



Strategic Highway Safety Plan

Prepared by

**NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION**

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September 2006

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NORTH DAKOTA DEPARTMENT OF TRANSPORTATION STRATEGIC PLAN

The mission of the North Dakota Department of Transportation is

“Providing a transportation system that safely moves people and goods.”

A Strategic Goal of the Department of Transportation is to

“Increase safety on North Dakota’s transportation system and within the Department of Transportation”

The objective is to

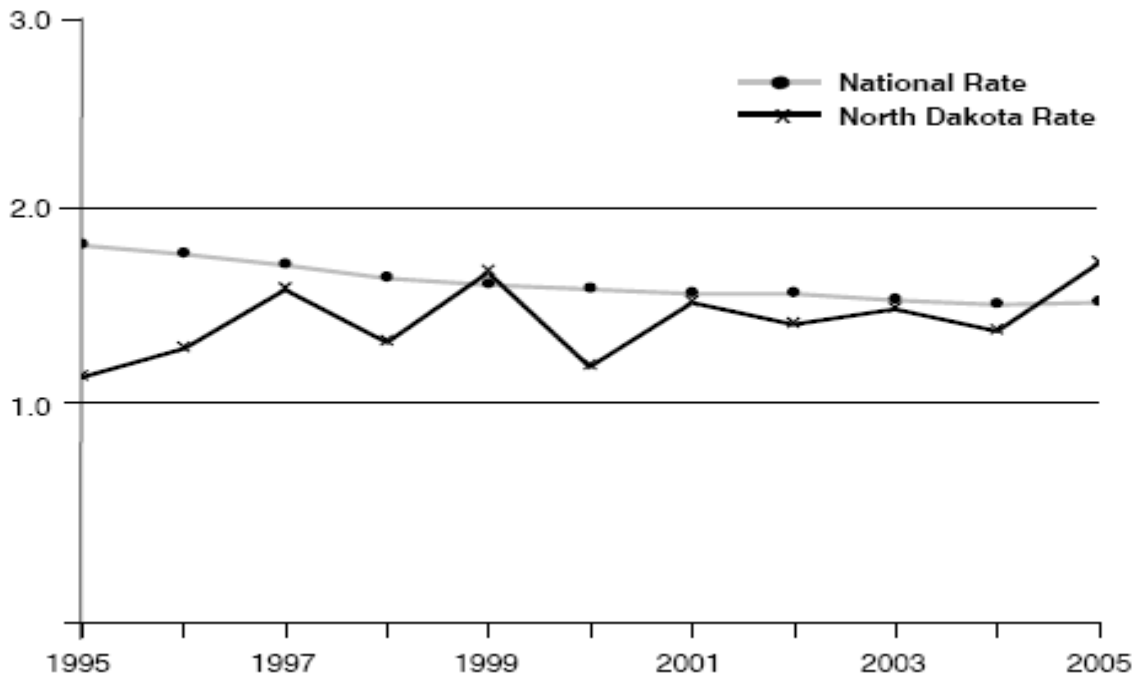
“Develop and implement a Strategic Highway Safety Plan that incorporates the Comprehensive Highway Safety Plan and reduces transportation-related reportable crashes, injuries, and fatalities relative to vehicle miles traveled (VMT) by 10% NLT September 30, 2007.”

INTRODUCTION

Background

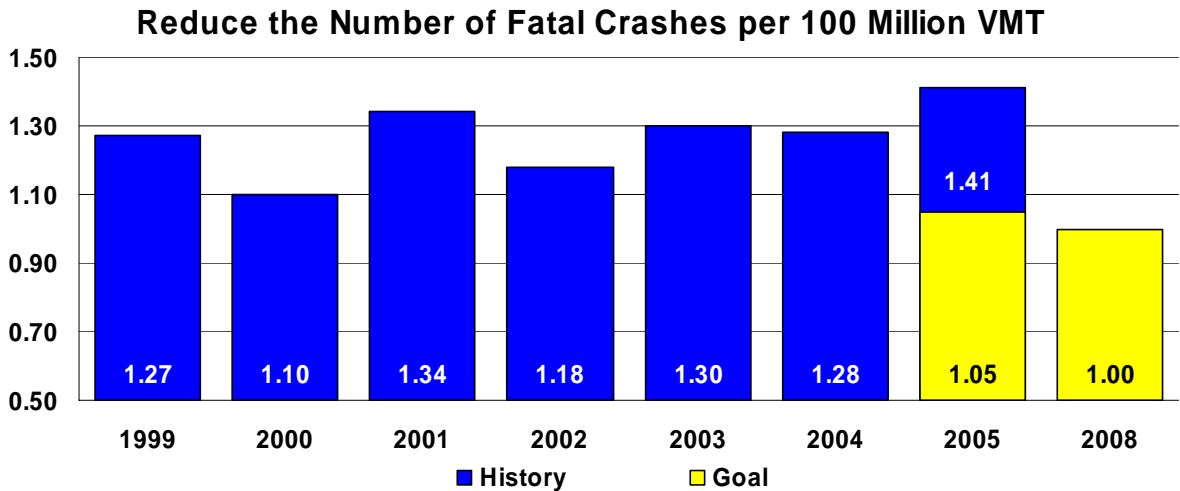
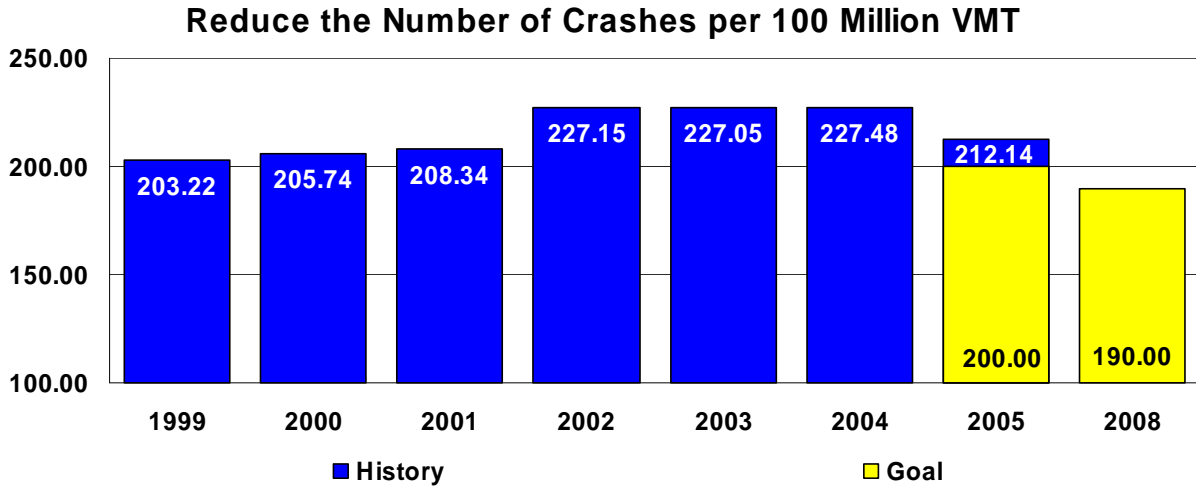
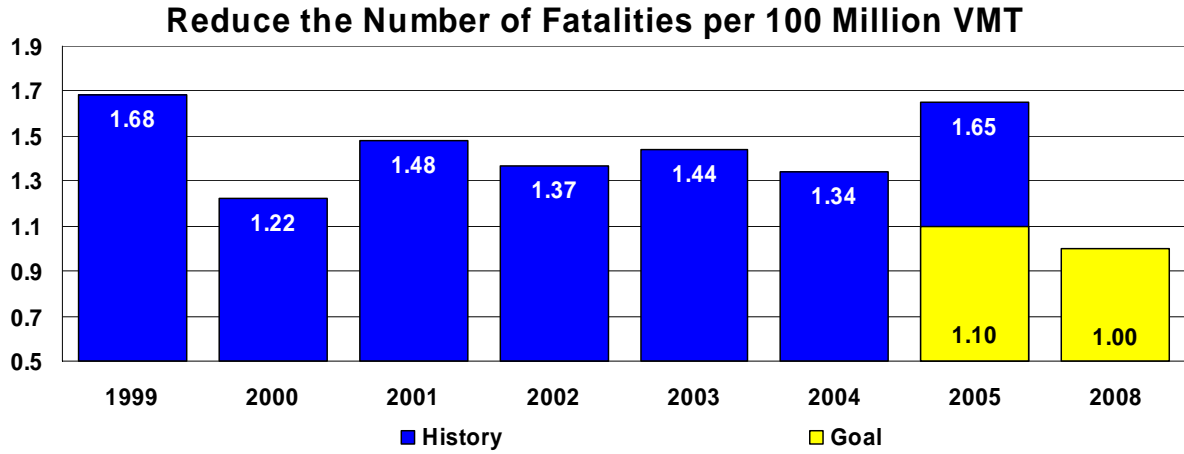
North Dakota has consistently ranked as one of the safest states in the nation and strives to maintain that distinction through effective traffic safety programs. The number of motor vehicle fatalities each year in North Dakota has dropped from a high of 227 in 1971 to the 123 experienced in 2005. The fatality rate has reflected a decrease from 5.73 deaths per 100 million vehicle miles of travel (VMT) in 1971 to 1.65 deaths per 100 million VMT in 2005. The statewide fatality rate has been consistently lower than the national fatality rate since 1979, with the exception of 1999 and 2005.

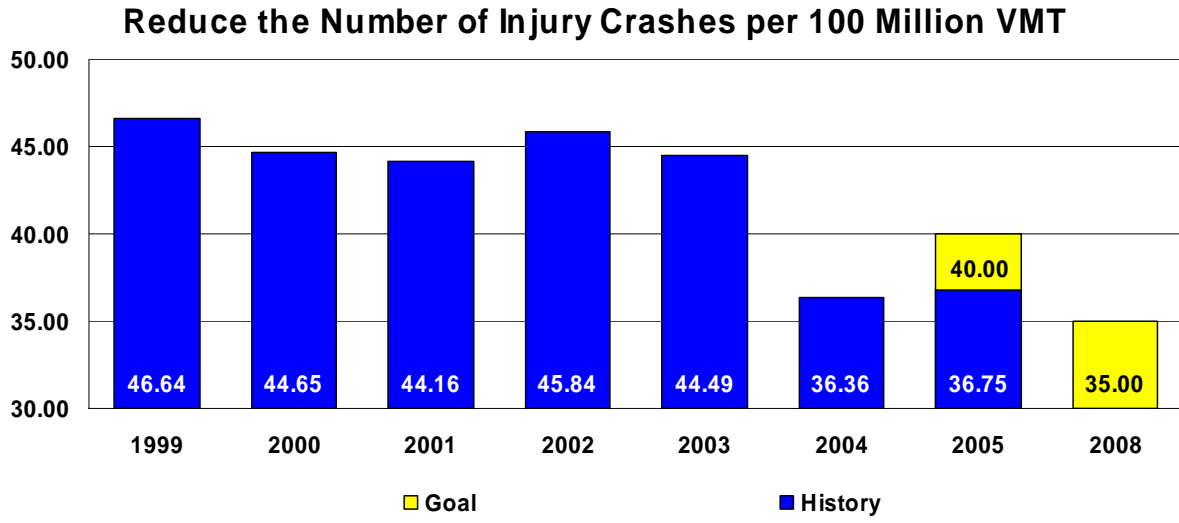
ND Fatality Rate vs. National Fatality Rate



In light of the fatality rate experienced in 2005, there is no question traffic safety must be at the forefront of what we do and we must remain vigilant.

The following are performance measures identified in the 2005 ND Highway Safety Plan.





PURPOSE

The purpose of this Strategic Highway Safety Plan (SHSP) is to identify North Dakota’s key safety problems/needs and guide investment decisions to achieve significant reductions in highway fatalities and serious injuries on all public roads. It was developed by the State DOT in a collaborative process including a wide range of safety stakeholders including Federal, State, local, and private sector entities.

The SHSP is a data-driven, four to five year comprehensive plan that integrates the 4Es – engineering, education, enforcement and emergency medical services (EMS). The purpose of a data-driven process is to direct resources where they are most needed and have the greatest potential for impact. This plan identifies key safety issues within the state of North Dakota, strategies/countermeasures to address these issues, and suggested action plans for critical strategies. The goal of the plan is to coordinate efforts statewide to save lives and reduce injuries occurring on roadways within the state. The development of this plan is a major step in moving “Towards Zero Deaths”.

The strategies presented in this plan are “potential strategies”. As resources are available the strategies should be researched further to determine which ones are most appropriate to address the emphasis areas and how to proceed toward implementation.

Partners

The following entities were consulted in the development of the SHSP and are crucial in achieving the SHSP goals:

American Association of Motor Vehicle Administrators	ND Game & Fish Department
American Traffic Safety Services Association	ND Department of Transportation
Association of Counties	ND Highway Patrol
Burleigh County Sheriff’s Office	ND Human Services Department
Cass County Sheriff’s Office	ND Peace Officers Association
ND Emergency Medical Services (EMS) Association	ND Traffic Operations Roundtable
Fargo City Police	Operation Lifesaver
Federal Motor Carrier Safety Administration	Railroads
Grand Forks City Police	Rural Transportation Safety & Security Center
Local Technical Assistance Program	Safe Communities
Medical Community	Safe Routes to School Coordinator
Metropolitan Planning Organizations	Stark County Sheriff’s Office
Minot City Police	Tribal Technical Assistance Program
National Highway Traffic Safety Administration	Altru Ambulance Service
ND Department of Health	F-M Ambulance Service
Division of Emergency Medical Services	ND Association of Public-Safety Communications
Division of Vital Records	Officials (APCO)

Development Process

In June 2005 the NDDOT launched a Comprehensive Highway Safety Plan (CHSP). The CHSP was developed under a goal in the Department's Strategic Plan and included involvement mainly from the NDDOT, Federal Highway Administration, and the North Dakota Peace Officers Association. The CHSP was used as a starting point in development of this SHSP. The two main issues to address in the evolution from the CHSP to the SHSP were:

Increased stakeholder involvement

Re-evaluate emphasis areas (data-driven)

A work team already existed from the development of the CHSP. This team met and discussed the need for increased stakeholder involvement. It was determined a work team/sub-committee structure would best facilitate the process. Sub-committees were developed for each of the 4Es. The work team consists of leaders from each of the sub-committees along with other core members. See Appendix A for an organizational chart.

The following safety objective was adopted in the Department's Strategic Plan and applies to this plan:

“Develop and implement a Strategic Highway Safety Plan that incorporates the Comprehensive Highway Safety Plan and reduces transportation-related reportable crashes, injuries, and fatalities relative to vehicle miles traveled (VMT) by 10% NLT September 30, 2007.”

The following steps were taken in the development of the SHSP. See Appendix B for handouts used in the process.

Gather Data

Crash data relevant to the AASHTO 22 emphasis areas, plus 2 state specific emphasis areas, was compiled.

Analyze Data

Sub-committees ranked the top 10 emphasis areas in order of priority. Their rankings were combined using weighted points and the emphasis areas were given an overall ranking.

Identify Key Emphasis Areas

From the crash rankings, the work team decided on 7 key emphasis areas.

Identify Strategies, Countermeasures, and Performance Based Goals

Sub-committees brainstormed about the 3 items listed above.

Determine Priorities for Implementation

The work team reviewed the information from the sub-committees and compiled strategy lists for each emphasis area to include the 4Es.

Develop Action Plans for Critical Strategies

Two critical strategies for each emphasis area were chosen and action plans were developed for each one. (For some emphasis areas only one critical

strategy was chosen because information from that activity was needed to provide direction for other critical strategies in that emphasis area.)

