

# State DOT Road Safety Audit Programs

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**Arizona**

**Roads and Streets  
Conference**

**April 2006**



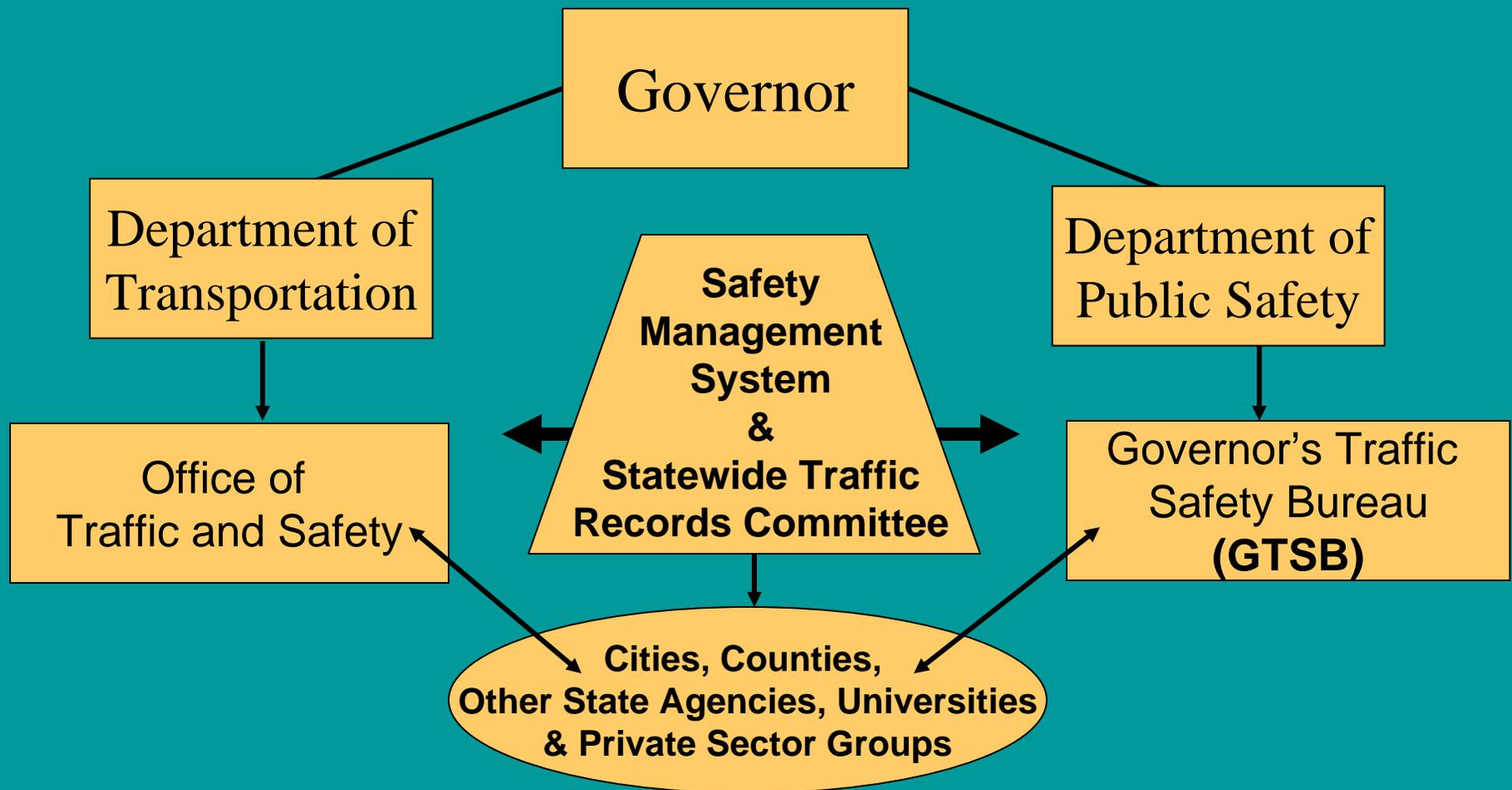
## WORLD HEALTH ORGANIZATION

1.2 million people will die as a result of road crashes this year –

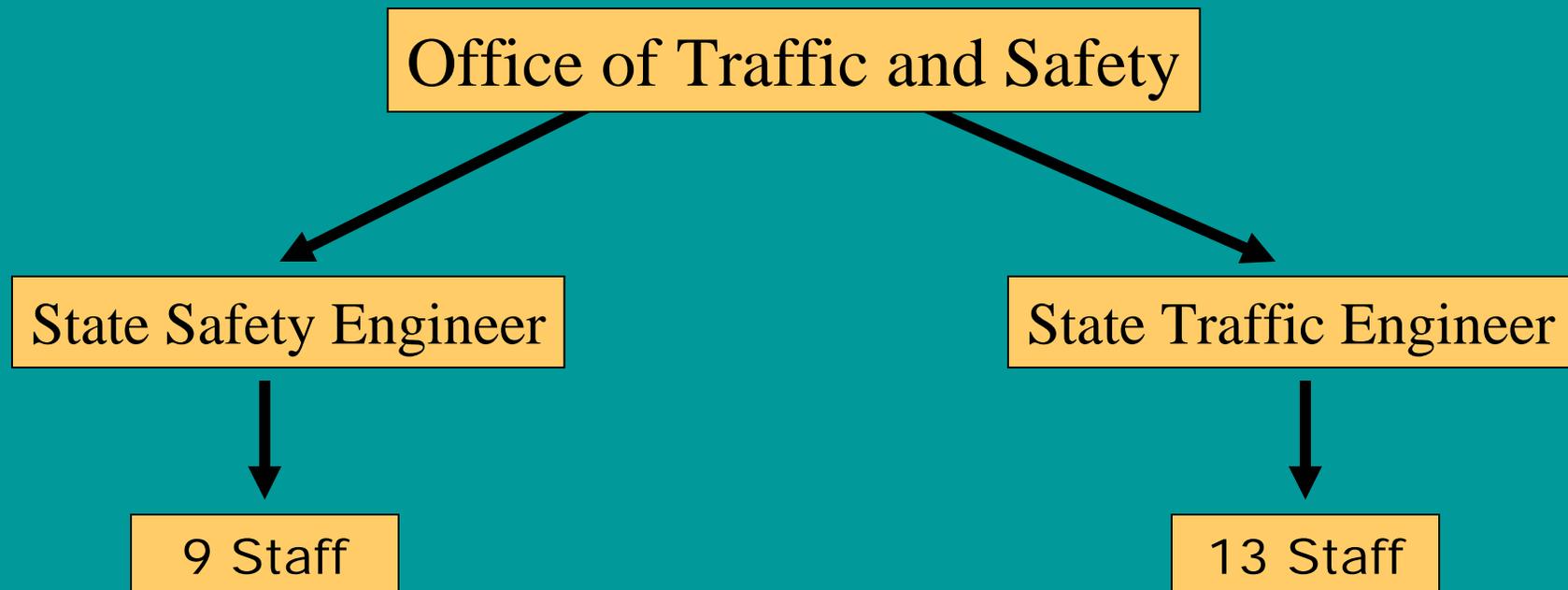
more than 3200 deaths each day

**ROAD SAFETY IS NO ACCIDENT**

# Iowa's Highway Safety Management



# Iowa's Highway Safety Management



# Iowa DOT Safety Programs

## Statewide Programs

- Federal Hazard Elimination Program
- Highway Safety Management System (SMS)
- Data-Driven Highway Safety Program
- Safety Conscious Planning
- 3R Roadway Safety Audits

## Local Assistance Programs

- State Traffic Safety Improvement Programs (TSIP)
- Traffic Engineering Assistance Program (TEAP)
- Safety Data Products
  - Crash Data Analysis Tools
  - Iowa Traffic Safety Data Services (ITSDS)
- Traffic & Safety Engineering Forum
- Small town signing program

# AASHTO

## Technology Information Group

- In 2004, AASHTO's TIG selected RSAs as focus technology
- Tom Welch and Terecia Wilson Co-Chairs
- Team includes AASHTO, NACE, LTAP, FHWA, Universities
- RSA Brochure
- Video
- Regional Peer Exchange Workshops



## *What is a Road Safety Audit?*

A road safety audit is a formal examination of an existing or future road or traffic project, or any project which interacts with road users, in which an independent, qualified examiner reports on the project's crash potential and safety performance.

