit an annual report describing not less than 5 percent of their highway locations exhibiting the most severe safety needs.
- Created the High Risk Rural Roads Program to correct or improve hazardous road locations or features on any rural public road.
- Established the Safe Routes to School (SRTS) program to encourage children to walk or bike to school, and fosters this by ensuring that programs and projects are in place to make the trip as safe as possible.
- Established Safety Belt Performance Grants that provide incentives to States that pass primary seat belt laws or achieve 85% use rates for two consecutive years prior to the grant. For Minnesota, this provision would provide a federal incentive grant of over \$15 million if a primary seat belt law was passed in 2007.

1.2 National and Minnesota Trends in Traffic Fatalities

From the early 1970s until the early 1990s, the number of traffic fatalities in the Nation dropped approximately 13,000 from 52,627 to 39,250 (Figure 1.1). Since then, traffic fatalities have grown

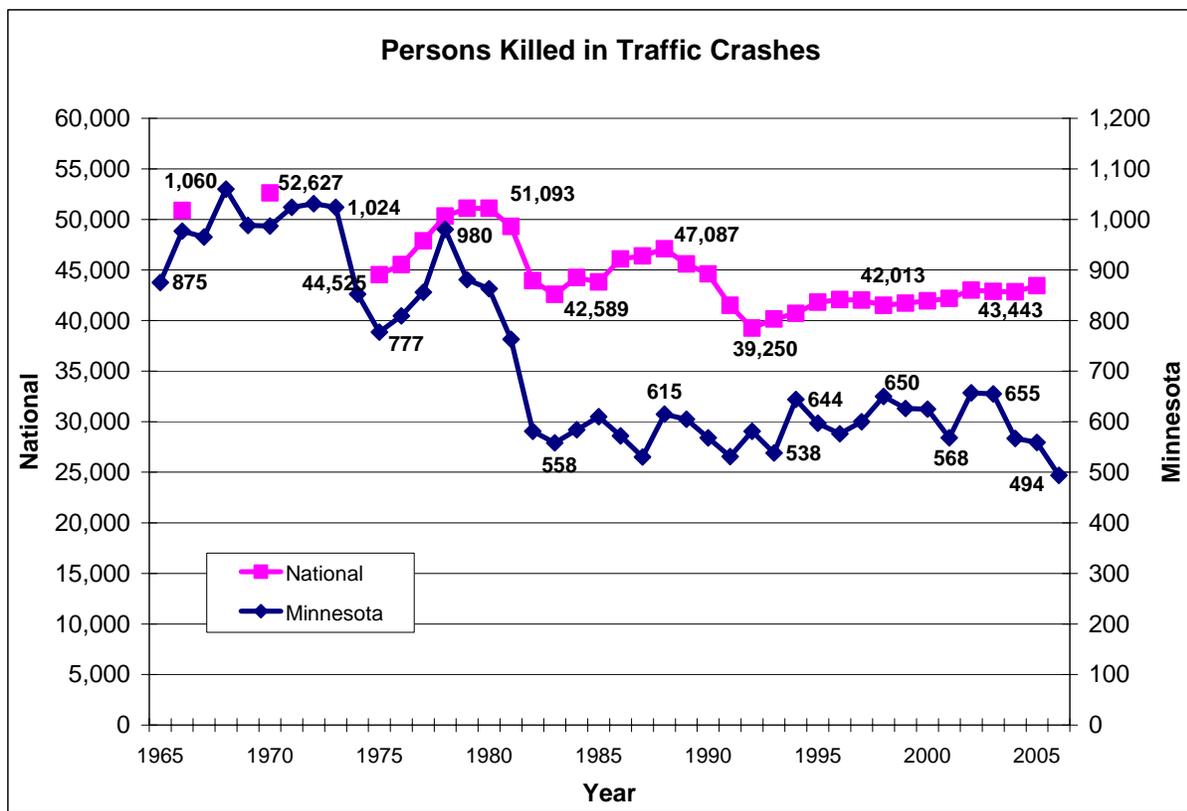


FIGURE 1.1
Annual Traffic Fatality Totals Nationally and in Minnesota

steadily to 43,443 in 2005, the highest total since 1990. This alarming trend was the reason behind the initiative of a comprehensive approach to traffic safety that integrated the Four Safety Es -- Education, Enforcement, Engineering, and EMS. The vision for this was first stated by the American Association of State Highway and Transportation Officials (AASHTO) in their Strategic Highway Safety Plan (SHSP), first published in 1997 and updated in 2004. The SHSP outlines twenty-two key emphasis areas where significant reduction in traffic fatalities and life threatening injuries could be made. Highway and roadway agencies were given support in implementing the SHSP through a series of guides, the *National Cooperative Highway Research Program (NCHRP) Report 500: Guidance for Implementation of the AASHTO Strategic Highway Safety Plan*. This series currently has seventeen volumes, with more being developed.

In Minnesota, the pattern in traffic fatalities closely matched what was happening at the National level up until 2003. In 2004, the year which the Minnesota CHSP was developed and written, the number of fatalities did drop to 567 and dropped slightly again in 2005 to 559. The number of traffic fatalities in 2006 is 494, the lowest number of traffic fatalities in Minnesota in recent history.

Unlike the number of traffic fatalities, there is a downward trend in the National fatality rate, despite the growing number of fatalities (**Figure 1.2**). This is because the growth in miles traveled has been faster than the growth in fatalities. While a downward trend is desired, the real goal is to reduce the number of lives lost. In 2003, FHWA established the National traffic safety goal, which is to reduce the fatality rate to 1.0 fatalities per 100 million vehicle miles

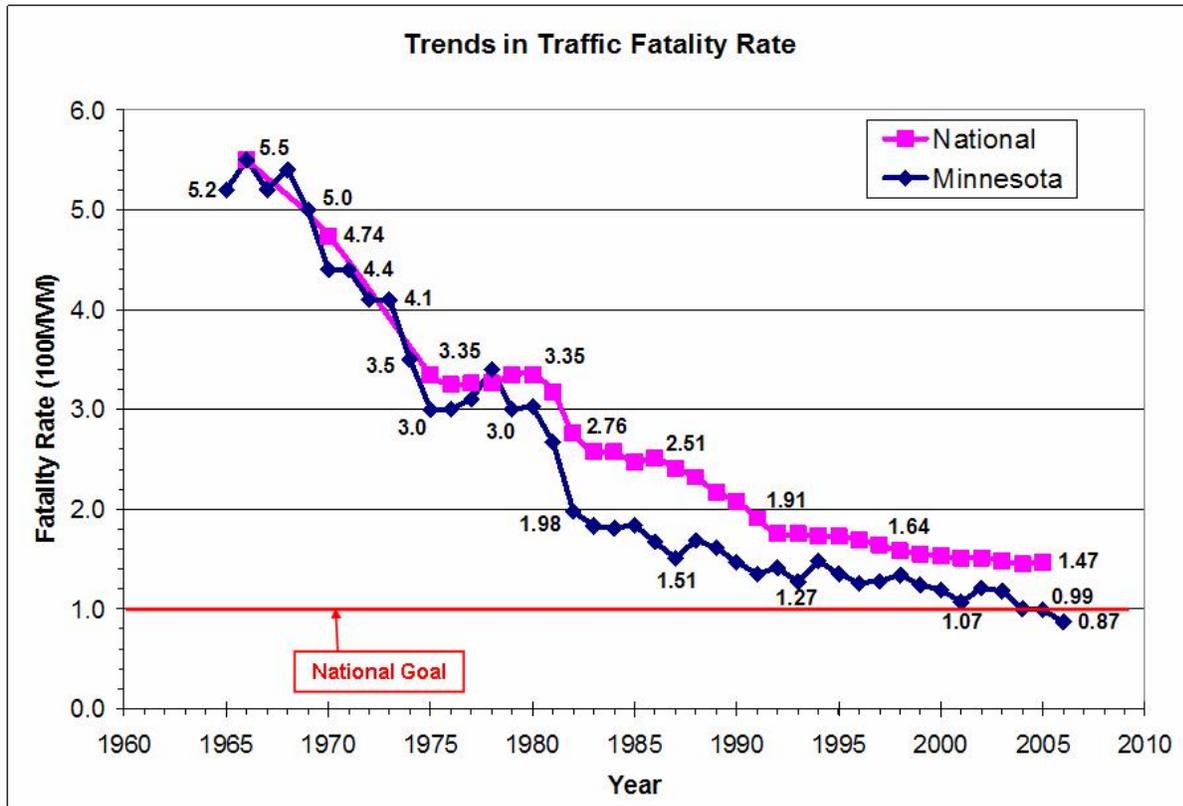


FIGURE 1.2
National and Minnesota Traffic Fatality Rates

traveled (HMVMT) by 2008. However, the fatality rate has remained nearly constant since 2003, and the likelihood of attaining the National goal in the short-term is diminishing. Because of this national trend, it is even more important for each state to focus their efforts in order to have aggressive, active and coordinated safety programs that contribute to the reduction in the number of traffic fatalities.

Minnesota did meet the National goal in 2004 with a fatality rate of 1.0 and was slightly below the goal in 2005 with a 0.99 fatality rate. Based on the most current information, the fatality rate in 2006 shows another drop to 0.87.

1.3 Minnesota Safety Goal

The Statewide safety goal adopted in the Minnesota CHSP was to reduce the number of traffic fatalities to 500 or fewer by 2008. This goal was achieved in 2006 when the number of traffic fatalities was reduced to 494 (see **Figure 1.3**), after three continuous years of a decrease in fatalities. Even though there was a general upward trend prior to the Minnesota CHSP, fluctuations can be observed in the number of fatalities (i.e., peaks and valleys). Therefore, it is important to continue aggressive traffic safety programs and monitor the number of traffic fatalities to ensure the number of traffic fatalities continues to decrease.

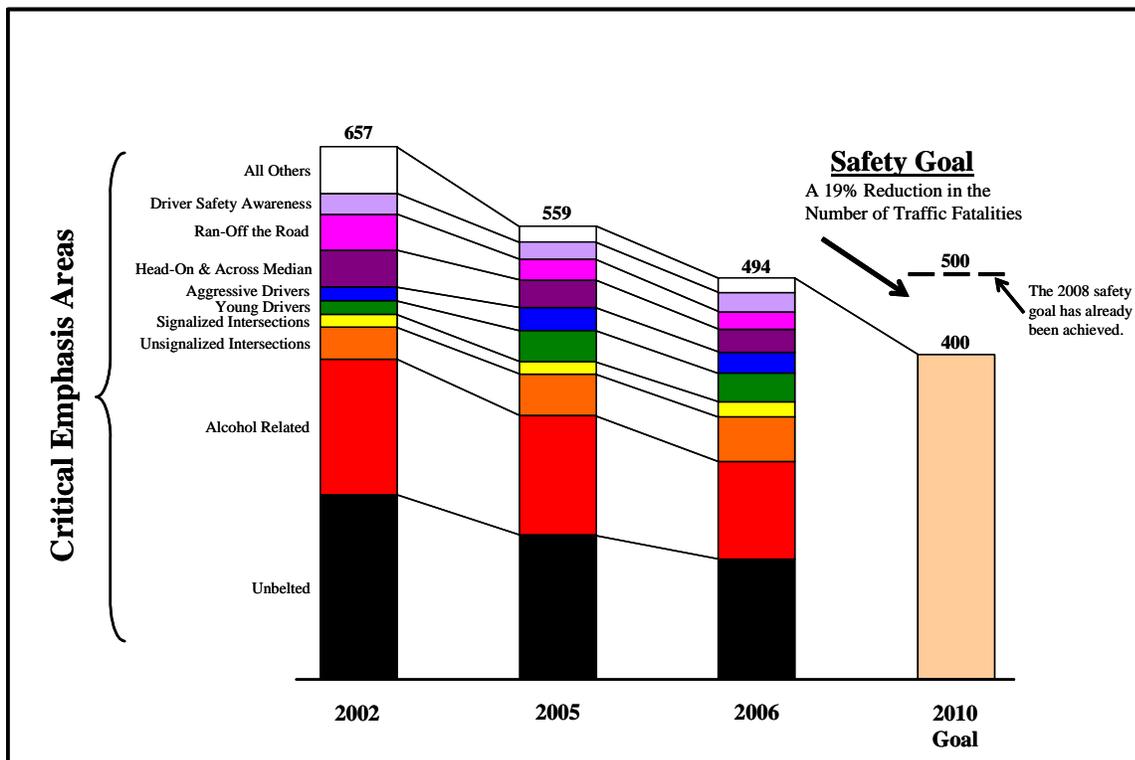


FIGURE 1.3
Minnesota's Statewide Safety Goal

Based on recent success, the TZD Executive Committee has adopted a new statewide safety goal. The new goal is to reduce the number of traffic fatalities to 400 or fewer by 2010. This



goal is an aggressive goal; encouraging innovative methods and partnerships to more effectively implement safety programs. Furthermore, this is consistent with and complements Minnesota efforts to work “Toward Zero Deaths”.

1.4 SHSP Development Process

The development of the Minnesota SHSP began with the previous Minnesota CHSP. The Minnesota CHSP followed the principles for a SHSP in that the preparation was data driven, was developed and adopted in partnership with DPS, involved the State’s safety partners, addressed all roads, and incorporated the Four Es. In addition, a screening process was used to identify the CEAs and Critical Strategies as a means to focus the limited safety resources. Supplemental information regarding the Critical Strategies was provided in action plans, a deployment plan was developed to guide safety investments, and agency champions were designated for each strategy. To oversee the update or amendment the Minnesota CHSP, an Interagency Working Group was formed. The participating agencies include:

- Minnesota Department of Transportation
- Minnesota Department of Public Safety
- Minnesota Department of Health
- FHWA Division Office
- County Highway Department (Houston County)

The first action taken by the Interagency Working Group was a review of safety programs and plans by the various agencies that have a role in traffic safety – see Chapter 2. Following, was a general review the fatal and serious injury crash records to validate the previous selection of the CEAs – see Chapter 3. The Critical Strategies were then reviewed to confirm they still adequately address the issues within the CEAs. The detailed review of crash information identified a need to expand the engineering strategies for intersection crashes in the Twin Cities Metro area – discussed in Chapter 4. Furthermore, the Critical Strategies from the Minnesota CHSP were combined with the many countermeasures that make up many of the existing safety plans by various agencies and departments – these results are also in Chapter 4.

The development of the SHSP also identified a preferred process for implementing, evaluating, revising and reporting on the SHSP – see Chapter 5. Finally, a review of fatal and serious injury crash records supported the development of the guidance for the Area Transportation Partnerships (ATPs) on the best ways to invest – provided in Chapter 6. Since the ATPs recommend programming of federally funded infrastructure projects through Mn/DOT, the guidance is primarily for the programming of engineering safety countermeasures for HSIP funds.

2. Coordination of Minnesota Safety Plans and Programs

Minnesota has a long history of developing and implementing programs focused on improving traffic safety. Prior to 2001, these safety activities were primarily the responsibility of individual state agencies – they received their own dedicated funding, set their own goals and objectives, established their own evaluating criteria and implemented their own projects. In response to an increasing trend in the number of traffic related fatalities in Minnesota and concerns about the effectiveness of the individual safety efforts, the Minnesota Departments of Public Safety and Transportation established the Towards Zero Deaths (TZD) program to serve as an umbrella organization to coordinate safety planning efforts in Minnesota (**Figure 2.1**).

The vision of the TZD program is to work towards eliminating fatal and life-changing injury crashes in Minnesota by establishing fatalities as the key statewide safety performance measure, by taking advantage of synergies that become available when agencies work together, and by reaching out to include local road authorities, law enforcement, community leaders, and public health as integral partners in the statewide safety planning efforts.

The mission of TZD is, “to move Minnesota toward zero deaths on our roads, using Education, Enforcement, Engineering, and Emergency Services.” The five goals established for the TZD program include:

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

To aid local organizations, the TZD program team works in partnership with community and corridor groups to improve the traffic safety of a designated area. TZD provides the technical assistance, materials and guidance to the local groups who are committed to reducing crashes – and the fatalities and severe injuries that result from them. Furthermore, a statewide TZD effort is to examine new technologies and activities that can help local organizations address safety concerns. This includes finding short term, lower-cost alternatives to traditional engineering solutions, which can be cost prohibitive or take too long to complete. The TZD program also provides local groups with information on a variety of traffic safety topics, covering each of the Four Es.

Even though the TZD program was established prior to enactment of SAFETEA-LU, this program serves as an excellent over-arching forum for Minnesota’s traffic safety initiatives, including the Minnesota SHSP. The relationships, partnerships, and annual safety conference can be used to disseminate information regarding key programs and initiatives in this Plan and other Minnesota safety plans.

The following sections provide an overview of key safety programs and activities that the TZD partners are currently working on.