Compile SHSP Document

Data Analysis

In the late 1990's, significant gains in highway safety appeared to have stalled nationwide. In response to this, the American Association of State Highway and Transportation Official's (AASHTO) created a federal Strategic Highway Safety Plan (SHSP). The federal SHSP acknowledges the need for the states to look at traffic safety in a new way and identifies 22 emphasis areas where the greatest number of lives can be saved.

As a starting point for this plan, statewide crash data for a 5 year time period (2000-2004) was compiled for crash types relevant to each of AASHTO's 22 emphasis areas, and two state specific emphasis areas. This includes crashes occurring on all roadways within the state. The list below shows the 24 emphasis areas and the percent of total fatal crashes for the 5 year period.

<u>AASHTO 22 Emphasis Areas</u>	<u>% of Total Fatal Crashes</u>
Part 1: Drivers	
1. Instituting Graduated Licensing for Young Drivers	26%
2. Ensuring Drivers are Licensed and Fully Competent	---
3. Sustaining Proficiency in Older Drivers	21%
4. Curbing Aggressive Driving	34%
5. Reducing Impaired Driving	47%
6. Keeping Drivers Alert	10%
7. Increasing Driver Safety Awareness	---
8. Increasing Seat Belt Usage and Improving Airbag Effectiveness	79%
Part 2: Special Users	
9. Making Walking and Street Crossing Easier	5%
10. Ensuring Safer Bicycle Travel	1%
Part 3: Vehicles	
11. Improving Motorcycle Safety and Increasing Motorcycle Awareness	5%
12. Making Truck Travel Safer	14%
13. Increasing Safety Enhancements in Vehicles	---
Part 4: Highways	
14. Reducing Vehicle-Train Crashes	2%
15. Keeping Vehicles on the Roadway	40%
16. Minimizing the Consequences of Leaving the Road	35%
17. Improving the Design and Operation of Highway Intersections	24%
18. Reducing Head-On and Across-Median Crashes	12%
19. Designing Safer Work Zones	2%
Part 5: Emergency Medical Services	
20. Enhancing Emergency Medical Capabilities to Increase Survivability	---
Part 6: Management Systems	
21. Improving Information and Decision Support Systems	---
22. Creating More Effective Processes and Safety Management	---
<i>State Specific</i>	
23. Reducing Deer-Vehicle Crashes	1%
24. Reducing Weather Related Crashes	14%

Source: AASHTO Strategic Highway Safety Plan: <http://safety.transportation.org/>

All stakeholders were given the crash data (more extensive than what is shown on the previous page) and asked to rank the top ten emphasis areas in order of priority. See Appendix C for the data and the rankings.

Emphasis Areas

From the data analysis and discussion by the work team, it was decided to focus on the following 7 emphasis areas. It was decided seven was a reasonable number of emphasis areas to be able to focus the efforts to achieve the best results.

- 1. Reduce Alcohol Impaired Driving**
- 2. Increase the Use of Safety Restraints for all Occupants**
- 3. Younger Driver/Older Driver Safety**
- 4. Curb Aggressive Driving**
- 5. Improvements to Address Lane Departure Crashes**
- 6. Enhancing Emergency Medical Capabilities to Increase Survivability**
- 7. Improve Intersection Safety**

EMPHASIS AREAS

1. Reduce Alcohol Impaired Driving

Background

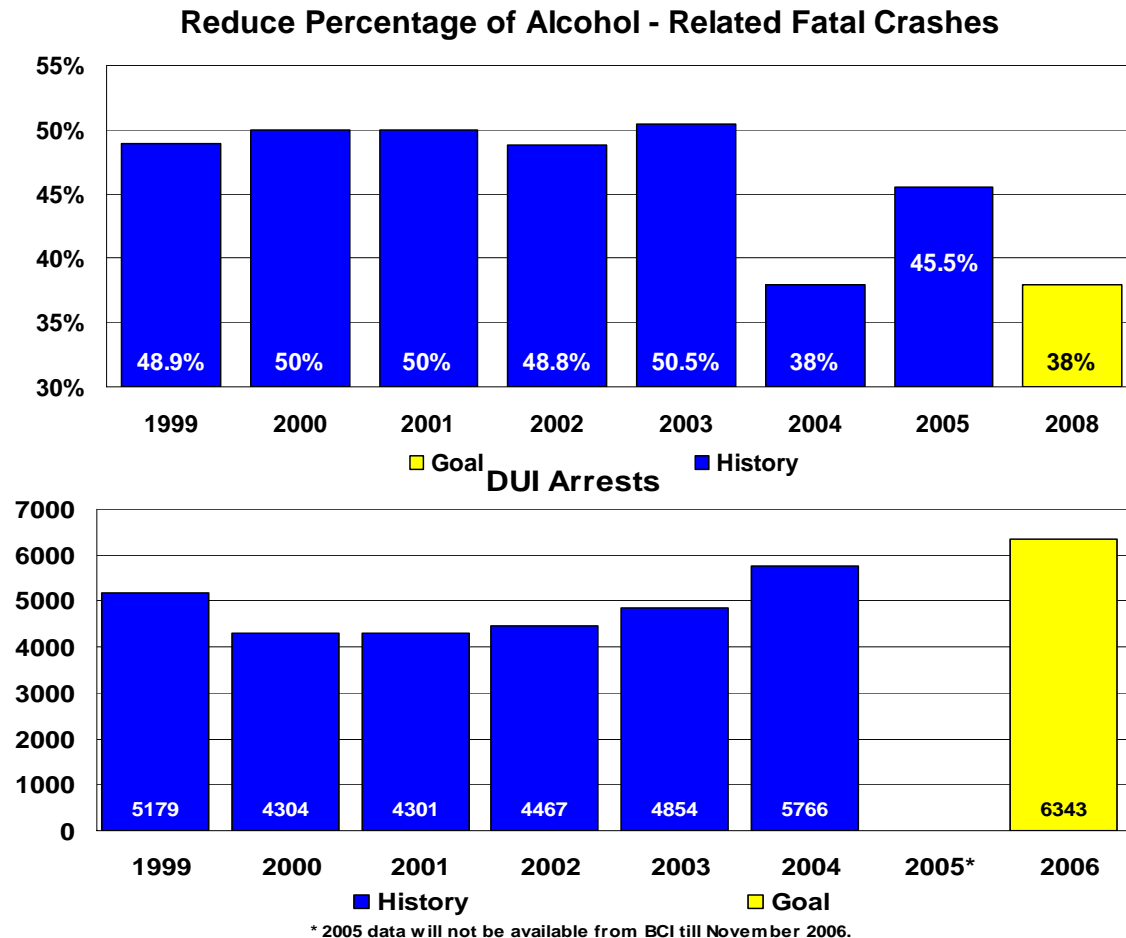
In 2004, North Dakota experienced a dramatic reduction in the number of alcohol-related fatalities which can be attributed to enhanced alcohol sanctions and stronger enforcement efforts.

Objective

Reduce the percentage of alcohol-related fatalities to 38% by 2008, and increase the number of DUI (Driving while Under the Influence) arrests from 5766 in 2004 to 6343 in 2006.

Performance Measures

The percentage of alcohol-related fatalities and the number of DUI arrests will be used to monitor the objective.



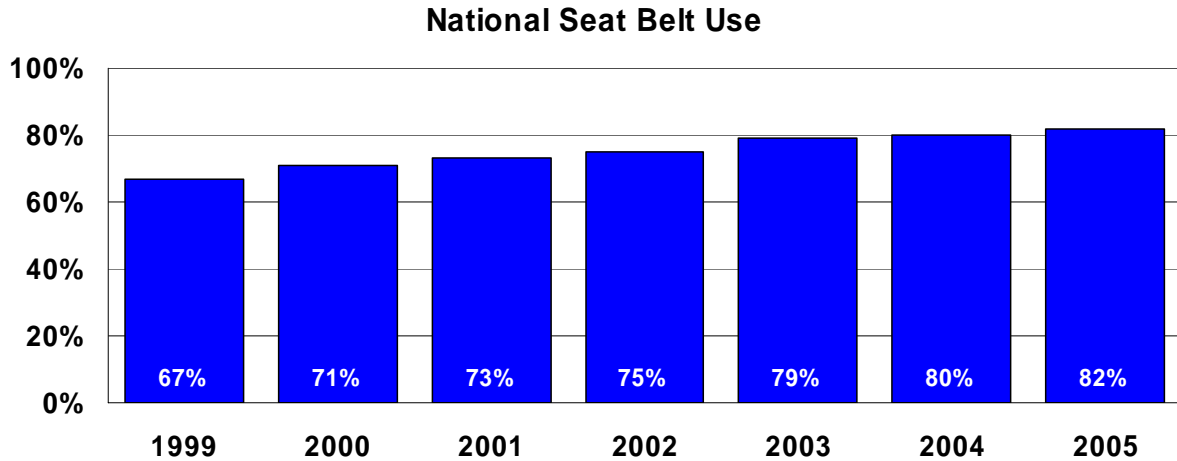
Potential Strategies

- Conduct Well-Publicized Compliance Checks of alcohol retailers to reduce sales to underage persons.
- Conduct Well-Publicized Sobriety Checkpoints or special saturation patrols.
- Well publicized enforcement and consequences for drivers under age 21.
- Promote operation prom and “ghost out” activities in schools.
- Establish a “Whiskey Plate” for repeat DUI offenders.
- Promote MADD and SADD programs.
- Provide funding to law enforcement agencies to supplement enforcement efforts.

2. Increase the Use of Safety Restraints for All Occupants

Background

North Dakota's safety belt usage observed in 2006 is 79%, the highest rate ever in the state. However, in more than 60% of motor vehicle fatalities in 2005 drivers were not wearing proper restraints. And the statewide usage rate is still below the national usage rate.

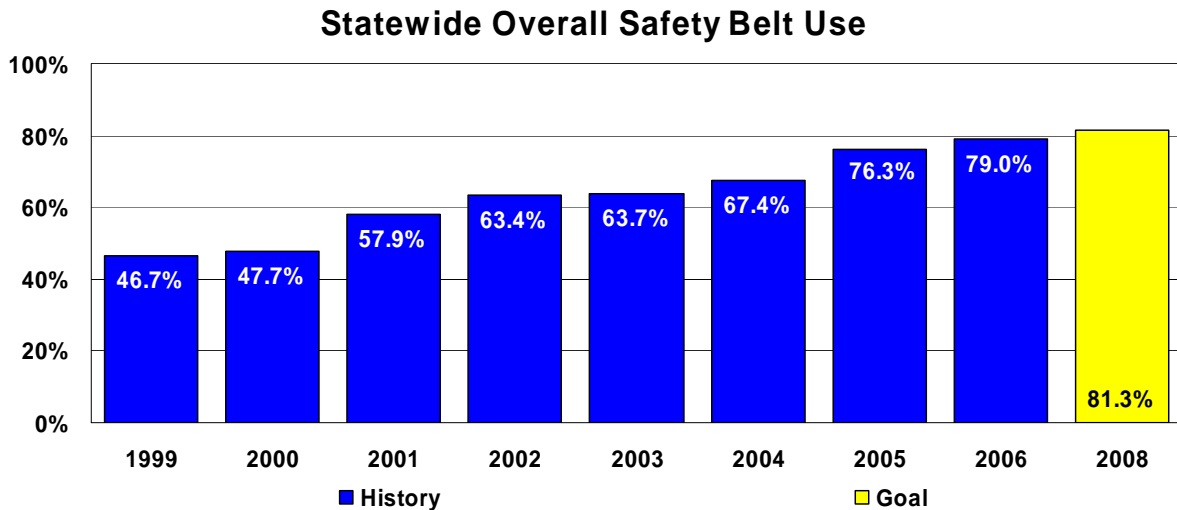


Objective

Increase statewide seatbelt usage to 81.3% by 2008.

Performance Measure

The statewide seatbelt usage percentage will be used to monitor the objective.



Potential Strategies

- Conduct highly publicized enforcement campaigns to maximize restraint use.
- Conduct high profile “Child Passenger Safety” inspection clinics to educate on the proper use of restraint devices.
- Train law enforcement to check for proper child restraint use in motorist encounters.
- Create a state-level clearing house for materials that offer guidance in implementing programs to increase restraint use.
- Provide tools/information on the benefits and ways to achieve the highest usage percentage possible.
- Implement a long-term comprehensive public education program.
- Continue to provide funding to law enforcement agencies to supplement enforcement efforts.

3. Improve Younger Driver and Older Driver Safety

Background

Younger Drivers

North Dakota has a minors licensing law for persons under the age of 18 because new drivers are involved in a significant number of crashes.

Any person who is at least 14 years old may apply for an instruction permit. This instruction permit is valid for a period of one year. The permit holder must be accompanied by a licensed driver at least 18 years of age who has had at least three years of driving experience. An individual, other than the supervising driver and the permit holder, may not be in the front seat unless the vehicle has only one seat, in which case, the supervising driver must be seated next to the permit holder.

The instruction permit must be held for six months prior to completing the road test for an operator's license. If under the age of 16, driver's education must also be completed prior to road testing. Upon successful completion of the road test, a restricted license will be issued. Anyone under the age of 16 is restricted to the parent or legal guardian's vehicles or to vehicles equipped with dual controls. Anyone under the age of 16 cannot carry more passengers than the vehicle manufacturers suggested passenger capacity.

The director shall cancel the permit or license of a minor under 18 years of age who accumulates six or more points on their driving record or commits an alcohol-related offense while operating a motor vehicle.

Older Drivers

As people age, they must make adjustments to their driving due to conditions that accompany age, such as loss of vision, diminished hearing, and slowed reaction time. These adjustments are necessary to promote safe driving.

Older (65 + years) drivers make up more than 17% percent of all licensed drivers in North Dakota and are involved in 9.2% of all crashes. With the aging of the "baby boomers," the older driver population will continue to increase substantially.