Road Safety Audits are

A  
PROACTIVE SAFETY  
TOOL



# Road Safety Audits Are Not:

- Praise or Critique of Design Work or Personnel
- Crash Investigation Only (Reactive)
- Provide Alternative Designs
- High-Cost or Resource-Intensive
- Replace Engineering, Fiscal Decision-Making

# In the Beginning

## 1994 FHWA Safety Management Scanning Tour

- Australia
- New Zealand

# FHWA Safety Audit Workshops

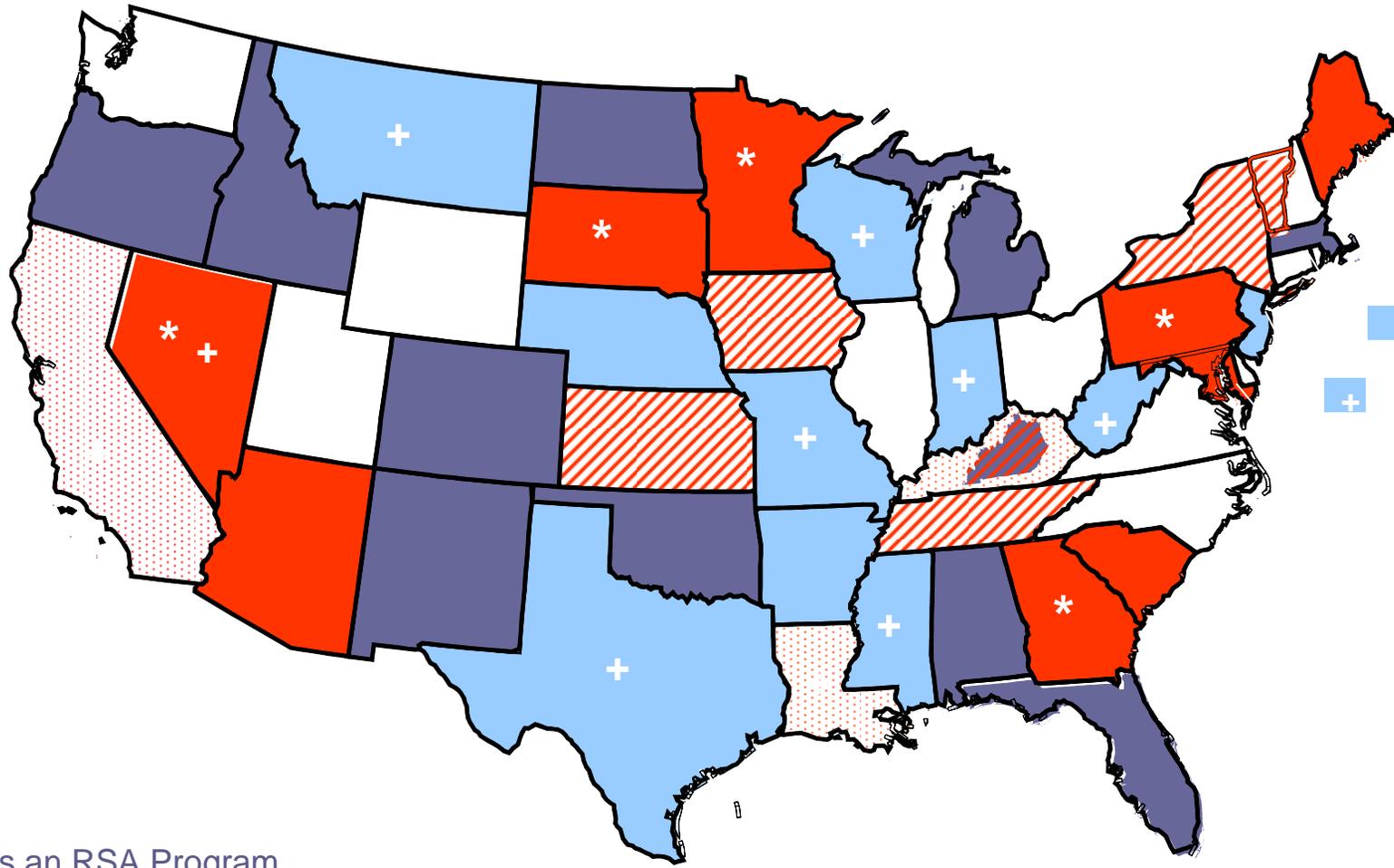
1997 in St. Louis

- 13 DOTs attended
- Many concerns raised

# Training Courses

2000 FHWA

2001 NHI Courses



 Has an RSA Program

 Has Informal RSA Program

 Considering an RSA Program

 RSA Only on Existing Roads

 NO RSA Program but has some RSA activity

 NO RSA Program

 NO Response / Unknown

# TRADITIONAL RSA PROGRAMS

# When Can RSA's Be Used?

## Traditional:

- ◆ Planning & Land Use Development - Best
- ◆ Preliminary Design, Detailed Design
- ◆ Construction
- ◆ Operations, Maintenance

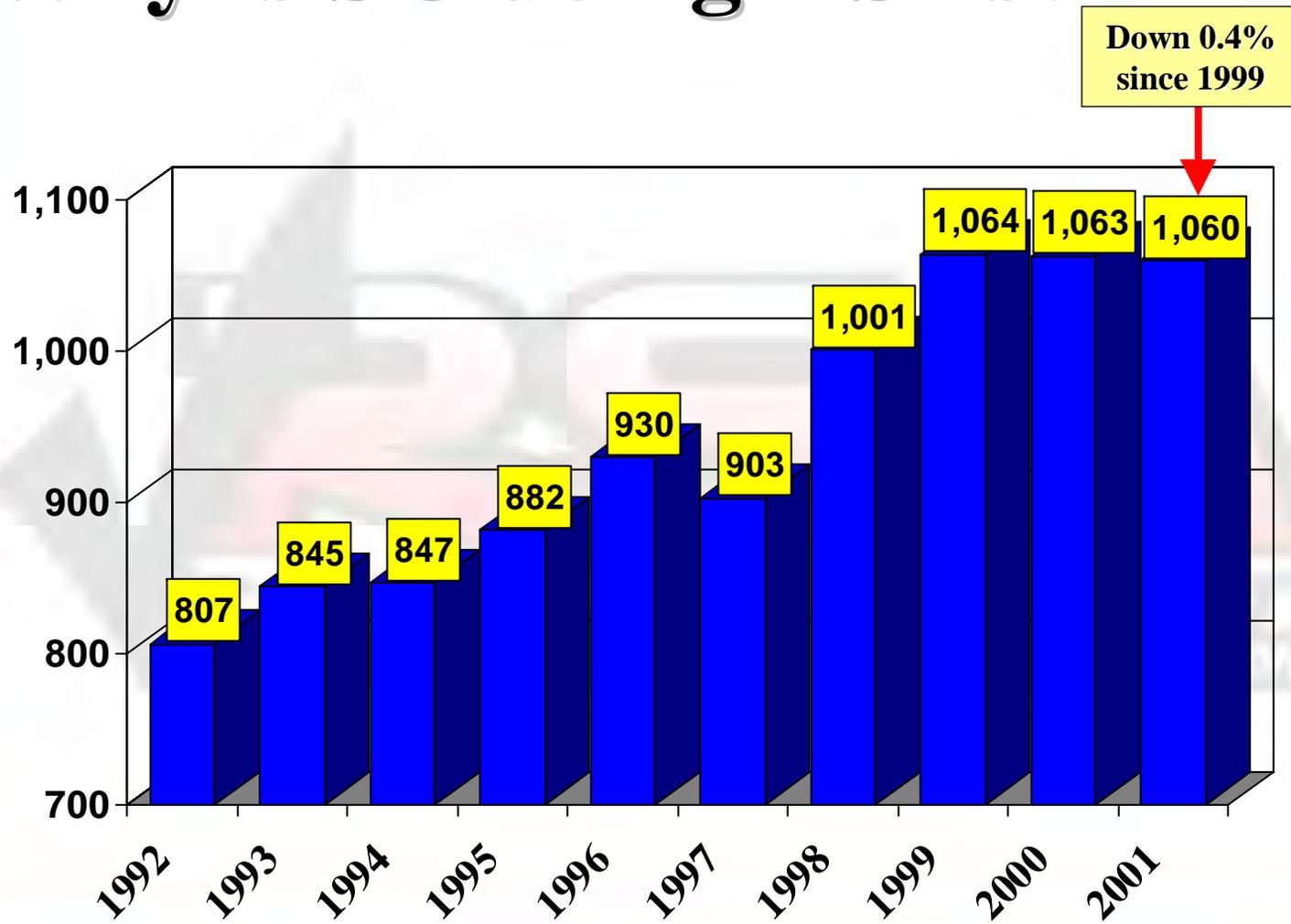
## NonTraditional:

- ◆ Rehabilitation

Rte. 148, Industry



# Why is SC doing RSAs?





# Why is SC doing RSAs?

- Proactive approach to highway safety.
- Widely used in other countries, highly effective.
- Possible even with limited resources.
- Supports Strategic Plan Goal of improving safety.



# Projects

- The first year will feature 4 existing roads, 2 new projects, and 5 under construction.

# AASHTO TIG Brochure

“We view RSAs as a proactive, low cost approach to improve safety. The RSA helped our engineering team develop a number of solutions incorporating measures that were not originally included in the projects. The very first audit conducted saved SCDOT thousands of dollars by correcting a design problem.”