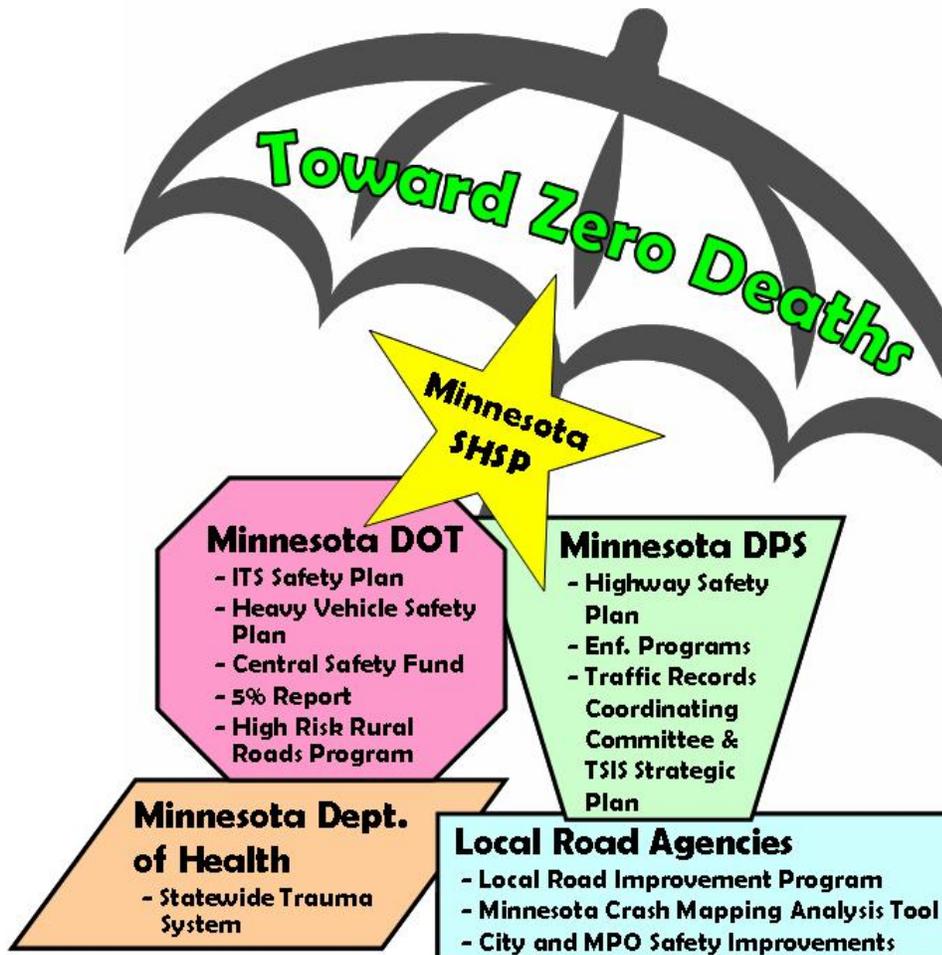


FIGURE 2.1
Relationship of TZD, the Minnesota SHSP and Minnesota Agencies

2.1 Minnesota Department of Public Safety

2.1.1 Highway Safety Plan

The Office of Traffic Safety (OTS) prepares the annual Highway Safety Plan (HSP) using a continual cycle of development and evaluation. The HSP is a required report which lays out the OTS plan to use the federal funds provided by the National Highway Traffic Safety Administration (NHTSA) and other funds earmarked for traffic safety related initiatives in the upcoming year.

The stated purpose of the projects in the HSP is “to save lives and protect families by reducing the number of deaths, injuries, and crashes that occur on our streets and highways.” To aid



OTS in measuring progress towards its primary objective of Moving Toward Zero Deaths, the 2007 HSP contains the following goals:

- Fatalities: Reduce the number of deaths from 559 in 2005 to no more than 480 by 2010.
- Serious Injuries: Reduce the number of serious injuries from 2,019 in 2005 to no more than 1,800 by 2010.
- Fatality Rate: Reduce the fatality rate from 0.99 in 2005 to no more than 0.75 by 2010.
- Seat Belt Use: Increase seat belt use in the general population from 84% in 2005 to at least 94% by 2010.
- Impaired Driving: Reduce the number (and percentage) of fatalities that are alcohol-related from 197 (35% of traffic deaths) in 2005 to no more than 125 (26% of traffic deaths) by 2010.
- Economic Loss: Reduce the economic loss due to traffic crashes from \$1.66 billion in 2005 to no more than \$1 billion by 2010.

To accomplish these goals, OTS will be implementing many projects and initiatives aimed at changing driver behavior, improving traffic safety records and support systems, and building partnerships and multi-agency approaches. A balanced HSP will include projects in a broad range of program areas including occupant protection, impaired driving, police traffic services, traffic records projects, safe community efforts, motorcycle projects, and roadway safety initiatives. Some of the key projects in the current HSP include:

- *The Safe & Sober Campaign* and *NightCAP* are established traffic enforcement programs which pay for overtime hours to increase law enforcement presence on roadways. These grant programs focus primarily on deterring impaired driving, increasing seat belt usage and managing speed. Over the course of the year, statewide traffic enforcement mobilizations take place around major holidays with special emphasis over the Memorial Day, Labor Day, and December holidays. All enforcement efforts are combined with media to ensure drivers are aware of the increase risk of being stopped.
- Highway Enforcement of Aggressive Traffic (HEAT) is a joint project involving engineering, education and special traffic enforcement. Speed patterns were studied and speed limits were changed on select corridors. Local media informed the public of the change and the added enforcement patrolling in the area. Led by the State Patrol, HEAT is a pilot project with the goal of reducing speeding-related crashes. (Note: more information available in Section 2.3.1.)
- A number of Safe Community Coalitions work to foster local level public support and education efforts that target driver behavior, including activities to reduce the incidence of impaired driving, teen crashes, distracted driving, and to raise seat belt use.
- Motorcycle Safety Program promotes rider training and public information to reverse the growing trend in motorcycle fatalities.
- Public Information and Education provides educational materials on traffic safety to partners throughout the state as well as media releases to ensure traffic enforcement and other traffic safety activity is visible to the public.
- Law Enforcement, Child Passenger Safety, and Public Health Liaisons engage local agencies to participate in local traffic enforcement and traffic safety educational activities.
- The Minnesota Child Passenger Safety Program which coordinates statewide training of child safety seat technicians and distribution of outreach materials.



- Support and encouragement for the court systems in Minnesota that are establishing or piloting intensive supervision and/or judicial monitoring of repeat impaired driving offenders to reduce the probability of additional DWI offenses.
- Traffic Records program that supports a variety of problem identification, effective project evaluation, research, and other data sources to mine information about traffic fatalities and injuries. This program area supports the Traffic Records Coordinating Committee which develops a separate strategic plan described in the following section.

A copy of the current Minnesota Highway Safety Plan can be found on the Office of Traffic Safety website – www.dps.state.mn.us/ots/general_info.

2.1.2 Traffic Records Coordinating Committee

The Traffic Records Coordinating Committee (TRCC) is an ongoing forum charged with making significant improvements in coordination and sharing of highway safety data and traffic records systems in Minnesota. This group includes policy-level and program-level representatives from traffic safety, highway infrastructure, law enforcement, adjudication, public health, injury control, private industry, motor vehicle and driver licensing agencies, and motor carrier agencies.

The TRCC's mission is to improve the quality of traffic data, information, and systems in order to better support the analytical processes associated with roadway transportation safety. This effort is consistent with one of the prioritized list of Critical Strategies that was previously identified in Minnesota's CHSP – improving data systems.

The committee develops an annual Traffic Safety Information Systems (TSIS) Strategic Plan which covers six TSIS areas, including the following:

- Motor vehicle crashes
- Roadway inventory data
- Drivers' license information
- Motor vehicle registration
- Crash outcome/injury surveillance
- Traffic citations and adjudication.

Through a detailed review of the six TSIS areas, the TRCC identified 19 action items to be included in the 2006 plan. Some of the major action items include:

1. Fund a project coordinator in DVS for crash data improvements.
2. Publish DVS crash database standards for law enforcement records management systems set up.
3. Train law enforcement about the importance of crash data collection and uses.
4. Build an electronic interface between the DVS crash database and law enforcement records management systems.
5. Build an Impaired Driving Offender Tracking System.

For each project, the TSIS Strategic Plan provides additional information including: the lead agency, funding sources, projected funding and staff hours needed, purpose, description, and possible milestones.

For more information on the TSIS Strategic Plan, visit the Minnesota TRCC online at www.dps.state.mn.us/OTS/crashdata/TRCC/.

2.2 Minnesota Department of Health

2.2.1 Statewide Trauma System

Motor vehicle crash-related trauma is a leading cause of injury death and disability; a comprehensive trauma system saves lives and assures improved care and better patient outcomes. Minnesota has implemented a statewide comprehensive trauma system which is expected to have a substantial impact on reducing the number of crash-related fatalities in Greater Minnesota. This will be accomplished through (1) faster emergency responses to crashes; (2) improved emergency triage practices at crash scenes; (3) improved understanding of and knowledge about the most appropriate site for definitive care – including pre-established transfer protocols; and (4) strengthened capacity of pre-hospital and hospital staff members to respond to trauma.

Participating hospitals undergo a verification/designation process; a multi-disciplinary team visits the hospital to assess the appropriate trauma level for that particular institution – Level 1 for facilities that handle the most severe and difficult cases and Level 4 as the lowest trauma level designation. During 2006, two hospitals were visited and verified as Level 3 Trauma Centers. During 2007, an additional four hospitals are expected to be verified as Level 3 Trauma Centers and perhaps as many as five to be verified as Level 4 Trauma Centers. Minnesota currently has four Level 1 Trauma Centers (three in the Twin Cities and one in Greater MN) and three Level 2 Trauma Centers, with an additional two or three hospitals nearly verified as Level 2 Trauma Centers.

The Minnesota Department of Health (MHD) provides epidemiology and programming support for the Trauma System. Each participating hospital is provided a web-secure portal to enter data on the trauma cases meeting the case definition established by the State Trauma System Advisory Committee. Hospitals review their own data for internal quality improvement efforts; the MDH epidemiologists assess and analyze the data in aggregate, in order to monitor the health of the trauma system as a whole.

To strengthen the statewide comprehensive trauma system, the following strategies or policies should be adopted or implemented:

1. Verify additional Level 3 and Level 4 Trauma Centers in Greater Minnesota.
2. Support (financially and with training, education and equipment) existing ambulance services in Greater Minnesota.
3. Support training and education of hospital staff members in Greater Minnesota in the diagnosis and treatment of trauma and reporting of data elements.
4. Support training of local law enforcement officers in Greater Minnesota. These officers are often the first responders to motor vehicle-related trauma and they are not currently required to maintain their first responder training (16 hours of emergency medical training every two years).
5. Explore strategic deployment of air medical transport resources (helicopter and fixed wing) across Minnesota.

2.3 Minnesota Department of Transportation

The Minnesota SHSP is part of Mn/DOT's long range planning effort along with the Plans prepared for each District and the Modal Plans for Aeronautics, Freight, Transit and Bicycles. These Long Range Plans are part of Mn/DOT's Highway Planning and Project Programming Process (**Figure 2.2**) which includes the following components:

- Mn/DOT Strategic Plan: the high level statement of the Department's vision, mission, purpose, priorities and three overarching Strategic Directions – Safeguard what exists, Make the network operate better and Make Mn/DOT work better.
- Statewide Transportation Plan: a policy framework with performance goals to document Mn/DOT's progress in achieving the directions in the Strategic Plan relating to –
 - system infrastructure and services
 - safety and system operations/management
 - system preservation and expansion
 - the movement of people and freight
 - the range of competitive and cost-effective travel choices
- Long Range Plans: local, regional, District and Modal Plans that identify investment levels, strategies and major projects to achieve performance targets
- Ten-Year Highway Improvement Plan: documents the prioritized list of specific projects developed through the Long Range Planning process that will be funded and implemented

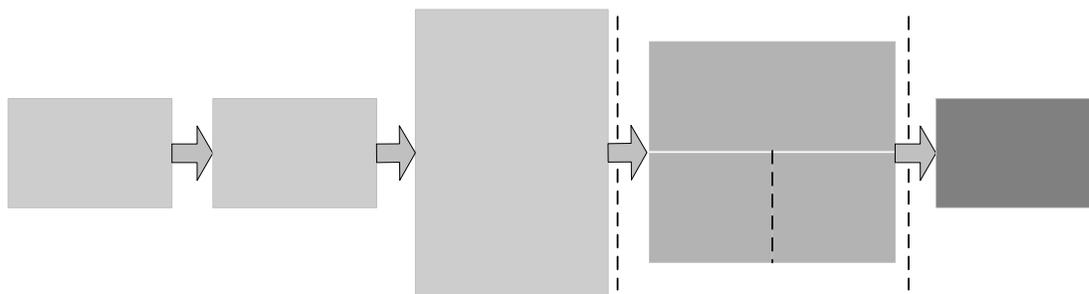


FIGURE 2.2
Mn/DOT's Highway Planning and Project Programming Process

All of these long range strategic planning documents address highway safety in some fashion – it is the intent of the Minnesota SHSP to focus on the low-cost safety strategies that can be proactively deployed across wide segments of both the state and local highway systems.

2.3.1 Central Safety Fund

Since completing the Minnesota CHSP in 2004, one of the biggest changes to Minnesota's safety programs was creating the Central Safety Fund (CSF), with funds contributed by DPS and



Mn/DOT and made available by the Section 164 transfer penalty. The purpose of the CSF is to fund safety programs from any of the Four Es, consistent with the CHSP and address a significant need. The CSF provides a mechanism that allows Mn/DOT to more easily direct safety funds to local roadway agencies, counties in particular. This outreach to local agencies, similar to the approach by the Office of Traffic Safety at the DPS, was identified as being important in order to reduce fatalities since approximately half of fatalities occur on local roads (Chapter 6 of the Minnesota CHSP).

To date, the CSF has been used to fund three different programs, including cable median guardrail construction, the Minnesota Speed Management Program, and safety needs on county highways.

Cable Median Guardrail

Through the CSF and ATP HSIP funds, approximately 22 miles of cable median barrier in the Minneapolis - St. Paul Metropolitan area and another 17 miles in greater Minnesota have been installed. Planned installations during 2007-2008 include an additional 19 miles in the Metro area and nearly 37 miles in greater Minnesota. This means by the end of 2008, 91 miles of cable median barrier will have been installed along Minnesota freeways. Another 123 miles of freeway have been identified as potential locations in need of cable median barrier, with installation expected after 2008. The basis for the selected locations was crash data, traffic volumes and existing median widths.

Minnesota Speed Management Program *(also known as Highway Enforcement of Aggressive Traffic or HEAT)*

The Minnesota Speed Management Program was a joint effort of Mn/DOT and DPS to address speeding – especially in rural areas – by providing speed limits consistent with design speeds combined with enhanced enforcement. In the fall of 2005, Mn/DOT increased the speed limit from 55 mph to 60 mph on 970 miles of rural two-lane/two-way highways that were constructed with design speeds to safely accommodate these higher travel speeds. This increase in speed limit was accompanied by a targeted and aggressive enforcement and paired with a media campaign to reduce speeding. Using speed data collected via automatic traffic recording devices, law enforcement scheduled and monitored their extra speed enforcement.

Approximately \$2.5 million was used to fund 50,000 hours of overtime enforcement to control speeding on the 970 miles of two-lane highways where the speed limit was raised and also along 1,870 miles of Interstate and expressway that had an increase in the speed limit in 1997. There was also \$350,000 invested in paid media as part of a public information and education campaign.

The results were impressive with 28.7% decrease in the number of drivers traveling over 10 miles per hour above the speed limit on two-lane two-way rural highways. A second aggressive enforcement and education campaign to reduce speeding began in June 2007 with \$1.5 million to fund 25,000 hour of overtime speed enforcement.

County Highway Safety Project Solicitation

In order to direct greater level of technical and financial resources to county highway departments, Mn/DOT awarded \$2 million in 2005 and \$4 million in 2007 to 46 counties through the CSF to make safety improvements to county roadways. The recipients used the



grants to conduct road safety audits, make guardrail or turn lane improvements, widen shoulders, install edgeline rumble stripes, enhanced pavement markings, enhance signing, and install intersection lighting.

Another goal of the county solicitation process is to develop a dialog among local safety advocates to explain the Minnesota SHSP and Towards Zero Death (TZD) goals and objectives. This is being accomplished by requiring counties that receive a grant to host a Community Traffic Safety Meeting – involving safety partners and other community leaders such as law enforcement, emergency responders, Mn/DOT District representatives, school representatives, and township officials. This meeting will give these partners a chance to share individual efforts intended to reduce fatalities and look for ways to cooperate in future project that may involve all Four Es.