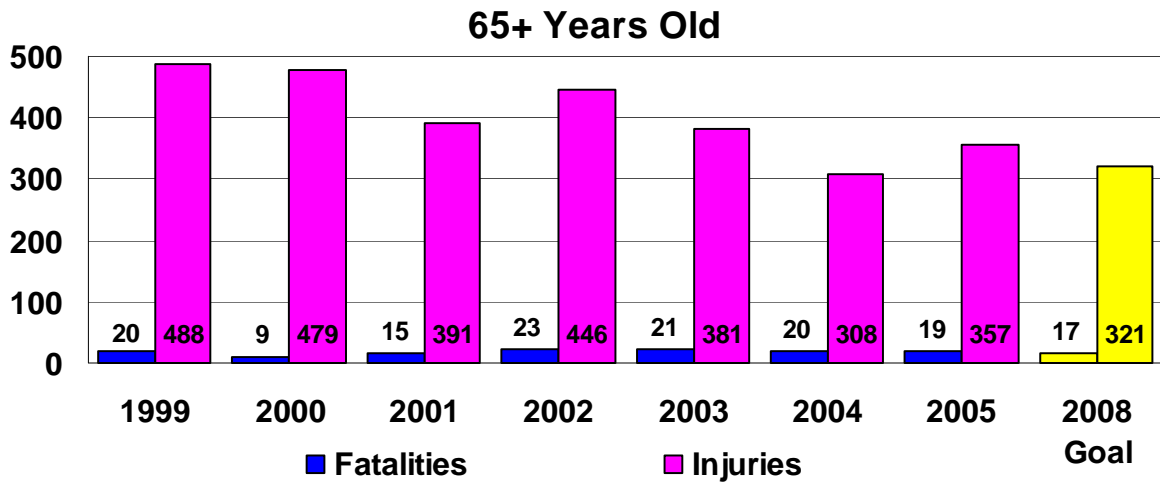
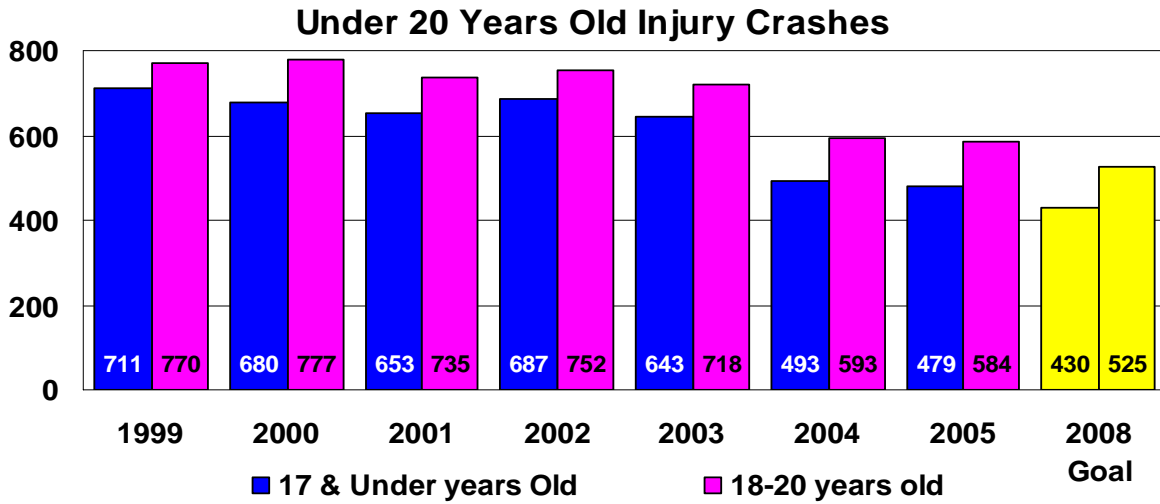
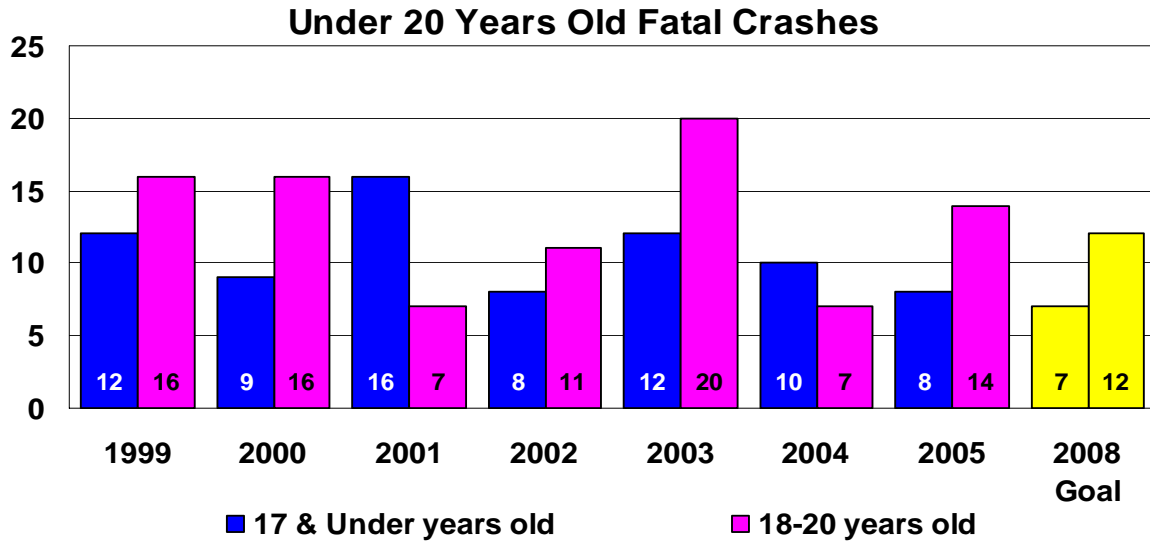
Objectives

Reduce the number of fatal and injury crashes involving under age 20 drivers by 10% by 2008.

Reduce the number of fatal and injury crashes involving age 65+ drivers by 10% by 2008.

Performance Measures

The number of crashes involving under age 20 drivers and the number of crashes involving age 65+ drivers will be used to monitor the objective.



Potential Strategies

- Analysis to determine exact causes in younger driver involved crashes.
- Consider revising crash reporting to include capture of issues such as cell phone use.
- Promote drivers education to all new drivers.
- Support graduated driver's license legislation that would restrict driving conditions while a new driver obtains sufficient driving experience.
- Provide parents of new drivers with information on safe driving habits and state laws.
- Strengthen the role of medical advisory boards.
- Require physician reporting of individuals that they feel are not qualified to drive.
- Consider re-verification of driving skills for older drivers.
- Support/implement an education component aimed at senior groups (AARP), families, and care providers.
- Increase the size and letter height of roadway signs.
- Improve roadway delineation

4. Curb Aggressive Driving

Background

“Aggressive driving” can be defined as operating a motor vehicle in a selfish, pushy, or impatient manner, often unsafely, that directly affects other drivers. While aggressive driving is harder to pinpoint than other emphasis area behaviors/actions, the national perception is that it is becoming more prevalent. Traffic safety experts suggest that any or all of the following elements have to be in place to be considered aggressive driving: speeding, verbal or non-verbal expressions of anger toward other drivers designed to encourage retaliation, deliberately ignoring traffic controls, and driving in a way that attempts to gain an advantage over other drivers.

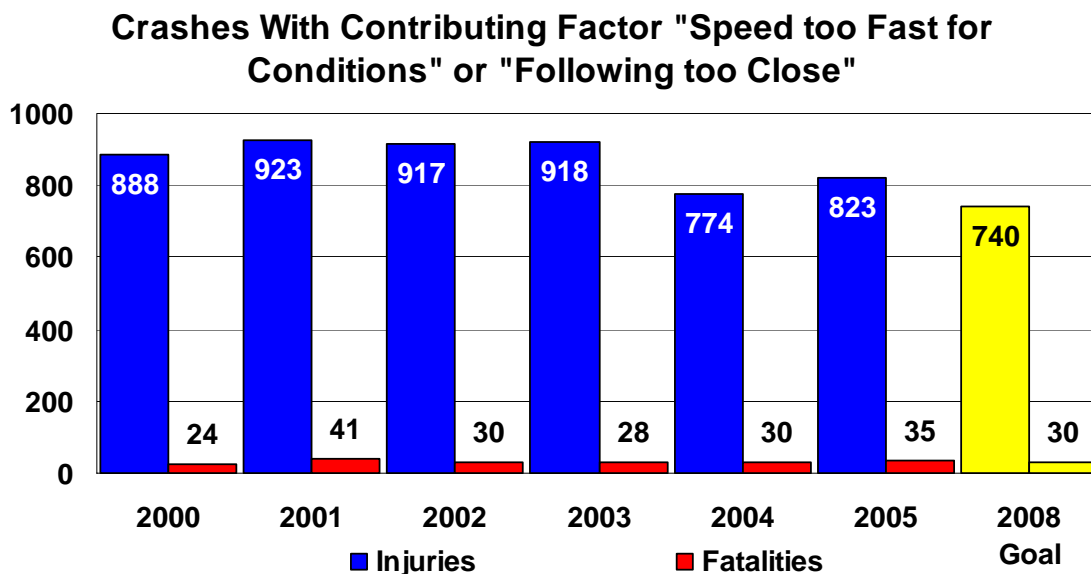
In an attempt to determine the extent of aggressive driving as a factor in ND crashes, the contributing factors of speeding and following too closely were used as indicators.

Objective

Reduce the number of crashes with contributing factors of speeding and following too closely by 10% by 2008. Analyze crashes and work with law enforcement too determine what are the main factors related to aggressive driving and how can we best capture when it is contributing to crashes and if it is truly a significant area of concern in the state.

Performance Measure

The number of crashes with contributing factors of speeding and following too closely will be used to monitor the objective until further analysis is completed to accurately assess if aggressive driving is the correct issue to be focusing on related to these factors.



Potential Strategies

- Analyze data and experience to clearly define aggressive driving and identify factors contributing to aggressive driving.
- Conduct educational and public information campaigns aimed at aggressive driving.
- Support/implement an education program to law enforcement and the public detailing the societal costs associated with aggressive driving. Emphasis placed on driving in inclement weather conditions, vehicle capabilities, and psychological effects.
- Educate and enhance penalties for repeat offenders.
- Encourage strict enforcement of violations associated with aggressive driving. It is felt that current legislation in place is sufficient.
- Change or mitigate the effects of identified elements in the environment
- Reduce nonrecurring delays and provide better information about these delays

5. Improvements to Address Lane Departure Crashes

Background

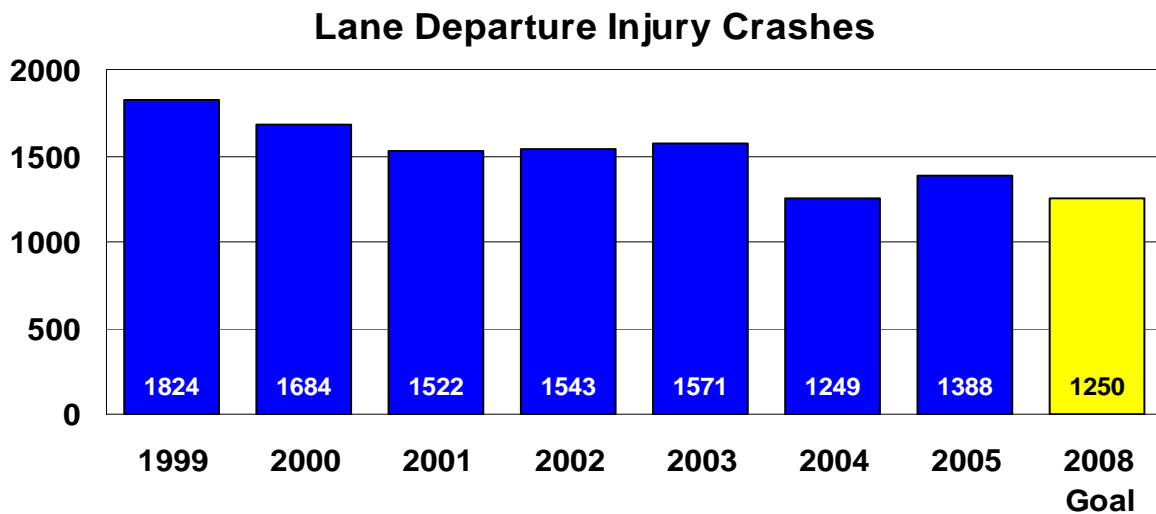
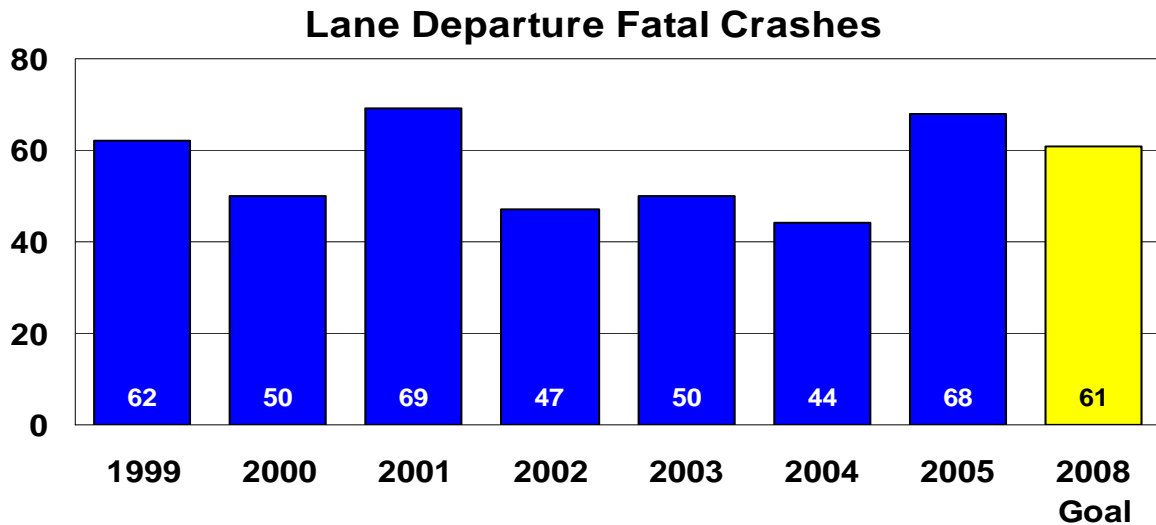
Factors such as driver fatigue, impaired driving, speeding, driving at night, curves, grades, weather, animals on the road and certain pavement conditions may all contribute to a vehicle leaving the roadway. To address the full extent of the problem, a comprehensive approach must be taken. Emphasis must be placed on keeping vehicles in their proper travel lanes and attempting to reduce the likelihood of them overturning or striking objects if they do leave the roadway. Minimizing the potential consequences if a crash does occur is also a primary objective.

Objective

Reduce the number of run off the road fatalities and injuries by 10% by 2008.

Performance Measures

The number of run off the road fatalities and injuries will be used to monitor the objective.



Potential Strategies

- Educate design team on when and how to use safety improvements.
- Educate the motoring public on the importance of staying with the road (ie avoiding hitting a deer).
- Provide information to defensive driving program on the dangers of fatigue and inattentive driving.
- Improve lane visibility during snow storms.
- Improve road maintenance; i.e. snow removal.
- Install edgeline “profile marking”, edgeline rumble strips or modified shoulder rumble strips on section with narrow or no paved shoulders.
- Provide enhanced shoulder or in-lane delineation and marking for sharp curves.
- Provide enhanced pavement markings.
- Install shoulder rumble strips.
- Install centerline rumble strips.
- Install recovery approaches at T-intersections.
- Prevent edge dropoffs, widen the roadway.
- Develop, revise, and implement planting guidelines to prevent placing trees in hazardous locations.
- Mowing and vegetation control guidelines (focus on animal crashes).
- Eliminate existing alfalfa with spraying (focus on animal crashes).
- Relocate poles in hazardous locations further from the roadway or to a less vulnerable location.
- Use breakaway poles.
- Decrease the number of poles along the corridor.

6. Enhancing Emergency Medical Capabilities to Increase Survivability

Background

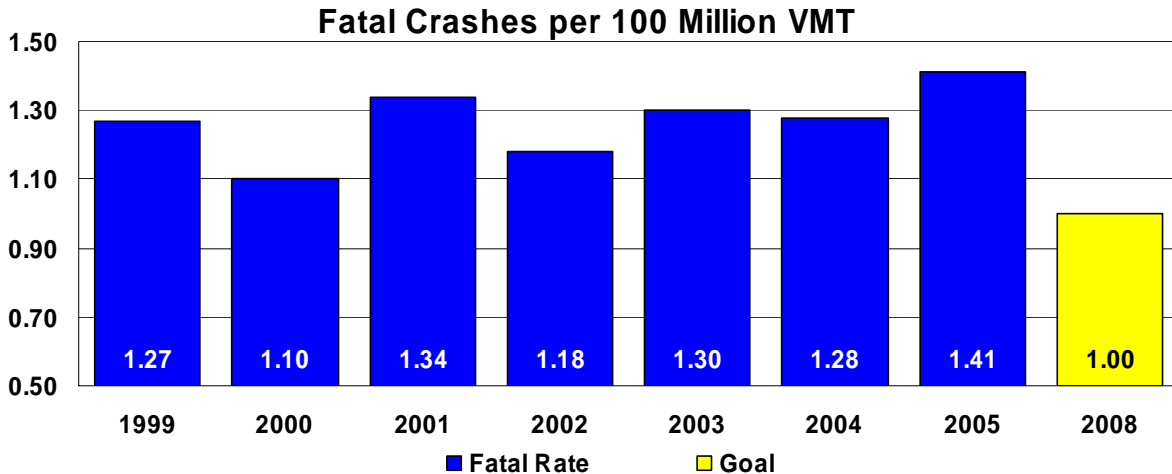
Emergency Medical Services (EMS) begins at the Public Safety Answering Point (PSAP) when the 9-1-1 dispatcher receives a call. The dispatcher notifies ambulance services, quick response units, fire departments and law enforcement agencies based on the need of the situation. All of these public safety responders including dispatchers have initial and recurrent medical training requirements. North Dakota is one of only a few states that completely adhere to the national standards for personnel training as set forth by the National Highway Transportation and Safety Administration (NHTSA). The EMS system continues through hospital emergency rooms, operating rooms, intensive care units, and rehabilitation services. The Division of Emergency Medical Services regulates the EMS system from dispatching through hospital admission. To increase the survivability of trauma patients in our state all EMS providers are in a constant state of training and re-training.