-Terecia Wilson  
Director of Safety, South Carolina DOT

# The MaineDOT Approach

- Focus on Planning & Scoping Activities
  - Maximum Life Cycle Safety Benefits
  - Minimal Life Cycle Cost
  - Reduced Need for Follow-Up Safety Projects
- Minimal Administration & Resources
- Selective RSAs in Subsequent Phases

Rte. 136, Freeport

# MaineDOT RSA Findings -Driver Expectations-

- Consistency in Road Geometry
- Driver Information Signs
- Speed Control, Speed Limits
- Railroad & Other Crossings
- User Mix (Bike, Ped, Large Vehicles, Other)

Litchfield

# MaineDOT RSA Findings

## -Geometrics-

- Lane & Shoulder Widths, Types
- Access Control, Entrance & Egress
- Lane Changes, Turning Movements
- Parking
- Lighting, Sun Glare

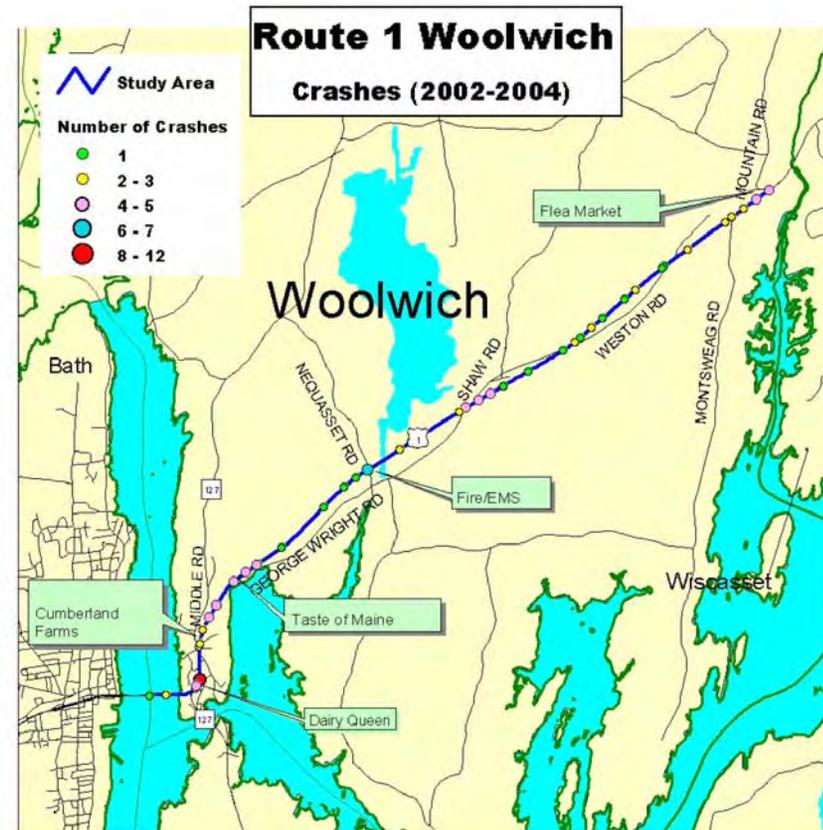
Bethel

# NON- TRADITIONAL RSA PROGRAMS

# Maine Example Report

## Woolwich Route 1 Road Safety Audit Report September 23, 2005

Prepared by  
Duane Brunell, Safety Office, MaineDOT



# IOWA 3 R SAFETY AUDIT PROGRAM



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# Typical Iowa “New Construction”

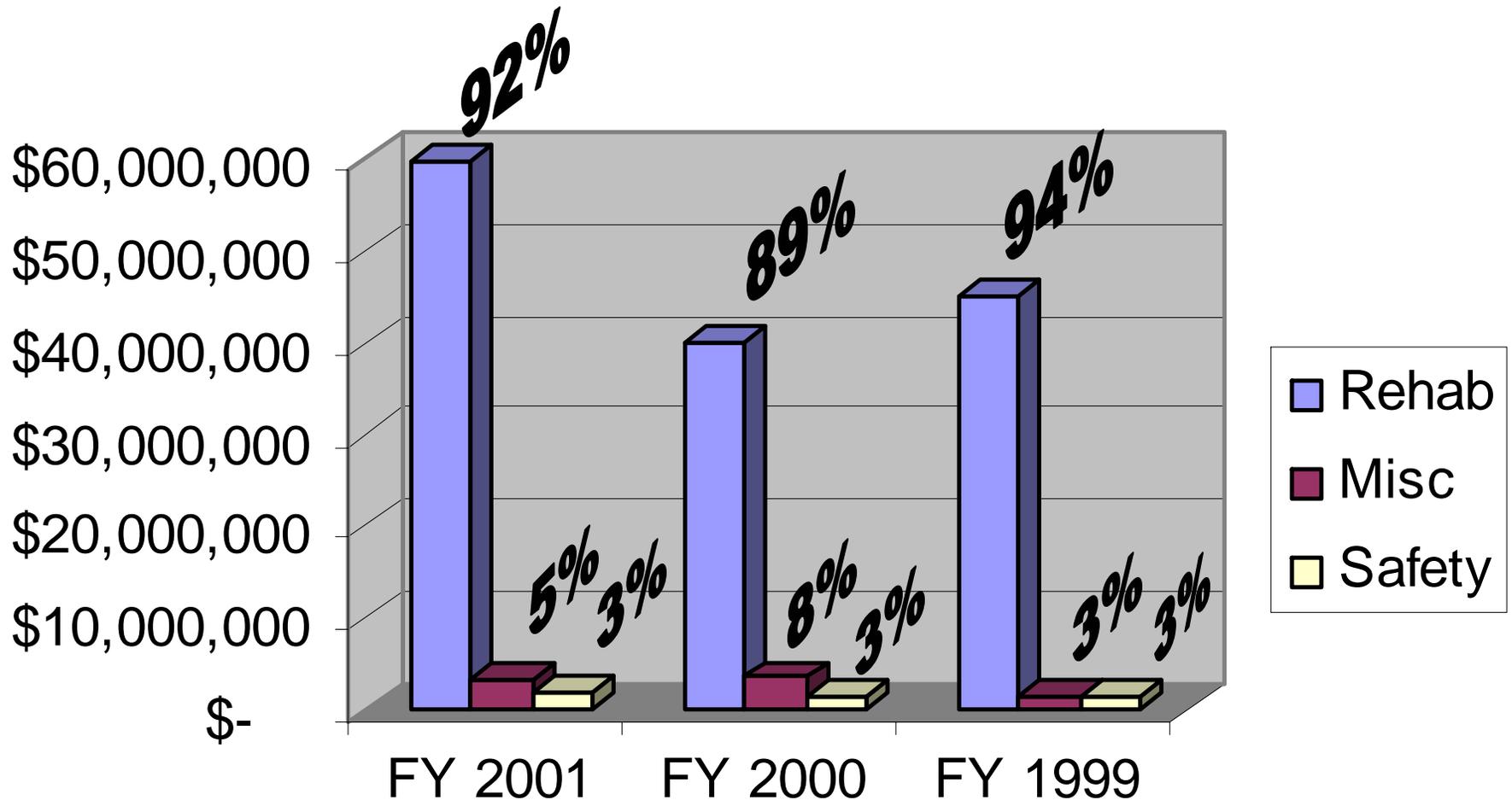


# From 1R to 3R

- We were resurfacing the roads and nothing else.
- 3 inch overlay every 20 years would cost \$100,000,000 a year so that was our program goal
- Safety and incidental items slowed this down

**Prior to 2000**

## 3R Project Annual Cost Breakdown



# Safety

## Program Focus:

Low cost improvements  
to improve safety  
on all roadways  
in the next 20 years

November 5-6, 2002

# 3R Safety Workshop



## Roadway Resurfacing Safety Workshops

Sponsored by the  
Office of  
Traffic and Safety

## SAFETY REVIEW CHECKLIST

### FOR PROJECT REVIEW

Updated: 02/19/02

( It is assumed that the accident history has already been reviewed for 'hot spots' and substandard geometrics etc have been identified )

### SAFETY RELATED ITEMS ( Done with project or later ) Not all inclusive

NOTE: This is not an all or nothing proposition – i.e.:

- A) If fixed objects cannot be moved to the clear zone – can they be moved a part of the distance — 6' from the back of curb is better than in the back of curb
- B) If it is cost prohibitive to correct all the substandard cross slopes can those on the outside of curves or where a vertical face exists be corrected
- C) If all the poles / trees cannot be moved / eliminated are there some that can be taken care of – unused or single line drop poles are usually easy to eliminate, move or combine
- D) Special attention should be paid to those areas that a review of the accident history has highlighted as hot spots