2.3.2 Statewide Heavy Vehicle Safety Plan

Development of the Statewide Heavy Vehicle Safety Plan (SHVSP) was a joint partnership between the Office of Freight & Commercial Vehicle Operations at Mn/DOT and the Commercial Vehicle Enforcement Section of the Minnesota State Patrol. Completed June 30, 2005; the primary purpose of the SHVSP is to identify strategies to reduce the number of heavy vehicle fatal and serious injury traffic crashes and heavy vehicle fatalities and serious injuries on Minnesota roadways. A secondary purpose is to encourage implementation of a Four E demonstration project in a selected corridor with high volumes of heavy commercial traffic and a high number of crashes involving heavy vehicles.

The safety goal in the SHVSP is to decrease the annual number of fatal heavy vehicle crashes to 60 or fewer by 2008, from an annual average of approximately 75. The plan also endorses the more aggressive goal established by the Federal Motor Carrier Safety Administration (FMCSA), which is 56 or fewer heavy vehicle fatal crashes annually by 2008 – as part of the National goal to reduce the heavy vehicle fatal crash rate to 1.65 fatal crashes per hundred-million truck vehicle miles traveled.

The development of the Minnesota SHVSP began with assembling four years of crash information; which was reviewed to develop an understanding of the characteristics of heavy vehicle crashes and how they differ from all crashes. Thirteen individuals from state agencies and the private sector were interviewed to identify areas of emphasis and implementation within each organization. This information, along with a review of current National and State programs, was shared with 40 participants at a workshop. Workshop participants then reviewed, discussed, and prioritized a series of strategies identified from NCHRP Report 500 (Volume 14), the Pennsylvania Unified Truck Safety Strategy, or suggested during the interview process. Following the workshop, the Steering Committee used the input from the safety partners to identify the following ten Critical Strategies.

1. Promote the effective and efficient use of law enforcement and inspector resources.
2. Implement cost effective road and roadside improvements to address related heavy vehicle crashes. These improvement include constructing paved shoulders, rumbles strips (centerline and edge line), turn lanes, left/right turn acceleration lanes and truck pull-offs for driver/vehicle inspections.



3. Improve CDL requirements on testing, training, and qualification of all CDL holders and examiners.
4. Educate drivers of passenger vehicles to raise their awareness of safety issues related to driving around heavy vehicles.
5. Install four-cable median barriers to prevent head-on and sideswipe-opposing crashes on divided roadways.
6. Provide carriers automatic notification of driving convictions for any driver that works for them.
7. Identify and implement a demonstration corridor(s) with a comprehensive set of safety strategies to address engineering, enforcement, education and emergency response issues.
8. Improve work zones to better accommodate needs of heavy vehicles.
9. Address heavy vehicle crashes with targeted enforcement of heavy vehicles using State resources and partnerships with local agencies.
10. Improve accuracy, availability, and completeness of heavy vehicle data to support heavy vehicle problem identification and program evaluation.

The Minnesota SHVSP also established performance measures for each of the Four Es to help organizations track how well the Plan is being implemented. Furthermore, one key recommendation from the interview process was to implement a demonstration project involving a comprehensive Four E approach to heavy vehicle safety.

The SHVSP also documented the review of traffic and crash records that was used to select 16 segments that have a high volume of heavy vehicles and a recognizable crash problem. For each identified segment, possible countermeasures were identified using available information.

2.3.3 ITS Safety Plan

The ITS Safety Plan (October 31, 2006) was prepared by the Office of Traffic, Security and Operations at Mn/DOT. Other key partners included DPS, Mille Lacs County and representatives that participated in a survey, workshop or interviews.

The stated purpose of the ITS Safety Plan is to “develop technology based 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 established in the Plan is to move Minnesota “Toward Zero Deaths” by supporting the CHSP with an ITS Safety Plan

The process to develop the ITS Safety Plan began with a survey of over 100 ITS experts from Minnesota and across the nation to identify potential ITS safety countermeasures. The survey process helped identify the first 50 strategies. The second phase was a workshop with 50 participants from Federal, state, and local agencies, as well as University of Minnesota, safety advocacy groups and private firms. Ideas generated by the workshop participants increased the number of strategies to 91. A prioritization process at the workshop along with interviews of 14 key program leaders resulted in identification of six ITS Critical Strategies that total 22 ITS initiatives.



ITS Critical Strategy 1: Implement In-vehicle Based Safety System

- 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 Systems

- 3.1 Implement improved lane route 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

- 5.1 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.

2.3.4 High Risk Rural Roads Program

SAFETEA-LU legislation created the High Risk Rural Roads Program (HRRRP) in order to proactively address two compelling facts – fatal crashes are over represented in rural areas and lower volume local roads in these rural areas tend to have the highest fatality rates. Funding set aside for the HRRRP is intended for roads functionally classified as a rural major collector, rural minor collector, or a rural local road. Furthermore, the road should have a fatal and serious injury crash rate above the statewide average for similarly classified roadways or a significant increase in traffic volumes is expected such that the roadway could develop a fatal and serious



injury crash rate above the threshold. Minnesota's set-aside funding for these roadways will be between \$1.5 million and \$1.9 million for the first year.

The multi-step process to identify the eligible segments began with Mn/DOT calculating that the average fatal and serious injury crash rate for the eligible functional classifications, which is 7.9 crashes per 100 million vehicle miles traveled. Of the segments that met the crash rate threshold, any segment that had an ADT less than 150 vehicles per day was then eliminated. This two-part process identified 295 miles of state maintained trunk highway and 9,026 miles of roadway under local jurisdiction. Mn/DOT then identified another 322 miles of eligible roadways under local jurisdiction that met the ADT threshold, had three or more fatal or serious injury crashes, but was below the crash rate threshold. In total, there are 9,644 miles of roadway in Minnesota that are eligible for the special funding through the HRRRP (out of a statewide total of approximately 133,000 miles). This list of roadways is available from Mn/DOT's Office of Traffic, Security and Operations (<http://www.dot.state.mn.us/otso>).

2.3.5 5% Report

SAFETEA-LU requires each state to prepare a report that identifies at least 5% of locations that exhibit the most severe highway safety needs. FHWA's guidance memo advises that the selection process should be based primarily on fatalities and serious injuries (<http://safety.fhwa.dot.gov/safetealu/fiveguidance.htm>). The 5% Report must also include potential countermeasures along with implementation costs and impediments.

The methodology used by Mn/DOT to create the 5% Report was to identify the top ten locations from each of the Top 200 Intersection and Top 150 Sections list identified annually by Mn/DOT.

For 2007, Mn/DOT will modify the approach to address some of the limitations of the first report. First, the process was limited to the State maintained highways due to the inability to compute crash statistics for local roads – Mn/DOT does not maintain the local roadway and intersection geometry information necessary to perform the calculations. A second limitation was that the process used crash cost computed from all crashes and not just fatal and serious injury crashes.

This resulted in selecting high-volume urban-freeway segments and urban-signalized locations only on the State Trunk Highway system, which does not reasonably reflect the data that shows severe crashes are over represented in rural areas and also along local roads. Therefore, it was decided to develop a new process that more accurately reflects the data. Several key aspects of the enhanced process include:

- Using only fatal and serious injury crashes in the analysis.
- Creating separate 5% Reports specifically for the CEAs that Mn/DOT is best capable to address – intersection and lane departure crashes.
- Incorporating roads under the authority of local agencies into the analysis.
- Utilizing a clustering function to identify the highest crash locations which would include 5% of the total targeted (intersections and road departure) fatal and serious injury crashes.

While this process is still being refined, the early results of locations identified for the 5% Report of lane departure crashes has resulted in 53% of the clusters in the Metro District and only 54%

of clusters on the State Trunk Highway system. This demonstrates that the new process is performing better at identifying a diverse selection of locations that reasonably reflect the distribution of these severe crashes.

2.4 Local Road Authorities

The focus of initiatives addressing the local road systems is on the county roadways – because the most severe crashes (fatal and serious injury) are most often over represented on the system of roadways under the their jurisdiction. While municipal streets are not a significant problem for severe crashes when considering the entire state system; individual cities are encouraged to continue to monitor crashes within their jurisdictions and to designate a portion of their capital improvement program for low-cost safety investments. This will allow cities to design and implement safety programs in response to crash problems or proactively address crashes before becoming a significant problem.

2.4.1 County Safety Activities

A key component of Minnesota's comprehensive and data driven approach to addressing the number of fatal crashes involves providing technical assistance to and designated safety funds for projects on the county highway system. In Minnesota, the counties administer over 45,000 miles of mostly two-lane rural roads, which account for almost half of the statewide fatalities and have a fatal crash rate that is 20% higher than comparable roads on the State system.

In order to direct resources where needs are great, Mn/DOT has dedicated a portion of their Central Safety Fund (approximately \$2 million/year) for specific projects on the county highway system, has provided technical support and staff for road safety audits on the local systems and partnered with the County Engineers and the Local Road Research Board to develop GIS based crash software – the Minnesota Crash Mapping Analysis Tool (MnCMAT) that has been distributed to all of the counties in the State.

The Minnesota County Engineers Association (MCEA) has a very active County Highway Safety Committee which has operated since 2003. They have been instrumental in providing information on safety issues, developing potential solutions, acquiring funding, directing safety research, and publishing a bi-monthly newsletter. As partners, they are dedicated to reducing fatalities and serious injuries on their roadway system.

The County Engineers have also been successful in getting additional safety funding through the legislature. The Local Roadway Improvement Program (LRIP) dedicated \$5.0 Million in 2005 and \$7.7 Million in 2006 toward Rural Road Safety projects. These dollars were in addition to the Comprehensive Highway Safety Program and Federal SAFETEA-LU mentioned previously.

2.4.2 Metropolitan Planning Organizations

The long-range transportation plans of each of Minnesota's seven metropolitan planning organizations (MPOs) are required by SAFETEA-LU and federal rule [23 CFR 450.322 (h)] to include a safety element that incorporates or summarizes the priorities, goals, countermeasures, or projects contained in the Minnesota SHSP. For the individual MPOs, a model for



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development of their own data driven process and resulting recommendations can be found in Chapter 6 and the key elements of the process are outlined in the following:

- Adopt a safety goal.
- Conduct a crash analysis to identify the factors contributing to the most severe crashes.
- Develop a prioritized list of safety strategies that addresses the Four Es.
- Complete a mapping exercise that links crash casual factors to the most effective strategies.
- Identify safety investment targets that reflect the results of the crash analysis.
- Conduct follow-up reviews of the safety project in order to make adjustments as necessary to continue increasing the effectiveness of the program.

3. Critical Emphasis Areas

3.1 Critical Emphasis Area Selection Process for the CHSP

The Critical Emphasis Areas (CEAs) selected for the Minnesota CHSP was from input of three sources. A detailed description of the selection process is included in Chapter 2 of the Minnesota CHSP, but a brief overview is also provided below.

- AASHTO Self-Assessment Tool – Individuals were either interviewed using the self-assessment tool or were asked to fill out the survey independently. Responses provided an understanding of the State’s progress towards implementing the AASHTO SHSP. Of the twelve types of agencies listed in the self-assessment tool, eleven were interviewed. The only missing interview was a representative from the Minnesota State Legislature – the timing of the interview was near the end of the session making it difficult to find an available Legislator.
- Review of Fatal Crash Records – Five years of fatal crash records (1998-2002) were reviewed to determine the number of fatalities that were related to each of the emphasis areas identified in the AASHTO SHSP. This information allowed decision makers to understand the magnitude of each emphasis area and identify the largest groups of fatalities.
- Stakeholder Input – A workshop was conducted on May 3, 2004 to allow 38 of Minnesota’s Safety Partners provide input into the selection of the CEAs. These participants were from a variety of agencies that represented the Four Safety Es – Enforcement, Education, Engineering, and Emergency Medical Services (EMS). The workshop format included educating participants on the activities of each Safety E, sharing results of the AASHTO self-assessment surveys and the fatal crash analysis, and open small group discussion of participants. This culminated in a prioritization exercise that allowed participants to rank the possible emphasis areas.

A total of ten emphasis areas from the AASHTO SHSP were selected to represent Minnesota. These ten were restructured to create five CEAs.

CEA 1 - Reducing Impaired Driving & Increasing Seat Belt Use

CEA 2 - Improving the Design and Operation of Highway Intersections

CEA 3 - Addressing Young Drivers (Under the Age of 21) Over Involvement & Curbing Aggressive Driving (Speeding-Related)

CEA 4 - Reducing Head-On and Across-Median Crashes, Keeping Vehicles on the Roadway & Minimizing the Consequences of Leaving the Road

CEA 5 - Increasing Driver Safety Awareness & Improving Information Systems



3.2 Evaluation of the Original Critical Emphasis Areas

Five years of the most recent fatal crash records was again reviewed to validate that the CEAs are still appropriate. **Table 3.1** summarizes the traffic fatalities by the AASHTO emphasis areas. Appendix 1 contains additional information regarding the AASHTO emphasis areas, specifically the number of related serious injuries.

TABLE 3.1
Summary of Minnesota's 2001-2005 Fatalities by AASHTO's Emphasis Area

	Emphasis Area	Minnesota Fatalities*	Percent
Part 1: Drivers	Instituting Graduated Licensing for Young Drivers	718 fatalities involved a driver under 21	24%
	Ensuring Drivers are Licensed and Fully Competent	197 fatalities involved a driver with an invalid license**	11%
	Sustaining Proficiency in Older Drivers	533 fatalities involved a driver over 64	18%
	Curbing Aggressive Driving	850 fatalities involved a speeding driver	28%
	Reducing Impaired Driving	1,068 fatalities were alcohol related	36%
	Keeping Drivers Alert	568 fatalities involved an inattentive driver	19%
	Increasing Driver Safety Awareness	-- Not Quantifiable --	
	Increasing Seat Belt Usage and Improving Airbag Effectiveness	1,271 vehicle occupant fatalities were not using a restraint device***	52%
Part 2: Special Users	Making Walking and Street Crossing Safer	227 pedestrian fatalities	8%
	Ensuring Safer Bicycle Travel	37 bicyclists fatalities	1%
Part 3: Vehicles	Improving Motorcycle Safety and Increasing Motorcycle Awareness	259 motorcyclists fatalities	9%
	Making Truck Travel Safer	447 fatalities involving heavy vehicles	15%
	Increasing Safety Enhancements in Vehicles	-- Not Quantifiable --	
Part 4: Highways	Reducing Vehicle-Train Crashes	42 fatalities involving a collision with a train	1%
	Keeping Vehicles on the Roadway	965 single vehicle run-off the road fatalities	32%
		Top 5 most harmful events for single vehicle run -off the road fatalities were:	
	Minimizing the Consequences of Leaving the Road	- Overturn/Rollover (51%) - Collision with a tree/shrubbery (19%) - Collision with an embankment/ditch (5%) - Collision with a utility pole (4%) - Collision with guardrail (4%)	
	Improving the Design and Operation of Highway Intersections	1,004 fatalities at an intersection	33%



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TABLE 3.1
Summary of Minnesota's 2001-2005 Fatalities by AASHTO's Emphasis Area

	Emphasis Area	Minnesota Fatalities*	Percent
Part 4: Highways continued	Reducing Head-On and Across-Median Crashes	611 head-on and across-median fatalities	20%
	Designing Safer Work Zones	57 work zone fatalities	2%
Part 5: EMS	Enhancing Emergency Medical Capabilities to Increase Survivability	In 2005, the average response time (time of crash to arrival hospital) was 46.5 minutes for 351 rural fatal crashes (time exceeded one hour in 31 of the crashes). For 149 urban fatal crashes, the average response time was 34.9 minutes (time exceeded one hour in three of the crashes)****	
Part 6: Manage- ment	Improving Information and Decision Support Systems	-- Not Quantifiable --	
	Creating More Effective Processes and Safety Management Systems	-- Not Quantifiable --	

* Source: Minnesota Crash Records (2001 – 2005)

** Information regarding driver license status was added to the crash record database in 2003. The 197 related fatalities are out of a three-year total of 1,781 fatalities.

*** Between 2001 and 2005, there were 2,429 vehicle occupant fatalities.

**** Information regarding EMS response times was from the FARS database.

NOTE: Between 2001 and 2005, there were 2,701 fatal crashes that resulted in 3,008 fatalities.

Table 3.2 compares the top emphasis areas (based on fatal crashes and fatalities) between the two analysis periods – 1998-2002 for the Minnesota CHSP and 2001-2005 for the Minnesota SHSP. This table reveals that the top ten emphasis areas remained the same between the two analysis periods, in fact the top four – unbelted, alcohol-related, intersection, and single-vehicle run off the road – were in the exact same order. In the updated analysis, the AASHTO emphasis areas that were selected for the Minnesota CEAs represented the top seven. Based on this information, the decision by the Interagency Working Group was that the CEAs selected as part of the Minnesota CHSP accurately reflect existing priorities; therefore, no changes were made to the CEAs.



