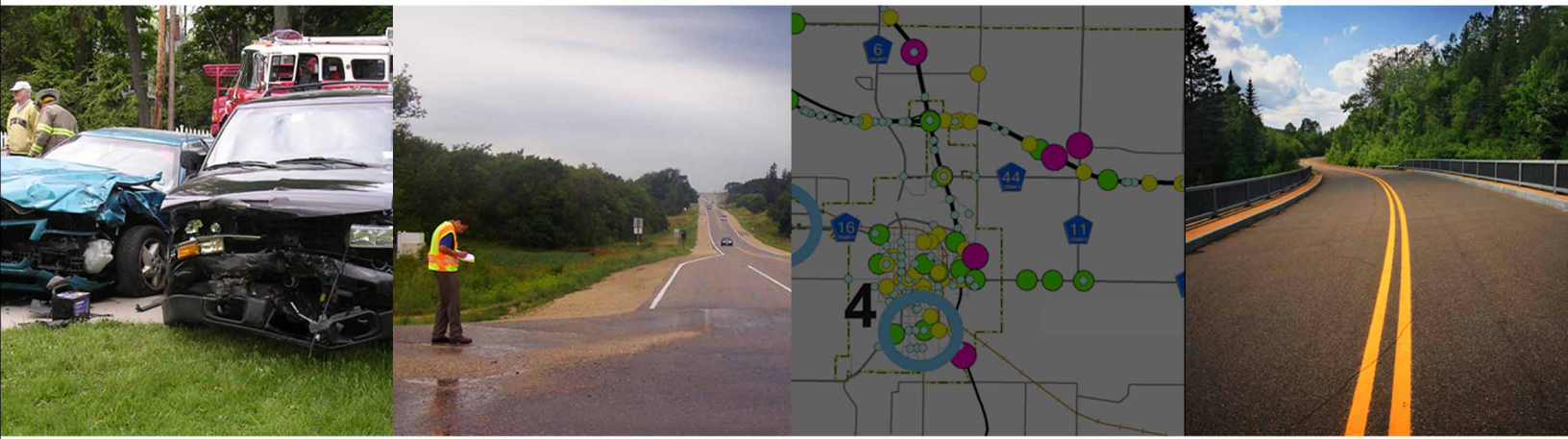


Rural Road Safety Solutions



Rural Road Safety Workshop





Rural Road Safety Solutions Workshop

Course Agenda

- 8:30-9:00** **Sign-in**
- 9:00-9:45** **Introducing the Issues**
- Course Objective
 - Present the need for safety
 - Initiatives
- 9:45-10:30** **Understanding the Problem**
- Overview of 15 Critical Strategies (from the CHSP, SHSP)
 - Specific Strategies for Engineers
- 10:30-10:45** **Break**
- 10:45-12:00** **Tools and Techniques**
- Identifying the Problem – via the tools
- 12:00-12:30** **Lunch (catered in)**
- 12:30-2:00** **Tools and Techniques (continued)**
- Identifying the Solution – the techniques
- 2:00-2:15** **Break**
- 2:15-3:30** **Putting Safety into Practice**
- Funding
 - Stakeholder Involvement
 - Foster a “Culture of Safety”
 - Steps to get started: Policy Solutions – County Comprehensive Highway Safety
 - Case studies
- Questions/Answers Session**



Instructor(s)

- Dave Engstrom**, MnDOT (All workshops)
- Dave Kopacz**, FHWA (All workshops)
- Karen Sprattler**, SRF Consulting Group, Inc. (All workshops)
- Sue Miller**, Freeborn County (D7 and D6 workshops)
- Wayne Fingalson**, Wright County (D8 and D3 workshops)
- Rick West**, Otter Tail County (D4 and D2 workshops)
- Wayne Sandberg**, Washington County (Metro and D1 workshops)

GREATER MN PROACTIVE SPECTRUM

Examples of HSIP Intersection Proactive/Systematic Strategy Deployments

≥ 70%

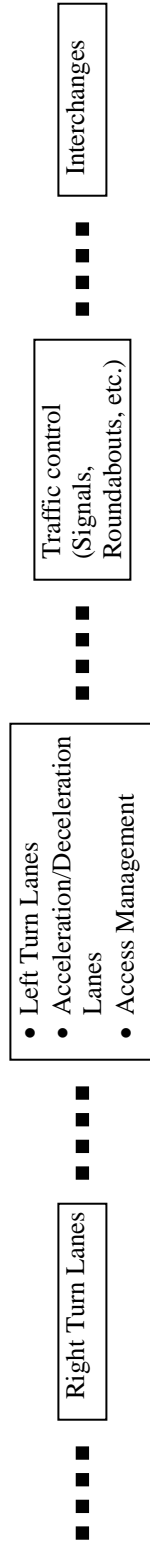
- Pavement Markings (Stop Bars)
- Lighting
- Curb Extensions
- Sign Enhancements
- Active Warning Systems
- Sight Distance Improvements (Sign relocations, etc.)

Low Cost

Pure Proactive

High HSIP Priority

≤ 30%



High Cost

More Reactive

Low HSIP Priority

Examples of HSIP Lane Departure Proactive/Systematic Strategy Deployments

- Rumble Strips
- Rumble Stripes
- Sign Updates
- Wider lines
- Wet Reflective Lines
- Safety Edge
- Curve Appurtenances
- Cable Barrier
- Profile Stripes
- Active Warning System
- New Guardrail



NOTE: The Proactive Spectrum is not all inclusive of all safety strategies. Additional strategies may be appropriate for some roadways.



Rural Road Safety Solutions Workshop

Technique Resources

Pavement Markings

Texas Transportation Institute, Texas A&M University, *Treatments for Crashes on Rural Two-lane Highways in Texas Report 4048-2*, April 2002

<http://tti.tamu.edu/documents/4048-2.pdf>

Lighting

NCHRP, 500. *Volume 5: A Guide to Addressing Unsignalized Intersection Collisions*.

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_500v9.pdf

Agenet, Kenneth R. et. Al. *Development of Accident Reduction Factors. Research Report KTC-96-13*. Kentucky Transportation Center College of Engineering, June 1996

http://www.its.pdx.edu/CRF/reports/Kentucky_CRF.pdf

U.S. Department of Transportation and Institute of Transportation Engineers, *Toolbox of Countermeasures and Their Potential Effectiveness to Make Intersections Safe*, April 2004, <http://www.ite.org/library/IntersectionSafety/toolbox.pdf>

Signing

American Traffic Safety Devices Association, *Low Cost Local Road Safety Solutions*, Fredricksburg, VA, 2006, Volume 1, Number 1

<http://www.atssa.com/galleries/default-file/LowCostLocalRoads.pdf>

NCHRP, 500. *Volume 5: A Guide to Addressing Unsignalized Intersection Collisions*.

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_500v9.pdf

Sightline Improvements

Minnesota Department of Transportation, Office of Traffic Engineering, *Traffic Safety Fundamentals Handbook*, April 2001

<http://www.dot.state.mn.us/trafficeng/otepubl/fundamentals/safetyfundamentals.pdf>



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Rumble Strips

American Traffic Safety Devices Association, *Low Cost Local Road Safety Solutions*, Fredricksburg, VA, 2006, Volume 1, Number 9 and 10

<http://www.atssa.com/galleries/default-file/LowCostLocalRoads.pdf>

Rumble StipEs

American Traffic Safety Devices Association, *Low Cost Local Road Safety Solutions*, Fredricksburg, VA, 2006, Volume 1, Number 11

<http://www.atssa.com/galleries/default-file/LowCostLocalRoads.pdf>

Safety Edge

Federal Highway Administration and U.S. Department of Transportation, *The Safety Edge: The Georgia Department of Transportation Experience Pavement Edge Treatment* FHWA Publication No. FHWA-SA-05-004,

http://safety.fhwa.dot.gov/roadway_dept/docs/sa05004.pdf

Federal Highway Administration and U.S. Department of Transportation, *The Safety Edge Pavement Edge Treatment* FHWA Publication No. FHWA-SA-05-003,

http://safety.fhwa.dot.gov/roadway_dept/docs/sa05003.pdf

LTAP The Pennsylvania Local Roads Program. *Remedy for Pavement Edge Drop-offs from Resurfacing Projects*, LTAP Technical Information Sheet #123, Fall 2005

ftp://ftp.dot.state.pa.us/public/pdf/BPR_PDF_FILES/Documents/LTAP/TechSheets/TS_123.pdf

Clear Zone Management

Federal Highway Administration and U.S. Department of Transportation, *Desktop Reference for Crash Reduction Factors Report* No. FHWA-SA-07-015, September 2007

<http://www.transportation.org/sites/safetymanagement/docs/Desktop%20Reference%20Complete.pdf>



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ITS Applications – Dynamic Speed Display Signs

American Traffic Safety Devices Association, *Low Cost Local Road Safety Solutions*,
Fredricksburg, VA, 2006, Volume 1, Number 5

<http://www.atssa.com/galleries/default-file/LowCostLocalRoads.pdf>

ITS Applications – Animal Detection Systems

Huijser, Marcel, *Animal Detection Systems*, Montana State University Western
Transportation Institute,

<http://www.coe.montana.edu/wti/wwwshare/Report%20animal%20detection%20systems>

Shoulder Paving/Widening

Texas Transportation Institute, Texas A&M University, *Treatments for Crashes on Rural
Two-lane Highways in Texas Report 4048-2*, April 2002

<http://tti.tamu.edu/documents/4048-2.pdf>

Federal Highway Administration and U.S. Department of Transportation, *Desktop
Reference for Crash Reduction Factors Report No. FHWA-SA-07-015*, September 2007