#### 1) Clear Zone

- a) May need to remove / protect objects beyond clear zone
- b) Removal of vegetation that has been allowed to grow in the foreslopes or at the toe of a traversable foreslope etc.
- c) Move poles to inside from outside of curves
- d) Move / remove poles / trees
- e) Fill large gullies in foreslopes or at toe of slope

#### 2) Access

- a) Correct / relocate drives / entrances with poor sight distance
- b) Catch ones that could create a problem with future development

#### 3) Curves

- a) Add / correct superelevation
- b) Pave outside / inside of shoulder
- c) Flatten outside foreslope
- d) Add delineators, chevron, RPM's
- e) Ball bank for advisory speed
- f) Add advance warning signs – check for correct sign for advisory speed

# 3R Checklist

6 Page Worksheet

31 Review Categories

# 3R Roadway Safety Audits



# 3R Safety Audits

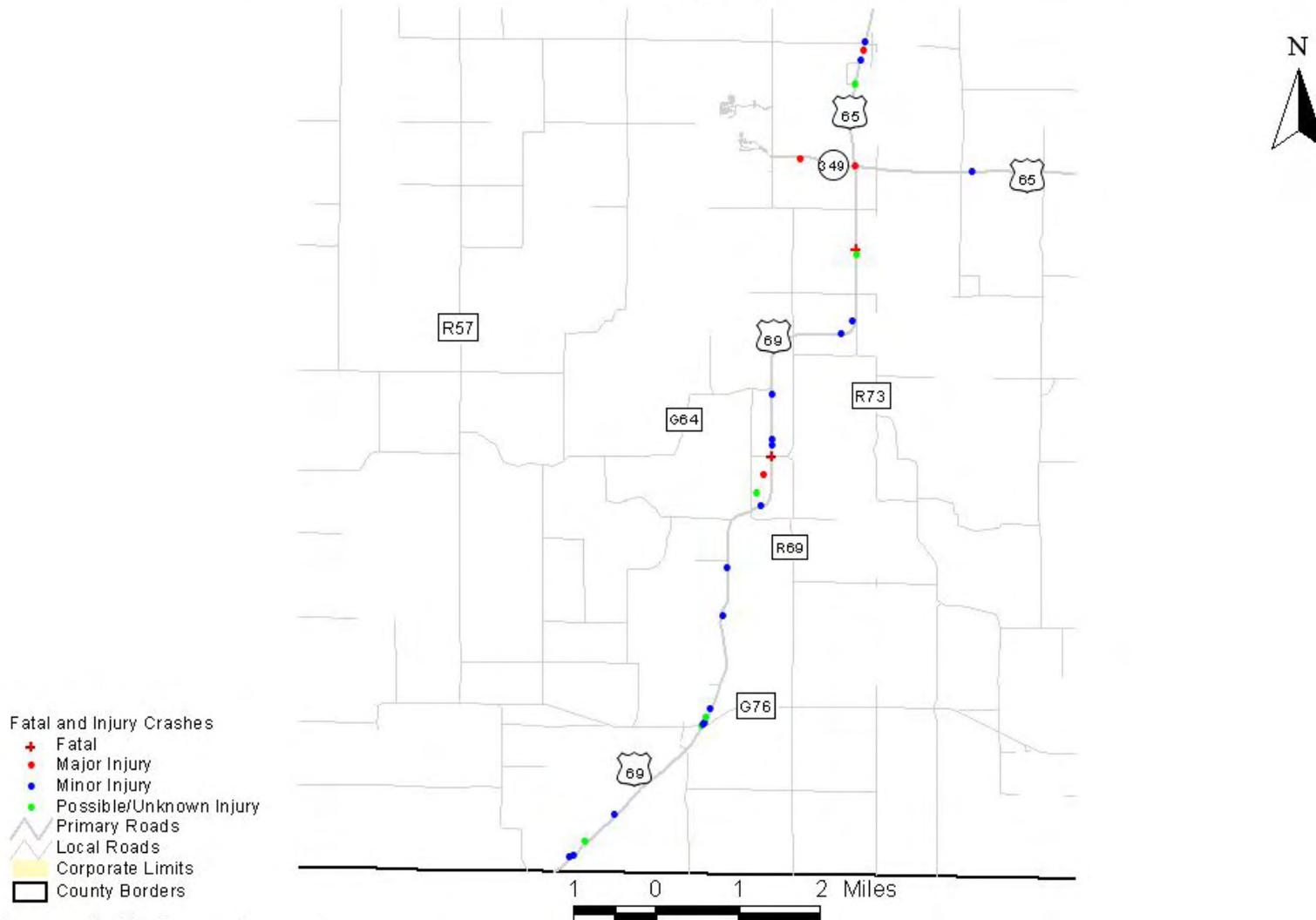
- By Districts
- Recently Completed 3R Projects
- Proposed 3R Projects
- Crash Analysis
- Prepare Audit Report
- Annual Report to Chief Engineer

# 3R Safety Audit Review Team

- Safety
  - DOT
  - FHWA
- Design
- Maintenance
- Construction
- Older driver
- Local enforcement input

# Warren County

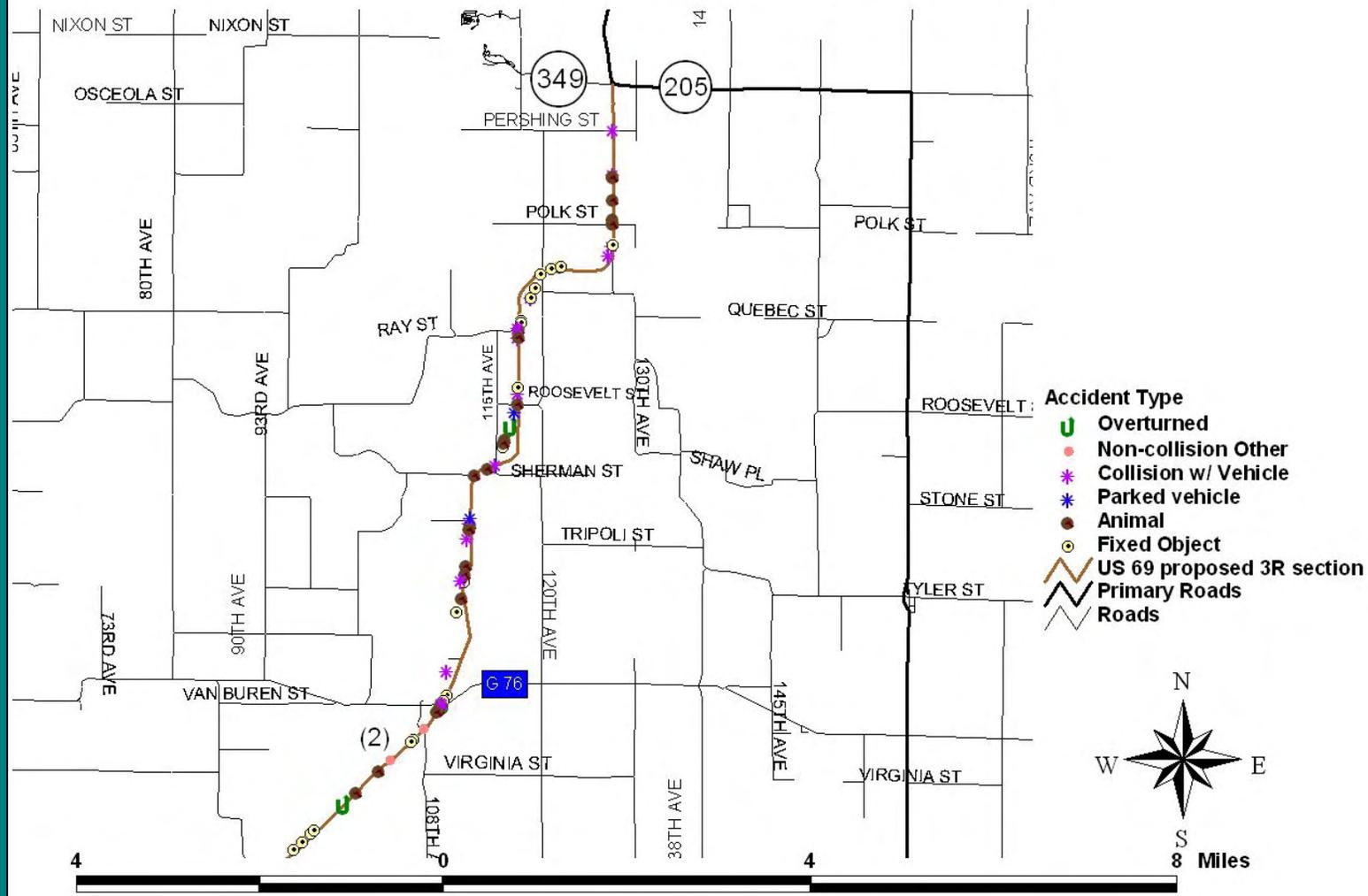
## US 69 Fatal and Injury Crashes Warren County (Clarke County to Iowa 349) (1996-2000)



\*As recorded in the crash record.