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TABLE 3.2
Top 10 Emphasis Areas

CEAs in the Minn. CHSP	Top 10 Emphasis Areas (Based on 2001-2005 Minnesota Data)	1998-2002			2001-2005		
		Related Fatal Crashes		Previous Rank	Related Fatalities		Current Rank
✓	Increasing Seat Belt Usage and Improving Airbag Effectiveness	1,351 fatalities	53%	1	1,271 fatalities	52%	1
✓	Reducing Impaired Driving	1,020 fatal crashes	36%	2	1,068 fatalities	36%	2
✓	Improving the Design and Operation of Highway Intersections	1,013 fatal crashes	36%	3	1,004 fatalities	33%	3
✓	Keeping Vehicles on the Roadway (combined with Minimizing the Consequences of Leaving the Road)	959 fatal crashes	34%	4	965 fatalities	32%	4
✓	Curbing Aggressive Driving	675 fatal crashes	24%	7	850 fatalities	28%	5
✓	Instituting Graduated Licensing for Young Drivers	705 fatal crashes	25%	5	718 fatalities	24%	6
✓	Reducing Head-On and Across-Median Crashes	505 fatal crashes	18%	9	611 fatalities	20%	7
	Keeping Drivers Alert	681 fatal crashes	24%	6	568 fatalities	19%	8
	Sustaining Proficiency in Older Drivers	594 fatal crashes	21%	8	533 fatalities	18%	9
	Making Truck Travel Safer	379 fatal crashes	14%	10	447 fatalities	15%	10
✓	Increasing Driver Safety Awareness						
✓	Improving Information and Decision Support Systems						

1998-2002: 2,797 fatal crashes; 3,126 fatalities; 2,572 vehicle occupant fatalities

2001-2005: 2,701 fatal crashes; 3,008 fatalities; 2,429 vehicle occupant fatalities

4. Implementation Countermeasures

Minnesota has a long history of traffic safety planning and implementation by various agencies, demonstrated by the wide variety of programs reviewed in Chapter 2. Including the strategies in the Minnesota CHSP and those listed in Chapter 2, there are over 50 strategies identified through separate strategic planning processes. In an effort to link the key safety programs in the state, the objective of this Chapter is to review the strategies in the individual plans, combine similar strategies and then reorganize them by the Four Es.

Table 4.1 is a summary of the safety strategies referenced in Chapter 2. For detailed information regarding each strategy, please refer to the original document. Furthermore, a detailed review of fatal and serious injury intersection crash data for Mn/DOT's districts revealed that the intersection problems in the Metro District are unique when compared to the rest of the state – intersection safety problems in Greater Minnesota are often widely spread across rural unsignalized intersections while the Metro area has noticeable problems at urban and suburban signalized intersections. Since the original prioritization process used by in the development of the Minnesota CHSP relied on statewide data, only a few of the engineering intersection countermeasures have potential for widespread use in the Metro area. Therefore, a second prioritization process was performed in February 2007 for the Metro ATP.

This screening process involved engineering staff from the Mn/DOT Metro District as well counties and cities. Using a crash data summary (see Appendix II) and open discussion format, the strategies in the NCHRP Report 500 (Volumes 5 and 12) were edited to fit the needs of the Metro area. The six strategies that comprise the suite of strategies selected for the Metro ATP are also summarized in **Table 4.1** while more information is provided in Appendix III.

4.1 Strategies Organized by the Four Es

The strategies from the various safety plans have been categorized by the Four Es, data systems, and technology. A brief summary of these strategies are in **Tables 4.2 - 4.7**, while detailed information is contained in the respective plans. Also, similar strategies have been combined to simplify the list and information such as implementation status, champion, and goal have been included if appropriate.



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TABLE 4.1
Summary List of Safety Strategies in Minnesota's Strategic Safety Plans

Safety Strategy		Countermeasure
Minnesota CHSP		
C.1)	Provide adequate law enforcement resources	<ul style="list-style-type: none"> Provide adequate resources to perform traffic enforcement for speeding, unbelted occupants and impaired drivers.
C.2)	Primary seat belt law	<ul style="list-style-type: none"> Encourage enactment of a statewide primary seat belt law that provides universal coverage to all vehicle occupants.
C.3)	Implement automated enforcement	<ul style="list-style-type: none"> Red-light running cameras Automated speed enforcement
C.4)	Stronger graduated driver licensing system	<ul style="list-style-type: none"> Implement a more effective GDL system.
C.5)	Cost effective lane departure improvements	<ul style="list-style-type: none"> Construct median barriers for narrow-width medians on multilane roads. Utilize centerline rumble strips on undivided, two-way roads. Utilize shoulder or mid-lane rumble strips. Enhance delineation of sharp curves and unexpected changes in horizontal alignment. Enhance pavement markings. Eliminate shoulder drop-offs. Delineate roadside objects.
C.6)	Communication and marketing task force	<ul style="list-style-type: none"> Create a communications/marketing task force to raise public awareness of traffic crash issues.
C.7)	High-level traffic safety panel and legislature action committee	<ul style="list-style-type: none"> Establish a high-level panel focused on traffic safety.
C.8)	Cost effective intersection improvements	<ul style="list-style-type: none"> Add offset and/or longer turn lanes. Add acceleration lanes. Utilize indirect left-turn treatments. Clear sight triangles. Eliminate parking near intersections. Provide pavement markings with supplementary messages, such as STOP AHEAD. Add double yellow centerline at intersections and at median openings. Provide lighting to increase intersection visibility.
C.9)	Roadway maintenance	<ul style="list-style-type: none"> Improving roadside hardware. Removing and relocating objects in hazardous locations. Winter storm maintenance (pre-treating and increasing number of snow plows) Maintain gravel shoulders. Keep roadways free of loose debris in construction zones. Maintain pavement marking lines.
C.10)	Support the enforcement of traffic safety laws	<ul style="list-style-type: none"> Work with courts to prevent the reduction or dismissal of traffic citations for impaired or aggressive driving.
C.11)	Target enforcement	<ul style="list-style-type: none"> Use well publicized saturations and targeted enforcement to deter impaired driving and aggressive drivers, and increase seat belt use.
C.12)	Enhance driver education	<ul style="list-style-type: none"> Require parental involvement. Implement uniform curriculum. Provide instructor quality control. Provide enhanced behind-the-wheel and classroom instruction. Improve driver training and licensing material with the addition of traffic safety statistics, stories, and testimonials.
C.13)	Road safety audits	<ul style="list-style-type: none"> Perform road safety audits at the network level.
C.14)	Improve data system	<ul style="list-style-type: none"> Ensure adequate staffing, equipment and other resources are available. Organize an oversight committee to coordinate all agencies involved in the collection, management, and use of highway safety data.
C.15)	Statewide trauma system	<ul style="list-style-type: none"> Create and implement a statewide trauma system.
Minnesota Statewide Heavy Vehicle Safety Plan		
H.1)	Law Enforcement and Inspector Resources	<ul style="list-style-type: none"> Increased and efficient use of traffic law enforcement.
H.2)	Cost Effective Road and Roadside Improvements	<ul style="list-style-type: none"> Install centerline rumble strips. Install edgeline rumble strips. Eliminate shoulder drop-offs by paving shoulders. Construct truck pull-offs as inspection sites.
H.3)	Strengthen CDL	<ul style="list-style-type: none"> Strict curriculum for driver training schools. Vehicle operating restrictions based on vehicle type tested in. Skill re-testing of veteran drivers, new residents, and problem drivers.
H.4)	Passenger Vehicle Driver Education	<ul style="list-style-type: none"> Public education and advertisement campaigns. Targeted education at high risk groups.
H.5)	Four-Cable Median Barrier	<ul style="list-style-type: none"> Install four-cable median barriers.
H.6)	Automatic Notification of Driver Convictions	<ul style="list-style-type: none"> List serve to automatically notify carriers of driving convictions.
H.7)	Demonstration Corridor	<ul style="list-style-type: none"> Implementation of a demonstration corridor.
H.8)	Work Zone	<ul style="list-style-type: none"> Review work zones to better accommodate large vehicles.
H.9)	Targeted Enforcement	<ul style="list-style-type: none"> Heavy vehicle targeted enforcement campaign.
H.10)	Improve Data Systems	<ul style="list-style-type: none"> Develop integrated system linking crash database with databases on vehicle owner and driver records.
Minnesota ITS Safety Plan		
I.1)	Implement In-vehicle Based Safety System	<ul style="list-style-type: none"> Require seatbelt ignition interlock on new vehicles. Require blood alcohol content level ignition interlocks on vehicles driven by repeat drunk driving offenders. Provide information to equip vehicles with systems that deliver real-time information and warnings to drivers. Use preemption on vehicle radios to provide real-time information. Research equipping vehicles with systems to detect driver distractions and provide warnings.
I.2)	Improve first Responder/Law Enforcement Systems	<ul style="list-style-type: none"> Coordinate emergency responder databases to allow access to consistent crash information. Allow law enforcement to retrieve data from onboard vehicle computers. Develop and provide a uniform, real-time automated crash reporting system. Implement automated enforcement of red light running at intersections. Expand quick clearance policies for incidents. Implement automated enforcement of speed violations.



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TABLE 4.1
Summary List of Safety Strategies in Minnesota's Strategic Safety Plans

Safety Strategy		Countermeasure
I.3)	Implement Vehicle Infrastructure Integration Systems	<ul style="list-style-type: none"> Implement improved lane route guidance system. Develop vehicle to vehicle and vehicle to infrastructure communication.
I.4)	Improve Infrastructure systems and Signage	<ul style="list-style-type: none"> Expand work zone safety systems. Implement variable speed limit signs. Expand the use of dynamic message signs to provide location based, real-time information to drivers. Research use of graphics (and text) for dynamic message sign messages. Expand geographic coverage of the RTMC systems. Integrate reporting systems across state and local borders.
I.5)	Use Intersection Collision Warning Systems	<ul style="list-style-type: none"> Install rural intersection warning and decision support systems.
I.6)	Improve Driver Education and Licensing Using ITS	<ul style="list-style-type: none"> Expand graduated driver licensing. Use driving simulation for teenage and mature driver education.
Metro Area Intersection Strategies		
M.1)	Left and Right Turn Lanes	<ul style="list-style-type: none"> Provide left and right turn lanes Use offset turn lanes to improve visibility Provide sufficient length to accommodate deceleration and queuing Add acceleration lanes Provide by-pass lanes at T-intersections
M.2)	Enhanced signing, lighting, pavement marking and delineation	<ul style="list-style-type: none"> Provide lighting (install or enhance) Install splitter islands on the minor-road approach to an intersection Provide a stop bar (or provide a wider stop bar) on minor-road approaches Install larger regulatory and warning signs at intersections Provide dashed marking (extended left edgelines) for major roadway continuity at divided highway intersections Provide supplementary stop signs Provide pavement markings with supplementary messages (i.e., STOP AHEAD) Install red flashing beacons on STOP signs at stop-controlled intersections Deploy mainline dynamic flashing beacons to warn drivers of entering traffic Use freeway style guide signs along high-speed segments Install advance warning flashers to inform driver of need to stop at high-speed signalized intersections
M.3)	Access management	<ul style="list-style-type: none"> Implement driveway closures/relocations Implement driveway turn restrictions Restrict cross median access near intersections Restrict or eliminate turning maneuvers by signing providing channelization or closing median openings
M.4)	Enforcement of red-light running	<ul style="list-style-type: none"> Implement automated enforcement of red-light running (cameras) Install confirmation lights on the back side of mast arms to assist in traditional red-light running enforcement
M.5)	Signal timing improvements	<ul style="list-style-type: none"> Employ multiphase signal operation Optimize clearance intervals Restrict or eliminate turning maneuvers (including right turns on red) Employ signal coordination Improve operation of pedestrian and bicycle facilities at signalized intersections (countdown heads)
M.6)	Improve intersection sight distance	<ul style="list-style-type: none"> Clear sight triangles on approaches to intersections or in the medians of divided highways near intersections Eliminate parking that restricts sight distance Utilize curb extensions
Statewide Trauma System		
TS.1)	Expand the Trauma Registry	Verify additional Level 3 and Level 4 Trauma Centers in Greater Minnesota
TS.2)	Enhance rural ambulance services	Support (financially and with training, education and equipment) existing ambulance services in Greater Minnesota
TS.3)	Improve trauma centers in rural Minnesota	Support training and education of hospital staff members in Greater Minnesota in the diagnosis and treatment of trauma and reporting of data elements
TS.4)	Enhance first responder capabilities	Support training of local law enforcement officers in Greater Minnesota
TS.5)	Utilize air support to reduce emergency response times	Explore strategic deployment of air medical transport resources (helicopter and fixed wing) across Minnesota
DPS Highway Safety Plan		
D.1)	Safe & Sober and NightCAP	Special enforcement and paid media to prevent impaired driving, increase seat belt usage and manage speeds
D.2)	Highway Enforcement of Aggressive Traffic	Special enforcement on select corridors to manage speeds, increase seat belt usage and reduce impaired driving
D.3)	Safe Community Coalitions	A number of coalitions are funded to foster local level public support and education efforts that target driver behavior, possibly including impaired driving, crashes involving teens, seat belt use, distracted driving, etc
D.4)	Motorcycle Safety Program	Advance rider training and reverse the growing trend in motorcycle fatalities
D.5)	Law Enforcement, Child Passenger Safety, and Public Health Liaisons	Aid and coordinate local agencies in local enforcement and educational activities
D.6)	Minnesota Child Passenger Safety Program	Provides statewide coordination of training of child safety seat advocates and creation of outreach materials
D.7)	Public Information and Education	Provide educational materials on traffic safety to partners throughout the state as well as media releases to ensure traffic enforcement and other traffic safety activity is visible to the public
D.8)	Monitoring of Drivers with Repeat Impaired Driving Offenses	Support and encouragement for the court systems in Minnesota that are establishing or piloting intensive supervision and/or judicial monitoring of repeat impaired driving offenders to reduce the probability of additional DWI offenses
Traffic Records Coordinating Committee		
T.1)	Hire a project coordinator in DVS for crash data improvements	
T.2)	Publish DVS crash database standards for law enforcement (LE) records management systems set up	
T.3)	Train law enforcement about importance of crash data collection & uses	
T.4)	Build an electronic interface between the DVS crash database and law enforcement records management systems	
T.5)	Build an Impaired Driving Offender Tracking System	



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TABLE 4.2
Education Strategies

Strategy	Source	CEA	Implementation Status	Champion	Goal
Encourage the enactment of a stronger graduated driver licensing system (C.4)	C.4	3	Yellow	DPS - OTS	Effective GDL is enacted.
Create a TZD communications/marketing task force to raise public awareness of traffic crash issues (C.6). In addition to raising public awareness, the task force could take on or support activities in other outreach programs. This may include overseeing the development of a demonstration corridor for heavy vehicle safety (H.7).	C.6. & H.7	1-5	Green - Yellow	DPS - OTS	TZD task force is formed, active, and develops a written communication plan.
Establish a TZD executive panel focused on traffic safety.	C.7	1-5	Yellow-Red	DPS & Mn/DOT	Process for executive participation leading TZD strategic planning is established..
Support the enforcement of traffic safety laws by working with courts to prevent the reduction or dismissal of traffic citations for impaired or aggressive driving.	C.10	1 & 3	Red	DPS & Mn/DOT	OTS collaborates with the judicial system on traffic safety prosecution initiatives.
Revise driver education with stronger mandates to include parent involvement, uniform curriculum, instructor quality control, and enhanced behind-the wheel and classroom instruction. Also improve driver training and licensing material with the addition of traffic safety statistics, stories, and testimonials (C.12). ITS approaches to improve young driving behavior may include in-vehicle monitoring systems or driving simulators (I.6)	C.12 & I.6	3	Yellow - Red	DPS - OTS	OTS keeps abreast of education innovations that have been proven to be effective in reducing teen crashes.
Utilize safe community coalitions to improve driver behavior, including impaired driving, crashes involving young drivers, using seat belts, aggressive drivers, distracted drivers, etc. (D.3). Safe community coalitions may also be used to educate passenger vehicle drivers (whether the general public or high risk groups) on driver safety around heavy vehicles (H.4).	D.3 & H.4	1-5	Yellow	DPS - OTS	Increase the number of data-driven Safe Community Coalitions.