Objective

Reduce the number of fatalities per 100 million VMT to 1.0 by 2008.

Performance Measure

The number of fatalities per 100 million VMT will be used to monitor the objective.



Potential Strategies

- Encourage EMS systems to participate in the Safe Communities Effort
- Utilize Technology-Based Training for Rural EMS Providers
- Establish an Exchange Program for Rural EMS Providers to Spend Time in Urban Systems.
- Include Principals of Traffic Safety and Injury Prevention as Part of EMS Continuing Education.
- Require First Care Training and Bystander Care Training.
- Provide EMS Training in High Schools. Provide high school or college credit for EMT training.
- Train EMS providers to national standards as prescribed by NHTSA.
- Require trauma designation for all ND hospitals.
- Improve access to ATLS for rural trauma center physicians and mid-level practitioners.
- Require E911 in all areas of the state. All public safety dispatching must be done by a PSAP.
- EMS manager and medical director specific training delivered regionally.
- Educate individual communities about their EMS capabilities and challenges.
- Promote Certified QRU development.
- Develop standards for response times.
- Yearly Skills Validation for EMS Providers.
- Collaboration of EMS services by county.
- Fund a retirement plan for volunteers. Support legislation to fund this.
- Continue to require First Responder certification for law enforcement. Encourage advanced training for law enforcement agencies in rural areas.

7. Improve Intersection Safety

Background

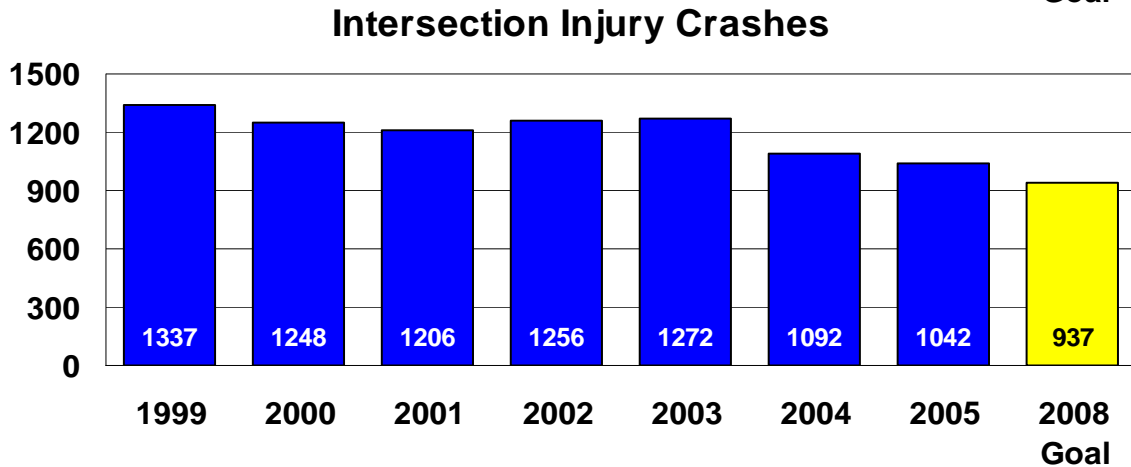
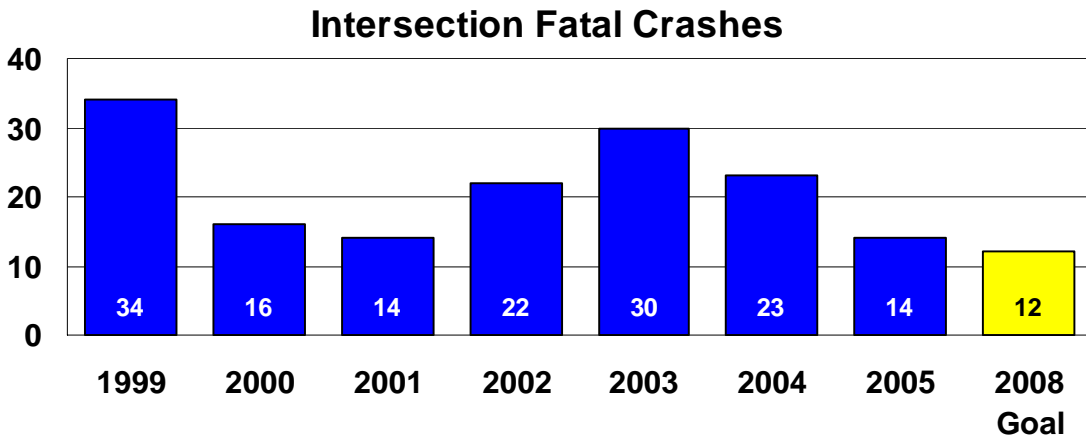
Because of increasing volumes of traffic and the increasing potential for vehicle/vehicle and vehicle/pedestrian conflicts, it is recognized that new strategies and effective application of existing strategies are needed to address this critical area of traffic safety. The vast majority of intersection crashes occur in North Dakota's urban areas, but conversely, most of the fatalities associated with intersection crashes occur in rural areas. By implementing strategies in the areas of education, enforcement and engineering, intersection safety should be improved and these serious crashes should be reduced.

Objective

Reduce the number of intersection fatal crashes and injury crashes by 10% by 2008.

Performance Measures

The number of intersection fatal crashes and injury crashes will be used to monitor the objective.



Potential Strategies

- Provide public information and education regarding Red Light Running violations and/or overall driver compliance with traffic control devices.
- Add components to new drivers manual on how to drive and maneuver through enhancements to intersections (Mark will review manual for updates).
- Improve blind intersections.
- Snow removal at intersections to improve visibility.
- Intersection warning devices.
- Improve the stopping ability at intersections during the winter months.
- Incorporate enforcement efforts with funded safety restraint and impaired driving enforcement programs. Special emphasis in rural areas.
- Support/implement an educational program detailing the impact of intersection crashes and safety problems at specific intersections.
- Provide left and/or right turn lanes at intersections.
- Realign intersection approaches to reduce or eliminate intersection skew.
- Change horizontal and/or vertical alignment of approaches to provide more sight distance.
- Provide targeted enforcement to reduce stop sign violations.
- Provide turn path markings.
- Provide lane assignment signing or marking at complex intersections.
- Optimize clearance intervals.
- Employ emergency vehicle preemption.
- Improve operation of pedestrian and bicycle facilities at signalized intersections.
- Improve geometry of pedestrian and bicycle facilities.

ASSOCIATED SAFETY PLANS & PROGRAMS

The SHSP is a statewide safety plan that provides a comprehensive framework for all safety-related activities within the State. The emphasis areas, strategies, goals, and action plans identified in this plan will influence other safety plans and programs and help provide a unified direction in the steps needed to significantly reduce fatalities and injuries. While this plan provides an overall direction and key areas to focus efforts on, it does not preclude other plans and programs from activities to reduce crashes related to other issues not addressed in this document.

The SHSP should be regarded in the development of the following associated plans and programs.

Traffic Records Strategic Plan

The strategic plan is a multi-year plan with annual updates intended to set the framework for improving all aspects of a Comprehensive Statewide Traffic Safety Information System Improvement Program, providing vision and focus for activities over both the short and long term. Although, accepted “best practice” within the highway safety system community has always been to make data-driven decisions, the reality has been that the data to drive those decisions has not been available. The development and implementation of a Statewide Traffic Safety Information System Strategic Plan is intended to address this data gap in the most efficient and effective manner possible.

Highway Safety Plan

In 1966, Congress created the U.S. Highway Safety Act which allocated funds to states for the reduction of highway deaths in injuries. These funds are distributed through the U.S. Department of Transportation, National Highway Traffic Safety Administration, to each state. States must review crash data and develop an annual plan which is comprised of projects designed to reduce the severity of crashes on North Dakota roadways. These funds are known as Section 402 State and Community Highway Safety Grant Program. This plan is submitted to the Rocky Mountain Region office in Denver, Colorado on September 1 for review and approval. In addition to the state’s 402 funding, incentive grants are also a part of this plan. These include: Section 408 Data Improvement Grant; Section 410 Alcohol Impaired Driving Countermeasures Incentive; 403 Highway Safety Research and Development; and Section 2010 Motorcycle Safety Grants.

Highway Safety Improvement Program

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) amended section 148 of Title 23 U.S.C. to establish a new “core” Highway Safety Improvement Program (HSIP) that provides funds to State Departments of Transportation (DOTs) to improve conditions at hazardous highway locations and hazardous railway-highway grade crossings on all public roads, including those maintained by Federal, State and local agencies. As a condition to receive full funding, the new HSIP requires States to develop a Strategic Highway Safety Plan (SHSP). The process of developing a SHSP establishes the overall framework for analysis of priority needs and opportunities for the HSIP. The HSIP funds are focused primarily on infrastructure-based safety projects described in the SHSP.

Traffic and Criminal Software (TraCS)

TraCS is a sophisticated data collection and reporting tool for the public safety community. TraCS provides organizations with an information management tool to streamline and automate the capture and transfer of incident data in the field. Using the latest mobile computing technologies to capture and report incident data where it occurs, TraCS improves the accuracy, completeness, and timeliness of incident data and reduces user's administrative duties and paperwork.

Commercial Vehicle Safety Plan

The Commercial Vehicle Safety Plan (CVSP) is an annual plan that details objectives, strategies, activities and measures to improve commercial vehicle safety in North Dakota. The CVSP provides a comprehensive operational and financial framework for the Motor Carrier Safety Assistance Program (MCSAP), which is managed by the North Dakota Highway Patrol in coordination with the Federal Motor Carrier Safety Administration. MCSAP is a \$1.5 million program that implements a number of enforcement, education, technology, and other strategies. Five core MCSAP activities are driver/vehicle inspections, compliance reviews, traffic enforcement, public education, and data collection. Two critical MCSAP objectives are to increase safety belt usage, and to decrease driver violations and driver-related factors that lead to crashes. These objectives are in complete harmony with several Strategic Highway Safety Plan (SHSP) emphasis areas.

IMPLEMENTATION PROCESS

As stated in the previous section, the SHSP serves as a framework for safety activities and must be regarded in the development of other safety plans and programs as well as roadway projects. Advancements must be made through a combination of stand alone safety projects as well as incorporating safety items into larger projects when possible and based on justifiable need.

As resources are available the potential strategies should be researched further to determine which ones are most appropriate to address the emphasis areas and how to proceed toward implementation. In order to focus efforts and ensure accountability, critical strategies from each emphasis area were determined and action plans were developed to help bring them closer to possible implementation. The action plans can be found in Appendix D.

EVALUATION PROCESS

In order to determine the success of strategies implemented and the overall progress being achieved for each emphasis area, evaluation is critical.

The performance measures for each emphasis area will be monitored and data updated on an annual basis. The work team/objective committee will remain active and meet at least

annually to review the progress, maintain momentum, and keep the channels of communication and coordination between the stakeholders open.

The SHSP will be revised every 5 years to ensure the plan reflects current safety goals and priorities. It is an opportunity to identify the overall progress made and re-focus efforts as needed. The process outlined in this document can be used.

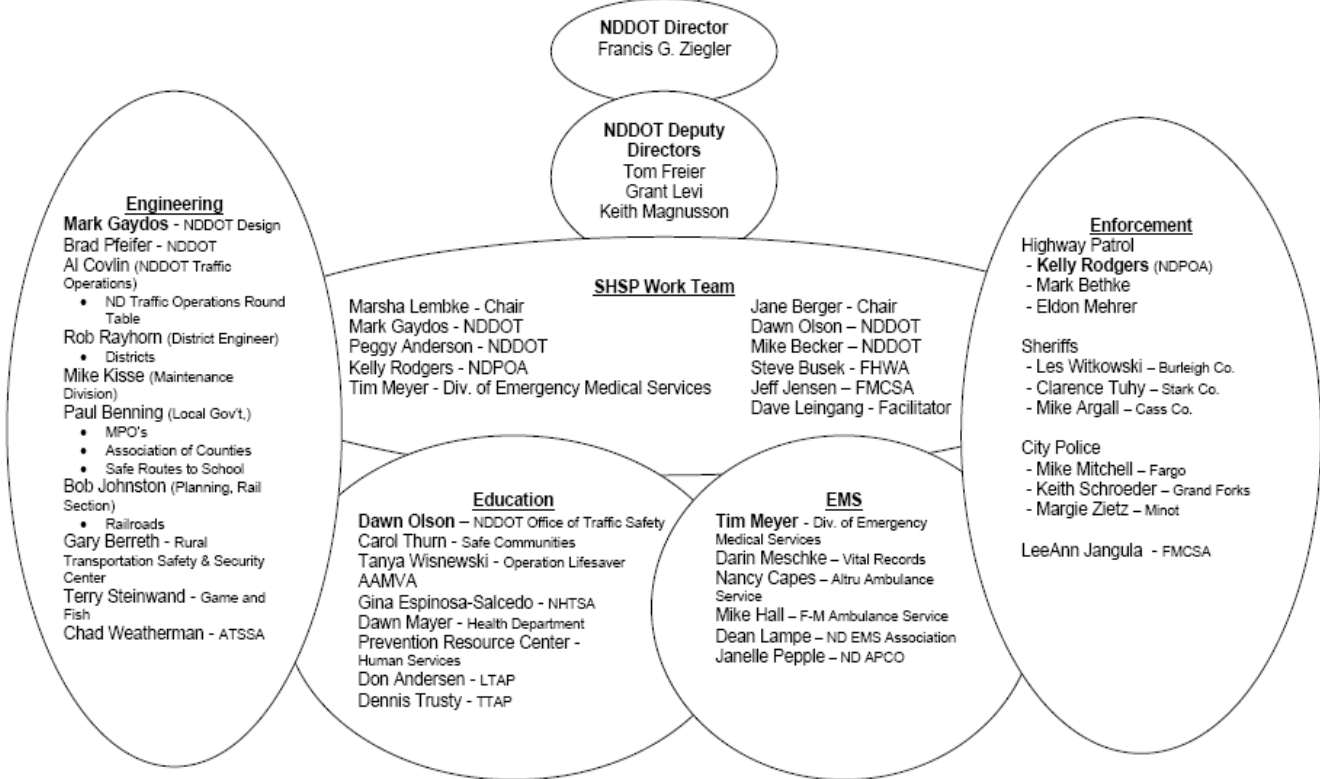
Consideration will be given to conducting an annual “Towards Zero Deaths” conference which will be an opportunity for all safety stakeholders to meet and collectively assess the progress of traffic safety within the state and share experiences and ideas.

NEXT STEPS

The SHSP is a “living” document. It is the responsibility of all safety stakeholders to be mindful of the emphasis areas, goals, and strategies outlined in this document and take action on them whenever possible. The action plans for critical strategies provide guidance for the next steps toward implementation.