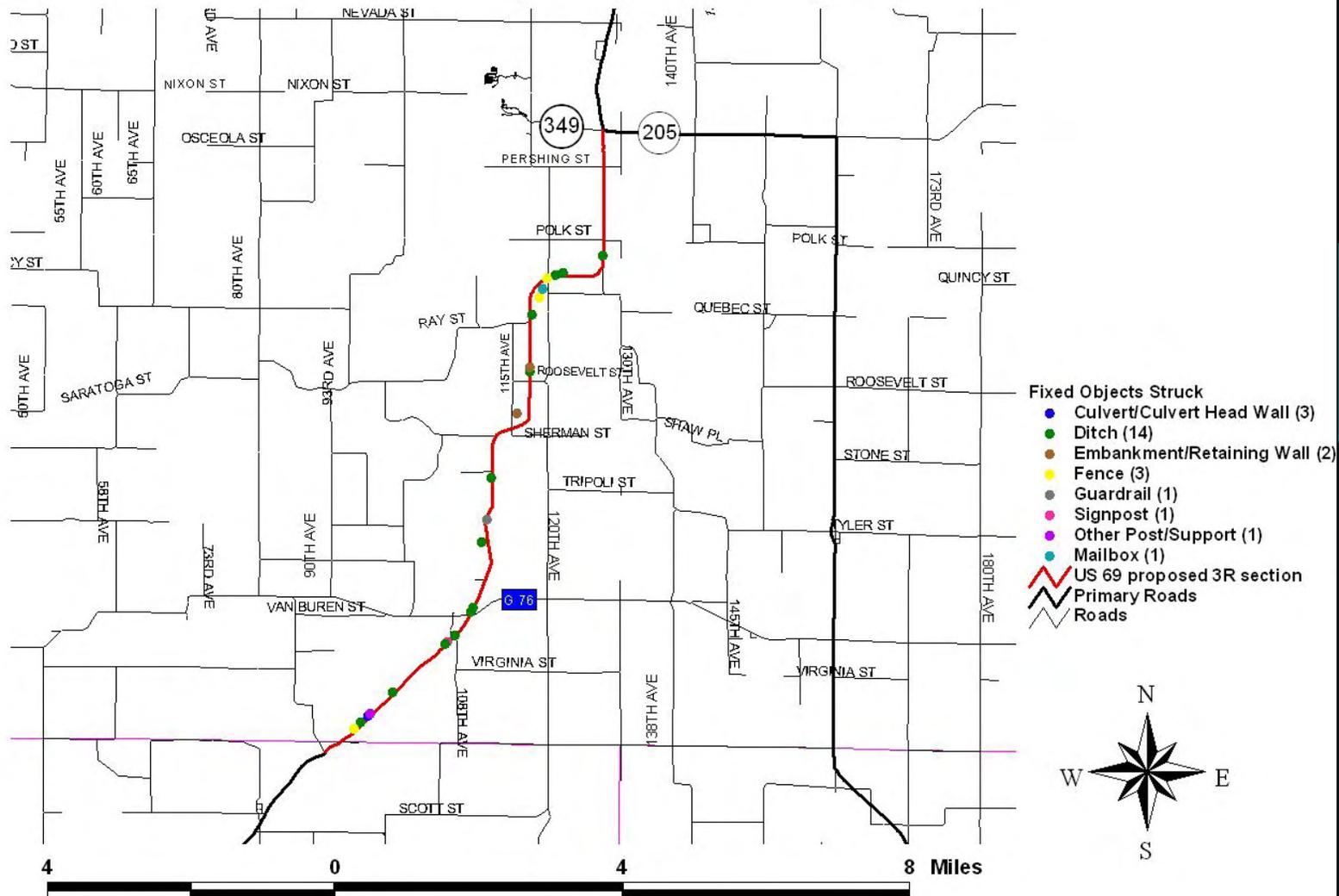
# Warren County

## US 69 Crashes by Accident Type (1995-1999)



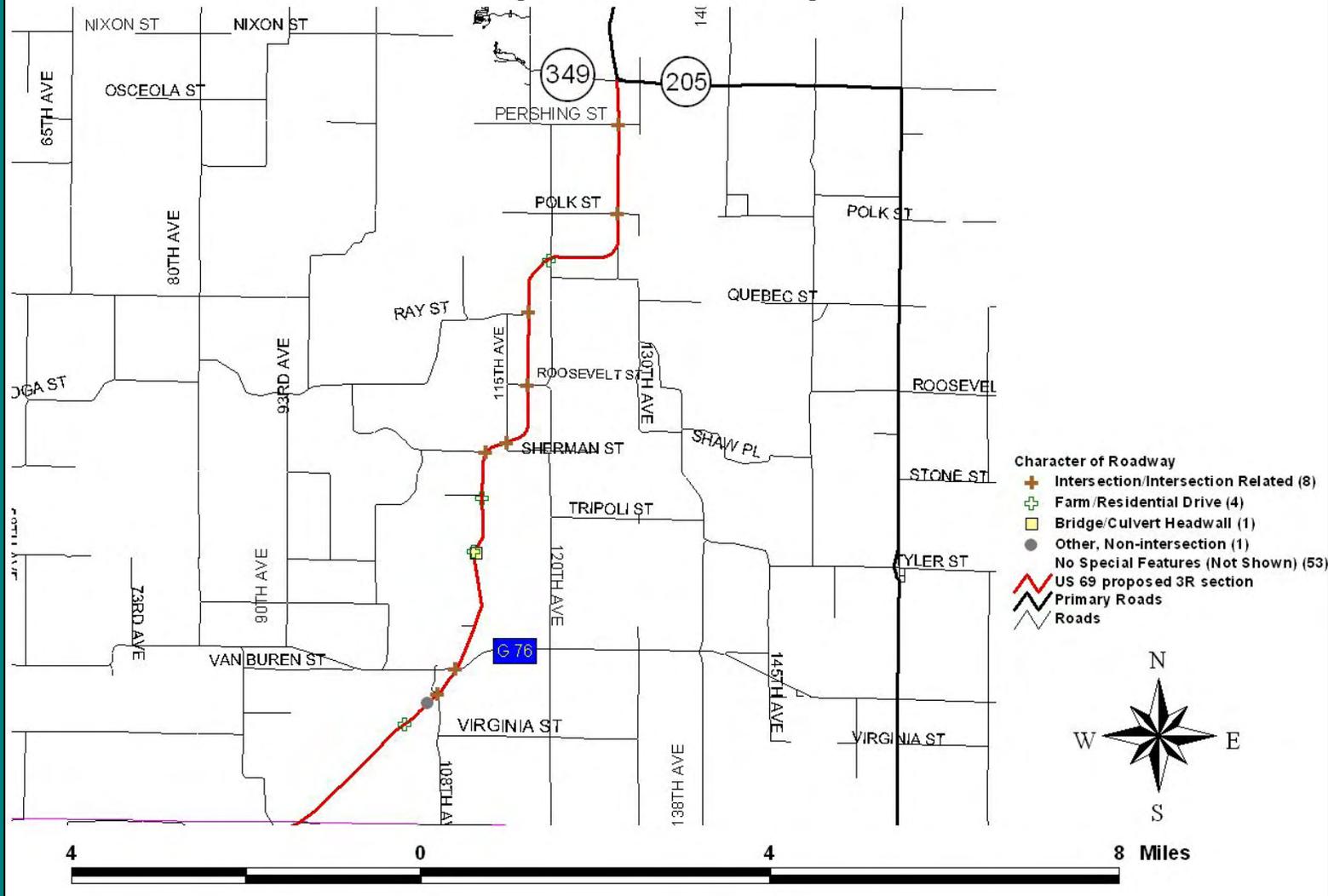
# Warren County

## US 69 Crashes by Fixed Objects Struck (1995-1999)



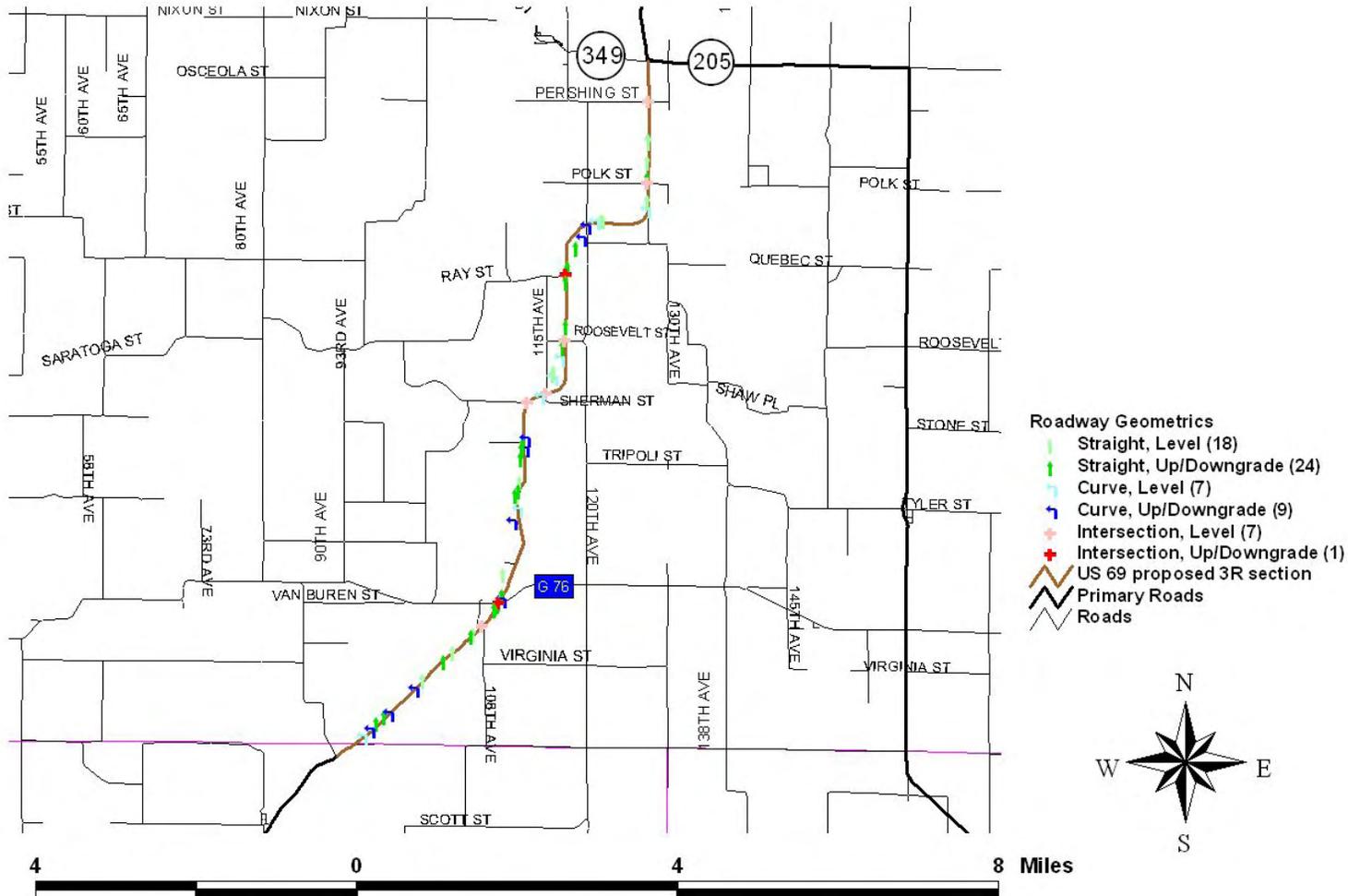
# Warren County

## US 69 Crashes by Character of Roadway (1995-1999)



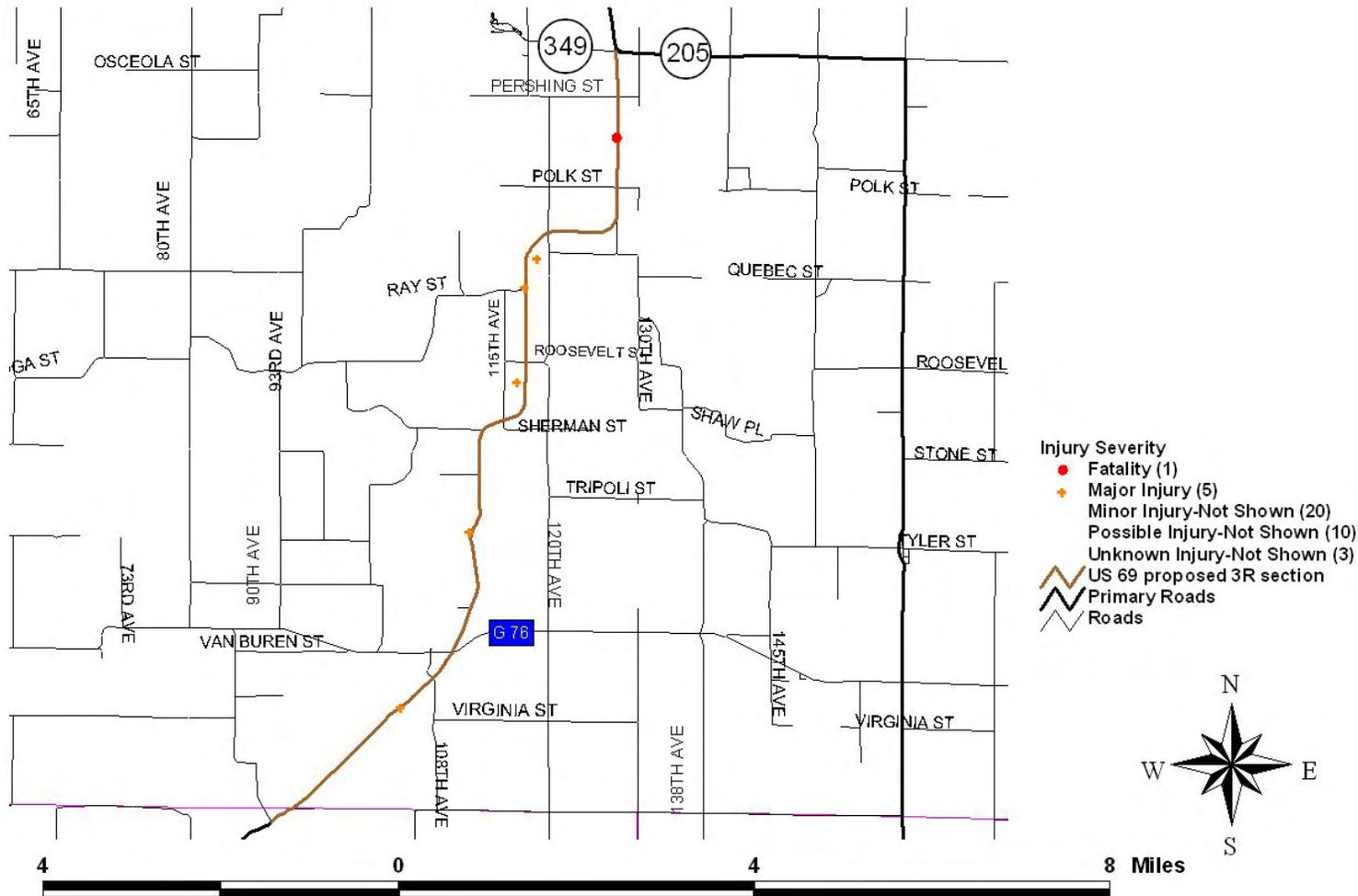