TABLE 4.3
Enforcement Strategies

Strategy	Source	CEA	Implementation Status	Champion	Goal
Provide adequate resources to allow state patrol, county sheriffs, and local police to perform traffic enforcement for speeding, unbelted occupants, and impaired driving (C.1). This may also include promoting the effective and efficient use of law enforcement and inspector resources for enforcement of heavy vehicles (H.1). <i>Note: Also includes data driven enforcement for more efficient and better utilization of current resources.</i>	C.1 & H.1	1 & 3	Yellow	DPS - State Patrol	Increase data driven enforcement.
Encourage the enactment of a statewide primary law that will permit standard enforcement and provide universal coverage to all vehicle occupants (C.2).	C.2	1	Yellow	DPS - OTS	Enact a primary universal seat belt law.
Support and implement automated enforcement (cameras) to deter red-light running and aggressive driving (C.3 & I.2). <i>Note: Until the State Legislature authorizes the use of automated enforcement, agencies need to develop a program and commit necessary resources to traditional enforcement methods.</i>	C.3 & I.2	2	Red	DPS - State Patrol	Strengthen agency partnerships for and improve public and policy makers' perception of and receptiveness to automated enforcement technologies.
Use well publicized saturations and targeted enforcement to deter impaired drivers and aggressive drivers, and increase seat belt use (C.11); this should also include heavy vehicle enforcement using a partnership of State and local resources (H.9). Existing programs include (but are not limited to) <i>Safe & Sober</i> , NightCAP (D.1), and Highway Enforcement of Aggressive Traffic (D.2)	C.11, H.9, & D.1-D.2	1 & 3	Green - Yellow	DPS - State Patrol	Increase agency participation in well-publicized, targeted enforcement saturations.
Support and encouragement for the court systems in Minnesota that are establishing or piloting intensive supervision and/or judicial monitoring of repeat impaired driving offenders to reduce the probability of additional DWI offenses	D.8	1	Yellow	DPS - OTS	Increase court participation in intensive supervised programs or judicial monitoring of repeat DWI offenders.
Conduct training for law enforcement on the importance of crash data collection and it uses (T.3). Develop and distribute a CD-ROM crash data collection training module and support and market it to law enforcement agencies.	T.3	5	Yellow	DPS - OTS	Ensure crash data collection meets reporting criteria and is submitted to DVS in an accurate, complete and timely manner.
Expand quick clearance policies for incidents and allow law enforcement to retrieve data from onboard vehicle computers.	I.2	1-5	Yellow - Red	DPS & Mn/DOT	Collaborate with the Minnesota Trucking Association to gain agreement on incident quick clearance legislation.



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TABLE 4.4
Engineering Strategies

Strategy	Source	CEA	Implementation Status	Champion	Goal
Utilize low cost safety improvements for lane departure crashes, including: installation of median barriers for narrow-width medians on multilane roads (including consideration of four-cable median barriers which may successfully stop heavy vehicles); addition of shoulder, edgeline or centerline rumble strips; enhance delineation of sharp curves and unexpected changes in horizontal alignment; enhance pavement markings; eliminate shoulder drop-offs (i.e., widen shoulders, pave shoulders, add safety wedge); delineate roadside objects; and construct truck pull-off areas for driver and vehicle inspections.	C.5, H.2, & H.5	4	Yellow - Red	Mn/DOT - OTSO & MCEA Safety Council	Invest 30% of available funds statewide on proactive lane departure strategies.
Make low-cost geometric improvements at intersections, including: provide left or right turn lanes; utilize offset turn lanes; lengthen turn lanes to provided sufficient length to accommodate deceleration and queuing; add left and right turn acceleration lanes, provide by-pass lanes at T-intersections, install splitter islands on the minor-road approach to improve visibility of an intersection; use curb extensions to allow stop sign to be moved closer to road (to make more visible, especially if on-street parking is allowed); utilize indirect left turn treatments (i.e., J-turn); and improve sight distance at intersections (i.e., clearing sight triangles on approaches and in medians, and eliminate on street parking that restricts sight distance).	C.8, M.1, M.6, & M.2	2	Yellow - Red	Mn/DOT - OTSO & MCEA Safety Council	Invest 15% of available funds statewide on proactive geometric improvements for intersections.
Make low-cost improvements to increase driver awareness of intersections, including: install or enhance intersection lighting; install larger regulatory and warning signs; use freeway style guide signs along high-speed expressways; provide supplementary stop signs; provide a stop bar (or wider stop bar) on the minor road approach; provide pavement markings with supplementary messages, such as STOP AHEAD; add double yellow centerline at intersections and at median openings; provide dashed markings (extended left edgelines) for major roadway continuity at divided highway intersections; install red flashing beacons on stop signs; deploy mainline dynamic flashing beacons to warn drivers of entering traffic; install advance warning flashers to inform drivers of a need to stop at high-speed signalized intersections, and install rural intersection warning and decision support systems.	C.8, M.2, & I.5	2	Yellow - Red	Mn/DOT - OTSO & MCEA Safety Council	Invest 15% of available funds statewide on proactive intersection awareness strategies.
Perform proper maintenance of roadway facilities, including: improve roadside hardware; remove and relocate objects in hazardous locations; enhance winter storm maintenance (pre-treating and increasing number of snow plows); maintain gravel shoulders; keep roadways in construction zones free of loose debris; and maintain pavement marking lines (C.9). An extension would be to review work zones (traffic management plans or actual construction site) to better accommodate heavy vehicles and provide advanced warning so drivers can select alternative routes (H.8).	C.9 & H.8	4	Yellow	Mn/DOT - OTSO, MCEA Safety Council, & LRRB	Develop and roll out training course for Mn/DOT, county, and city maintenance staff.
Perform road safety audits at the network level.	C.13	2 & 4	Green - Yellow	Mn/DOT - OTSO & MCEA Safety Council	Increase number of road safety audits with a focus on the network (i.e., sections).
Improve access management by: implement driveway closures and relocations; implement driveway turn restrictions; restrict cross median access near intersections; and restrict or eliminate turning maneuvers by signing, providing channelization or closing median openings.	M.3	2	Green - Yellow	Mn/DOT - OTSO & MCEA Safety Council	Utilize Mn/DOT manual in decision making.
Create partnerships with law enforcement agencies to facilitate red-light running enforcement by first assisting in the identification of locations with a history of red-light running violations and then supporting traditional red-light running enforcement with the installation of confirmation lights on the back side of mast arms (M.4). <i>Note: Roadway agencies could make confirmation lights a standard feature in signal design to facilitate widespread and cost effective deployment.</i>	M.4	2	Red	Mn/DOT - OTSO	Adopt as a standard for signal installation and implement at 50 intersections.
Reduce frequency and severity of intersection conflicts through traffic signal control and operational improvements. This may include: employ multiphase signal operation; optimize clearance intervals; restrict or eliminate turning maneuvers (including right turns on red); employ signal coordination; improve operation of pedestrian and bicycle facilities at signalized intersections (i.e., countdown heads)	M.5	2	Green - Yellow	Mn/DOT, County, and City Engineers	Maintain and increase programs which evaluate and optimize signal operations.
Improve infrastructure systems and signage, including: expand work zone safety systems; implement variable speed limit signs; expand the use of dynamic message signs to provide location based, real-time information to drivers; research use of graphics (and text) for dynamic message sign messages; expand geographic coverage of the RTMC systems; and integrate reporting systems across state and local borders.	I.4	2, 4 & 5	Yellow	Mn/DOT - OTSO	Develop ITS Work Zone contract and implement multiple ITS safety strategies.
Proactively incorporate low-cost safety project into preservation projects (i.e., Project Safety Review [PSR] checklist).	New	2 & 4	Yellow - Red	Mn/DOT - OTSO	Implement PSR on all preservation projects.



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TABLE 4.5
EMS Strategies

Strategy	Source	CEA	Implementation Status	Champion	Goal
Implement a statewide trauma system (C.15). A component of this may include verify additional Level 3 and Level 4 Trauma Centers in Greater Minnesota (TS.1), support existing ambulance services in Greater Minnesota (TS.2), support training and education of hospital staff in Greater Minnesota, and create an on-line database to coordinate emergency responder databases (I.2).	C.15, TS.1, TS.2, TS.3 & I.2	1-5	Yellow	MDH	100% participation by all hospital trauma centers.
In order to reduce emergency response time, provide common location information and communication standards to assist emergency responders in quickly and efficiently locating crash or other road safety related incidents. <i>Note: For example, Mn/DOT's 511 system could be modified to add features that allow EMTs access to information and assistance on route selection to the crash scene and from the crash scene to the best hospital given the level of trauma.</i>	I.2	1-5	Red	MDH and Mn/DOT	Provide improved location and routing information by 2010.
Improve emergency trauma response by supporting training of local law enforcement officer in Greater Minnesota (TS.4) and exploring strategic deployment of air medical transport resources (helicopter and fixed wing) across Minnesota.	TS.4 & TS.5	1-5	Yellow - Red	MDH and EMSRB	Develop a comprehensive, statewide trauma training plan for first responders (by 2008); train 20% of each region's first responders each year, and plan to repeat the cycle in five years. Develop a plan for air resource deployment involving payers, providers, and patients (by 2009).
Equip all law enforcement vehicles with Automatic External Defibrillators.	New	1-5	Yellow	DPS - State Patrol	Equip all State Patrol vehicles by 2008. Support equipping all law enforcement squads.

TABLE 4.6
Technology Strategies

Strategy	Source	CEA	Implementation Status	Champion	Goal
Explore in-vehicle based safety systems, such as ignition interlock system, real-time information and warnings to drivers, and other emerging technologies to prevent crashes, driver distraction, etc.	I.1	1 - 5	Yellow - Red	Mn/DOT & DPS	Pilot test and evaluate systems by 2010.
Implement vehicle infrastructure integration systems with improved lane/route guidance systems and develop vehicle-to-vehicle and vehicle-to-infrastructure communication.	I.3	1 - 5	Yellow - Red	Mn/DOT - OTSO	Develop and test pilot program by 2010.

TABLE 4.7
Data System Strategies

Strategy	Source	CEA	Implementation Status	Champion	Goal
<p>Improve data systems by providing adequate staffing, equipment and other resources to meet the identified goals. In addition, consult system users when changes are being planned and implemented. Furthermore, organize an oversight committee to coordinate all agencies involved in the collection, management, and use of highway safety data. (C.14). Develop within the Traffic Records Coordinating Committee a strategic plan and implement identified projects which include:</p> <ul style="list-style-type: none"> • Fund a project coordinator in DVS for crash data improvements (T.1). • Publish DVS crash database standards for law enforcement (LE) records management systems set up (T.2). • Build an electronic interface between the DVS crash database and law enforcement records management systems (T.4). • Build an Impaired Driving Offender Tracking System (T.5). 	C.14, T.1, T.2, T.4, & T.5	5	Yellow	DPS – DVS & OTS	Reinvigorate and expand the TRCC, adopt a Traffic Safety Information Systems Strategic Plan, and begin implementation of high priority projects such as those listed under "Strategy."
Provide carriers with automatic notification of driving convictions for any driver that works for them (H.6) and improve accuracy, availability and completeness of heavy vehicle data to support heavy vehicle problem identification and program evaluation.	H.6 & H.10	5	Red	DVS	Develop and test pilot program by 2010.



5. Minnesota SHSP – A Living Document

The Minnesota SHSP is a Living Document, which means that periodic reviews will be needed to ensure the Plan is current. Suggestions on implementing, post project evaluation, revising, and report follow.

5.1 Process for Implementing

Implementation of the Minnesota SHSP will be completed through the numerous Minnesota agencies that have a role in traffic safety. In order to provide coordination across agencies and help build partnerships, initiatives will be discussed and worked out in more detail through the TZD program. The TZD program is a multi-disciplinary model structure and network already in place that can be accessed in order to address many issues. For example, the TZD Steering Committee is expected to take a leadership role in oversight of the implementation of the Minnesota SHSP. Furthermore, smaller tasks teams can be formed from TZD members on a “as needed” basis to develop integrated and coordinated action plans.

The funding for safety projects will come from a number of different sources, including the FHWA HSIP funds administered by Mn/DOT, the various NHTSA funds (Section 402, etc.) administered by the DPS, and the Motor Carrier Safety Assistance funds administered by the State Patrol, and the Central Safety fund which are funded through the Section 164 transfer penalty. Each agency will be responsible for following the planning and programming process required by its federal counterpart.

In addition to the implementation of the safety projects and programs that occur as a direct result of the Minnesota SHSP, many agencies are improving traffic safety through their normal course-of-work – sometimes referred to as nominal safety. Examples of nominal safety improvements include reconstructing roads and highways to improved standards and guidelines, law enforcement agencies conducting traditional traffic enforcement, or conventional driver training courses and materials directed towards novice drivers. While this is a necessary element to an overall plan to reduce fatalities and serious injuries on Minnesota’s streets and highways, this sort of implementation is not addressed within this plan. Instead, the Minnesota SHSP has a focus on implementation of strategies intended to address a specific safety problem – known as substantive safety. Example implementation of substantive safety programs are widespread deployment of centerline and shoulder/edgeline rumble strips; special and high-visibility, targeted enforcement programs for speeding, impaired drivers, or seat belt use; and enacting an graduated driver licensing program with enhanced provisions.

5.2 Process for Post Project Evaluation

After the completion of the SHSP, the Interagency Work Group will continue to meet regularly to set priorities for and to oversee implementation of the safety program. This group can also direct and advise the members of the implementation task teams. Individual projects will be selected to further the goals of the SHSP and a responsible agency will be assigned to each new project. This responsible agency will be accountable for implementation of the project,



reporting on the progress of the project at future Interagency Working Group meetings, and performing an evaluation of the effectiveness of the project.

Since Mn/DOT is responsible for preparation and maintenance of the Minnesota SHSP, all findings from formal evaluation (especially any project receiving HSIP funding) will be cataloged by the Department in order to create a project clearinghouse. Evaluation results will guide the Working Group and task teams in making future project programming and implementation.

5.3 Process for Revising

It is expected that the Interagency Executive Committee will be responsible for providing guidance and direction in future updates while the Interagency Working Group will execute the update. Since time will be needed to implement and evaluate projects, major updates to the Minnesota SHSP are not expected to be an annual process. Some of the areas that may be updated in future plans are described in the following paragraphs.

The importance of the selected CEAs may decrease in the future, especially if implementation has successful and lasting impacts. For this reason, the update process for the SHSP should begin with the CEAs. The simplest and first review should be of the fatal and serious injury crash records (**Table 3.1**). If this analysis supports the existing CEAs, then no additional efforts may be needed. However, if the data points towards a change in the CEAs, then several methodologies for selecting the new CEAs are available (including a combination of methodologies).

- Priority given to emphasis areas with the greatest number of fatalities and serious injuries
- Interview agencies using the AASHTO Self-Assessment
- Stakeholder input through a workshop
- Discussion and decision made by the Interagency Executive Committee and Interagency Working Group.

If new CEAs are selected, the Critical Strategies have not been reviewed for several years, or evaluation process finds that the Critical Strategies are no longer effective, then an effort to update the Critical Strategies will be needed. In updating the Critical Strategies, one of the most important elements is to attain stakeholder input into the process.

Since the Minnesota SHSP coordinates the numerous safety plans prepared by agencies, updates to the Plan will be needed if the various agency plans have significant change.

5.4 Process for Reporting

Mn/DOT will report annually to FHWA on the HSIP. This will include types of projects initiated, funds expended, and any evaluation results that are available.

6. Implementation Guidance for Area Transportation Partnerships

Following the publication of the Minnesota CHSP in December, 2004, Mn/DOT began working on the next phase of the highway safety improvement process – implementation of the highest priority strategies. In Mn/DOT’s decentralized organization, project prioritization, development and implementation is the responsibility of the eight Districts, with the assistance of the Area Transportation Partnerships (groups formed to assist Mn/DOT with project review and prioritization and made up of representatives of cities, counties and MPO staff within each of the Districts).

As the Districts and the ATPs began their efforts working towards implementation, two key questions arose.

- First, we understand the statewide crash data, but are the data for our District similar?
- Second, we understand the statewide prioritized safety strategies, but what are the highest priorities in our District?

In response to these questions, a new process was developed for analyzing the statewide crash data (**Figure 6.1**). This process consisted of the following six steps and resulted in identifying a prioritized list of safety strategies for every Mn/DOT District that is a subset of the original list of 15 Critical Strategies identified in the Minnesota CHSP.