APPENDIX A

Strategic Highway Safety Plan



APPENDIX B STRATEGIC HIGHWAY SAFETY PLAN (SHSP)

What is it:

The new transportation bill (SAFETEA-LU) establishes a new Highway Safety Improvement Program (HSIP) that is structured to make significant progress in reducing highway fatalities and serious injuries. A requirement of the new program is that states develop and implement a **Strategic Highway Safety Plan (SHSP)** that involves a **comprehensive, data driven** approach to highway safety. See <http://safety.fhwa.dot.gov/safetealu/toc.htm> for FHWA guidance on the SHSP.

The purpose of the SHSP is to identify critical highway safety problems and opportunities within the state for reducing highway fatalities and injuries. The SHSP will be a *Living Document* to continually guide our efforts in improving highway safety.

The existing NDDOT Comprehensive Highway Safety Plan will serve as the starting point in development of the SHSP. The SHSP will be the same basic format, but will be developed with greater stakeholder involvement and will include a data driven approach to focusing on emphasis areas, strategies, and evaluation.

Critical to integrate the “four E’s” of safety:

Engineering, Education, Enforcement, & Emergency Services

Why is it important:

- Strengthen existing plans
- Strengthen partnerships
- Build new safety coalitions
- Define best methods of improving safety
- Share data, knowledge, and resources
- Avoid redundant systems
- Save lives, time, effort, and money
- It's the law!

When is it needed:

We need your help **NOW!** Required to have developed and implemented a SHSP by **October 1, 2006** in order to obligate funds for all HSIP eligible activities.

How do we accomplish it:

Involvement by all stakeholders is critical! We need your expertise to develop the SHSP and your commitment to work toward the common goal of reducing highway fatalities and injuries. Steps include: identify emphasis areas, identify strategies and countermeasures, determine priorities for implementation, and write SHSP.

Structure:

NDDOT has developed a Strategic Highway Safety Plan Committee. The committee is led by NDDOT staff and is comprised of subcommittee chairs from each of the “four E’s”. Your subcommittee chair will work with you in development of the SHSP. They will provide you with information and be requesting input from you. See the attached flow chart. As the process proceeds, the subcommittees will likely be

reorganized so we will all have a chance to interact with members from each of the “four E’s”.

The *national plan* to improve roadway safety is AASHTO’s Strategic Highway Safety Plan (SHSP) which is based on 22 emphasis areas that broadly address the “four Es” – Engineering, Enforcement, Education and Emergency Medical Services (EMS). Each emphasis area targets a distinct area where it is believed that a significant number of deaths can be prevented each year from happening on the nation’s highways. Listed below are the 22 emphasis areas identified by AASHTO. They are grouped into six parts (Drivers, Special Users, Vehicles, Highways, Emergency Medical Services, and Management).

AASHTO 22 Emphasis Areas

- | | |
|------------------------------------|--|
| Part 1: Drivers | 1. Instituting Graduated Licensing for Young Drivers
2. Ensuring Drivers are Licensed and Fully Competent
3. Sustaining Proficiency in Older Drivers
4. Curbing Aggressive Driving
5. Reducing Impaired Driving
6. Keeping Drivers Alert
7. Increasing Driver Safety Awareness
8. Increasing Seat Belt Usage and Improving Airbag Effectiveness |
| Part 2: Special Users | 9. Making Walking and Street Crossing Easier
10. Ensuring Safer Bicycle Travel |
| Part 3: Vehicles | 11. Improving Motorcycle Safety and Increasing Motorcycle Awareness
12. Making Truck Travel Safer |
| Part 4: Highways | 13. Increasing Safety Enhancements in Vehicles
14. Reducing Vehicle-Train Crashes
15. Keeping Vehicles on the Roadway
16. Minimizing the Consequences of Leaving the Road
17. Improving the Design and Operation of Highway Intersections
18. Reducing Head-On and Across-Median Crashes
19. Designing Safer Work Zones |
| Part 5: Emergency Medical Services | 20. Enhancing Emergency Medical Capabilities to Increase Survivability |
| Part 6: Management Systems | 21. Improving Information and Decision Support Systems
22. Creating More Effective Processes and Safety Management |
| <i>State Specific</i> | 23. Reducing Deer-Vehicle Crashes
24. Reducing Weather Related Crashes |

Source: AASHTO Strategic Highway Safety Plan: <http://safety.transportation.org/>

We have elected to use the AASHTO 22 emphasis areas plus 2 additional “state specific” emphasis areas as a starting point for determining if the emphasis areas identified in our Comprehensive Highway Safety Plan are truly reflective of the state’s issues. To begin the data-driven approach to identifying the most important emphasis areas, five years of crash history (2000-2004) was compiled for crash types relevant to each of the 24 emphasis areas. This data is presented on the attached spreadsheet. Using the crash data, and your specific knowledge of the issues you see are the most important to the state of North Dakota, please rank your top 10 emphasis areas (with 1 being the most important). Consider all 24 emphasis areas, even those that do not have crash data associated with them. The rankings from all stakeholders will be compiled and the top 5 to 10 emphasis areas (possibly combining some) will be determined. We will continue the process with focus on these areas. The process will include a more in depth crash analysis for each emphasis area to help identify appropriate strategies and countermeasures. We will also set measurable goals, and identify priorities for implementation.

2000 - 2004 Crash Reporting System

Reporting Agency:

	POC*	Injury	Fatal	Total	Measure	POC*	Injury	Fatal	Total	POC*	Injury	Fatal	Total
1. Instituting Graduated Licensing for Young Drivers	Crashes 63.011	15,502	450	78,963	Involving Driver Under Age 21	18,803	6,349	116	25,268	30%	41%	26%	32%
2. Ensuring Drivers are Licensed and Fully Competent	NA												
3. Sustaining Proficiency in Older Drivers	Crashes 63.011	15,502	450	78,963	Involving Driver age 65 to 74	4,060	1,053	41	5,154	6%	7%	9%	7%
	Crashes 63.011	15,502	450	78,963	Involving Drivers over the age of 74	3,539	1,073	53	4,665	6%	7%	12%	6%
4. Curbing Aggressive Driving	Crashes 63.011	15,502	450	78,963	Excessive Speed or Following Too Closely as a Contributing Factor	11,498	4,420	153	16,071	18%	29%	34%	20%
5. Reducing Impaired Driving	Crashes 63.011	15,502	450	78,963	Alcohol Related	2,694	2,217	210	5,121	4%	14%	47%	6%
6. Keeping Drivers Alert	Crashes 63.011	15,502	450	78,963	Attention Distracted as a Contributing Factor	7,621	2,854	37	10,512	12%	18%	8%	13%
	Crashes 63.011	15,502	450	78,963	Asleep or Fatigued as the Drivers' Physical Condition	348	237	11	596	1%	2%	2%	1%
7. Increasing Driver Safety Awareness	NA												
8. Increasing Seat Belt Usage and Improving Airbag Effectiveness	Persons 111,462	21,359	428	133,249	Vehicle Occupants not using Restraint Device	31,526	8,551	337	40,414	28%	40%	79%	30%
9. Making Walking and Street Crossing Easier	Crashes 63.011	15,502	450	78,963	Crashes Involving a Pedestrian	3	426	23	452	0%	3%	5%	1%
10. Ensuring Safer Bicycle Travel	Crashes 63.011	15,502	450	78,963	Crashes Involving a Pedalcyclist	14	408	5	427	0%	3%	1%	1%
11. Improving Motorcycle Safety and Increasing Motorcycle Awareness	Crashes 63.011	15,502	450	78,963	Crashes Involving a Motorcycle	121	549	22	692	0%	4%	5%	1%
12. Making Truck Travel Safer	Crashes 63.011	15,502	450	78,963	Crashes Involving a Heavy Truck	2,786	762	65	3,613	4%	5%	14%	5%
13. Increasing Safety Enhancements in Vehicles	NA												
14. Reducing Vehicle-Train Crashes	Crashes 63.011	15,502	450	78,963	Train Collisions	55	31	9	95	0%	0%	2%	0%
15. Keeping Vehicles on the Roadway	Crashes 63.011	15,502	450	78,963	Run-off Road Crashes	7,635	3,808	182	11,625	12%	25%	40%	15%
16. Minimizing the Consequences of Leaving the Road	Crashes 63.011	15,502	450	78,963	Rollover (Most Harmful Event)	3,060	2,448	141	5,649	5%	16%	31%	7%
	Crashes 63.011	15,502	450	78,963	Tree (Most Harmful Event)	570	231	7	808	1%	1%	2%	1%
	Crashes 63.011	15,502	450	78,963	Luminaire/Light Support (Most Harmful Event)	472	134	0	606	1%	1%	0%	1%
	Crashes 63.011	15,502	450	78,963	Highway Sign (Most Harmful Event)	548	51	1	600	1%	0%	0%	1%
	Crashes 63.011	15,502	450	78,963	Embankment/Ditch/Curb (Most Harmful Event)	611	406	7	1,024	1%	3%	2%	1%
17. Improving the Design and Operations of Highway Intersections	Crashes 63.011	15,502	450	78,963	Intersection Crashes	15,894	6,146	106	22,146	25%	40%	24%	28%
18. Reducing Head-On and Across-Median Crashes	Crashes 63.011	15,502	450	78,963	Head-On Only	903	585	53	1,541	1%	4%	12%	2%
19. Designing Safer Work Zones	Crashes 63.011	15,502	450	78,963	Road Condition = "Under Construction, Maintenance"	1,014	333	8	1,355	2%	2%	2%	2%
20. Enhancing Emergency Medical Capabilities to Increase Survivability	NA												
21. Improving Information and Decision Support Systems	NA												
22. Creating More Effective Processes and Safety Management Systems	NA												
23. Reducing Deer/Vehicle Crashes (Urban & Rural)	Crashes 63.011	15,502	450	78,963	Crashes involving a deer as the First Harmful Event	18,158	152	4	18,314	29%	1%	1%	23%
24. Reducing Weather-related Crashes	Crashes 63.011	15,502	450	78,963	Surface Condition = Snow, Slush, Ice/Snow, or Frost	14,853	3,356	62	18,271	24%	22%	14%	23%

Top Five Run-Off-the-Road Crashes

*POC=Property Damage Only

The following 7 emphasis areas were determined after review and discussion of the crash data rankings completed by the 4 E sub-committees. These are the emphasis areas that will be carried forward in the SHSP process. With the exception of #4 (Curb Aggressive Driving), all of the other emphasis areas were previously identified in the Comprehensive Highway Safety Plan.

North Dakota SHSP Emphasis Areas

1. Reduce Alcohol Impaired Driving
2. Increase the Use of Safety Restraints for all Occupants
3. Younger Driver/Older Driver Safety
4. Curb Aggressive Driving
5. Improvements to Address Lane Departure Crashes
6. Enhancing Emergency Medical Capabilities to Increase Survivability
7. Improve Intersection Safety

The next step in the process is to identify strategies and countermeasures. Each of the 4 E sub-committees should identify strategies and countermeasures for each of the 7 emphasis areas. Although the strategies and countermeasures will likely relate to the E sub-committee working on it, all sub-committees should be mindful of all of the 4 E's.

Guidance documents have been published to assist in implementation of the AASHTO Strategic Highway Safety Plan. These documents may be helpful to the sub-committees as they are working through this process. All of the 7 emphasis areas have documents relating to them available at the following website: <http://safety.transportation.org/guides.aspx> The following are the emphasis areas and the volume #s relating to them. (for some volumes you have to click on it in the "ordering the guides" section and then "view this PDF".)

Emphasis area	NCHRP 500 Volume #
1	16
2	11
3	9
4	1
5	6
6	15
7	5 & 12

Please inform me of any additional crash data you may need to help identify strategies/countermeasures. The next meeting is scheduled for Thursday, June 1, 2006. Please have strategies/countermeasures available for discussion at the June 1 meeting.

APPENDIX C CRASH DATA RANKING

2000 - 2004 Crash Reporting System

	PDO*	Injury	Fatal	Total	Measure	PDO*	Injury	Fatal	Total	PDO*	Injury	Fatal	Total	RANK
5. Reducing Impaired Driving	Crashes 63,011	15,502	450	78,963	Alcohol Related	2,894	2,217	210	5,121	4%	14%	47%	6%	1
8. Increasing Seat Belt Usage and Improving Airbag Effectiveness	Persons 111,462	21,359	428	133,249	Vehicle Occupants not using Restraint	31,526	8,551	337	40,414	28%	40%	79%	30%	2
1. Instituting Graduated Licensing for Young Drivers	Crashes 63,011	15,502	450	78,963	Involving Driver Under Age 21	18,803	6,349	116	25,268	30%	41%	26%	32%	3
4. Curbing Aggressive Driving	Crashes 63,011	15,502	450	78,963	Excessive Speed or Following Too Closely as a Contributing Factor	11,498	4,420	153	16,071	18%	29%	34%	20%	4
15. Keeping Vehicles on the Roadway	Crashes 63,011	15,502	450	78,963	Run-off Road Crashes	7,635	3,808	182	11,625	12%	25%	40%	15%	5
20. Enhancing Emergency Medical Capabilities to Increase Survivability	NA													6
16. Minimizing the Consequences of Leaving the Road	Crashes 63,011	15,502	450	78,963	Rollover (Most Harmful Event)	3,060	2,448	141	5,649	5%	16%	31%	7%	7
	Crashes 63,011	15,502	450	78,963	Tree (Most Harmful Event)	570	231	7	808	1%	1%	2%	1%	1
	Crashes 63,011	15,502	450	78,963	Luminaire/Light Support (Most Harmful Event)	472	134	0	606	1%	1%	0%	1%	1
	Crashes 63,011	15,502	450	78,963	Highway Sign (Most Harmful Event)	548	51	1	600	1%	0%	0%	1%	1
	Crashes 63,011	15,502	450	78,963	Embankment/Ditch/Curb (Most Harmful Event)	611	406	7	1,024	1%	3%	2%	1%	1
17. Improving the Design and Operations of Highway Intersections	Crashes 63,011	15,502	450	78,963	Intersection Crashes	15,894	6,146	106	22,146	25%	40%	24%	28%	8
21. Improving Information and Decision Support Systems	NA													9
22. Creating More Effective Processes and Safety Management Systems	NA													10
24. Reducing Weather-related Crashes	Crashes 63,011	15,502	450	78,963	Surface Condition = Snow, Slush, Ice/Snow, or Frost	14,853	3,356	62	18,271	24%	22%	14%	23%	11
3. Sustaining Proficiency in Older Drivers	Crashes 63,011	15,502	450	78,963	Involving Driver age 65 to 74	4,060	1,053	41	5,154	6%	7%	9%	7%	12
19. Designing Safer Work Zones	Crashes 63,011	15,502	450	78,963	Involving Drivers over the age of 74	3,539	1,073	53	4,665	6%	7%	12%	6%	13
11. Improving Motorcycle Safety and Increasing Motorcycle Awareness	Crashes 63,011	15,502	450	78,963	Road Condition = "Under Construction, Maintenance"	1,014	333	8	1,355	2%	2%	2%	2%	13
2. Ensuring Drivers are Licensed and Fully Competent	Crashes 63,011	15,502	450	78,963	Crashes Involving a Motorcycle	121	549	22	692	0%	4%	5%	1%	14
6. Keeping Drivers Alert	Crashes 63,011	15,502	450	78,963	Attention Distracted as a Contributing Factor	7,621	2,854	37	10,512	12%	18%	8%	13%	
7. Increasing Driver Safety Awareness	Crashes 63,011	15,502	450	78,963	Asleep or Fatigued as the Driver's Physical Condition	348	237	11	596	1%	2%	2%	1%	
9. Making Walking and Street Crossing Easier	Crashes 63,011	15,502	450	78,963	Crashes Involving a Pedestrian	3	426	23	452	0%	3%	5%	1%	
10. Ensuring Safer Bicycle Travel	Crashes 63,011	15,502	450	78,963	Crashes Involving a Pedalcyclist	14	408	5	427	0%	3%	1%	1%	
12. Making Truck Travel Safer	Crashes 63,011	15,502	450	78,963	Crashes Involving a Heavy Truck	2,786	762	65	3,613	4%	5%	14%	5%	
13. Increasing Safety Enhancements in Vehicles	NA													
14. Reducing Vehicle-Train Crashes	Crashes 63,011	15,502	450	78,963	Train Collisions	55	31	9	95	0%	0%	2%	0%	
18. Reducing Head-On and Across-Median Crashes	Crashes 63,011	15,502	450	78,963	Head-On Only	903	585	53	1,541	1%	4%	12%	2%	
23. Reducing Deer/Vehicle Crashes (Urban & Rural)	Crashes 63,011	15,502	450	78,963	Crashes involving a deer as the First Harmful Event	18,158	152	4	18,314	29%	1%	1%	23%	

Top Five Run-Off-the-Road Crashes

The SHSP work team combined items 15 and 16 into one emphasis area, and items 1 and 3 into one emphasis area.