# Warren County

## US 69 Crashes by Roadway Geometrics (1995-1999)

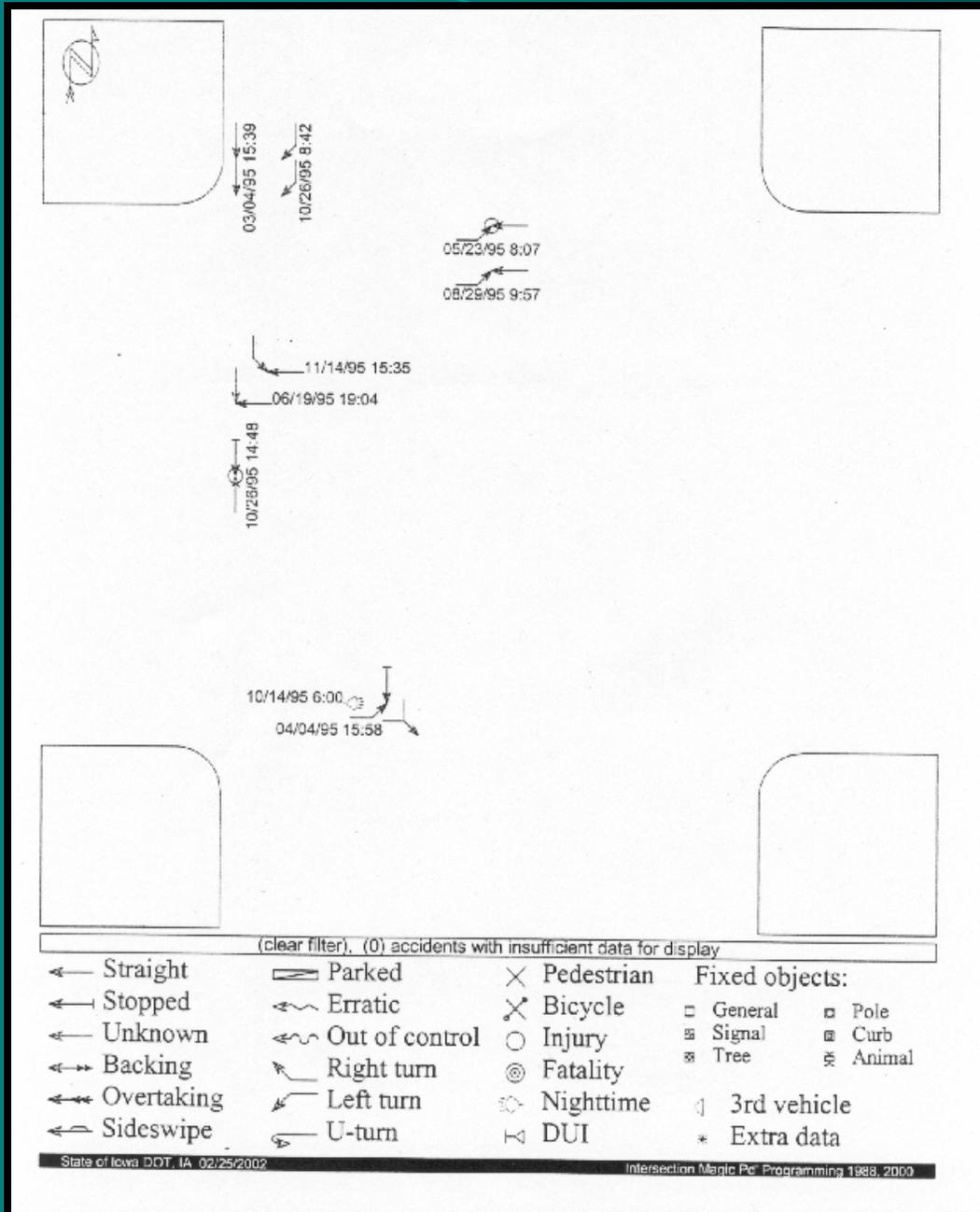


# Warren County

## US 69 Crashes by Injury Severity (1995-1999)



# Collision Diagrams



# Safety Improvements Incorporated Into 3R Projects

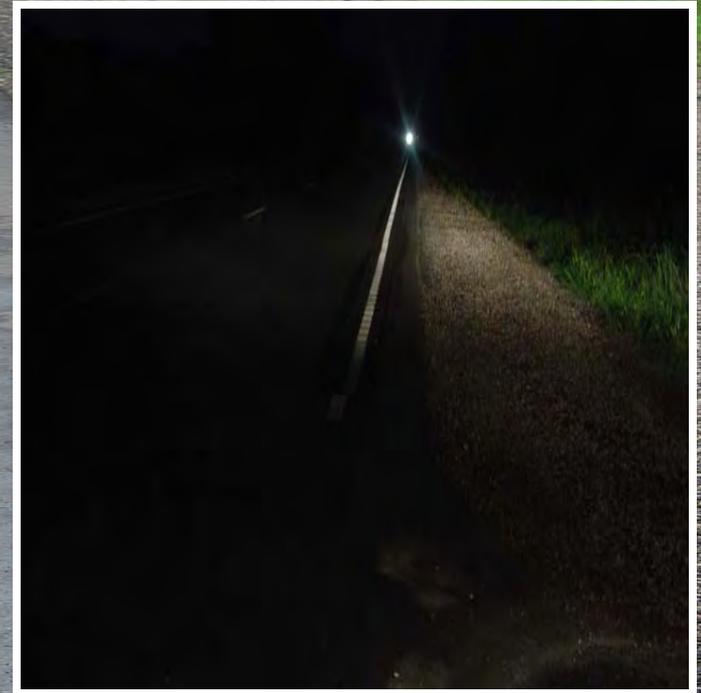