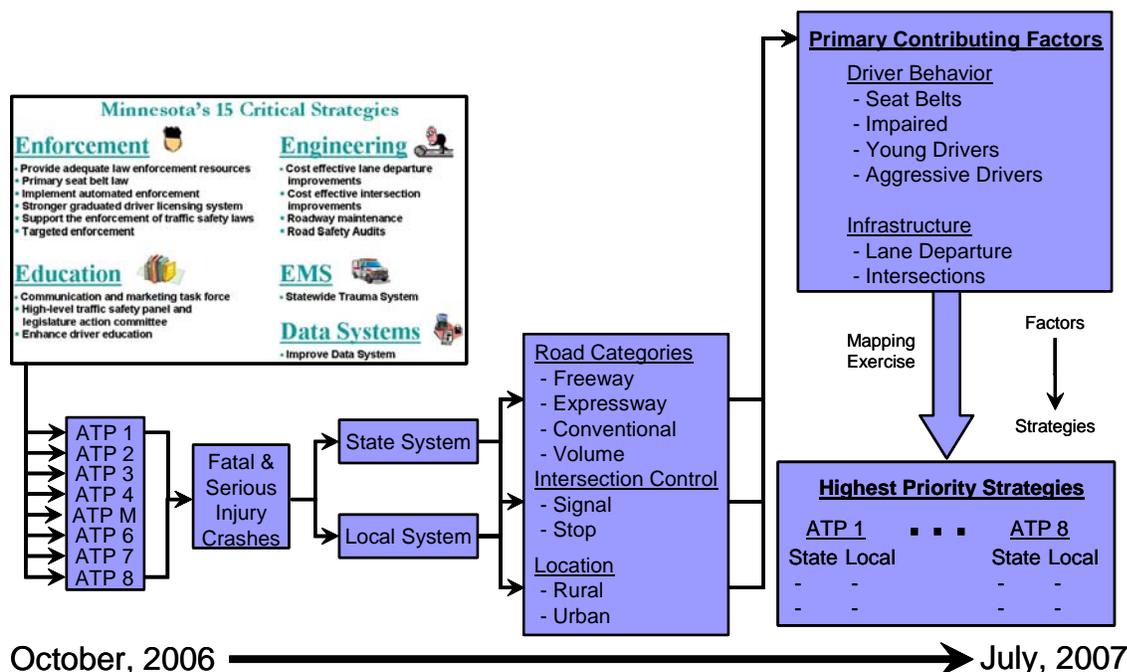


FIGURE 6.1
Process for Analyzing District/ATP Crash Data

1. Disaggregating the statewide crash database by District/ATP.
2. Screening the crash database in order to focus on the fatal and serious injury crashes.
3. Disaggregating the subset of serious crashes by the road system – State vs. Local.
4. On the State system, disaggregating the crash data by location (rural vs. urban) and facility type (freeway, expressway, multi-lane and 2-lane conventional). Note: This effort was limited to the State system because the equivalent facility type information is not currently available for roadways on the local system.
5. Documenting the primary factors that contributed to the most severe crashes.
6. And finally, conducting a mapping exercise that relates the contributing factors to the most effective safety strategies.

A summary of the fatalities and serious injuries by District/ATP is documented in **Table 6.1**. This data leads to two key conclusions. First, there is a need to direct safety resources to the seven Greater Minnesota Districts where almost 70% of the fatalities and over 50% of the serious injury crashes occur. And second, there is a need to direct safety resources to the local road system where almost 50% of the fatalities and 70% of the serious injuries occur.

The key results of the application of the model analytical process are summarized in the following sections and the complete information for each District is included in Appendix IV.

TABLE 6.1
Fatalities and Serious Injuries by ATP (2001 – 2005)

	ATP								
	Statewide	1	2	3	4	6	7	8	Metro
Number of Fatalities	3,008	310	174	581	218	368	205	207	945
State Road System	1,554 (52%)	176 (57%)	78 (45%)	280 (48%)	118 (54%)	217 (59%)	112 (55%)	108 (52%)	465 (49%)
Local Road System	1,454 (48%)	134 (43%)	96 (55%)	301 (52%)	100 (46%)	151 (41%)	93 (45%)	99 (48%)	480 (51%)
Number of Serious Injuries	12,158	828	425	1,662	704	1,373	664	712	5,790
State Road System	3,640 (30%)	359 (43%)	179 (42%)	551 (33%)	243 (35%)	456 (33%)	222 (33%)	267 (38%)	1,363 (24%)
Local Road System	8,518 (70%)	469 (57%)	246 (58%)	1,111 (67%)	461 (65%)	917 (67%)	442 (67%)	445 (62%)	4,427 (76%)
Fatalities + Serious Injuries	15,166	1,138	599	2,243	922	1,741	869	919	6,735
State Road System	5,194 (34%)	535 (47%)	257 (43%)	831 (37%)	361 (39%)	673 (39%)	334 (38%)	375 (41%)	1,828 (27%)
Local Road System	9,972 (66%)	603 (53%)	342 (57%)	1,412 (63%)	561 (61%)	1,068 (61%)	535 (62%)	544 (59%)	4,907 (73%)

6.1 Analysis of the State Trunk Highway System

6.1.1 Identification of Priority Facility Types

The priority facility types on the State Trunk Highway (STH) system for the individual Mn/DOT Districts is documented in **Table 6.2**. This breakdown was based on individual District specific data and determined using the total number of fatal and serious injury crashes, crash rate, severity rate, fatal crash rate and crash density on the system of Mn/DOT's standard facility types – rural and urban freeways, expressways, multi-lane conventional and two-lane conventional highways. A similar summary for the Greater Minnesota Districts (**Table 6.3**) and Metro District (**Table 6.4**) illustrate the differences between the predominately rural districts and the Metro urban area.



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TABLE 6.2
Priority Facility Types by District – State System Only

Facility Type	District								
	1	2	3	4	6	7	8	M	
Freeway	✓ (6)		✓ (16)	✓ (8)	✓ (18)	✓ (6)		✓ (22)	
4-lane Expressway	✓ (9)	✓ (1)	✓ (24)		✓ (6)	✓ (7)		✓ (17)	
4-Lane Undivided									
Rural 4-Lane Divided Conventional (Non expressway)			✓ (5)		✓ (2)		✓ (4)		
ADT < 1,500	✓ (15)	✓ (7)	✓ (8)	✓ (6)		✓ (14)	✓ (6)		
2-Lane 1,500 ≤ ADT < 5,000	✓ (14)	✓ (15)	✓ (23)	✓ (12)	✓ (13)	✓ (7)	✓ (19)		
5,000 ≤ ADT < 8,000	✓ (4)		✓ (12)	✓ (6)	✓ (12)		✓ (4)	✓ (8)	
ADT ≥ 8,000			✓ (18)					✓ (17)	
Freeway								✓ (43)	
4-lane Expressway		✓ (1)	✓ (0)	✓ (1)				✓ (17)	
4-Lane Undivided								✓ (2)	
4-Lane Divided Conventional (Non expressway)					✓ (6)			✓ (3)	
Urban Three-Lane									
Five-Lane									
ADT < 1,500									
2-Lane 1,500 ≤ ADT < 5,000									
5,000 ≤ ADT < 8,000					✓ (7)				
ADT ≥ 8,000								✓ (6)	

✓ - Facility Types selected as a priority within each District.

(#) – Number of fatal crashes that occurred on the facility type during 2004-2005.



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TABLE 6.3
Priority Facility Types for Greater Minnesota Districts – State System Only

Facility Type	Miles	Crashes		Crash Rate	Severity Rate	Fatal Rate	Crash Density	Priority
		Fatal	Serious Injury					
Freeway	702	54	77	0.6	0.8	0.6	3.7	✓
4-Lane Expressway	712	49	94	0.8	1.2	0.8	3.5	✓
4-Lane Undivided	27	0	4	0.9	1.4	0.0	2.5	
4-Lane Divided Conventional (Non expressway)	123	11	24	1.2	1.9	1.2	4.4	
Rural ADT < 1,500	3,774	48	74	0.8	1.4	1.9	0.3	✓
2-Lane 1,500 ≤ ADT < 5,000	3,916	110	185	0.7	1.2	1.4	0.7	✓
2-Lane 5,000 ≤ ADT < 8,000	583	45	52	0.9	1.4	1.7	2.0	✓
ADT ≥ 8,000	198	24	35	0.9	1.4	1.5	3.5	✓
Sub Total	10,034	341	545					
Freeway	21	2	7	1.4	1.9	0.3	21.3	
4-Lane Expressway	41	4	19	2.4	3.5	0.9	12.6	
4-Lane Undivided	43	1	20	3.9	5.6	0.3	16.9	
4-Lane Divided Conventional (Non expressway)	66	8	45	3.3	5.1	1.2	17.6	
Urban Three-Lane	30	0	10	2.8	3.8	0.0	10.1	
Five-Lane	12	2	4	2.8	3.9	1.6	13.7	
ADT < 1,500	81	1	4	1.9	3.0	1.8	0.7	
2-Lane 1,500 ≤ ADT < 5,000	238	0	22	2.1	3.0	0.0	2.4	
2-Lane 5,000 ≤ ADT < 8,000	111	10	19	2.0	2.8	1.9	4.6	
ADT ≥ 8,000	75	5	19	2.6	3.7	0.8	10.5	
Sub Total	718	33	169					

Source: 2004-2005 Minnesota Crash Data.

Shaded cells indicate totals that are noticeably greater than other facility types — first priority on number of fatal and serious injury crashes.



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TABLE 6.4
Priority Facility Types for Metro District – State System Only

Facility Type	Miles	Crashes		Crash Rate	Severity Rate	Fatal Rate	Crash Density	Priority
		Fatal	Crashes					
Rural								
Freeway	122	22	24	0.6	0.9	0.5	11.1	✓
4-Lane Expressway	111	17	65	1.0	1.5	0.7	10.3	✓
4-Lane Undivided	0	0	0	2.5	3.1	0.0	14.8	
4-Lane Divided Conventional (Non expressway)	1	0	0	1.3	2.0	0.0	9.2	
ADT < 1,500	13	0	2	0.0	0.0	0.0	0.5	
2-Lane 1,500 ≤ ADT < 5,000	89	5	8	1.0	1.5	2.0	1.3	
2-Lane 5,000 ≤ ADT < 8,000	98	8	18	1.2	2.0	1.8	2.7	✓
ADT ≥ 8,000	137	17	33	1.3	2.0	1.2	6.9	✓
Sub Total	571	69	150					
Urban								
Freeway	267	43	128	1.2	1.6	0.2	41.7	✓
4-Lane Expressway	124	17	81	1.9	2.7	0.5	23.9	✓
4-Lane Undivided	20	2	25	5.8	7.8	0.7	41.3	✓
4-Lane Divided Conventional (Non expressway)	21	3	19	5.0	6.8	0.9	38.6	✓
Three-Lane	9	0	2	3.1	4.3	0.0	16.8	
Five-Lane	2	0	3	5.6	8.8	0.0	52.4	
ADT < 1,500	1	0	0	4.0	6.3	0.0	2.1	
2-Lane 1,500 ≤ ADT < 5,000	9	0	0	2.8	3.9	0.0	3.7	
2-Lane 5,000 ≤ ADT < 8,000	26	2	2	2.3	3.3	1.6	5.5	
ADT ≥ 8,000	54	6	20	3.0	4.2	1.1	15.6	✓
Sub Total	533	73	280					

Source: 2004-2005 Minnesota Crash Data.

Shaded cells indicate totals that are noticeably greater than other facility types — first priority on number of fatal and serious injury crashes.

This data leads to the following key conclusions:

- The data for the Greater Minnesota Districts is very similar – over 90% of the fatal and 75% of the injury crashes are on facilities designated as rural.
- In the Greater Minnesota Districts, the two-lane conventional roads are the part of the State system most at risk based on having two-thirds of the fatal crashes. (A further breakdown by daily traffic volume category was inconclusive – the lowest volume category had the highest fatal crash rate, the middle volume category had the highest number of fatal and serious injury crashes and the highest volume category had the highest crash density.)
- Risk and opportunity are based on numbers of fatal and serious injury crashes, not crash severity or fatal crash rate. As a result, because of the total number of fatal crashes, rural freeway and expressway facility types are also designated as priorities.
- In the Greater Minnesota Districts, over 85% of all fatal crashes are on the identified priority facility types.
- The crash data in the Metro District is sufficiently differently distributed than in the Greater Minnesota Districts such that it should be considered separately. This data also indicates that urban and rural freeways and expressways represent the greatest opportunities based on the highest number of fatal and serious injury crashes.
- In the Greater Minnesota Districts, the high mileage of all rural facility types (10,034) combined with a fairly low number of fatal crashes annually (170) and crash densities that are generally less than one-half of those in the Metro District suggests a need to focus on a more proactive approach to implementation.
- In the Metro District, a much lower number of miles (1,104) and much higher crash densities suggest a need to focus on a more reactive approach to implementation.

6.1.2 Ranking of the Priority Facility Types within each CEA by District

For each district, the number of fatal and serious injury crashes was compiled by CEA for each priority facility type. This was used to rank the priority facility types. A description of this process and the ranking results for the individual districts are included in Appendix IV. A summary of the ranking results for the Greater Minnesota Districts is provided in **Table 6.5** and the Metro District is summarized in **Table 6.6**.

A summary of the District rankings of the priority facility types (**Table 6.7**) reveals that some of the greatest priorities for the STH system in Minnesota include:

Rural Facilities

- Freeways – Head-On and Road Departures
- Expressways – Intersections and Head-On
- 2-Lane Roads – Intersections, Head-On, and Road Departures

Urban Facilities

- Freeways – Head-On and Road Departures
- Expressways – Intersections, Head-On, and Road Departures
- 2-Lane Roads – Head-On

TABLE 6.5
Priority Facility Type Rankings for the Greater Minnesota Districts by CEAs – State System Only

Priority Facility Type	Fatal Crashes						
	Alcohol-Related	Unbelted Veh. Occupant	Under the Age of 21	Speeding-Related	Intersection	Head-on and Sideswipe	Single Vehicle ROR
Rural							
Freeway	17	54	30	60	32	25	67
4-Lane Expressway	17	47	36	30	84	19	30
Multi-Lane Subtotal	34	101	66	90	116	44	97
2-Lane Conventional: ADT < 1,500	37	44	20	36	45	11	54
2-Lane Conventional: 1,500 ≤ ADT < 5,000	52	101	72	57	103	102	59
2-Lane Conventional: 5,000 ≤ ADT < 8,000	20	36	18	32	36	41	23
2-Lane Conventional: ADT ≥ 8,000	7	10	6	9	16	16	4
2-Lane Conventional Subtotal	116	191	116	134	200	170	140
Rural Subtotal	150	292	182	224	316	214	237
TOTAL	150	292	182	224	316	214	237

Priority Facility Type	Fatal + Serious Injury Crashes						
	Alcohol-Related	Unbelted Veh. Occupant	Under the Age of 21	Speeding-Related	Intersection	Head-on and Sideswipe	Single Vehicle ROR
Rural							
Freeway	46	105 ✓✓	72 ✓	144 ✓✓	95	41 ✓	161 ✓✓
4-Lane Expressway	50 ✓	98	101 ✓✓	66	224 ✓✓	32	87
Multi-Lane Subtotal	96	203	173	210	319	73	248
2-Lane Conventional: ADT < 1,500	112 ✓✓	102 ✓	70	85 ✓	122 ✓✓	41 ✓	150 ✓
2-Lane Conventional: 1,500 ≤ ADT < 5,000	164 ✓✓✓	234 ✓✓✓	211 ✓✓✓	152 ✓✓✓	317 ✓✓✓	201 ✓✓✓	221 ✓✓✓
2-Lane Conventional: 5,000 ≤ ADT < 8,000	42	70	62	69	108	82 ✓✓	53
2-Lane Conventional: ADT ≥ 8,000	19	34	28	16	70	31	18
2-Lane Conventional Subtotal	337	440	371	322	617	355	442
Rural Subtotal	433	643	544	532	936	428	690
TOTAL	433	643	544	532	936	428	690

Source: 2004-2005 Minnesota Crash Data.

✓ - Additional checkmarks represent a higher priority. Refer to Appendix IV for description of the ranking process.