<http://www.transportation.org/sites/safetymanagement/docs/Desktop%20Reference%20Complete.pdf>

Turn-lane Treatments

Agnet, Kenneth R. et. Al. *Development of Accident Reduction Factors. Research Report
KTC-96-13*. Kentucky Transportation Center College of Engineering, June 1996

http://www.its.pdx.edu/CRF/reports/Kentucky_CRF.pdf

U.S. Department of Transportation and Institute of Transportation Engineers, *Toolbox of
Countermeasures and Their Potential Effectiveness to Make Intersections Safe*, April

2004, <http://www.ite.org/library/IntersectionSafety/toolbox.pdf>



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Other Resources

“Room To Live” Video Clip

A FOX 9 news story by Trish Van Pilsum that underscores the important role of seat belts. Courtesy of the Minnesota Department of Public Safety. Available for free download at: <http://www.dps.state.mn.us/ots/>

Minnesota Motor Vehicle Crash Facts

The Minnesota Office of Traffic Safety researchers annually produce *Minnesota Motor Vehicle Crash Facts*. This detailed report summarizes all sorts of information in regards to crashes: who, what, where, when and why. In addition, it breaks out information regarding the following: alcohol, seat belt use, motorcycles, trucks, pedestrians, bicycles, school buses and trains.

http://www.dps.state.mn.us/OTS/crashdata/crash_facts.asp

Minnesota Strategic Highway Safety Plan (SHSP) June 2007

<http://www.dot.state.mn.us/trafficeng/safety/shsp/MinnesotaSHSPCover2007.pdf>

Minnesota Crash Mapping Analysis (MnCMAT) Tool

The Minnesota Crash Mapping Analysis Tool (MnCMAT) enables users to analyze crash data based on a number of attributes, including County, City and accident case number, just to name a few. The development of this graphical application provides Transportation Professional's with a powerful tool for grouping and analyzing crash data. This easy to use software produces a map with plotted crash locations, a series of charts and automated crash reports based to selected crash data. The software uses data filters to reduce the number selected incidents, allowing users to customize crash data searches to their requirements. http://www.dot.state.mn.us/stateaid/res_crash_map_tool.html

MnDOT's Access Management Manual

<http://www.oim.dot.state.mn.us/access/>



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MnDOT's 2007 Highway Safety Improvement Program

<http://www.dot.state.mn.us/trafficeng/safety/hes/index.html>

Toward Zero Deaths

Toward Zero Deaths is a multi-agency partnership that includes representatives from the Minnesota Department of Transportation, Minnesota Department of Public Safety, Minnesota State Patrol, Federal Highway Administration, and the Center for Transportation Studies at the University of Minnesota. The goal is to raise awareness of traffic safety issues and to develop tools that can be used to reduce the number of deaths and injuries resulting from traffic accidents in Minnesota.

<http://www.tzd.state.mn.us/>

Workshop Sponsors

Local Road Research Board: <http://www.lrrb.org/>

Minnesota Department of Transportation: <http://www.dot.state.mn.us>



Rural Road Safety Solutions Workshop


Part 1- Introducing the Issues



Rural Road Safety Solutions




Rural Safety Workshop
Part 1 – Introducing the Issues




Presentation Outline

1. Introducing the Issues
2. Understanding the Problem
3. Tools and Techniques
4. Putting Safety into Practice




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Why are we concerned about highway safety?

- A. In the average lifetime of a driver or passenger, only 1 in 100 people will NEVER be involved in a crash
- B. Motor vehicle traffic crashes were the leading cause of death for the age group 2 through 34 (2004)
- C. Economic impact of traffic crashes is \$230 billion (2000)
- D. All of the above

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Why are we concerned about highway safety?

- In 2006: 42,463 people died nationwide
2.5M people injured.....
On average, 116 people died each day....
1 every 12 minutes
- Motor vehicle fatalities account for more than 90% of all transportation-related fatalities

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Highway Safety

Three aspects of improving highway safety:



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Driver Behavior

National traffic safety experience

- Speed
- Failure to use seatbelts
- Alcohol
- Motorcycles

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Driver Behavior
National traffic safety experience

Speed

- Speed-related crashes cost approximately **\$40.4 billion** per year
- 86% of speed-related fatalities occurred on non-Interstate highways (2005)

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Driver Behavior
National traffic safety experience

Seatbelts

- A 35 mph crash with no seatbelt is equivalent to falling from a third-story window
- In 2006, the national seatbelt use was 81%



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Driver Behavior
National traffic safety experience

“Room To Live” video clip

a FOX 9 news story by Trish Van Pilsum that underscores the important role of seat belts

Courtesy of the Minnesota Department of Public Safety

Available for free download at:
<http://www.dps.state.mn.us/ots/>

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Driver Behavior National crash experience

Alcohol-Related crashes

- 3 in 10 Americans will be involved in an alcohol-related crash in their lifetime
- There were 16,885 alcohol-related fatalities in 2005 (39% of total)
- 1 out of 139 licensed drivers were arrested for DWI (in 2004, 1.4 million nationwide)!!!

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Driver Behavior National traffic safety experience

Motorcycles

- Motorcycle fatalities have increased 104% over the past decade while overall fatalities have increased only 4%
- Motorcyclists were 34 times more likely to die and 8 times more likely to be injured per VMT than other vehicle drivers (2004).

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Other considerations National traffic safety experience

Approximately 25% of travel occurs during darkness, yet...
49% of fatalities occur at night

Daytime Fatalities		Nighttime Fatalities
53%	Seatbelt use	36%
18%	Alcohol-involved	60%
21%	Speed-related	37%
39%	Single vehicle crash	62%

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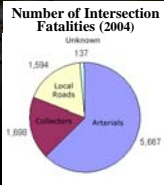
Lane departure National crash experience

- Of the 42,643 people killed on our nation's highways in 2003, 25,321 were lane departure fatalities (59 %)
- At this rate, a road departure fatality occurs every 21 minutes





Intersection Crashes National crash experience

- Intersection crashes account for more than 45% of all reported crashes and 21% of fatalities
- In 2004, 9096 intersection related fatalities occurred—a rate of more than one every hour



Highway Safety in Minnesota






Highway Safety in Minnesota

- **In 2006**
 - 494 people died
 - 35,025 people injured
 - 78,745 traffic crashes were reported to DPS
 - \$3.8 billion estimated economic cost to Minnesota
- **On an average day**
 - 1.4 people die
 - 96 people injured
 - 216 crashes occur
 - \$10.3 million average daily cost


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Cost of Motor Vehicle Crashes 2006 - State of Minnesota

Category	Incidence	Cost Per Incident	Total Cost
Fatal Crashes	456	\$3,400,000	\$1,550,400,000
Severe Injury Crashes	1,528	\$280,000	\$427,840,000
Moderate Injury Crashes	7,111	\$63,000	\$477,993,000
Minor Injury Crashes	16,024	\$31,000	\$496,744,000
Property Damage Crashes	53,626	\$4,600	\$246,679,600
Total			\$3,169,656,600
		Per Capita:	\$614
Total Crashes	78,745		

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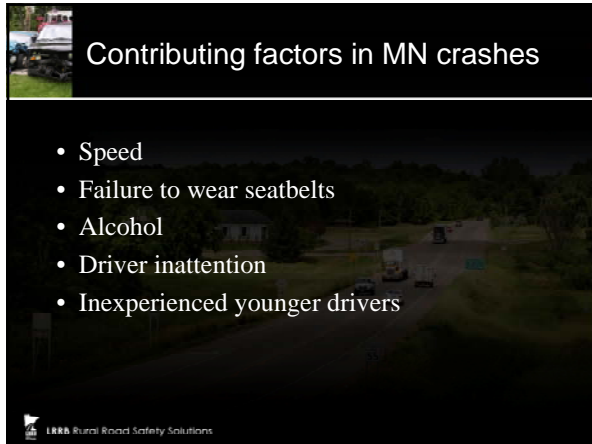


2006 Minnesota Crash Facts

By Road Design

	Fatalities	Injuries
Two lane two way	326	14,332
Other divided highway	67	5,420
Freeway	52	4,309

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Contributing factors in MN crashes

- Speed
- Failure to wear seatbelts
- Alcohol
- Driver inattention
- Inexperienced younger drivers

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2006 Minnesota Crash Facts

Speed

- Most commonly cited contributing factor in fatal crashes
- 151 fatalities and 5,940 persons injured in speed-related crashes

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2006 Minnesota Crash Facts

Seatbelts

- 83% of MN motorists used their seatbelts
- 52% of occupant fatalities were not using seatbelts
- 27% of all occupant fatalities are vehicle ejections

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2006 Minnesota Crash Facts

Alcohol-Related

- 166 fatalities (34%), 3,501 injuries
- 80% are single vehicle crashes
- 41,842 DWI arrests in 2006
- 1 in 8 MN licensed drivers have 1 or more DWI arrest on record (493,059 total)

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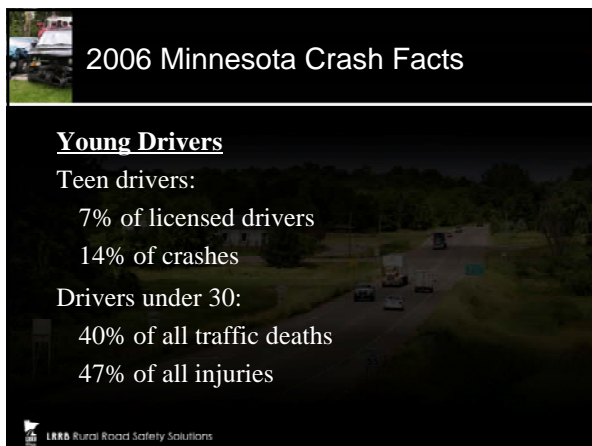