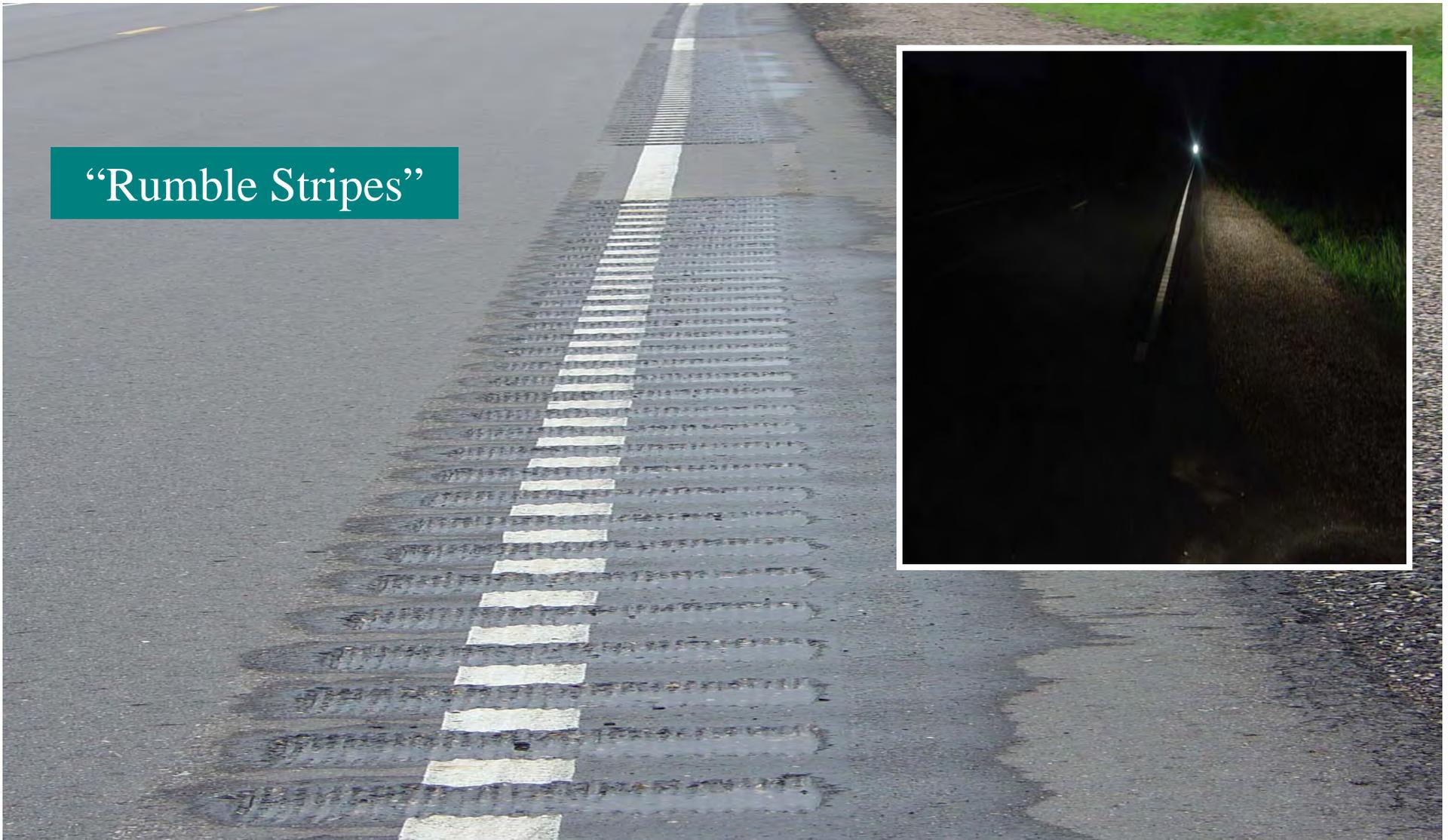


4' Paved Shoulders with milled  
rumble strips

6.16.2000

# Safety Improvements Incorporated Into 3R Projects

“Rumble Stripes”



# Curves



- Super elevation: add or correct
- Pave shoulders: outside & inside
- Flatten outside slope
- Remove objects outside curve
- Delineate, chevron, RPM's, ball bank advisory