6.1.3 Mapping Exercise – Priority Facility Types to Contributing Factors to Safety Strategies

The primary objective of this analytical effort is to provide each District/ATP with insight regarding the identification of their highest priority safety strategies. The analysis started with identifying the priority facility types and then the primary factors contributing for fatal and serious injury crashes in each District. The analysis ends with the identification of the safety strategies that are most directly linked to mitigating the factors leading to the severe crashes. While general countermeasures for each district are provided in **Table 6.7**, more specific recommendations for each District are available in Appendix IV. The recommendations are for the infrastructure countermeasures originally included in the Minnesota CHSP; and does not included the new strategies incorporated into the Minnesota SHSP from the various safety plans and programs in Minnesota. Based on the analysis, some of the highest engineering priorities for the STH system include:



Rural Facilities

- Freeways – Median Barriers and Edge Treatments
- Expressways – Intersection Improvements and Median Barriers
- 2-Lane Roads – Intersection Improvements, Median Barriers, and Edge Treatments

Urban Facilities

- Freeways – Median Barriers and Edge Treatments
- Expressways – Intersection Improvements, Median Barriers, and Edge Treatments
- 2-Lane Roads – Median Barriers

TABLE 6.6
Priority Facility Type Rankings for the Metro District by CEAs – State System Only

Priority Facility Type	Fatal Crashes						
	Alcohol-Related	Unbelted Veh. Occupant	Under the Age of 21	Speeding-Related	Intersection	Head-on and Sideswipe	Single Vehicle ROR
Rural							
Freeway	6	19	12	20	11	6	20
4-Lane Expressway	6	15	9	7	31	4	4
Multi-Lane Subtotal	12	34	21	27	42	10	24
2-Lane Conventional: 5,000 ≤ ADT < 8,000	3	7	7	6	13	8	5
2-Lane Conventional: ADT ≥ 8,000	3	14	12	9	16	23	1
2-Lane Conventional Subtotal	6	21	19	15	29	31	6
Rural Subtotal	18	55	40	42	71	41	30
Urban							
Freeway	42	33	21	71	73	9	50
4-Lane Expressway	8	12	10	8	34	7	6
4-Lane Undivided	3	0	0	0	3	0	0
4-Lane Divided Conventional (Non expressway)	2	1	3	1	6	0	1
Multi-Lane Subtotal	55	46	34	80	116	16	57
2-Lane Conventional: ADT ≥ 8,000	2	4	3	2	8	5	1
2-Lane Conventional Subtotal	2	4	3	2	8	5	1
Urban Subtotal	57	50	37	82	124	21	58
TOTAL	75	105	77	124	195	62	88

Priority Facility Type	Fatal + Serious Injury Crashes						
	Alcohol-Related	Unbelted Veh. Occupant	Under the Age of 21	Speeding-Related	Intersection	Head-on and Sideswipe	Single Vehicle ROR
Rural							
Freeway	19 ✓	37 ✓	28 ✓	42 ✓✓	35 ✓	8	50 ✓✓
4-Lane Expressway	26 ✓✓	38 ✓✓	45 ✓	32	152 ✓	12	30
Multi-Lane Subtotal	45	75	73	74	187	20	80
2-Lane Conventional: 5,000 ≤ ADT < 8,000	11	14	19 ✓	10	32 ✓	17 ✓	17
2-Lane Conventional: ADT ≥ 8,000	17	27 ✓	32 ✓	25 ✓	55 ✓	43 ✓✓✓	7
2-Lane Conventional Subtotal	28	41	51	35	87	60	24
Rural Subtotal	73	116	124	109	274	80	104
Urban							
Freeway	123 ✓✓✓	87 ✓✓✓	88 ✓✓✓	166 ✓✓✓	244 ✓✓✓	28 ✓✓✓	150 ✓✓✓
4-Lane Expressway	54 ✓✓✓	39 ✓✓✓	57 ✓✓✓	48 ✓✓✓	220 ✓✓✓	17 ✓✓	31 ✓✓
4-Lane Undivided	17 ✓	6	16	8	63 ✓	13	6
4-Lane Divided Conventional (Non expressway)	7 ✓	3 ✓	16	4	49 ✓	3	4 ✓
Multi-Lane Subtotal	201	135	177	226	576	61	191
2-Lane Conventional: ADT ≥ 8,000	10 ✓	11 ✓	17 ✓	13 ✓	53	13 ✓	2 ✓
2-Lane Conventional Subtotal	10	11	17	13	53	13	2
Urban Subtotal	211	146	194	239	629	74	193
TOTAL	284	262	318	348	903	154	297

Source: 2004-2005 Minnesota Crash Data.

✓ - Additional checkmarks represent a higher priority. Refer to Appendix IV for description of the ranking process.



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TABLE 6.7
Priority Rankings for Facility Types by District – State System Only

Priority Facility Types	CEA / General Safety Countermeasures	District / ATP							
		1	2	3	4	6	7	8	Metro
Rural									
Freeway	Head-On and Sideswipe / Median Barriers			✓	✓	✓✓	✓		
	Single Vehicle Run-off Road / Edge Treatments	✓			✓	✓✓✓	✓✓		✓✓
4-Lane Expressway	Intersection / Intersection Improvements	✓✓	✓	✓✓✓		✓✓✓	✓✓		✓
	Head-On and Sideswipe / Median Barriers	✓✓✓							
	Single Vehicle Run-off Road / Edge Treatments		✓	✓		✓	✓		
4-Lane Divided Conventional	Intersection / Intersection Improvements					✓		✓✓	
	Head-On and Sideswipe / Median Barriers							✓	
	Single Vehicle Run-off Road / Edge Treatments			✓				✓	
2-Lane	Intersection / Intersection Improvements	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓
	Head-On and Sideswipe / Centerline Treatments	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
	Single Vehicle Run-off Road / Edge Treatments	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Urban									
Freeway	Head-On and Sideswipe / Median Barriers								✓✓✓
	Single Vehicle Run-off Road								✓✓✓
4-Lane Expressway	Intersection / Intersection Improvements				✓				✓✓✓
	Head-On and Sideswipe / Median Barriers		✓						✓✓
	Single Vehicle Run-off Road / Edge Treatments								✓✓
4-Lane Undivided Conventional	Intersection / Intersection Improvements								✓
	Head-On and Sideswipe / Centerline Treatments								
	Single Vehicle Run-off Road / Edge Treatments								
4-Lane Divided Conventional	Intersection / Intersection Improvements			✓✓		✓✓			✓
	Head-On and Sideswipe / Median Barriers					✓			
	Single Vehicle Run-off Road / Edge Treatments			✓		✓			✓
2-Lane	Intersection / Intersection Improvements					✓			
	Head-On and Sideswipe / Centerline Treatments					✓✓			✓
	Single Vehicle Run-off Road / Edge Treatments								✓

✓ - Additional checkmarks represent a higher priority.

6.2 Analysis of the Local Road System

6.2.1 Data Analysis

The fatal and serious injury crash information could not be analyzed by facility type (i.e., freeway, expressway, two-lane, etc.) for the local road system. Instead, the analysis focused on identifying the number of fatalities and serious injuries by CEA within each county. Also, the number of fatalities and serious injuries were determined for the local road system separately from the STH system. A summary of the local road analysis for each ATP is provided in **Table 6.8** while more complete information for individual ATPs and the counties that make up the ATPs is in Appendix IV.

TABLE 6.8
Fatalities for the CEAs by ATP and Jurisdiction

Emphasis Area	Statewide	ATP							
		1	2	3	4	6	7	8	Metro
Driver Behavior									
Unbelted Vehicle Occupant	1,271	145	95	265	105	168	86	104	303
<i>State Road System</i>		80	43	124	56	87	43	43	162
<i>Local Road System</i>		65	52	141	49	81	43	61	141
Alcohol-Related	1,068	117	72	232	98	108	57	60	324
<i>State Road System</i>		53	25	87	43	38	24	14	167
<i>Local Road System</i>		64	47	145	55	70	33	46	157
Speeding Driver	850	77	33	146	72	124	43	51	304
<i>State Road System</i>		40	16	63	37	62	23	21	145
<i>Local Road System</i>		37	17	83	35	62	20	30	159
Young Driver Involved	718	66	30	144	57	89	46	55	231
<i>State Road System</i>		30	15	59	33	40	20	27	103
<i>Local Road System</i>		36	15	85	24	49	26	28	128
Infrastructure									
Single Vehicle ROR	965	121	64	191	94	142	62	67	224
<i>State Road System</i>		57	15	71	34	68	20	17	108
<i>Local Road System</i>		64	49	120	60	74	42	50	116
Intersection	1004	81	65	182	70	99	75	86	347
<i>State Road System</i>		47	36	88	41	66	38	44	126
<i>Local Road System</i>		34	29	94	29	33	37	42	221
Head-on	611	56	27	135	40	78	37	51	188
<i>State Road System</i>		40	22	79	28	50	31	45	112
<i>Local Road System</i>		16	5	56	12	28	6	6	76

In order to provide additional guidance to assist the ATPs in their efforts to prioritize safety projects for the local road system, the CEAs were ranked (based on number of fatalities) for each ATP (**Table 6.9**). This suggests a relative priority – addressing seat belts, alcohol, and road departure crashes in the Greater Minnesota Districts and intersections, alcohol and speeding in the Metropolitan District.

6.2.2 Mapping Contributing Factors to Safety Strategies

As previously explained, the crash problems identified were mapped to the infrastructure strategies in the Minnesota CHSP to aid ATPs in prioritizing projects for funds intended for engineering improvements. Prioritized strategies for each ATP are located in Appendix IV, but the general recommendation for the Greater Minnesota ATPs is a focus on intersection improvements and treatments along the edge of the travel way to prevent run-off the road crashes. In the Metro ATP, local agencies should take a strong focus on intersection improvements in order to reduce the number of fatalities and serious injuries.

TABLE 6.9
Ranking of the CEAs for the Local Road System within each ATP

Emphasis Area	Statewide	ATP							
		1	2	3	4	6	7	8	Metro
Driver Behavior									
Unbelted Vehicle Occupant	1	1	1	2	3	1	1	1	4
Alcohol-Related	2	2 (tied)	3	1	2	3	4	3	3
Speeding Driver	5	4	5	6	4	4	6	5	2
Young Driver Involved	6	5	6	5	6	5	5	6	5
Infrastructure									
Single Vehicle ROR	4	2 (tied)	2	3	1	2	2	2	6
Intersection	3	6	4	4	5	6	3	4	1
Head-on	7	7	7	7		7	7	7	7

6.3 HSIP Implementation — Reactive versus Proactive

Historically, Minnesota’s HSIP was focused on the State Highway system and consisted entirely of investments in infrastructure. In addition, the past 25 years of the safety programs was entirely reactive – identified and improved the worst locations using all crashes. However, FHWA’s new guidance based on the changes in SAFETEA-LU has requested the states to change the focus of their safety programs – all roads, address the Four Es, focus on fatal and life threatening crashes, and a priority on implementation of low-cost and proven strategies with a system wide approach.

The review of Minnesota’s crash data and Critical Strategies indicates that this SHSP will consist of both reactive and proactive components – with the importance between the two components varying among the ATPs. Even though the ATPs that make up Greater Minnesota accounted for nearly 70% of fatalities and over 50% of serious injuries (2001-2005), the crashes often tend to be spread over many miles. Therefore, ATPs in Greater Minnesota should focus HSIP funds on proactive implementation – attaining at least 70% investment in proactive implementation. In contrast, the Metro ATP has a much higher concentration of crashes and consequently more intersections and segments with a high number of life threatening crashes.



In light of this, an investment strategy for the Metro ATP is to direct only 30% of safety investments to proactive implementation.

Guidance on Funding Reactive Projects: While the goal is to develop a proactive program for HSIP funds, each ATP will continue to have one or more locations where severe crashes happen consistently. In these circumstances, use of HSIP funds in a reactive project is justifiable. Many of the strategies in **Table 4.4** can also be deployed reactively and may be appropriate given the circumstances. However, some situations that require a reactive fix may be better served by a strategy not listed in Chapter 4. If the best solution is a higher-cost strategy not in **Table 4.4**, such as a roundabout, traffic signal, road alignment changes or grade separation; while it may have significant safety benefit at the particular location, the pay-back towards achieving the safety goal – fatal and serious injury crashes prevented – is unlikely to be commensurate with the investment.

Guidance on Creating a Proactive Deployment Plan: The question often asked is “If I select one of the strategies identified as proactive to use at a location that has a crash problem, is this a reactive or proactive deployment?” The simple answer is both. If the plan is to deploy the strategy system wide (or across much of the system), then this could be part of proactive deployment plan. Furthermore, to aid proactive deployment, a prioritized plan needs to be established in order to facilitate the best use of the available resources, implementing at the locations with the greatest need first. While many factors or criteria can be used to develop a prioritized implementation plan (examples can be found on Table 7.2 of the Minnesota CHSP), the safety record can be one such criteria. However, it need not be the only criteria. Functional classification, posted speed limit, traffic volumes, lane/shoulder/median width are just a few examples of other criteria that can be used to develop a prioritized plan as part of a proactive approach.

Guidance on Identifying Reactive and Proactive Strategies: As reviewed above, safety countermeasures can be proactive or reactive, depending on the situation. However, certain countermeasures lend themselves better to proactive deployment because they are low cost allowing wide spread use, are effective in many situations, and address predominate crash types. **Figure 6.2** illustrates how many of the countermeasures from the Minnesota SHSP fall on the reactive-proactive continuum – strategies to the left are best for reactive deployment (i.e., generally high cost); strategies to the right are best for proactive deployment; and strategies in the middle filling in the continuum. Also illustrated in **Figure 6.2** are the spending goals for the Metro ATP and the ATPs from Greater Minnesota.

Example Safety Improvements



FIGURE 6.2
Illustration of the Reactive and Proactive Safety Countermeasures



6.4 Summary of Recommendations for the ATPs

6.4.1 Greater Minnesota Districts and ATPs

For the investment of safety funds, the recommended goal for spending on proactive strategies is at least 70%; this is in response to low crash densities. To focus the proactive improvements, some general priorities for the ATP that make up Greater Minnesota include: rural roads (90% of fatalities on roads classified as rural), two-lane facilities, improving the edge of roadways (paved shoulders, edge drop-offs, shoulder rumble strips, and edgeline rumble stripes), identify and address needs on local roads, select low-cost and proven strategies, and building partnerships with law enforcement to address alcohol-related, speeding-related, and unbelted vehicle occupant fatalities and serious injuries.

6.4.2 Metropolitan Area

In the Metro area, a high density of crashes resulted in the recommendation that the ATP invest only 30% of safety funds on proactive strategies. This allows the ATP to still focus much of the resources in correcting high-crash locations. To reduce the maximum number of fatalities and serious injuries, the following guidance is provided for planning and implementing safety countermeasures: focus on the freeway and multi-lane facilities, focus on edge of roadways and median barriers on freeway facilities, focus on intersection improvements along the multi-lane arterials, and building partnerships with law enforcement to address fatalities and serious injuries related to either speeding or red-light running.

7. Summary

Minnesota has prepared this Strategic Highway Safety Plan (SHSP) to comply with the requirements of SAFETEA-LU and as part of a commitment to conduct a 360 degree review process to update and enhance the previous safety plan – the Comprehensive Highway Safety Plan (CHSP) that was published in December, 2004. This document follows the FHWA guidance (*Strategic Highway Safety Plans: A Champion's Guide to Saving Lives*) in that the development process included input from the State's safety partners, was data driven, the Critical Strategies are comprehensive (addresses all Four Es), and the implementation process was adjusted so address all roads.

A key component of the CHSP was the adoption of a statewide safety goal to reduce the number of highway traffic related fatalities to 500 or fewer by 2008. This was clearly a stretch goal (approximately 25% reduction from the 655 fatalities in 2003) and represented Minnesota's contribution to the National goal of reducing the fatality rate below 1.0 fatalities per 100 million vehicle miles traveled, established by the FHWA. In 2006, Minnesota achieved the initial statewide goal – there were 494 fatalities and the fatality rate dropped to 0.87. Based on this success and the continued commitment of the State's safety partners, a new safety goal has been adopted by the Toward Zero Deaths (TZD) Executive Committee – to reduce the number of highway traffic related fatalities to fewer than 400 by 2010. This new stretch goal requires Minnesota to continue to explore innovative ways to more effectively implement safety strategies and is intended to be consistent with and compliment efforts to Move Towards Zero Deaths.

Minnesota's Departments of Public Safety and Transportation are using the TZD program to serve as an umbrella organization to coordinate safety planning efforts. The vision of the TZD program is to work towards eliminating fatal and life changing injury crashes in Minnesota by establishing fatalities as the key statewide safety performance measure, by taking advantage of synergies that become available when agencies work together, and by reaching out to local agencies as integral partners in a comprehensive and coordinated safety planning effort.

The key steps in preparation of the Minnesota SHSP included the following:

- The analysis of Minnesota crash data confirmed that the Critical Emphasis Areas (CEAs) identified in the 2004 CHSP still represent the focus of where Minnesota's safety planning and implementation should be directed – the CEAs represent both Driver Behavior (seat belt usage, impaired driving, aggressive driving and young drivers), Infrastructure (road departure, intersections and head on crashes), Data Information Systems and Driver Safety Awareness. It should be noted that seat belt usage (52%) is the top factor contributing to the severity of crashes in Minnesota followed by impaired driving (36%), intersections (33%) and road departures (32%) – crash data from 2001 through 2005.
- Following the confirmation of the CEA's, the safety partners reviewed the 15 Critical Strategies that were identified in the Minnesota CHSP. It was concluded that implementation of these strategies still represented the best opportunity to reduce the number of severe crashes, with two modifications. The first includes a suite of intersection



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improvements to better address that intersections crashes in the Minneapolis/St. Paul Metropolitan area account for more than twice as many severe crashes as any other emphasis area. The second is an effort to integrate the Critical Strategies in the Minnesota CHSP with strategies in the numerous strategic safety plans prepared by Minnesota's agencies. Additional strategies were also identified to address any gaps in these plans, especially strategies to improve emergency response times.

- The Minnesota Department of Transportation (Mn/DOT) is responsible for preparation of this SHSP and will continue to be the agency responsible for periodic review and update. However, an effort will be made to add structure in order to provide assistance with both implementation and coordination between agencies and traffic safety advocacy groups in future planning efforts. In order to do so, Mn/DOT will work with the members of the TZD program including the program's co-leader, the Minnesota Department of Public Safety.
- The 2004 CHSP was based on an analysis of statewide crash data. Following the release of the Plan, questions arose about whether the data and the resulting recommended safety strategies were representative of actual conditions in each Mn/DOT District. In response, a detailed review of fatal and serious injury crash records was performed using the following steps:
 1. Analyze and review crash data by Mn/DOT District.
 2. Disaggregate the subset of serious crashes in each District by road system – State Highways vs. Local Roads.
 3. For the State Trunk Highways, further disaggregate the crash data by location (rural vs. urban) and facility type (freeway, expressway, multi-lane and 2-lane conventional).
 4. For the local roads, further disaggregate the crash data by the counties that make up the District. Note: An analysis similar to what was performed for the State Trunk Highways could not be completed because the necessary roadway information is not available for the local road system.
 5. For the lowest levels of disaggregation, identify the primary contributing factors for fatal and serious injury crashes.
 6. Map from the contributing factors to cost-effective safety strategies.