2006 Minnesota Crash Facts

Driver Inattention

- # 1 cited factor in multiple vehicle crashes (25.3%)
- 75 people killed, 10,216 injured in inattentive driving crashes in 2006

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2006 Minnesota Crash Facts

Young Drivers

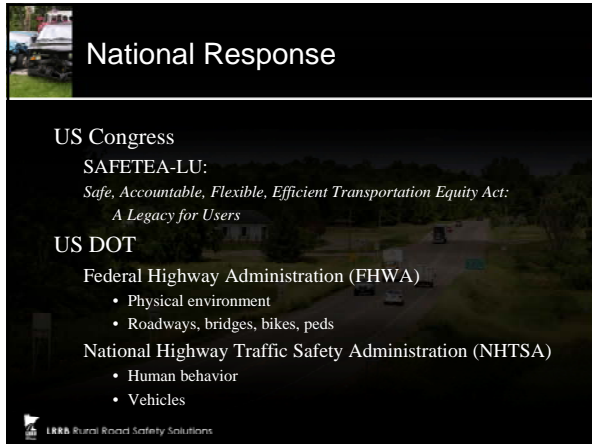
Teen drivers:

- 7% of licensed drivers
- 14% of crashes

Drivers under 30:

- 40% of all traffic deaths
- 47% of all injuries

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National Response

US Congress
SAFETEA-LU:
*Safe, Accountable, Flexible, Efficient Transportation Equity Act:
A Legacy for Users*

US DOT
Federal Highway Administration (FHWA)
• Physical environment
• Roadways, bridges, bikes, peds

National Highway Traffic Safety Administration (NHTSA)
• Human behavior
• Vehicles

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State of Minnesota Response

Minnesota Strategic Highway Safety Plan (SHSP)

Toward Zero Deaths Campaign (TZD)

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Minnesota Strategic Highway Safety Plan (SHSP)

- The MN SHSP is the 2007 update to the 2004 MN CHSP (Comprehensive Highway Safety Plan)
- The MN SHSP is a cooperative effort by the MN Departments of Transportation and Public Safety
- VISION: To reduce fatal and life changing crashes on Minnesota roadways by aggressively implementing systematic and proactive safety strategies with an ultimate goal of moving Toward Zero Deaths

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Toward Zero Deaths Campaign (TZD)

VISION: To reduce fatalities and injuries on Minnesota's roads to zero.

MISSION: To move the State of Minnesota toward zero traffic deaths on our roads through the application of engineering, enforcement, education, emergency services, research activities and community involvement.

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LRRB Workshop Objective

Creating an operating culture where **safety** is the mind set...
and
data drives priorities and decisions

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Rural Road Safety Solutions Workshop


Part 2- Understanding the Problem



Rural Road Safety Solutions




Rural Safety Workshop
Part 2 – Understanding the Problem




Presentation Outline

1. Introducing the Issues
2. Understanding the Problem
3. Tools and Techniques
4. Putting Safety into Practice



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Understanding the Problem

- What are Minnesota's greatest safety problems?
 - Comprehensive Highway Safety Plan (CHSP-2004) - a strategic effort to prioritize highway safety solutions in Minnesota developed by
 - Mn/DOT
 - MN DPS
 - Broad range of traffic safety partners
 - Strategic Highway Safety Plan (SHSP-2007)

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Minnesota 2007 SHSP update

Purpose:

- Update MN's CHSP in compliance with SAFETEA-LU
- Provide overview and coordination of other safety plans and programs in MN
- Confirm 2004 CHSP "Critical Emphasis Areas (CEAs)" with recent crash data







Minnesota 2007 SHSP update

Purpose (continued):

- Review/update 15 "Critical Safety Strategies (CSS)" in CHSP to reflect new initiatives and program advances
- Provide assistance to local agencies with prioritizing and deploying countermeasures
- Define a process for updating the SHSP in the future






Minnesota 2007 SHSP update

Critical Emphasis Areas (CEA) and Critical Safety Strategies (CSS) in the 2004 CHSP are representative of the areas the 2007 SHSP should focus upon, with three modifications:

- Crash data was broken down to a local level
- New strategies for metro intersection improvements were identified
- All strategic safety plans developed by MN agencies were integrated

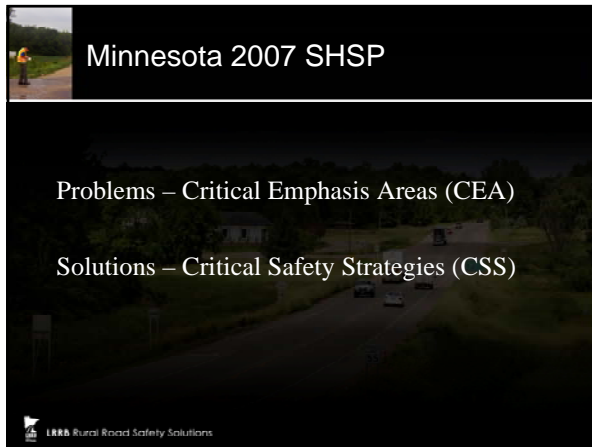




Minnesota 2007 SHSP update

To obtain a copy of the SHSP, visit MnDOT's website at:
<http://www.dot.state.mn.us/trafficeng/safety/shsp/index.html>

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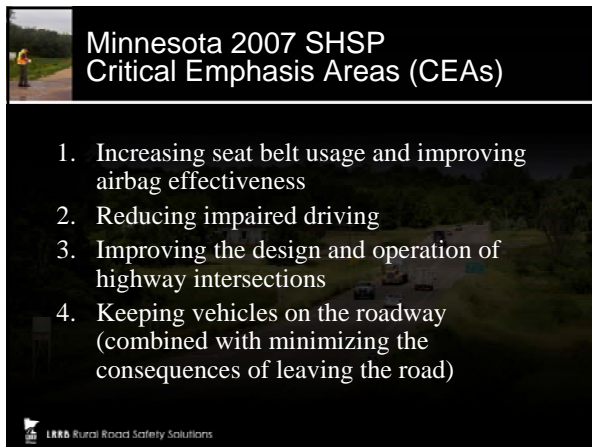


Minnesota 2007 SHSP

Problems – Critical Emphasis Areas (CEA)

Solutions – Critical Safety Strategies (CSS)

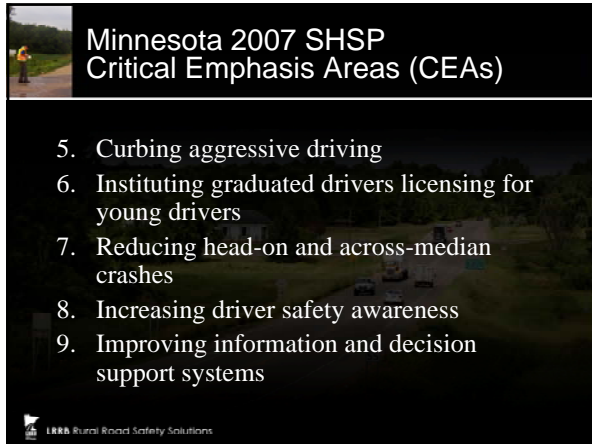
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Minnesota 2007 SHSP
Critical Emphasis Areas (CEAs)

1. Increasing seat belt usage and improving airbag effectiveness
2. Reducing impaired driving
3. Improving the design and operation of highway intersections
4. Keeping vehicles on the roadway (combined with minimizing the consequences of leaving the road)

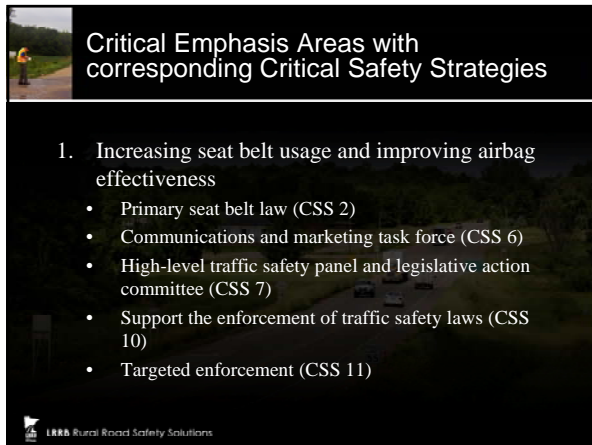
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**Minnesota 2007 SHSP
Critical Emphasis Areas (CEAs)**

5. Curbing aggressive driving
6. Instituting graduated drivers licensing for young drivers
7. Reducing head-on and across-median crashes
8. Increasing driver safety awareness
9. Improving information and decision support systems

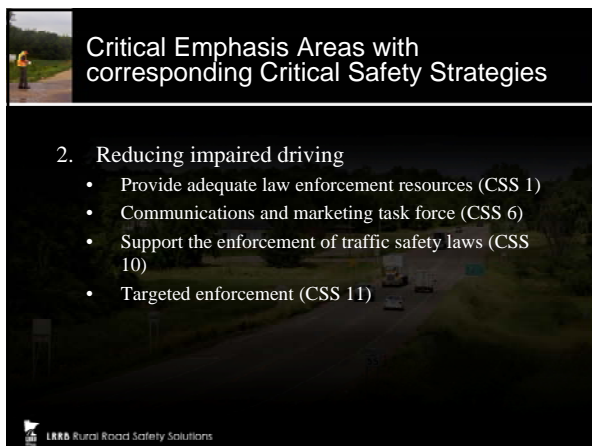
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**Critical Emphasis Areas with
corresponding Critical Safety Strategies**