APPENDIX D Action Plans

**North Dakota Department of Transportation
Strategic Highway Safety Plan
Critical Strategy Action Plan**

Emphasis Area	REDUCE ALCOHOL IMPAIRED DRIVING
Critical Strategy	HIGHLY PUBLICIZED ENFORCEMENT AND COMPLIANCE/SOBRIETY CHECKPOINTS

Description / Target Group	The driving population, and those drivers who choose to drive after consumption of alcohol or drugs.
Location	Statewide
Effectiveness	Proven , Tried, or Experimental
Goal / Performance Measure	Reduce alcohol related fatal crashes to 40% by 2008
Keys to Success	<p>The key to successfully reducing the number of alcohol related crashes is to combine a sustained public information and education campaign, along with an aggressive enforcement effort.</p> <p>Strong cooperative agreements among law enforcement agencies are needed to ensure that all law enforcement agencies are involved in enforcement and PI&E activities. Multi-agency media advisories and enforcement campaigns will send a clear message to the community that the impaired driver is a problem, for the whole community.</p> <p>The utilization of sobriety checkpoints is an effective deterrent to impaired driving, provided the motoring public fears arrest. An aggressive multi-agency enforcement effort will send a clear message to the public that the impaired driver is a societal problem, and that law enforcement is united in combating the problem.</p>

Challenges	Because of calls for service, and priority activities of law enforcement agencies, it is difficult to have every agency commit the necessary resources to impact the impaired driving problem. Sobriety checkpoints are very labor intensive, and most agencies do not have the available manpower to devote to the project, without the utilization of overtime funds.		
Needs (training, personnel, labor & material, etc.)	Training to law enforcement agencies may be needed to inform officers as to the magnitude of the problem, and the importance of an aggressive enforcement effort. Agency administrators may need training in the development of sobriety checkpoint policies, if not already in place.		
Relative Cost	High, Medium, or Low	Possible Funding Source	<p>PI&E costs associated with conducting sobriety checkpoints would be minimal. Public notification of an upcoming checkpoint would be made through media advisories. Informational materials would be needed to handout to the public, to inform the public why checkpoints are important.</p> <p>Overtime expense for use by law enforcement agencies.</p> <p>Funding Source: Office of Traffic Safety.</p>
Legislative Needs	No legislative needs.		
Timeframe for Implementation	Continue throughout the year.		
Responsible Entity	Office of Traffic Safety and statewide law enforcement agencies.		

**North Dakota Department of Transportation
Strategic Highway Safety Plan
Critical Strategy Action Plan**

Emphasis Area	REDUCE ALCOHOL IMPAIRED DRIVING
Critical Strategy	WELL PUBLICIZED ENFORCEMENT AND CONSEQUENCES

Description / Target Group	North Dakota youth under the age of 21
Location	Statewide
Effectiveness	Proven, Tried, or Experimental
Goal / Performance Measure	Reduce the incidence of underage drinking and driving by 10% by 2008.
Keys to Success	<p>Publicity about enforcement is key to ensuring that young drivers are aware of zero tolerance and the consequences for violating the law. This publicity can take many forms but should use communication channels that are likely to reach teens. Officers speaking to students and educational materials provided to new license applicants are licensing sites are some means to educate.</p> <p>Publicity, without enforcement, will likely be viewed by teens as an empty threat. Therefore, it is critical that law enforcement officers be familiar with the law and look for violations when they stop young drivers for any infraction.</p> <p>Zero tolerance is most effective when implemented administratively and when it includes immediate suspension of the young driver's license. Certainty and swiftness are essential if the desired effect is to be realized.</p>
Challenges	Drinking drivers at low BACs are difficult to identify. Such drivers barely exhibit any visible signs of impairment and may perform well on the SFST.

Needs (training, personnel, labor & material, etc.)	Training should be given to all new law enforcement officers covering the procedures for enforcement.		
Relative Cost	High, Medium, or Low	Possible Funding Source	Materials distributed to license applicants at licensing sites can be produced at a low cost. Well publicized media campaign will be costly but more effective if targeted accordingly.
Legislative Needs	North Dakota's zero tolerance law is not as actively enforced as it should be. It should be reviewed and modifications should be considered.		
Timeframe for Implementation	Year round and on-going		
Responsible Entity	Office of Traffic Safety and statewide law enforcement agencies.		

<p>North Dakota Department of Transportation Strategic Highway Safety Plan Critical Strategy Action Plan</p>

Emphasis Area	INCREASE USE OF SAFETY RESTRAINTS
Critical Strategy	EDUCATE ON PROPER CHILD RESTRAINT USE

Description / Target Group	Parents and others desiring to ensure child safety and booster seats are properly installed.		
Location	Statewide		
Effectiveness	Proven , Tried, or Experimental		
Goal / Performance Measure	Increase the proper use of child safety restraints by 90% to 2008.		
Keys to Success	The primary key to success is for entities to agree to host inspection clinics that are available and convenient for child safety seat users. Certified inspectors must staff the clinics to ensure compliance with standardized criteria.		
Challenges	There may be difficulty in finding appropriate locations to attract potential users. Care should be given to assure those that come to the clinics that no enforcement action will be taken in conjunction with the visit.		
Needs (training, personnel, labor & material, etc.)	Inspectors must attend a week long classroom and interactive course in order to become certified. They must also take tests and submit their information to a national database to maintain this certification. Law enforcement should also be trained in detecting improper use and provide information on upcoming clinics.		
Relative Cost	High, Medium, or Low	Possible Funding Source	Participants are asked to contribute \$20 for each new car seat provided at the inspection. If they are unable to pay, this fee is waived. The cost of the inspectors' time is paid by the agency they represent. Funding source: Office of Traffic Safety and private contributions
Legislative Needs	North Dakota's recently upgraded the child passenger safety law to include booster seats. There is no plan to make any further enhancements.		

Timeframe for Implementation	Year round and on-going
Responsible Entity	Office of Traffic Safety, Health Department, Public Health Units, and Safe Communities programs.

**North Dakota Department of Transportation
Strategic Highway Safety Plan
Critical Strategy Action Plan**

Emphasis Area	INCREASE USE OF SAFETY RESTRAINTS
Critical Strategy	HIGHLY PUBLICIZED ENFORCEMENT CAMPAIGNS

Description / Target Group	The driving population and occupants who seldom or never use safety belts.
Location	Statewide
Effectiveness	Proven , Tried, or Experimental
Goal / Performance Measure	Increase safety belt use rate to 81.3% by 2008.
Keys to Success	<p>The effectiveness of increased safety belt and restraint device usage has been generally estimated by NHTSA. Approximately, 45% of occupants involved in a crash are saved or their injuries are significantly reduced. Success and effectiveness are usually measured in terms of the measurable increase in usage. North Dakota has experienced significant success in the utilizing the "Click It or Ticket" public information campaign.</p> <p>The primary key to success is to combine the enforcement and PI&E efforts. The successful campaigns publicize the campaign heavily, in a mix of media, and then make sure that enforcement efforts are as visible as possible, as well as being reported to the media.</p> <p>Strong cooperative agreements are also needed if more than one agency is going to participate in the event. All law enforcement agencies operating in the area must agree to participate in the project.</p>
Challenges	<p>Because of the rural nature of North Dakota, it is often difficult to make occupant protection by law enforcement a priority. Because of the secondary law, often times law enforcement places little to no emphasis on enforcing because of perceived public perception.</p>
Needs (training, personnel, labor & material, etc.)	The need for a strong coordinated PI&E campaign requires the services of a private public information firm to design, prepare, implement, and monitor the program. Also, a private contractor conducts the annual survey to determine compliance.

Relative Cost	High, Medium, or Low	Possible Funding Source	<p>There are two potential costs with this strategy: media and overtime for officers. Funding must be in secure for media. A statewide comprehensive media plan is important. Pre-and Post observational surveys are costly but required.</p> <p>The other cost is overtime expense required for use by enforcement personnel.</p> <p>Funding source: Office of Traffic Safety</p>
Legislative Needs	Proper restraint use by occupants over the age of 18 is a secondary offense. North Dakota would experience a significant increase in usage rates and reduction in fatalities if this law would be changed to make it a standard or "primary."		
Timeframe for Implementation	Law enforcement must enforce occupant protection laws each and every day. The major media emphasis and enforcement period will take place in May of each year. The annual observational survey will be done June of each year.		
Responsible Entity	Office of Traffic Safety (public information and statewide law enforcement agencies).		

**North Dakota Department of Transportation
Strategic Highway Safety Plan
Critical Strategy Action Plan**

Emphasis Area	YOUNG DRIVERS/OLDER DRIVERS
Critical Strategy	ANALYZE DATA AND MAKE RECOMMENDATIONS FOR FACTORS AFFECTING YOUNG DRIVERS

Description / Target Group	Drivers between 14 and 17, and drivers between 18 and 20		
Location	Statewide		
Effectiveness	Proven, Tried, or Experimental		
Goal / Performance Measure	Reduce the number of crashes in these age groups by 10% by 2008.		
Keys to Success	<p>Young drivers are over-represented in the crash statistics. According to the 2004 crash analysis section of the North Dakota Highway Safety Plan, drivers ages 14 – 17 comprise 3.9% of all licensed drivers yet 9.5% of all crashes. Drivers 18 – 20 represent 5.8%, and 12.5% of all crashes.</p> <p>More analysis needs to be done in order to determine the exact causes which are contributing to these numbers. The emerging concern over cell phone use will be a reviewed.</p>		
Challenges	Currently, cell phone use is not captured on the crash report. This will need to be changed. Also, law enforcement may experience difficulty in reporting cell phone use if the driver does not provide this information.		
Needs (training, personnel, labor & material, etc.)	Data analysis for research analyst will be required.		
Relative Cost	High, Medium, or Low	Possible Funding Source	OTS Funding
Legislative Needs	None at this time.		

Timeframe for Implementation	Annual analysis of data
Responsible Entity	OTS, Law enforcement crash reports

**North Dakota Department of Transportation
Strategic Highway Safety Plan
Critical Strategy Action Plan**

Emphasis Area	CURB AGGRESSIVE DRIVING
Critical Strategy	ANALYZE AND MAKE RECOMMENDATIONS FOR FACTORS CONTRIBUTING TO AGGRESSIVE DRIVING

Description / Target Group	General population of drivers at defined locations where frequent crashes occur because due driver frustrations and aggressive behaviors.		
Location	Statewide		
Effectiveness	Proven, Tried, or Experimental		
Goal / Performance Measure	Identify the elements that are contributing to aggressive driving and countermeasures to minimize the level of frustration.		
Keys to Success	Aspects of the driving environment must be identified to aid in probability that an aggressive driving behavior will occur. This is an uncharted area that requires judgment, analysis, and planning. According to North Dakota crash statistics, excessive speed and following too close are the main identified factors that contribute to aggressive driving. However, at this point, we can not clearly define speed as an aggressive behavior. Other data factors, such as red light running, need to be carefully captured and analyzed in order to make determine appropriate countermeasures.		
Challenges	Gaining clear consensus on how to define aggressive driving. Also, enhancements to the crash report if additional data is required.		
Needs (training, personnel, labor & material, etc.)	Law enforcement should be trained on how to recognize aggressive driving behaviors. This may be in a roll call format, or utilizing law enforcement training academies		
Relative Cost	High, Medium, or Low	Possible Funding Source	Office of Traffic Safety funds

Legislative Needs	If automated enforcement approaches are optional, this will require legislative action.
Timeframe for Implementation	Annual
Responsible Entity	Office of Traffic Safety, Safe Communities programs, law enforcement agencies.

**North Dakota Department of Transportation
Strategic Highway Safety Plan
Critical Strategy Action Plan**

Emphasis Area	Improvements to Address Lane Departure Crashes
Critical Strategy	Rumble Strips

Description / Target Group	<p>(shoulder rumble strips) - Drivers of errant vehicles, using sound and sensation to directly alert the individual of encroachment or pending encroachment.</p> <p>(centerline rumble strips) - Drivers of vehicles who unintentionally cross the centerline.</p>
Location	<p>(shoulder rumble strips) - Review industries that use shift schedules, identify short curvy sections in an otherwise straight roadway where a driver could fall asleep or acquire road daze, review crash data to determine locations.</p> <p>(centerline rumble strips) - Review crash data to determine locations. Potential locations may be horizontal curves in otherwise straight roadways.</p>
Effectiveness	<p>Proven, Tried, or Experimental</p> <p>(shoulder rumble strips) - Proven.</p> <p>(centerline rumble strips) - Tried</p>
Goal / Performance Measure	<p>(shoulder rumble strips) - Process measures of program effectiveness would include the number of miles of road or the number of hazardous locations where rumble strips are installed.</p> <p>Impact measures include the number of ROR crashes reduced at these locations and the changes in total crashes. If possible, the impact measure should include potential "crash migration" (i.e., crashes occurring on downstream sections where rumble strips have not been applied, but where drowsy drivers may still be on the road) effects on adjacent roadways.</p> <p>The advent of low-cost vehicle-sensing and recording devices might allow for the use of a surrogate measure based upon the number of encroachments onto the shoulder over a specific section of road (e.g., a curve). In addition to process and crash data, the agency should also collect information on acceptance by the public and by bicyclists and on any adverse noise problems for adjacent properties.</p> <p>(centerline rumble strips) - In an evaluation of centerline rumble strip programs, process measures would include the number of road miles or number of hazardous locations where rumble strips are installed. Process measures may also include the aspect of exposure—number of</p>

	<p>vehicle miles of travel exposed to centerline rumble strips.</p> <p>Impact measures will include the number (or rate) of head-on crashes reduced at these locations, along with any change in total crashes. Another measure may be public acceptance, including complaints from roadway users and even nonusers adjacent to the road.</p> <p>Accident data, traffic volume data, and roadway data will be required to identify appropriate sites for installation.</p>
<p>Keys to Success</p>	<p>(shoulder rumble strips) - If the use of shoulder rumble strips on freeways continues to be as effective as studies indicate, states should readily adopt them on these roads. The key to increased installation on two-lane and other nonfreeway roads would appear to be further proof of effectiveness on these roads and resolution of incompatibility issues such as bicycle use, noise, etc. (See "Potential Difficulties" below.) The use of prototype studies is suggested to establish the validity of extending this strategy to nonfreeway facilities. It will also be important to identify appropriate road sections—sites where ROR crashes are a problem and continuous shoulder rumble strips can be installed.</p> <p>(centerline rumble strips) - To be effective, centerline rumble strips must be implemented over a continuous length of facility. It may not be cost-effective to implement this strategy on all undivided road sections. Therefore, a key to success is identifying the characteristics of the roadway (traffic volume, speed, alignment quality, cross section) for which rumble strips may be expected to have the greatest positive effect.</p>
<p>Challenges</p>	<p>(shoulder rumble strips) - Incompatibilities may exist between shoulder rumble strips and bicycle use. Since the transportation community encourages increased bicycle use, this may become a serious issue. In a recent Draft Technical Advisory on Roadway Shoulder Rumble Strips, FHWA has noted its full support of AASHTO's position, as stated in the 1999 AASHTO Guide for the Development of Bicycle Facilities, that</p> <p>Rumble strips or raised pavement markers . . . are not recommended where shoulders are used by bicyclists unless there is a minimum clear path of 0.3 m (1 foot) from the rumble strip to the traveled way, 1.2 m (4 feet) from the rumble strip to the outside edge of paved shoulder, or 1.5 m (5 feet) to adjacent guardrail, curb or other obstacle. (Draft Technical Advisory on Roadway Shoulder Rumble Strips)</p> <p>In that same advisory, the FHWA describes current state efforts to develop bicycle-friendly rumble strip programs and stresses the need for states to regularly sweep shoulders to remove debris where rumble strips and bicycles coincide in order to allow the bicyclists to use the outer rather than inner part of the paved shoulder.</p> <p>It is also noted that the Association of Pedestrian and Bicycle Professionals (APBP) has commented on these guidelines (see http://www.apbp.org). Key suggestions for locations with bike traffic include only using rumble strips on two-lane roads where there is a</p>

significant, demonstrated crash problem (rather than a systemwide approach), minimizing the depth of the cut to 3/8 inch, preferably retaining 8 feet of clear paved shoulder outside the rumble strip, installing the strip at or under the edgeline rather than leaving the 1-foot "no man's land" between the edgeline and rumble strip, using 12-inch-wide strips with gaps, and no installation of rumble strips where there will be 4 feet or less of clear paved shoulder after installation without "overwhelming justification" and without warning signs to bicyclists.