The results of this analysis lead to a general conclusion and a series of specific recommendations for implementation directed at both Greater Minnesota Districts and the Metropolitan Area. First, new implementation guidance recognizes that crash densities in rural areas are typically less than one-half of the densities on comparable urban facilities. This guidance suggests that safety programs in rural Districts and rural counties would be most effective if they focused on proactively deploying low cost intersection and road departure strategies broadly across their systems while programs in urban areas would be most effective if they focused on reactively deploying higher cost intersection treatments. Furthermore, there is a need to direct safety resources to the seven Greater Minnesota Districts and to the local road system because fatal and serious injury crashes are over represented in these areas. The implementation recommendations include:



Greater Minnesota Districts

- Establish a goal to spend at least 70% of the safety investment on low cost proactive strategies (in response to low crash densities).
- Invest in rural roads (90% of the fatalities occur on roads classified as rural)
- Invest in two-lane facilities (67% of the fatalities).
- Invest in low cost and proven strategies that can be widely deployed across the system.
- Develop a process to aid implementation of safety projects on the local road system.
- Focus investments in improving the edges of roadways (paved shoulders, safety wedge, rumble strips/stripes).
- Build partnerships with law enforcement to address alcohol-related, speeding-related and unbelted vehicle occupant fatalities and injuries.

Metro District

- Establish a goal to spend 70% of the safety investment on reactive strategies at identified high crash locations. (Currently, Metro District's safety program is almost exclusively reactive.)
- Continue investing in safety projects on the local road system.
- Invest in freeway and multi-lane facilities (70% of the fatalities).
- Focus investments in road edges and median barriers on freeway facilities and intersection improvements on multi-lane arterials.
- Build partnerships with law enforcement to address serious crashes related to speeding and red-light running.



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TABLE A.1.1
Summary of Minnesota's 2001-2005 Serious Injuries by AASHTO's Emphasis Area

	Emphasis Area	Minnesota Serious Injuries*	Percent
Part 1: Drivers	Instituting Graduated Licensing for Young Drivers	3,625 serious injuries involved a driver under 21	30%
	Ensuring Drivers are Licensed and Fully Competent	668 serious injuries involved a driver with an invalid license**	10%
	Sustaining Proficiency in Older Drivers	1,458 serious injuries involved a driver over 64	12%
	Curbing Aggressive Driving	2,661 serious injuries involved a speeding driver	22%
	Reducing Impaired Driving	2,505 serious injuries were alcohol related	21%
	Keeping Drivers Alert	1,966 serious injuries involved an inattentive driver	16%
	Increasing Driver Safety Awareness	-- Not Quantifiable --	
	Increasing Seat Belt Usage and Improving Airbag Effectiveness	3,080 vehicle occupant serious injuries were not using a restraint device***	33%
Part 2: Special Users	Making Walking and Street Crossing Safer	834 pedestrian serious injuries	7%
	Ensuring Safer Bicycle Travel	397 bicyclists serious injuries	3%
Part 3: Vehicles	Improving Motorcycle Safety and Increasing Motorcycle Awareness	1,114 motorcyclists serious injuries	9%
	Making Truck Travel Safer	812 serious injuries involving heavy vehicles	7%
	Increasing Safety Enhancements in Vehicles	-- Not Quantifiable --	
Part 4: Highways	Reducing Vehicle-Train Crashes	26 serious injuries involving a collision with a train	< 1%
	Keeping Vehicles on the Roadway	2,880 single vehicle run-off the road serious injuries	24%
	Minimizing the Consequences of Leaving the Road	Top 5 most harmful events for single vehicle run -off the road serious injuries were: - Overturn/Rollover (38%) - Collision with a tree/shrubbery (15%) - Officer did not report (12%) - Collision with an embankment/ditch (9%) - Collision with an utility pole (4%)	
	Improving the Design and Operation of Highway Intersections	5,892 serious injuries at an intersection	48%
	Reducing Head-On and Across-Median Crashes	1,605 head-on and across-median serious injuries	13%
	Designing Safer Work Zones	230 work zone serious injuries	2%



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TABLE A.1.1
Summary of Minnesota's 2001-2005 Serious Injuries by AASHTO's Emphasis Area

	Emphasis Area	Minnesota Serious Injuries*	Percent
Part 5: EMS	Enhancing Emergency Medical Capabilities to Increase Survivability	-- Not Quantifiable --	
Part 6: Management	Improving Information and Decision Support Systems	-- Not Quantifiable --	
	Creating More Effective Processes and Safety Management Systems	-- Not Quantifiable --	

* Source: Minnesota Crash Records (2001 – 2005)

** Information regarding driver license status was added to the crash record database in 2003. The 668 related serious injuries are out of a three-year total of 6,776 serious injuries.

*** Between 2001 and 2005, there were 9,456 vehicle occupant serious injuries.

NOTE: Between 2001 and 2005, there were 10,298 serious injury crashes that resulted in 12,166 serious injuries.

Fatal and Serious Injury Crashes at Metro Int.

SUMMARY FROM MN/DOT GREEN SHEETS (2001-2005) – STATE ROADS

How Significant is the Problem in the Metro District?

Intersection Type		No. of Int.	Fatal Crashes		"A" Inj. Crashes	
			Freq.	% of Statewide	Freq.	% of Statewide
Signalized	Low Vol., High Speed	12	0	0%	2	10%
	High Vol., High Speed	273	37	63%	196	71%
	Low Vol., Low Speed	9	0	0%	2	5%
	High Vol., Low Speed	70	6	55%	30	25%
Unsignalized	Urban/Suburban Thru-Stop	793	17	33%	84	48%
	Rural Thru-Stop	760	49	20%	109	23%
	All-Way Stop	16	0	0%	3	27%

- Between 2001 and 2005, Mn/DOT's records show 109 fatal crashes and 426 serious injury crashes at ints. on the STH system.
- The int. type with the greatest number of fatal crashes is rural thru-stop (49); followed by high-volume, high-speed signals (37).
- The in. type with the greatest number of serious injury crashes is high-volume, high-speed

signals (196); followed by rural thru-stop (109).

- At high-volume, high-speed signals, over 60% of fatal crashes and 70% of serious injury crashes occur in the Metro District.

Location of Junction-Related Crashes in the Metro District.

Facility Type		Fatal Crashes	"A" Inj. Crashes
2-Lane Roadway			
Rural	ADT < 1,500	2	0
	1,500 ≤ ADT < 5,000	2	6
	5,000 ≤ ADT < 8,000	13	19
	ADT ≥ 8,000	16	39
Urban	ADT < 1,500	0	0
	1,500 ≤ ADT < 5,000	0	1
	5,000 ≤ ADT < 8,000	0	8
	ADT ≥ 8,000	8	45

Facility Type		Fatal Crashes	"A" Inj. Crashes
Multi-Lane Roadway			
Rural	Freeway	11	24
	Expressway	31	121
	4-Lane Undivided	0	0
	4-Ln. Div. (Conv.)	0	1
Urban	Freeway	73	171
	Expressway	34	186
	4-Lane Undivided	3	60
	4-Ln. Div. (Conv.)	6	43
	Three-Lane	1	5
Five-Lane	0	10	

- Of two-lane roadways, most severe junction-related crashes occurred on facilities with an ADT of at least 8,000 vpd.
- On multi-lane facilities, the urban freeway had the most junction-related crashes, followed by the urban and rural expressway categories.

Fatalities and Serious Injuries at Metro Intersections

SUMMARY FROM DPS CRASH RECORDS (2001-2005)

Following information includes the counties of Anoka, Carver, Chisago, Dakota, Hennepin, Ramsey, Scott, and Washington.

- 46% (1,666 of 3,621) of intersection fatalities and serious injuries were reported at signalized intersections.

County Distribution

FATALITIES			
County	Local	State	Total
Anoka	23	30	53
Carver	1	9	10
Chisago	3	7	10
Dakota	33	23	56
Hennepin	92	24	116
Ramsey	37	8	45
Scott	12	13	25
Washington	20	12	32
Total	221	126	347

FATALITIES + SERIOUS INJURIES			
County	Local	State	Total
Anoka	352	190	542
Carver	37	32	69
Chisago	23	14	37
Dakota	328	97	425
Hennepin	1,322	218	1,540
Ramsey	518	126	644
Scott	147	35	182
Washington	144	39	183
Total	2,871	751	3,622

- 63% of intersection-related fatalities occurred at local road intersections. This increased to 79% when serious injuries were included.

What are the Contributing Factors?

Location and Traffic Control

- Intersection fatalities and serious injuries were primarily in urban locations (3173 of 3621, 88%).

Location	Local	STH	Total
Rural	309 (11%)	139 (19%)	448 (12%)
Urban	2,562 (89%)	611 (81%)	3,173 (88%)
Total	2,871	750	3,621

Control	Local	STH	Total
Traffic Signal	1,244 (43%)	422 (56%)	1,666 (46%)
All-Way Stop	104 (4%)	4 (1%)	108 (3%)
Thru-STOP or Yield	831 (29%)	162 (22%)	993 (27%)
Other/Unknown	692 (24%)	162 (22%)	854 (24%)
Total	2,871	750	3,621

Light Condition

- Intersection fatalities and serious injuries most commonly occurred during daylight conditions (2,427 of 3,621, 67%).

Location	Local	STH	Total
Daylight	1,952 (68%)	475 (63%)	2,427 (67%)
Dawn/Dusk	144 (5%)	23 (3%)	169 (5%)
Dark (int. with lighting)	675 (24%)	206 (27%)	881 (24%)
Dark (int with no or unknown lighting)	78 (3%)	39 (5%)	117 (3%)
Other/Unknown	22 (1%)	5 (1%)	27 (1%)
Total	2,871	750	3,621

Weather Condition

- Nearly 90% (3,219 of 3,621) of intersection fatalities and serious injuries occurred when weather conditions were reported as clear or cloudy.

Location	Local	STH	Total
Clear/Cloudy	2,564 (89%)	655 (87%)	3,219 (89%)
Rain	182 (6%)	63 (8%)	245 (7%)
Snow/Sleet/Freezing Rain	93 (3%)	22 (3%)	115 (3%)
Fog/Smog/Smoke	16 (1%)	4 (1%)	20 (1%)
Blowing Sand/Dust/Snow or Severe Winds	3 (0%)	3 (0%)	6 (0%)
Other/Unknown	13 (0%)	3 (0%)	16 (0%)
Total	2,871	750	3,621



Road Design

- Intersection fatalities and serious injuries were primarily on 4/6-lane divided (1,165 of 3621, 32%) or 2-lane (1,202 of 3621, 33%).

Facility Type	Local	STH	Total
Freeway (+ ramps)	30 (1%)	40 (5%)	70 (2%)
Other Div. Hwy	381 (13%)	388 (52%)	769 (21%)
4 or 6 Ln. Undiv.	1,011 (35%)	154 (21%)	1,165 (32%)
2-Lane	1,079 (38%)	123 (16%)	1,202 (33%)
3 or 5-Lane	56 (2%)	9 (1%)	65 (2%)
One-Way	204 (7%)	24 (3%)	228 (6%)
Other/Unknown	110 (4%)	12 (2%)	122 (3%)
Total	2,871	750	3,621

- “Other Divided Highway”: Fatalities and serious injuries by traffic control.

Control	Local	STH	Total
Traffic Signal	244 (64%)	235 (61%)	479 (62%)
All-Way Stop	8 (2%)	0 (0%)	8 (1%)
Thru-STOP or Yield	81 (21%)	85 (22%)	166 (22%)
Other/Unknown	48 (13%)	68 (18%)	116 (15%)
Total	381	388	769

- “4 or 6-Lanes Undivided”: Fatalities and serious injuries by traffic control.

Control	Local	STH	Total
Traffic Signal	607 (60%)	117 (76%)	724 (62%)
All-Way Stop	25 (2%)	0 (0%)	25 (2%)
Thru-STOP or Yield	189 (19%)	13 (8%)	202 (17%)
Other/Unknown	190 (19%)	24 (16%)	214 (18%)
Total	1,011	154	1,165

- “Two-Lanes, Two-Way”: Fatalities and serious injuries by traffic control.

Control	Local	STH	Total
Traffic Signal	154 (14%)	13 (11%)	167 (14%)
All-Way Stop	68 (6%)	4 (3%)	72 (6%)
Thru-STOP or Yield	468 (43%)	56 (46%)	524 (44%)
Other/Unknown	389 (36%)	50 (41%)	439 (37%)
Total	1,079	123	1,202

Crash Type

- All Fatalities and Serious Injuries.

Crash Type	Local	STH	Total
Rear End & Sideswipe (passing)	351 (12%)	158 (21%)	509 (14%)
Left-Turn	351 (12%)	83 (11%)	434 (12%)
Right-Turn	30 (1%)	3 (0%)	33 (1%)
Right Angle	1,287 (45%)	335 (45%)	1,622 (45%)
Ran Off Road	167 (6%)	42 (6%)	209 (6%)
Head-On and Sideswipe (opposite)	279 (10%)	56 (7%)	335 (9%)
Other & Unknown	406 (14%)	73 (10%)	479 (13%)
Total	2,871	750	3,621

- Fatalities and Serious Injuries at Signalized Intersections.

Crash Type	Local	STH	Total
Rear End & Sideswipe (passing)	169 (14%)	96 (23%)	265 (16%)
Left-Turn	178 (14%)	59 (14%)	237 (14%)
Right-Turn	11 (1%)	1 (0%)	12 (1%)
Right Angle	602 (48%)	196 (46%)	798 (48%)
Ran Off Road	29 (2%)	11 (3%)	40 (2%)
Head-On and Sideswipe (opposite)	113 (9%)	31 (7%)	144 (9%)
Other & Unknown	142 (11%)	28 (7%)	170 (10%)
Total	1,244	422	1,666

- Fatalities and Serious Injuries at Thru-Stop and Yield Controlled Intersections.

Crash Type	Local	STH	Total
Rear End & Sideswipe (passing)	43 (5%)	10 (6%)	53 (5%)
Left-Turn	91 (11%)	8 (5%)	99 (10%)
Right-Turn	9 (1%)	1 (1%)	10 (1%)
Right Angle	477 (57%)	117 (72%)	594 (60%)
Ran Off Road	35 (4%)	3 (2%)	38 (4%)
Head-On and Sideswipe (opposite)	57 (7%)	9 (6%)	66 (7%)
Other & Unknown	119 (14%)	14 (9%)	133 (13%)
Total	831	162	993



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TABLE A.3.1
Intersection Safety Strategies for the Metro Area

Objective	Strategies
Improve management of access in intersection influence areas	Implement driveway closures/relocations, implement driveway turn restrictions, restrict cross median access near intersections; restrict or eliminate turning maneuvers by signing providing channelization or closing median openings
Reduce the frequency and severity of intersection conflicts through geometric design improvements	Provide left-turn lanes at intersections; provide sufficient length to accommodate deceleration and queuing, use offset turn lanes to provide better visibility if needed, provide left-turn acceleration lanes at divided highway intersections Provide bypass lanes on shoulders at T-intersections Provide right-turn lanes at intersections; provide sufficient length to accommodate deceleration and queuing, use offset turn lanes to provide better visibility if needed, provide left-turn acceleration lanes at divided highway intersections
Improve sight distance at intersections	Clear sight triangles on approaches to intersections or in the medians of divided highways near intersections; eliminate parking that restricts sight distance; utilize curb extensions
Improve driver awareness of intersections as viewed from the intersection approach	Improve visibility of intersections by providing enhanced signing, lighting, pavement marking and delineation; such as provide lighting (install or enhance), install splitter islands on the minor-road approach to an intersection, provide a stop bar (or provide a wider stop bar) on minor-road approaches, install larger regulatory and warning signs at intersections, provide dashed marking (extended left edgelines) for major roadway continuity at divided highway intersections, provide supplementary stop signs, provide pavement markings with supplementary messages (i.e., STOP AHEAD), install red flashing beacons on STOP signs at stop-controlled intersections, deploy mainline dynamic flashing beacons to warn drivers of entering traffic, use freeway style guide signs along high-speed segments, or install advance warning flashers to inform driver of need to stop at high-speed signalized intersections
Improve driver compliance with traffic control devices and traffic laws at intersections	Implement automated enforcement of red-light running (cameras) or install confirmation lights on the back side of mast arms to assist in traditional red-light running enforcement
Reduce frequency and severity of intersection conflicts through traffic signal control and operational improvements	Employ multiphase signal operation, optimize clearance intervals, restrict or eliminate turning maneuvers (including right turns on red), employ signal coordination, improve operation of pedestrian and bicycle facilities at signalized intersections (countdown heads)