1. Increasing seat belt usage and improving airbag effectiveness
 - Primary seat belt law (CSS 2)
 - Communications and marketing task force (CSS 6)
 - High-level traffic safety panel and legislative action committee (CSS 7)
 - Support the enforcement of traffic safety laws (CSS 10)
 - Targeted enforcement (CSS 11)


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**Critical Emphasis Areas with
corresponding Critical Safety Strategies**

2. Reducing impaired driving
 - Provide adequate law enforcement resources (CSS 1)
 - Communications and marketing task force (CSS 6)
 - Support the enforcement of traffic safety laws (CSS 10)
 - Targeted enforcement (CSS 11)

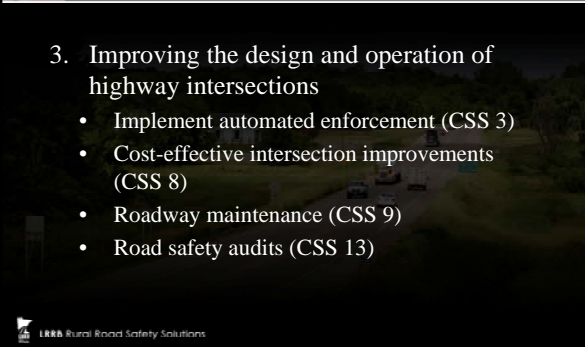
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Critical Emphasis Areas with corresponding Critical Safety Strategies

3. Improving the design and operation of highway intersections

- Implement automated enforcement (CSS 3)
- Cost-effective intersection improvements (CSS 8)
- Roadway maintenance (CSS 9)
- Road safety audits (CSS 13)



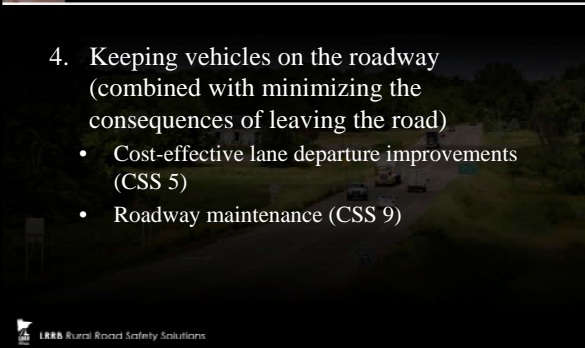
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Critical Emphasis Areas with corresponding Critical Safety Strategies

4. Keeping vehicles on the roadway (combined with minimizing the consequences of leaving the road)

- Cost-effective lane departure improvements (CSS 5)
- Roadway maintenance (CSS 9)



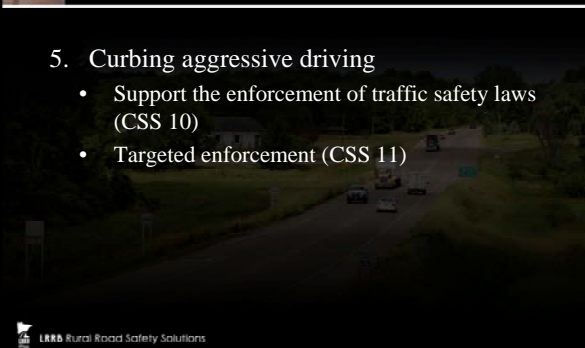
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Critical Emphasis Areas with corresponding Critical Safety Strategies

5. Curbing aggressive driving

- Support the enforcement of traffic safety laws (CSS 10)
- Targeted enforcement (CSS 11)




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Critical Emphasis Areas with corresponding Critical Safety Strategies

6. Instituting graduated drivers licensing for young drivers

- Stronger graduated licensing system (CSS 4)
- High-level traffic safety panel and legislative action committee (CSS 7)
- Enhance driver education (CSS 12)






Critical Emphasis Areas with corresponding Critical Safety Strategies

7. Reducing head-on and across-median crashes

- Roadway maintenance (CSS 9)
- Road safety audits (CSS 13)







Critical Emphasis Areas with corresponding Critical Safety Strategies

8. Increasing driver safety awareness

- Communications and marketing task force (CSS 6)
- High-level traffic safety panel and legislative action committee (CSS 7)

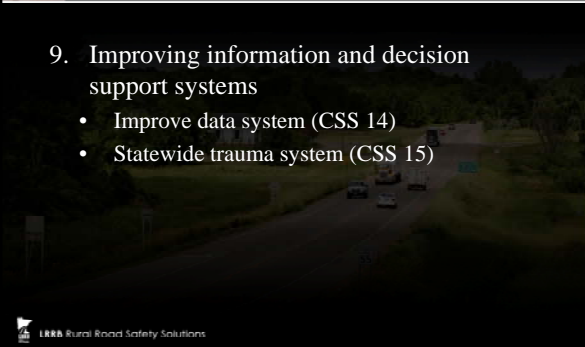




Critical Emphasis Areas with corresponding Critical Safety Strategies

9. Improving information and decision support systems

- Improve data system (CSS 14)
- Statewide trauma system (CSS 15)



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New to the Minnesota SHSP

- Crash data broken down to a local level
- Metro area intersection strategies
- Integrate various Minnesota safety plans to support “Toward Zero Deaths”
 - Statewide Heavy Vehicle Safety Plan
 - ITS Safety Plan
 - Statewide Trauma System
 - DPS Highway Safety Plan



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Metro Area Intersection Safety Plan Strategies

- Install left and right turn lanes
- Enhance signing, lighting, pavement marking and delineation
- Access management
- Enforcement of red-light running
- Signal timing improvements
- Improve intersection sight distance



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MN Statewide Heavy Vehicle Safety Plan Strategies

- Develop law enforcement and inspector resources
- Install cost effective road and roadside improvements
- Strengthen graduated drivers licensing
- Improve passenger vehicle driver education
- Install four-cable median barrier



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MN Statewide Heavy Vehicle Safety Plan Strategies

- Develop automatic notification of driver convictions
- Implement a demonstration corridor
- Review work zones
- Targeted enforcement
- Improve data systems



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Minnesota ITS Safety Plan Strategies

- Implement in-vehicle based safety system
- Improve first responder/law enforcement systems
- Implement vehicle infrastructure integration systems



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Minnesota ITS Safety Plan Strategies

- Improve infrastructure systems and signage
- Use intersection collision warning systems
- Improve driver education and licensing using ITS

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Statewide Trauma System Safety Plan Strategies

- Expand the trauma registry
- Enhance rural ambulance services
- Improve trauma centers in rural Minnesota
- Enhance first responder capabilities
- Utilize air support to reduce emergency response times

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Department Public Safety Highway Safety Plan Strategies

- Safe & Sober and NightCAP
- Highway enforcement of aggressive traffic
- Safe Communities coalitions
- Motorcycle safety program
- Law Enforcement, Child Passenger Safety and Public Health Liasons

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Department Public Safety Highway Safety Plan Strategies

- Minnesota child passenger safety program
- Public information and education
- Monitoring of drivers with repeat impaired driving offenses



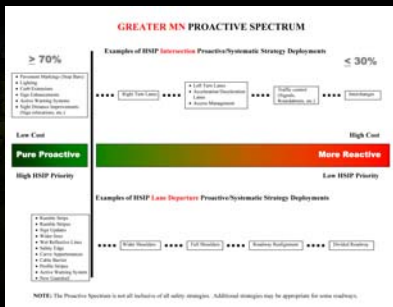
Common Engineering Strategies and Goals

Review of the various Minnesota strategic safety plans found similar strategies and goals:

- Low cost safety improvements for lane departures/intersections
- Perform proper maintenance
- Perform road safety audits/plans
- Create partnerships with law enforcement
- Improve sign systems



Common Engineering Strategies and Goals




GREATER MN PROACTIVE SPECTRUM

Examples of HSP **Intersection** Proactive/Systematic Strategy Deployments

Examples of HSP **Lane Departure** Proactive/Systematic Strategy Deployments

NOTE: The Proactive Spectrum is not all inclusive of all safety strategies. Additional strategies may be appropriate for some roadways.





Rural Road Safety Solutions Workshop


Part 3- Tools and Techniques



Rural Road Safety Solutions

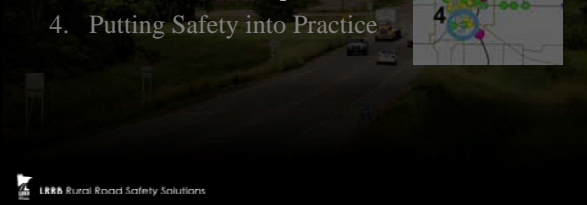



Rural Safety Workshop
Part 3 – Tools and Techniques




Presentation Outline

1. Introducing the Issues
2. Understanding the Problem
3. Tools and Techniques
4. Putting Safety into Practice



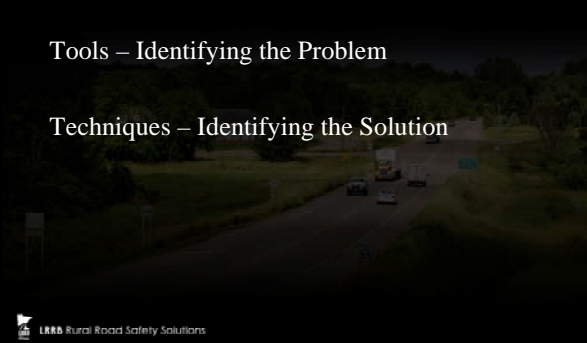
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Tools and Techniques

Tools – Identifying the Problem

Techniques – Identifying the Solution



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Tools – Identifying the Problem