In its early use of rumble strips, Pennsylvania would only use raised (edgeline) rumble strips where there was at least 4 feet of paved shoulder in order to accommodate bicycle use. The state required a minimum of 4 feet of paved shoulder for shoulder rumble strips and preferred 6 to 8 feet. Because of these concerns, Pennsylvania has developed a design to make shoulder rumble strips "bicycle-tolerable." Working for the Pennsylvania DOT, the Pennsylvania Transportation Institute researched alternative designs to alert motorists without being disruptive to bicyclists. The resulting design, which is used on shoulders at least 6 feet wide, is a 3/8-inch-deep cut that is 5 inches wide with a 7-inch space between cuts. The rumble strips begin 6 inches off the edge of the pavement. The Transportation Institute also recommended a similar pattern, except with a 6-inch space between cuts for lower-speed roads. Research in Pennsylvania continues on an appropriate design for roadways with narrower shoulders (2 to 4 feet). (See [Appendix 1](#) for detailed drawings.) Due to similar concerns, California DOT (Caltrans) tested the vibration, noise, and subjective comfort levels of 11 different rumble strip configurations using passenger cars, trucks, volunteer bicyclists and State Highway Patrol motorcyclists. Based upon a combination of results from the different tests, Caltrans adopted new standard rolled-in and milled-in rumble-strip designs for routes with bicycle usage. Where the shoulder is less than 5 feet wide, the policy allows for the use of raised/inverted profile thermoplastic traffic strips as the edgeline. See [Exhibit V-5](#).

Note that a similar raised edgeline design was modified in Great Britain due to bicycle and motorcycle concerns. The raised ribs in the final design are approximately 1/4 inch high. Details can be found at http://www.roads.dft.gov.uk/roadnetwork/ditm/tal/signs/02_95/index.htm. Of course, discouraging bicycle use on roadways prone to ROR crashes may be the appropriate thing to do (or providing safer, separated bicycle facilities within the same general corridor). To the extent that shoulder rumble strips would be used in a site-specific versus systemwide basis, this apparent conflict may be manageable. At least one state noted that motorcyclists may not be able to recover as well from riding along a rumble strip as from a normal paved shoulder. However, testing by Caltrans involving a very small sample of four state highway patrol motorcyclists indicated that the motorcyclists had no problems traversing any of the designs tested.

Other potential pitfalls include complications with snow removal, shoulder maintenance requirements, and noise. With respect to adverse weather, ice and snow can collect in rumble strips. When the trapped

water freezes, icy conditions may occur. However, the drainage designed for shoulders, as well as the speed, turbulence, and vibrations from passing vehicles, tends to knock the ice from the rumble strips. Continuous shoulder rumble strips also have proven to be an asset to truck drivers during inclement weather. The shoulder rumble strips aid in determining the edge of the roadway when low visibility makes it difficult to see painted roadway edges and markings. (Note, however, that North Carolina has found the raised/inverted profile edgelines do not tolerate snowplowing.)

With respect to maintenance, Pennsylvania has not noted any additional maintenance required for the rumble strips installed on interstates with shoulders in good condition. Neither Massachusetts nor New York has noted any degradation over the past 3 years. Indeed, in some user states, rumble strips have been shown to help snowplows find the edge of the travel lanes. While some states have expressed a concern that the installation of rumble strips might lead to pavement deterioration, the FHWA "Rumble Strip Community of Practice" Web page indicates that this does not occur with proper installation. Finally, with respect to degradation, Kansas is changing its rumble strip policy, which allowed rolled-in strips, to one requiring milled-in strips. This change is due to Kansas's observation that rolled-in strips have a tendency to "heal over" and reduce effectiveness over time.

There have been reports of noise complaints where shoulder rumble strips have been installed. New installations should acknowledge this concern and make provisions where necessary. Implementing a program of rumble strips systemwide should consider local sensitivities to maintain support for such a program.

Finally, there is not a crash-proven rumble strip design for two-lane roads without paved shoulders or with very narrow paved shoulders (e.g., 2 feet wide). This is a significant problem for some state agencies and many county and local agencies where most or all two-lane roads do not have paved shoulders. It is possible that the effectiveness of shoulder rumble strips may well be lessened from freeway experience, by poor or narrow shoulders that exist on many two-lane highways, so that even an "alerted" motorist might not be able to safely recover. However, given the numbers of such miles in the United States, there is clearly a need to test some potential designs. (See sections below concerning possible experimental strategies.)

(centerline rumble strips) - Shoulder rumble strips have either real or perceived drawbacks such as difficulty with snow removal, additional shoulder maintenance requirements, and undesirable noise levels. States not using rumble strips may have concerns about these effects. However, states that use rumble strips (on the roadway shoulder or otherwise) have not reported any additional maintenance requirements as long as the rumble strips are placed on pavement that is in good condition. This pitfall may make centerline rumble strips an expensive countermeasure if targeted implementation is not achieved (i.e., if an agency tried to implement rumble strips everywhere) and measurable

	<p>benefits are not accomplished. In a related vein, an effective implementation strategy may be to deploy centerline rumble strips in conjunction with resurfacing or reconstruction projects. This may, however, forestall the overall system wide benefits sought by AASHTO over the short term.</p> <p>There is the possibility of adverse effects on motorcycling. Note, however, that Pennsylvania has worked with motorcycle groups, and no major concerns were raised by these groups.</p> <p>Finally, it is possible that the use of a centerline rumble strip might have some negative operational effects by inhibiting passing maneuvers (due to the look and noise of the strip). However, states currently using these rumble strips have not reported such problems (e.g., Washington, Minnesota, Pennsylvania).</p>
<p>Needs (training, personnel, labor & material, etc.)</p>	<p>(shoulder rumble strips) - There have been a few reports of people who mistook the sounds produced by the rumble strips as car trouble. A public information or education campaign, as well as standard installation, should eliminate such misinterpretations. However, current moves to standardized use on freeways may provide the most effective public training.</p> <p>There appear to be no special personnel needs for implementing this strategy. Either agency personnel or contractors could do the installation. The need for training will depend on whether the agency has been using retrofitted rumble strips on freeways or other roadways. If not, either agency personnel or contractor personnel will need to be trained in proper installation techniques.</p> <p>(centerline rumble strips) - Since this countermeasure is relatively new (unlike shoulder rumble strips), there may be a need for public information to explain the function of the treatment in order to address any public concerns or potential misunderstandings. Such campaigns may address the concerns of motorcyclists and the education of the motoring public regarding the effects of centerline rumble strips on passing maneuvers.</p> <p>There appear to be no special personnel needs for implementing this strategy. States would either use agency personnel or contractors.</p> <p>Training of state safety engineers on the attributes, benefits, and applicability of centerline rumble strips would be necessary. Training regarding actual installation of the rumble strips would depend on whether the agency has been using retrofitted rumble strips on freeways or other roadways. If not, either agency personnel or contractor personnel would need to be trained in proper installation techniques.</p>
<p>Relative Cost</p>	<p>(shoulder rumble strips) - Due to increased installation and technological advances, the cost of continuous shoulder rumble strips has decreased over the years. For instance, in 1990, the New York DOT reported paying \$6.18 per linear meter compared with \$0.49 per linear meter in 1998. Specific cost of installation on the New York Thruway</p>

	<p>was reported to be \$3,995 per roadway mile for rumble strips on all four shoulders. The cost includes milling in the rumble strips, sweeping and discarding excess asphalt, and maintaining and protecting traffic. The Pennsylvania DOT reports an average cost of \$0.25 per foot or \$2,640 per mile for the installation of milled-in rumble strips on the shoulders on both sides of two-lane roads. Incremental costs would be even less for rumble strips being implemented concurrently with reconstruction or resurfacing of a highway.</p> <p>(centerline rumble strips) - Costs will vary depending on whether the strategy is implemented as a stand-alone project or incorporated as part of a reconstruction or resurfacing effort already programmed. Including rumble strips as part of a resurfacing project offers the opportunity for lowest cost implementation.</p> <p>In Pennsylvania, the cost of installation as a stand-alone project is estimated at about \$2 a linear foot (or about \$10,000 a mile) in 2002. This includes traffic control during installation. Costs of implementing as part of resurfacing or reconstruction would be substantially less. Virginia DOT cited a cost of 38 to 40 cents per foot on a stand-alone 1.9-mile project, and expected lower costs on longer projects.</p> <p>Another example, given in NCHRP Report 440, states that installation of both shoulder and centerline rumble strips over 15 miles (24.2 km) costs \$54,000 (\$3,600 per mile). The rumble strip installation occurred at the same time other improvements were made (such as the addition of turning lanes, channelization, and raised pavement markers).</p>
Possible Funding Source	Potential funding sources include federal, state, or local highway agencies.
Legislative Needs	<p>(shoulder rumble strips) - None Identified.</p> <p>(centerline rumble strips) - None Identified.</p>
Timeframe for Implementation	<p>(shoulder rumble strips) - Shoulder rumble strip programs can be implemented quickly, certainly within a year of an agency deciding to proceed. They can be implemented as components of both new construction and rehabilitation projects.</p> <p>(centerline rumble strips) - This low-cost strategy does not involve reconstruction and would not involve the environmental process or right-of-way acquisition. Rumble strips can be implemented quickly, certainly within a year once a site or highway is selected. Programmatic implementation may take slightly longer, depending on availability of necessary traffic, crash, and roadway data within an agency. Incorporation of centerline rumble strips as part of an agency's design practice for new construction or resurfacing can occur quickly (within 1 year).</p>
Responsible Entity	Engineering Divisions and Districts in NDDOT.

**North Dakota Department of Transportation
Strategic Highway Safety Plan
Critical Strategy Action Plan**

Emphasis Area	Improvements to Address Lane Departure Crashes
Critical Strategy	Pavement Marking

Description / Target Group	<p>(enhanced pavement markings at appropriate locations) - Drivers of vehicles who might leave the roadway because of inability to see the edge of the pavement in the roadway section ahead.</p> <p>(enhanced delineation of sharp curves) - Drivers of vehicles entering potentially hazardous curves.</p>
Location	<p>(enhanced pavement markings at appropriate locations) - Review existing pavement marking along with crash data to determine locations.</p> <p>(enhanced delineation of sharp curves) - Review existing delineation of sharp curves along with crash data to determine locations.</p>
Effectiveness	<p>Proven, Tried, or Experimental</p> <p>(enhanced pavement markings at appropriate locations) - None Identified.</p> <p>(enhanced delineation of sharp curves) - None Identified.</p>
Goal / Performance Measure	<p>(enhanced pavement markings at appropriate locations) - In agency evaluations of implementation effectiveness, process measures would include the number of hazardous curves treated and the type of treatment applied.</p> <p>Impact measures would involve before/after changes in crash frequencies or rates (with the study appropriately designed) and changes in speed from before to after treatment.</p> <p>It would also appear that data are needed to better target the treatment, targeting to sites where additional visual guidance is needed, but where speeds are less likely to be increased. This is a difficult task. It may be aided by use of video logs and conduct of safety audit types of studies.</p> <p>(enhanced delineation of sharp curves) - In the evaluation of these delineation programs, process measures would include the number of hazardous curves treated.</p> <p>Impact measures involve comparison of crash frequencies or rates (with the study appropriately designed) for the period before</p>

	<p>and after modifications. A useful surrogate measure is the change in speed for vehicles entering selected curves. The advent of low-cost vehicle-sensing and recording devices might also allow for the use of a surrogate measure based upon the number of encroachments onto the shoulder over a specific section of road (e.g., a curve). Sufficient data/information will be needed to target these treatments to the correct location. The expert system software noted in "Personnel and Other Training Needs" below will help in this effort.</p>
<p>Keys to Success</p>	<p>(enhanced pavement markings at appropriate locations) - Based upon the effectiveness studies, the key to success is the targeted application of this treatment to sites where more guidance is needed for the driver, but where vehicle speeds will not be increased to unsafe levels.</p> <p>(enhanced delineation of sharp curves) - The development of design standards, based upon sound evaluation studies of these innovative markings, will be important. The ability of interested states to have access to evaluations in other states will be important to achieve acceptance.</p>
<p>Challenges</p>	<p>(enhanced pavement markings at appropriate locations) - A potential difficulty with RPMs is the damage to the reflector or possible dislodging of the reflector during snow plowing. However, these concerns have lessened due to the creation of plowable RPMs. Another potential pitfall is nontargeted or erroneously targeted application of the devices on high-speed two-lane roads. This could result in adverse safety effects, which might negatively affect opinions about the treatment and therefore keep it from being implemented where needed.</p> <p>(enhanced delineation of sharp curves) - If these treatments are targeted to curves with actual or expected safety problems, there appear to be few potential difficulties. The Pennsylvania study of the initial transverse-bar sites noted some motorists driving on the shoulder to avoid the lines. This could be a problem with unpaved shoulders (but it is less likely to occur without paved shoulders) and if the vehicle makes a sudden avoidance maneuver without reducing speed (which, again, may not be likely to occur). Pennsylvania also noted that some drivers (presumably commuters) would drive across the centerline or onto the shoulders to avoid transverse rumble strips. Further observations of traffic behavior at treatment sites are needed to determine whether these are true problems. An attribute of these special treatments is their uniqueness and hence high level of notice by drivers. Overuse of these treatments could lead to them losing this uniqueness and ultimate effectiveness. A final possible difficulty could include maintaining the pavement markings over time, given that they are being crossed by all traffic.</p>

<p>Needs (training, personnel, labor & material, etc.)</p>	<p>(enhanced pavement markings at appropriate locations) - No new public information efforts appear to be needed since this is a publicly accepted treatment on other roads. (Efforts to train the public to use them correctly—i.e., not to increase speed—are not expected to be effective).</p> <p>There appear to be no special personnel or training needs for implementing this strategy. The installation would be done by either agency personnel or contractors and indeed is already being done in most state agencies.</p> <p>(enhanced delineation of sharp curves) - The transverse strips and the pavement arrow are new treatments, and a relatively modest public information effort may be helpful in garnering support for the effort. If evidence is found that a significant proportion of motorists do drive on the shoulder to avoid the transverse lines (see "Potential Difficulties" above) and if this is found to be a safety problem, then a more significant public education effort will be needed for this treatment.</p> <p>There appear to be no special personnel needs for implementing this strategy. Either agency personnel or contractors would do the installation.</p> <p>Since there are various low-cost devices available to the engineer, there is need for some guidance on treatment design and placement. Zwahlen and Schnell (1995) developed a PC-based expert system software package that helps the designer choose an appropriate treatment and place the devices for maximum effect. This expert system considers devices such as flexible post delineators, object markers, and various size chevrons.</p>
<p>Relative Cost</p>	<p>(enhanced pavement markings at appropriate locations) - An old cost figure states that Ohio's average cost is \$14.71 per unit for 35,000 units. A 1997 New York DOT report indicates that an RSPM (which is more expensive than a standard RPM) costs approximately \$2530 to install and \$68 each 3 years for reflector replacement. Installation was found to increase the cost of delineation from approximately \$2,000 to \$5,300 per mile. However, states have most likely developed their own cost estimates, since these treatments are being widely used.</p> <p>(enhanced delineation of sharp curves) - The cost of the arrow pavement marker is about \$2,000 per site (both directions) according to Pennsylvania's experience. Cost figures are not available for the other treatments. However, many states already use chevrons and other delineators in certain locations and may have cost figures of their own.</p>
<p>Possible Funding Source</p>	<p>Potential funding sources include federal, state, or local highway agencies.</p>

Legislative Needs	<p>(enhanced pavement markings at appropriate locations) - None identified.</p> <p>(enhanced delineation of sharp curves) - None identified.</p>
Timeframe for Implementation	<p>(enhanced pavement markings at appropriate locations) - Since these devices are relatively inexpensive and are standard devices, they could be implemented in a very short timeframe.</p> <p>(enhanced delineation of sharp curves) - Since these devices are relatively inexpensive and standard, they could be implemented very quickly.</p>
Responsible Entity	Engineering Divisions and Districts in NDDOT.