- Strategic Highway Safety Plan (SHSP)
- Minnesota Crash Mapping Analysis Tool (MnCMAT)
- Road Safety Audits (RSA's) and Road Safety Plans (RSP's)
- Safe Communities Coalition



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Strategic Highway Safety Plan (SHSP)

- Summarizes crash data and trends statewide and by Area Transportation Partnership (ATP)
- Provides agencies technical assistance in prioritization and deployment of safety countermeasures
- Documents highest priority strategies by ATP and county




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Strategic Highway Safety Plan (SHSP)

- Crash data priorities by ATP
 - Fatal and serious injury crashes
 - State and local roadway
 - Location (rural or urban)
 - Type of roadway (freeway, expressway, multi-lane or 2-lane conventional)
 - Primary contributing factors



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Strategic Highway Safety Plan (SHSP)

- Primary contributing factors
 - Under the age of 21
 - Speeding-related
 - Alcohol-related
 - Unbelted vehicle occupant
 - Single vehicle run-off-road
 - Intersection
 - Head-on and Sideswipe



Minnesota Crash Mapping Analysis Tool (MnCMAT)


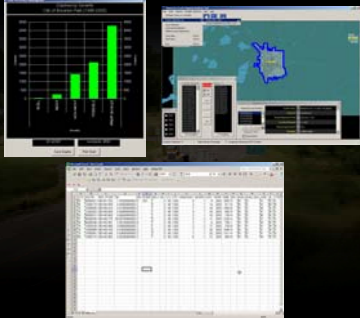
- Contains 10 years of detailed crash information for all 87 counties.
- User defined filtering on 32 different driver and crash categories.




Minnesota Crash Mapping Analysis Tool (MnCMAT)

Outputs

- Charts
- Graphics
- Reports







Minnesota Crash Mapping Analysis Tool (MnCMAT)


Future improvements to MnCMAT

- 2007 data is estimated for release in July 2008.
- The County Safety Committee and State Aid are researching the requirements for a web based application (2009).
 - Seamless application upgrades and near real-time data updates
 - The ability to integrate multiple layers
 - No on going licensing requirements






Minnesota Crash Mapping Analysis Tool (MnCMAT)



Crash Mapping Analysis Tool
Version 3.7.0
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Iowa State University Research Foundation, Inc.
All Rights Reserved

For more info:
Contact: MnCMAT@dot.state.mn.us
http://www.dot.state.mn.us/stateaid/res_crash_map_tool.html



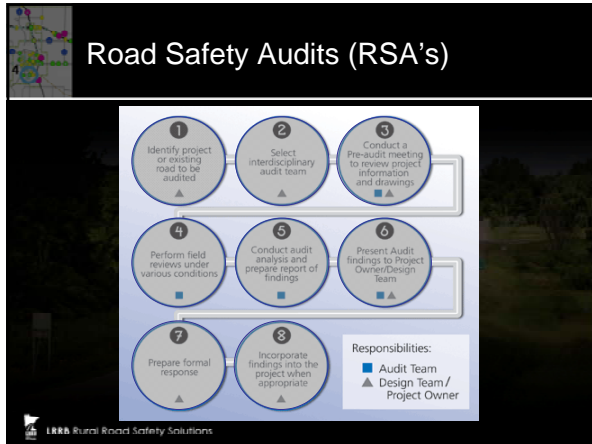


Road Safety Audits (RSA's)

Definition: A formal safety performance examination of an existing or future road or intersection by an independent audit team

- Formal examination with a structured process
- Conducted independently by professionals
- Completed by a multi-disciplinary team
- Focuses solely on safety issues





Road Safety Audits (RSA's)

RSA's can be performed at one or more stages of a roadway project:


- Planning or feasibility
- Preliminary design
- Final design
- Pre-opening or during construction
- On an existing roadway

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Road Safety Plan


- New process to systematically deploy safety enhancements throughout a jurisdiction
- Road Safety Audits = reactive
- Road Safety Plans = proactive

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Road Safety Plan

- Flexibility
 - System wide investigation
 - All roads
 - CSAH's
 - Intersections & segments
 - Identify high crash locations
 - Investigate “representative” roadways
 - Plan can be a stand alone document or part of a larger comprehensive transportation plan

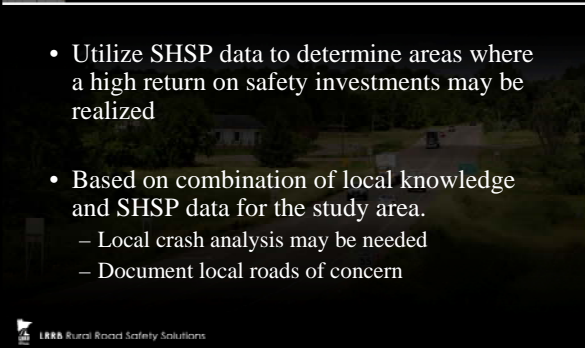


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Road Safety Plan

- Utilize SHSP data to determine areas where a high return on safety investments may be realized
- Based on combination of local knowledge and SHSP data for the study area.
 - Local crash analysis may be needed
 - Document local roads of concern



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Road Safety Plan

- Outcome is a plan that identifies traffic safety concerns and potential countermeasures to reduce crashes
- Provides basis for future safety project funding and deployments.

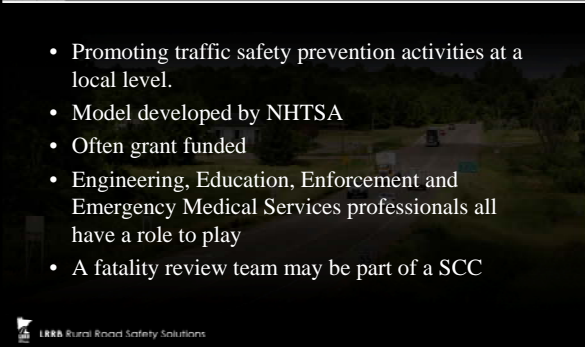


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Safe Communities Coalition (SCC)

- Promoting traffic safety prevention activities at a local level.
- Model developed by NHTSA
- Often grant funded
- Engineering, Education, Enforcement and Emergency Medical Services professionals all have a role to play
- A fatality review team may be part of a SCC



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Safe Communities Coalition (SCC)

- Example SCC Fatality Review Team
 - Comprised of diverse viewpoints
 - Engineers
 - MADD
 - Law Enforcement
 - Public Health
 - Students
 - County Attorney
 - Elected Officials

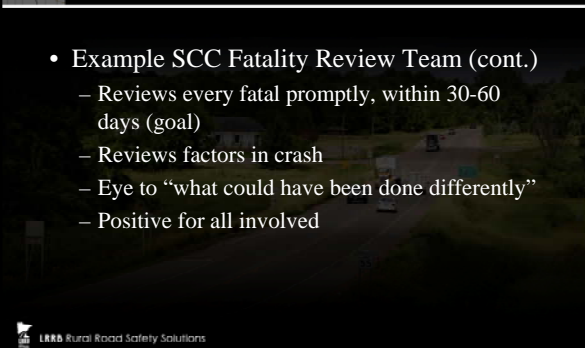


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Safe Communities Coalition (SCC)

- Example SCC Fatality Review Team (cont.)
 - Reviews every fatal promptly, within 30-60 days (goal)
 - Reviews factors in crash
 - Eye to “what could have been done differently”
 - Positive for all involved



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Techniques - Identifying the Solution

The chart, titled 'GREATER MN PROACTIVE SPECTRUM', maps road safety strategies from 'Pure Proactive' (left, green bar) to 'More Reactive' (right, red bar). The x-axis represents the percentage of High Priority (HSFP) roads, ranging from $\geq 70\%$ on the left to $\leq 30\%$ on the right. The y-axis represents cost, from 'Low Cost' at the bottom to 'High Cost' at the top. The 'Pure Proactive' section includes strategies like 'Enhanced Shoulder/Edge Treatments', 'Lighting', 'Signage', 'Sightline Improvements', 'Rumble Strips/Stripes', 'Safety Edge', 'Clear Zone Management', 'General Maintenance', 'ITS Applications', 'Shoulder Paving/Widening', and 'Turn-lane Treatments'. The 'More Reactive' section includes 'High Speed Cameras', 'Left Lane Closures', 'Lane Reductions', 'Traffic Signal Management', 'Signal Relocations', 'Signal Timing', 'Signalization', 'Signalization', 'Signalization', and 'Signalization'. A note at the bottom states: 'NOTE: The Proactive Spectrum is not all inclusive of all safety strategies. Additional strategies may be appropriate for some roadways.'

Techniques - Identifying the Solution

- Pavement Markings
- Lighting
- Signage
- Sightline Improvements
- Rumble Strips/Stripes
- Safety Edge
- Clear Zone Management
- General Maintenance
- ITS Applications
- Shoulder Paving/Widening
- Turn-lane Treatments

This slide features the same 'GREATER MN PROACTIVE SPECTRUM' chart as the first slide. A callout box on the right side of the chart highlights a specific set of techniques: 'Pavement Markings (Stop Bars)', 'Lighting', 'Curb Extensions', 'Sign Enhancements', 'Active Warning Systems', and 'Sight Distance Improvements (Sign relocations, etc.)'. The rest of the slide content is identical to the first slide.

Techniques - Identifying the Solution

- Pavement Markings
- Lighting
- Signage
- Sightline Improvements
- Rumble Strips/Stripes
- Safety Edge
- Clear Zone Management
- General Maintenance
- ITS Applications
- Shoulder Paving/Widening
- Turn-lane Treatments

This slide features the same 'GREATER MN PROACTIVE SPECTRUM' chart as the previous slides. A callout box on the right side of the chart highlights a specific set of techniques: 'Pavement Markings (Stop Bars)', 'Lighting', 'Curb Extensions', 'Sign Enhancements', 'Active Warning Systems', and 'Sight Distance Improvements (Sign relocations, etc.)'. The rest of the slide content is identical to the previous slides.

Pavement Markings

What it is:
Calling attention to the edge of the roadway by use of pavement markings.



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Pavement Markings

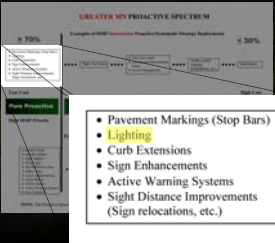
Research findings:

- Adding 4-inch edgelines to roadways with no delineation can reduce crashes by 36%
- Effectiveness of 8-inch edgelines is mixed and not cost effective in areas with snow and de-icing
- Cost: Low

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Techniques - Identifying the Solution


- Pavement Markings
- Lighting
- Signing
- Sightline Improvements
- Rumble Strips/StripEs
- Safety Edge
- Clear Zone Management
- General Maintenance
- ITS Applications
- Shoulder Paving/Widening
- Turn-lane Treatments



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Lighting

What it is:
Improving visibility
at an intersection
and its approaches in
nighttime conditions

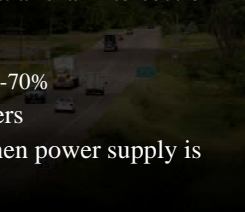


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Lighting

Research findings:

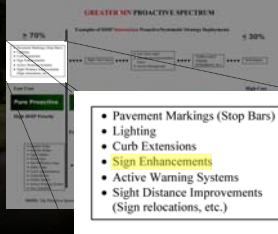
- Installation of lighting at a rural intersection can reduce:
 - All crashes by 19-75%
 - Nighttime crashes by 18-70%
- Effective for older drivers
- Cost: Medium (Low when power supply is available)



IRRB Rural Road Safety Solutions

Techniques - Identifying the Solution


- Pavement Markings
- Lighting
- **Signing**
- Sightline Improvements
- Rumble Strips/StripEs
- Safety Edge
- Clear Zone Management
- General Maintenance
- ITS Applications
- Shoulder Paving/Widening
- Turn-lane Treatments



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Signing

What it is:
Enhancing drivers
ability to react to
driving conditions
with the use of signing
and delineation

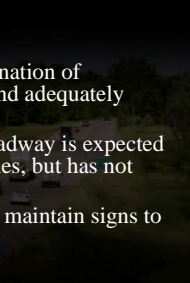


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Signing

Research findings:


- Key to success is using a combination of regulatory and warning signs; and adequately maintaining the signs
- Heightened awareness of the roadway is expected to be effective in reducing crashes, but has not been quantified
- Local agencies must adequately maintain signs to maintain effectiveness.
- Cost: Low



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Signing

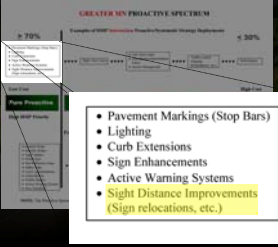
Other findings:
Care should be taken
to not overuse traffic
signing, which could
result in driver
confusion



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Techniques - Identifying the Solution

- Pavement Markings
- Lighting
- Signing
- Sightline Improvements
- Rumble Strips/StripEs
- Safety Edge
- Clear Zone Management
- General Maintenance
- ITS Applications
- Shoulder Paving/Widening
- Turn-lane Treatments



- Pavement Markings (Stop Bars)
- Lighting
- Curb Extensions
- Sign Enhancements
- Active Warning Systems
- Sight Distance Improvements (Sign relocations, etc.)

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Sightline Improvements

The sight distance at an intersection can be obstructed by various objects such as foliage, buildings, vertical and horizontal curves, parked vehicles and signs.



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Sightline Improvements

Research findings:

- Crash rates will generally decrease when sight obstructions are removed
- Reduction in head-on, right-angle and turning-related crashes (20%)
- Cost: Low (assuming objects are within the right-of-way)

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Techniques - Identifying the Solution

- Pavement Markings
- Lighting
- Signing
- Sightline Improvements
- Rumble Strips/StripEs
- Safety Edge
- Clear Zone Management
- General Maintenance
- ITS Applications
- Shoulder Paving/Widening
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GREATER MV PROACTIVE SPECTRUM

- Rumble Strips
- Rumble Stripes
- Sign Updates
- Wider lines
- Wet Reflective Lines
- Safety Edge
- Curve Appurtenances
- Cable Barrier
- Profile Stripes
- Active Warning System
- New Guardrail

LRBB Rural Road Safety Solutions

Rumble Strips

What they are:
Grooved patterns on the roadway that produce audible and tactile warnings when traversed by vehicles


LRBB Rural Road Safety Solutions

Rumble Strips

Edge line

- Located on shoulder to notify drivers they have left the travel lane
- Research Findings:
 - Reduction in run off the road crashes (15-70%)
 - Reduction in bicycle/vehicle crashes by keeping vehicles off the shoulder

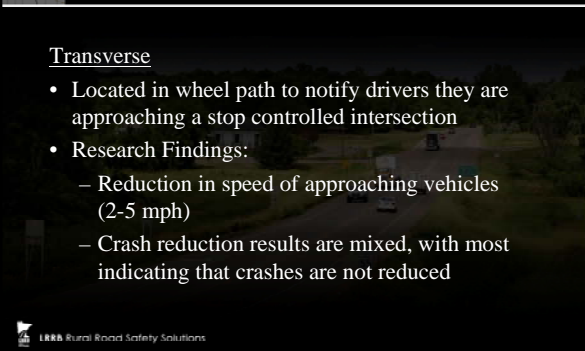
LRBB Rural Road Safety Solutions




Rumble Strips

Transverse

- Located in wheel path to notify drivers they are approaching a stop controlled intersection
- Research Findings:
 - Reduction in speed of approaching vehicles (2-5 mph)
 - Crash reduction results are mixed, with most indicating that crashes are not reduced



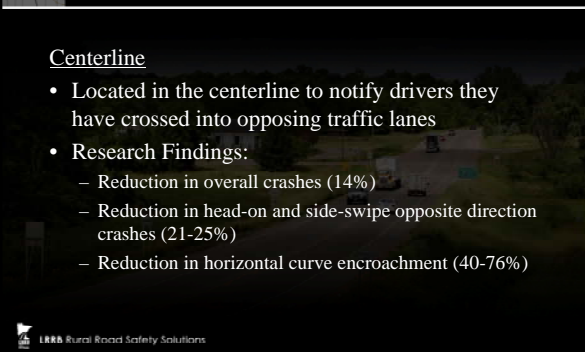
IRRB Rural Road Safety Solutions



Rumble Strips

Centerline

- Located in the centerline to notify drivers they have crossed into opposing traffic lanes
- Research Findings:
 - Reduction in overall crashes (14%)
 - Reduction in head-on and side-swipe opposite direction crashes (21-25%)
 - Reduction in horizontal curve encroachment (40-76%)



IRRB Rural Road Safety Solutions



Rumble Strips

Other concerns:

- Drivers using opposing lanes to drive around transverse rumble strips
- Drivers/motorcyclists/bicyclists losing control
- Noise complaints
- Cost: Low



IRRB Rural Road Safety Solutions

Rumble StripEs

What they are:
Pavement markings over centerline and edge line rumble strips to enhance the visibility of edge line pavement markings in wet weather conditions



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Rumble StripEs

Research Findings:

- Dry and wet edge line rumble stripE markings provide 2-4 times more reflectivity than flat markings
- Edge line markings are protected from plows and tires, extending the service life
- Cost: Low

LRBB Rural Road Safety Solutions

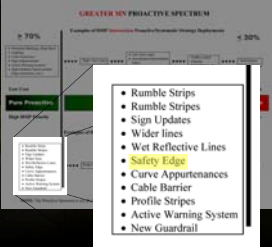
Rumble StripEs

START OF RUMBLE STRIPE
WET REFLECTIVE TAPE

LRBB Rural Road Safety Solutions

Techniques - Identifying the Solution

- Pavement Markings
- Lighting
- Signing
- Sightline Improvements
- Rumble Strips/StripEs
- **Safety Edge**
- Clear Zone Management
- General Maintenance
- ITS Applications
- Shoulder Paving/Widening
- Turn-lane Treatments




GREATER MV PROACTIVE SPECTRUM
Examples of 2007 Minnesota Roadway Inventory (Inventory) Requirements

- Rumble Strips
- Rumble Stripes
- Sign Updates
- Wider lines
- Wet Reflective Lines
- **Safety Edge**
- Curve Appurtenances
- Cable Barrier
- Profile Stripes
- Active Warning System
- New Guardrail

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Safety Edge

What it is:
A 30-35 degree angle asphalt fillet on the edge of the roadway to eliminate vertical drop offs



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Safety Edge

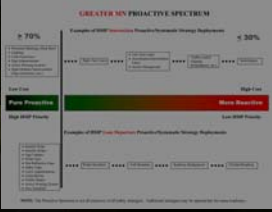
Research findings:

- Drop offs of more than 2 inches at a 90 degree angle are considered unsafe
- The Safety Edge helps vehicles that have left the roadway return safely
- Minimal research has been conducted on the effectiveness of the safety wedge
- Cost: Low – less than 1% of hot-mix asphalt material cost

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Techniques - Identifying the Solution


- Pavement Markings
- Lighting
- Signing
- Sightline Improvements
- Rumble Strips/StripEs
- Safety Edge
- Clear Zone Management
- General Maintenance
- ITS Applications
- Shoulder Paving/Widening
- Turn-lane Treatments



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Clear Zone Management

What it is:
Removing, relocating, shielding or protecting objects that are located on the side of the roadway within the clear zone.