**North Dakota Department of Transportation
Strategic Highway Safety Plan
Critical Strategy Action Plan**

Emphasis Area	Improve Intersection Safety
Critical Strategy	Turn Lanes

Description / Target Group	<p>(Left hand) - The strategy is targeted to reduce the frequency of collisions resulting from the conflict between (1) vehicles turning left and following vehicles and (2) vehicles turning left and opposing through vehicles.</p> <p>(Right hand) - The strategy is targeted to reduce the frequency of rear-end collisions resulting from conflicts between (1) vehicles turning right and following vehicles and (2) vehicles turning right and through vehicles coming from the left on the cross street.</p> <p>(Offset) -The strategy of providing offset left-turn lanes at unsignalized intersections is targeted to reduce the frequency of collisions between vehicles turning left and opposing through vehicles, as well as rear-end crashes between through vehicles on the opposing approach. The strategy is generally applicable to intersections on divided highways with medians wide enough to provide the appropriate offset.</p>
Location	Determined by evaluating crash data and intersection layouts.
Effectiveness	Proven, Tried, or Experimental (Left hand) – Proven (Right hand) – Proven (Offset) – Tried
Goal / Performance Measure	<p>(Left hand) – Key process measures include the number of intersection approaches for which left-turn lanes are implemented and the number of conflicts eliminated by the improvement.</p> <p>Crash frequency and severity, by type of crash, are key safety effectiveness measures. It is especially useful to identify crashes related to left turns and analyze them separately.</p> <p>Crash frequency and severity data are needed to evaluate such improvements. If feasible, both total crashes and crashes related to the targeted turning movements at the intersection should be analyzed separately. Traffic volume data are needed to represent exposure. It is especially desirable to obtain data on the volume of vehicles making the left-turn movements of interest and the opposing through volumes.</p> <p>(Right hand) – Key process measures include the number of intersection approaches where turn lanes are implemented and the number of conflicts eliminated by the improvement.</p>

	<p>Crash frequency and severity, by type, are key safety effectiveness measures. It is especially useful to identify crashes related to right turns and analyze them separately.</p> <p>Crash frequency and severity data are needed to evaluate such improvements. If feasible, both total crashes and crashes related to the targeted turning movements at the intersection should be analyzed separately. Traffic volume data are needed to represent exposure.</p> <p>(Offset) – Key process measures include the number of intersection approaches for which left-turn lane offsets are implemented and the number of conflicts affected by the improvements.</p> <p>Crash frequency and severity are key safety effectiveness measures. Separate analysis of the crash types targeted by the improvement (see above) is desirable.</p> <p>Crash frequency and severity data are needed to evaluate such improvements. If feasible, both total crashes and crashes related to targeted turning movements at the intersection should be analyzed separately. Traffic volume data are needed to represent exposure.</p>
<p>Keys to Success</p>	<p>(Left hand) – The key to success in installing left-turn lanes is to make sure that any left-turn lane considered is operationally or justified on the basis of an existing pattern of left-turn collisions. Otherwise, installation of a left-turn lane is unlikely to provide substantial safety benefits.</p> <p>(Right hand) – A key to success in installing right-turn lanes is to make sure that any right-turn lane considered is operationally justified on the basis of right-turning volumes or an existing pattern of right-turn collisions. Otherwise, installation of a right-turn lane is unlikely to provide substantial safety benefits.</p> <p>At some locations, it may be desirable to create a right-turn roadway by a channelizing island on the intersection approach. This allows the turning radius to be increased without introducing a large unused pavement area that might lead to operational problems. The right-turn roadway may be controlled by a yield sign where the roadway enters the intersecting street or may operate as a free-flow roadway where a right-turn acceleration lane is provided on the intersecting street.</p> <p>(Offset) – A key to success in installing offset left-turn lanes is to identify candidate locations at which opposing left-turn vehicles block drivers' views of approaching traffic. This can be determined by measuring the amount of offset (or lack of offset) present at existing intersections. Any intersection with a pattern of collisions between left-turning vehicles and opposing through vehicles that has existing left-turn lanes (or at which installation of left-turn lanes is being considered) should be checked to determine the amount of available offset.</p>

Challenges

(Left hand) – In providing left-turn lanes, vehicles in opposing left-turn lanes may block their respective driver's view of approaching vehicles in the through lanes. This potential problem can be resolved by offsetting the left-turn lanes.

Other potential pitfalls may occur in implementing this strategy. For example, a decision may be made to restripe a shoulder and through lane to make provision for a left-turn lane. However, part of the safety benefits may be lost due to the loss of shoulder, the greater proximity of traffic to roadside objects, and, possibly, a reduction in intersection sight distance (ISD).

Provision of a left-turn lane on an intersection approach may involve restricting left turns in and out of driveways on that intersection approach. Such restrictions may be implemented by signing or by provision of a median adjacent to the left-turn lane.

When installation of left-turn lanes increases the overall width of the intersection, the additional width may cause problems for pedestrians crossing the intersection. One possible solution to this problem is to provide a pedestrian refuge island in the median.

(Right hand) – One of the potential problems with installing a right-turn lane may occur in the design stage of this strategy. If, for example, a decision is made to restripe a shoulder and through lane to provide a right-turn lane, part of the safety benefits may be lost due to the loss of shoulder and the greater proximity of traffic to roadside objects. The effect of major-road right-turn lanes on the available sight distance for vehicles entering or crossing the major road from the adjacent minor-road approach should be considered in the design process. Vehicles using a major-road right-turn lane may obstruct the sight lines of drivers on the minor-road approach. Similarly, addition of the right-turn lane may be accompanied by shifting of the minor-road stop bar. Care should be taken to ensure that the sight triangle remains clear of obstructions on the stopped approach.

When installation of right-turn lanes increases the overall width of the intersection, the additional width may cause potential problems for pedestrians crossing the intersection. One possible solution to this problem is to provide a pedestrian refuge island in the median.

(Offset) – A potential pitfall of installing offset left-turn lanes is that drivers initially may be confused by the change in traffic patterns, particularly in areas where offset left-turn lanes have not been used previously. This can be minimized by effective use of advance guide signing and pavement markings. Research has verified that, in areas where drivers have become familiar with offset left-turn lanes, they operate effectively (Harwood et al., 1995).

When installation of offset left-turn lanes increases the overall width of the intersection, the additional width may cause potential

	<p>problems for pedestrians crossing the intersection. One possible solution to this problem is to provide a refuge island in the median for pedestrians.</p>
<p>Needs (training, personnel, labor & material, etc.)</p>	<p>(Left hand) – There is a definite need to inform the public, especially adjacent property owners, about the safety benefits of access management techniques and about methods to mitigate the adverse effects on any access restrictions associated with the provision of left-turn lanes.</p> <p>(Right hand) – Most drivers understand the operation of right-turn lanes. There is no need for special public information and education programs.</p> <p>(Offset) – Public information and education programs about the operation of offset left-turn lanes and their potential safety benefits should be considered when such treatments are used for the first time in a given area. Such programs can be useful in familiarizing drivers with the intended operation of offset left-turn lanes.</p>
<p>Relative Cost</p>	<p>(Left hand and Right hand) – Costs are highly variable. Where restriping within an existing roadway is possible, the costs are nominal. Where widening and/or reconstruction are necessary, costs over \$100,000 per intersection approach may be incurred.</p> <p>(Offset) – Costs may be highly variable and depend largely on the existing median width.</p>
<p>Possible Funding Source</p>	<p>Potential funding sources include federal, state, and local highway agencies.</p>
<p>Legislative Needs</p>	<p>None identified.</p>
<p>Timeframe for Implementation</p>	<p>(Left hand) - Implementation time may vary from 3 months to 4 years. At some locations, left-turn lanes can be quickly installed simply by restriping the roadway. At other locations, widening the roadway, installing a median, or acquiring additional right-of-way may be needed. Such projects require a substantial time for development and construction. Where right-of-way is required or where the environmental process requires analysis and documentation, project development and implementation may require as long as 4 years.</p> <p>(Right hand) – Implementing this strategy may take from 3 months to 4 years. At some locations, right-turn lanes can be quickly and simply installed by restriping the roadway. At other locations, widening of the roadway or acquisition of additional right-of-way may be needed. Such projects require a substantial time for development and construction. Where right-of-way is required or where the environmental process requires analysis and documentation, project development and implementation may require as long as 4 years.</p>

	<p>(Offset) - The implementation period for provision of offset left-turn lanes is 2 to 4 years. Intersections at which offset left-turn lanes can be provided simply by restriping the roadway are relatively rare. Therefore, time for project development and construction is required. Where a wide median is available, offset left-turn lanes can usually be provided without purchasing additional right-of-way; in such cases, implementation in 2 years may be possible. If the median must be widened, additional right-of-way may be needed and there may be substantial social and environmental impacts that need to be evaluated; in such cases, the implementation may take up to 4 years.</p> <p>The implementation period can be reduced where an agency adopts this design by policy and implements it on projects in preliminary or final design.</p>
Responsible Entity	Engineering Divisions and Districts in NDDOT.

**North Dakota Department of Transportation
Strategic Highway Safety Plan
Critical Strategy Action Plan**

Emphasis Area	Improve Intersection Safety
Critical Strategy	Intersection Geometry

Description / Target Group	<p>(eliminate skew) - The strategy is targeted to reduce the frequency of collisions resulting from insufficient intersection sight distance and awkward sight lines at a skewed intersection.</p> <p>(change horizontal or vertical alignment) - The target for this strategy should be unsignalized intersections with restricted sight distance due to horizontal and/or vertical geometry and with patterns of crashes related to that lack of sight distance that cannot be ameliorated by less expensive methods.</p>
Location	<p>(eliminate skew) - Review existing approach skew angle along with crash data to determine locations.</p> <p>(change horizontal or vertical alignment) – Review existing horizontal and vertical alignments of approaches along with crash data to determine locations.</p>
Effectiveness	<p>Proven, Tried, or Experimental</p> <p>(eliminate skew) - Proven (change horizontal or vertical alignment) - Tried</p>
Goal / Performance Measure	<p>(eliminate skew) - A key process measure is the number of skewed intersection approaches that have been realigned.</p> <p>Crash frequency and severity, by type, are key safety effectiveness measures. Separate analysis of crashes targeted by the improvement is desirable.</p> <p>Crash frequency and severity data are needed. If feasible, both total crashes and crashes related to the improvement should be analyzed separately. Traffic volume data are needed to represent exposure.</p> <p>(change horizontal or vertical alignment) - Key process measures are the number of intersection quadrants in which sight distance was improved and the amount of increase in sight distance achieved. Where issues of potential effect on adjacent properties exist, a process measure may be used to describe this, such as the number of private properties on which alterations were made.</p> <p>Crash frequency and severity, by type, are key safety effectiveness measures. Separate analysis of crashes targeted by the sight distance improvements is desirable.</p>

	<p>Crash frequency and severity data are needed. If feasible, both total crashes and crash types targeted by the improvement should be analyzed separately. Traffic volume data are needed to represent exposure.</p>
<p>Keys to Success</p>	<p>(eliminate skew) - A key to success in realigning a skewed intersection is identifying candidate locations at which there exist crash patterns related to the intersection angle. Any intersection with a pattern of right-angle or turning collisions should be checked to determine whether the skew angle of the intersection is contributing to these collisions.</p> <p>(change horizontal or vertical alignment) - A key to success for this strategy is effective diagnosis of whether a specific crash pattern observed at an intersection is in fact related to restricted sight distance. Currently this is a judgment made by an experienced safety analyst.</p> <p>Because adjacent properties may be affected by the redesign, all the stakeholders should be involved early in the planning process.</p>
<p>Challenges</p>	<p>(eliminate skew) - When realigning a skewed intersection approach, it is possible to create such a sharp horizontal curve that the curve itself becomes a safety concern. Thus, the designer should be alert to avoid trading one safety concern for another.</p> <p>Realignment may negatively affect adjacent properties.</p> <p>(change horizontal or vertical alignment) - The most difficult aspect of this strategy is the potential impact on adjacent property of making improvements to the horizontal or vertical geometry. Because of the potential impacts and the relatively high costs involved, this strategy should generally be considered only when less expensive strategies involving clearing of specific sight obstructions or modifying traffic control devices have been tried and have failed to ameliorate the crash patterns. If additional right-of-way is required, there may be significant environmental issues as well.</p>
<p>Needs (training, personnel, labor & material, etc.)</p>	<p>(eliminate skew) - None identified.</p> <p>(change horizontal or vertical alignment) - Training concerning removal of sight obstructions near intersections should be included in highway agency training concerning geometric design, highway safety, and highway maintenance.</p>
<p>Relative Cost</p>	<p>(eliminate skew) - Reducing or eliminating the skew angle of an intersection involves the realignment of at least one intersection approach. The cost of this type of construction project is usually high. Furthermore, additional right-of-way will generally need to be acquired.</p> <p>(change horizontal or vertical alignment) - Projects involving changing the horizontal and/or vertical alignment are generally</p>

	high cost, especially if additional right-of-way is required. High, Medium, or Low
Possible Funding Source	Potential funding sources include federal, state, or local highway agencies.
Legislative Needs	None identified.
Timeframe for Implementation	<p>(eliminate skew) - This strategy requires an implementation time of 1 to 4 years. At least 1 year is necessary to work out the details of intersection approach realignment and to communicate the plan to affected businesses and residents. Where relocation requires right-of-way acquisition and/or demolition of existing structures, an extensive project development process up to 4 years long may be required.</p> <p>(change horizontal or vertical alignment) - Projects involving changing the horizontal and/or vertical alignment to provide more sight distance are quite extensive and usually take from 1 to 3 years to accomplish. If additional right-of-way is required, these projects will also involve discussions with adjacent property owners, which may require a substantial period of time.</p>
Responsible Entity	Engineering Divisions and Districts in NDDOT.