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Clear Zone Management

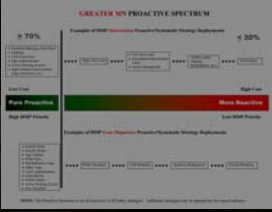
Research Findings:

- Removing or relocating objects that are located on the side of the roadway within the clear zone can reduce crashes by 17-61%
- Cost: Variable

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Techniques - Identifying the Solution


- Pavement Markings
- Lighting
- Signing
- Sightline Improvements
- Rumble Strips/StripEs
- Safety Edge
- Clear Zone Management
- **General Maintenance**
- ITS Applications
- Shoulder Paving/Widening
- Turn-lane Treatments



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General Maintenance

What it is:
Maintaining investment in roadways by ensuring that the road remains serviceable throughout its design life




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General Maintenance

Includes:

- Maintaining/mowing grass along the side of the road and in corners of intersections
- Erosion control
- Guardrails
- Sign life/reflectivity




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General Maintenance

Research Findings:

- No research had been completed to quantify the effectiveness of general maintenance practices

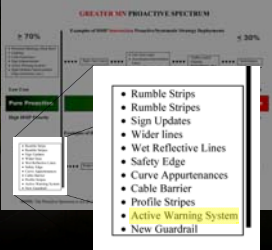


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Techniques - Identifying the Solution

- Pavement Markings
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ITS Applications


- Dynamic Speed Display Signs
- Dynamic Curve Warning System
- Animal Detection Systems



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ITS Applications: Dynamic Speed Display Signs

What it is:
A dynamic sign that measures approaching vehicle speed. This sign is typically mounted below a speed limit sign, to notify drivers if they are traveling above the limit




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ITS Applications: Dynamic Speed Display Signs

Display Actual Speed

Driver Speed Awareness Sign



Below Regulatory Sign

Flashes if Over Limit

Permanently Mounted

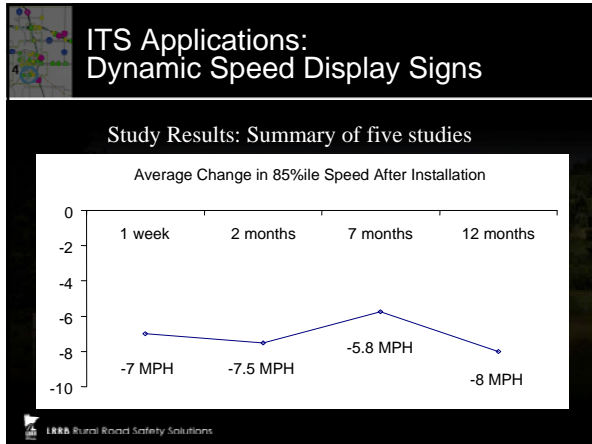
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ITS Applications: Dynamic Speed Display Signs

Five Studies were conducted in Washington and Dakota Counties:

- CSAH 8 - Hugo - from 50 mph to 30 mph
- CSAH 18 - Newport - from 55 mph to 40 mph
- CSAH 18 - Lakeland - 50 mph to 45 mph
- CSAH 46 - Hastings - 55 mph to 45 mph
- CSAH 46 - Hastings - 45 mph to 35 mph

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ITS Applications: Dynamic Curve Warning System

What it is:
Loop detector located in the pavement prior to a curve, that detects if a vehicle is traveling too fast for the curve. Drivers are warned to slow down with a flashing beacon

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ITS Applications: Dynamic Curve Warning System

- Low volume, rural road applications
- Solar powered and wireless
- Out-of-box user friendly for agency
- Moveable from location to location
- Limited research is available, however anecdotal evidence suggests that drivers have reacted positively to the system and have slowed down prior to curves

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**ITS Applications:
Animal Detection Systems**

What it is: Sensors detect animals on the edge of the roadway and drivers are warned by a flashing beacon



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**ITS Applications:
Animal Detection Systems**

Research Findings:

- Annually in the US, collisions with wildlife result in approximately:
 - 200 people killed
 - 15,000+ people injured
 - 300,000 vehicles damaged
- Montana University is currently conducting a 6-year study of this new technology

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**ITS Applications:
Animal Detection Systems**

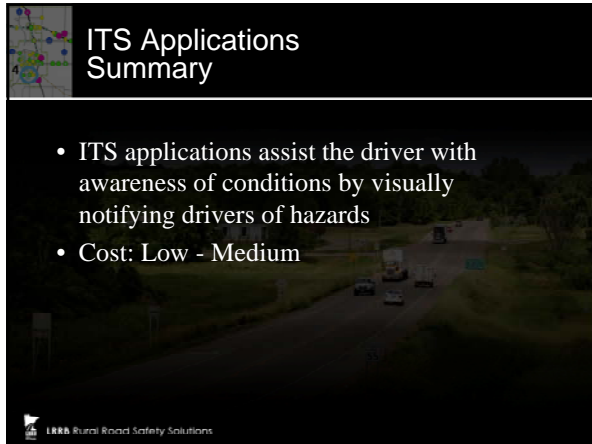
Research Findings:

- In April 2007, an animal detection system was installed in Marshall, MN
- Results so far have been extremely positive:
 - Before installation: 1 deer killed a week
 - After installation: 4 deer killed in 6 months
- One mile of system costs less than \$30K

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ITS Applications Summary

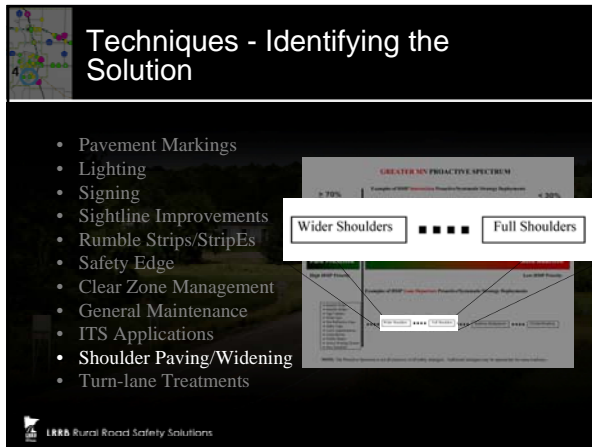
- ITS applications assist the driver with awareness of conditions by visually notifying drivers of hazards
- Cost: Low - Medium



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Techniques - Identifying the Solution

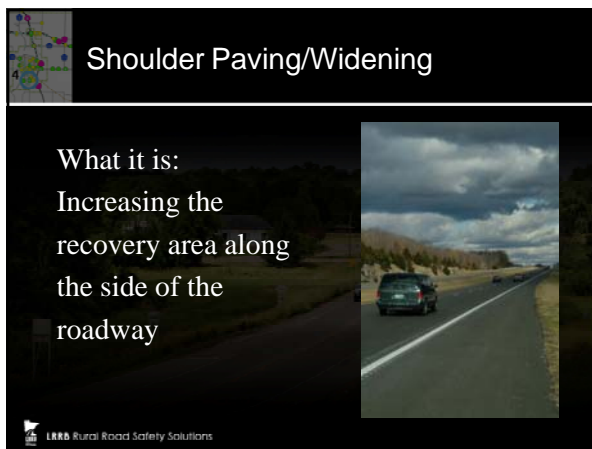
- Pavement Markings
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- Shoulder Paving/Widening
- Turn-lane Treatments



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Shoulder Paving/Widening

What it is:
Increasing the recovery area along the side of the roadway

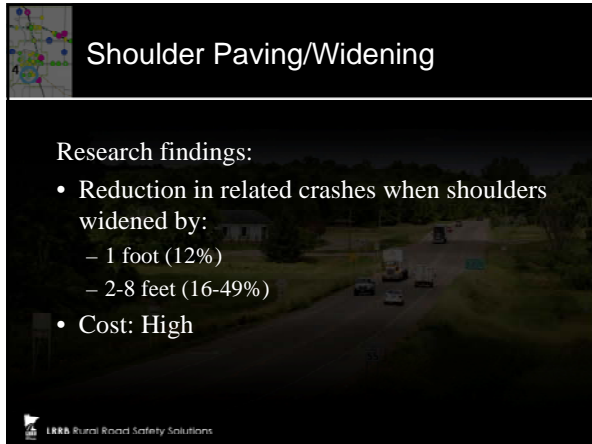


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Shoulder Paving/Widening

Research findings:

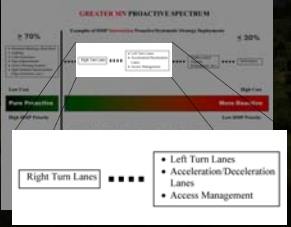
- Reduction in related crashes when shoulders widened by:
 - 1 foot (12%)
 - 2-8 feet (16-49%)
- Cost: High



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Techniques - Identifying the Solution


- Pavement Markings
- Lighting
- Signing
- Sightline Improvements
- Rumble Strips/StripEs
- Safety Edge
- Clear Zone Management
- General Maintenance
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- Turn-lane Treatments




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Turn-lane Treatments

What it is:
Adding right and/or left turn lanes at an intersection to separate turning vehicles from thru vehicles




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Turn-lane Treatments

Research Findings:

- Adding a left-turn lane:
 - Can reduce total crashes by 25-41%
 - Can reduce left-turn related crashes by 50-86%
- Cost: Medium-High




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Turn-lane Treatments

Research Findings:

- Adding a right-turn lane:
 - Can reduce total crashes by 24-30%
- Cost: Medium



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Turn-lane Treatments

MnDOT's Access Management Manual:
<http://www.oim.dot.state.mn.us/access/>



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Rural Road Safety Solutions Workshop


Part 4- Putting Safety into Practice



Rural Road Safety Solutions




Rural Safety Workshop
Part 4 - Putting Safety into Practice



Presentation Outline

1. Introducing the Issues
2. Understanding the Problem
3. Tools and Techniques
4. Putting Safety into Practice



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Funding (Old Process)

Four Major Safety Funding Sources:

- Highway Safety Improvement Program
- High Risk Rural Roads Program
- Local Road Improvement - Rural Road Safety Account
- Comprehensive Highway Safety Program

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Funding (Old Process)

Highway Safety Improvement Program:

- Replaces STP Hazard Elimination Set-aside (HES) program
- \$18M of **FEDERAL** funds were allocated for each year, 2007-2008
- Initially funds are used only for Infrastructure, then can be applied to other “E’s”
- Monies may be used for any public road or publicly owned bike/ped path or trail.

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Funding (Old Process)

High Risk Rural Roads Program:

- MnDOT State Aid administers funds through ATP process
- \$1.5M of **FEDERAL** funds were allocated for 2007
- Infrastructure only improvements
- Monies for Rural Major , Minor Collector or Local Roads with fatal and serious injury crash rates above state average.

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Funding (Old Process)

Rural Road Safety Account:

- Subprogram of the Local Road Improvement Program – Capital bonding
- \$7.65M of state funds were allocated for 2006/07
- Engineering only improvements with focus on reducing fatal and serious injury crashes
- Monies only for CSAH projects


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Funding (Old Process)

Comprehensive Highway Safety Program:

- MnDOT funds through Central Safety Fund
- \$4.15M of **FEDERAL** funds were allocated for 2007/08
- Monies only for CSAH or CR projects







Changes to Funding in 2007 (New Process)

The following funding sources have been combined into a new program called:

2007 Greater MN Combined Solicitation for FEDERAL Funds

- Comprehensive Highway Safety Program
- High Risk Rural Roads Program
- Highway Safety Improvement Program







2007 Greater MN Combined Solicitation for FEDERAL Funds (New Process)

Program Guidelines:

- \$14M will be awarded over 2 years (2009 and 2010)
- One application was used for all three programs
- Applications were due February 1, 2008
- Applicants were advised to consult the 2007 SHSP
- Safety projects must stand alone, not be a part of a larger project
- Another solicitation is scheduled for 2008







2007 Greater MN Combined Solicitation for FEDERAL Funds (New Process)

Program Guidelines (cont.):

- Minimum of 70% of funds to proactive projects; maximum of 30% of funds to reactive projects with a B/C ratio > 1
- New safety tool to be funded: Road Safety Plans
- Road Safety Audits will not be funded
- A stakeholder meeting must be held before the completion of the project






2007 Greater MN Combined Solicitation for FEDERAL Funds (New Process)

Program Guidelines (cont.):

- Maximum FEDERAL Funding is 90% of project costs up to:
 - \$250K for individual proactive projects
 - \$750K for proactive projects with more than one county, county/city, or ATP partnership
 - \$1M or as much available by ATP for reactive projects
- A minimum 10% local hard match is required
- Agencies may submit multiple applications



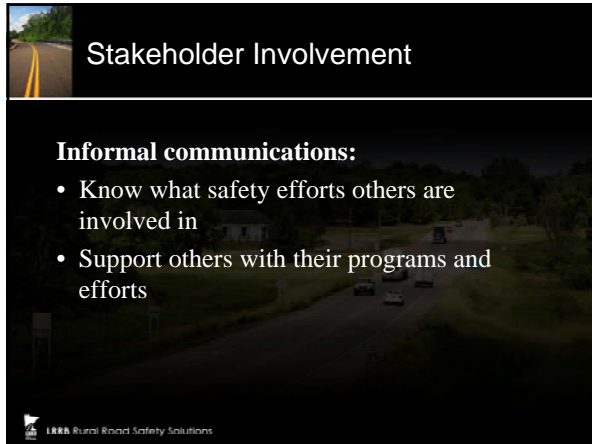


Stakeholder Involvement

Develop Safety Partnerships:

- Informal communications
- Safety-related community organizations





Stakeholder Involvement

Informal communications:

- Know what safety efforts others are involved in
- Support others with their programs and efforts

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Stakeholder Involvement

Safety-related community organizations:

- County staff is not alone, can get help and support for efforts from the community
- Funding is available through DPS for *Safe Communities* coalitions
- Find the right people
 - Passionate
 - Committed
 - Stake in the problem

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Stakeholder Involvement

Types of people involved:

- Engineers
- Law Enforcement
- Public Health
- Students
- Elected Officials
- Many others

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Stakeholder Involvement

Safety-related community organizations (cont.):

- Leadership has to be passionate to get attention of policymakers
- Start at local level; use policy to affect more people




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Foster a “Culture of Safety”

- In your community:
 - Incorporate all four “E’s”
 - Engineering
 - Enforcement
 - Education
 - Emergency Medical Services
- In the workplace
 - Incorporate into everyday activities




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Foster a “Culture of Safety”

Incorporate all four “E’s”

- No simple solutions
- Collaborative response by many players is needed
- To be most effective, all stakeholders need to be on the same page and work together



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Foster a “Culture of Safety”

Incorporate into everyday activities:

- Personal issue, we all spend time on the road
- Transportation is about getting people/goods to destination safely
- “Culture of Safety” focus upon keeping people/community/employees safe



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County Comprehensive Highway Safety Plan

- Next step?
- Use state version as a template
- Apply the 15 critical strategies to each county
- Formalize stakeholder involvement
- Develop a Road Safety Plan

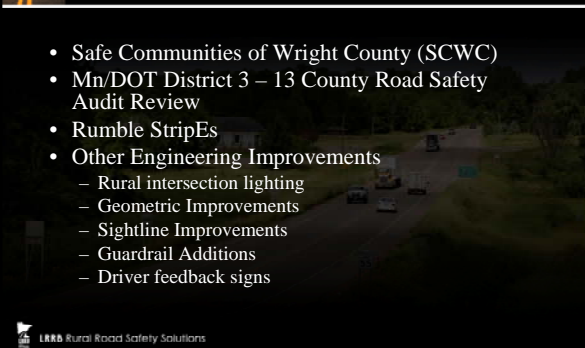


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Case Studies


- Safe Communities of Wright County (SCWC)
- Mn/DOT District 3 – 13 County Road Safety Audit Review
- Rumble StripEs
- Other Engineering Improvements
 - Rural intersection lighting
 - Geometric Improvements
 - Sightline Improvements
 - Guardrail Additions
 - Driver feedback signs



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**Case Studies:
Safe Communities of Wright County**

- Formed in 1997
- Broad community representation
- *Mission: To reduce traffic injuries and fatalities in Wright County.*




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**Case Studies:
Safe Communities of Wright County**

Initiatives

- Distracted Driving Campaigns
- Parent-Teen Driver's Ed Meetings
- Towards Zero Death Corridor Campaign (Highway 55)
- Drive Wright & Teen Drive Wright




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**Case Studies:
Safe Communities of Wright County**

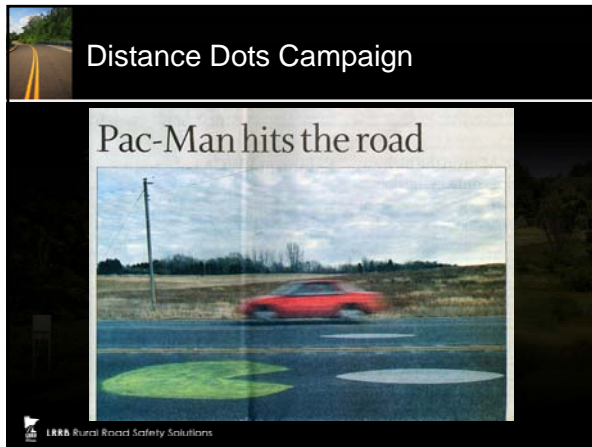
Initiatives

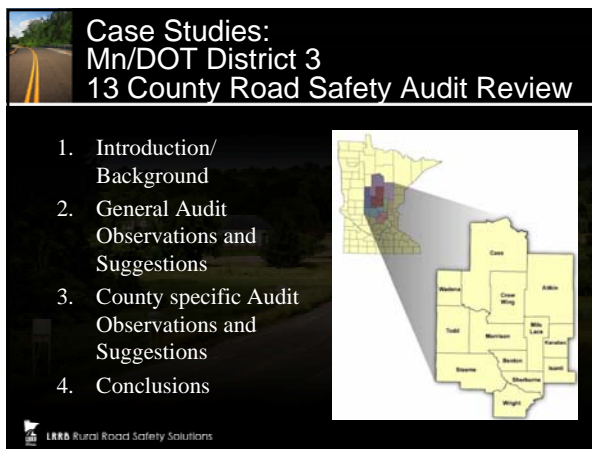
- Distance Dots Campaign
- Seat Belt Challenge
- Community Signs & Billboards
- Speed Trailer Grant Project



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**Case Studies:
Rumble StripEs**




Edgeline painted over rumble strips

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**Case Studies:
Guardrail Additions**

McLeod County – CSAH 8



Before Guardrail

After Guardrail

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**Case Studies:
Geometric Improvements**

**Washington County –
Intersection of CSAH 12/CSAH 17**




Before Left-turn Lane

After Left-turn Lane

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Case Studies:
Driver feedback signs

Anoka-Hennepin School District



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