# Safety Dikes ( escape ramps)



- Opposite all “T” intersections
- Free of fixed objects

# Daylight: Intersections, Drives



- Vegetation: crops, bushes
- Cut or fill problem
- Signs & poles

# Turn Lanes



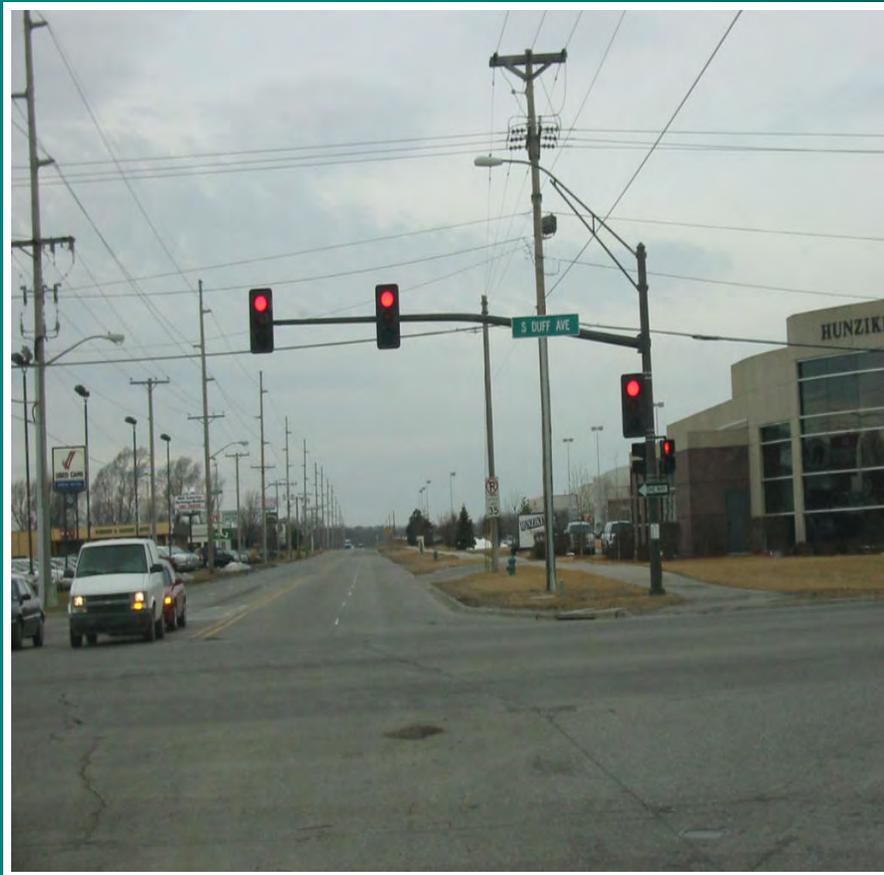
- Check warrants & crash history
- Offset left turn lanes

# Turn Lanes



- Offset Right Turn Lanes

# Signals



- Back plates
- Add mast arms
- Add far right side
- Head for each lane
- Replace < 12 inch
- Combination poles
- Detector location & operation
- Mill/patch affect detectors
- Pedestrian signal/buttons 49

# Rumble Strips



- At stop signs
- Replace if present
- On paved shoulder
- Re-cut if not effective
- Will project cover

# Improved Signing



# Cattle Passes



- Fill in if not in use (check for deer use)
- Guardrail
- Delineate

# Safety Improvements Incorporated Into 3R Projects



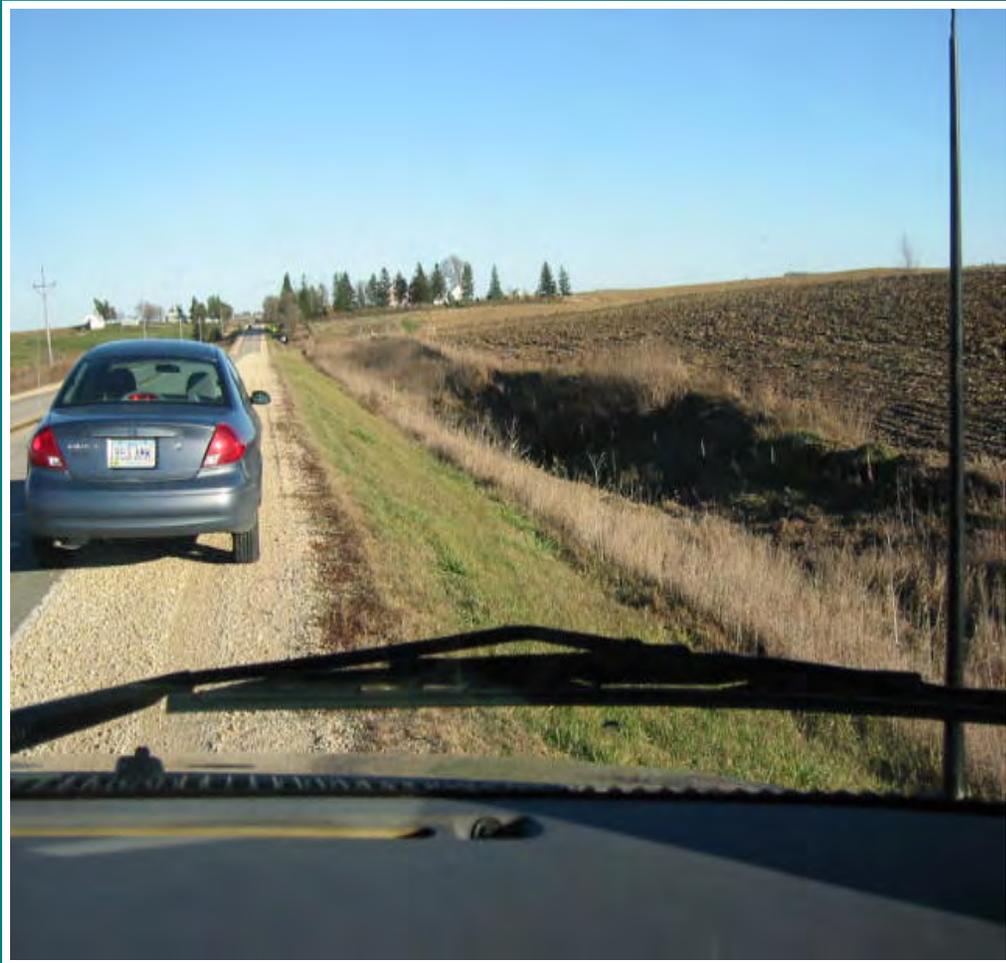
**Reduce Impact Severity**

# Safety Improvements Incorporated Into 3R Projects



**Extend Culverts**

# Culverts



- Consider drop inlets

# Culverts



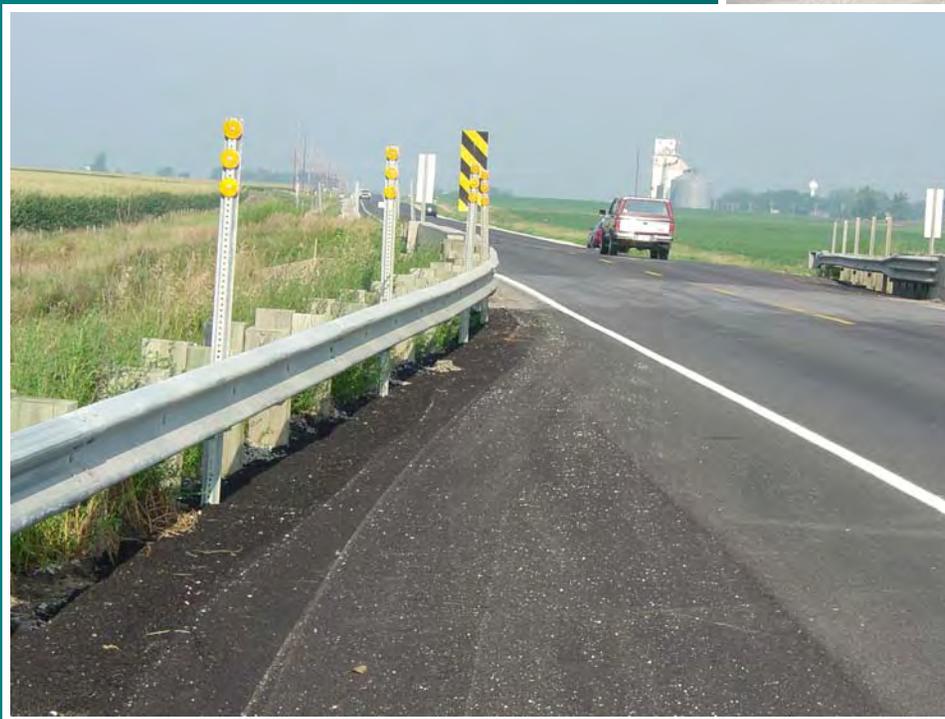
- Lengthen
- Grate
- Place guardrail

# Guardrail



- Upgrade all/ terminals
- Mounting height
- Pave to face of rail
- Remove fixed objects in front of or within deflection area

# Safety Improvements Incorporated Into 3R Projects



# Remove Driveways With Vertical Walls



# Safety Improvements Incorporated Into 3R Projects



**Flatten  
Transverse  
Slopes**

# Remove Roadside Trees



# Mailboxes



- Severe obstacles
- Replace with breakaway posts and well-fastened box

# Safety Improvements Incorporated Into 3R Projects



Improve Curve  
Signing

# 4-lane Undivided to 3-lane Conversions



**BEFORE**

Used in  
18 Iowa Sites



**AFTER**

# Rip Rap



- Back slope: any size?
- Fore slope and toe: maximum 4 inch
- Do not create a wall

# Utility Pole Delineation



# Milled Center-line Rumble Strip

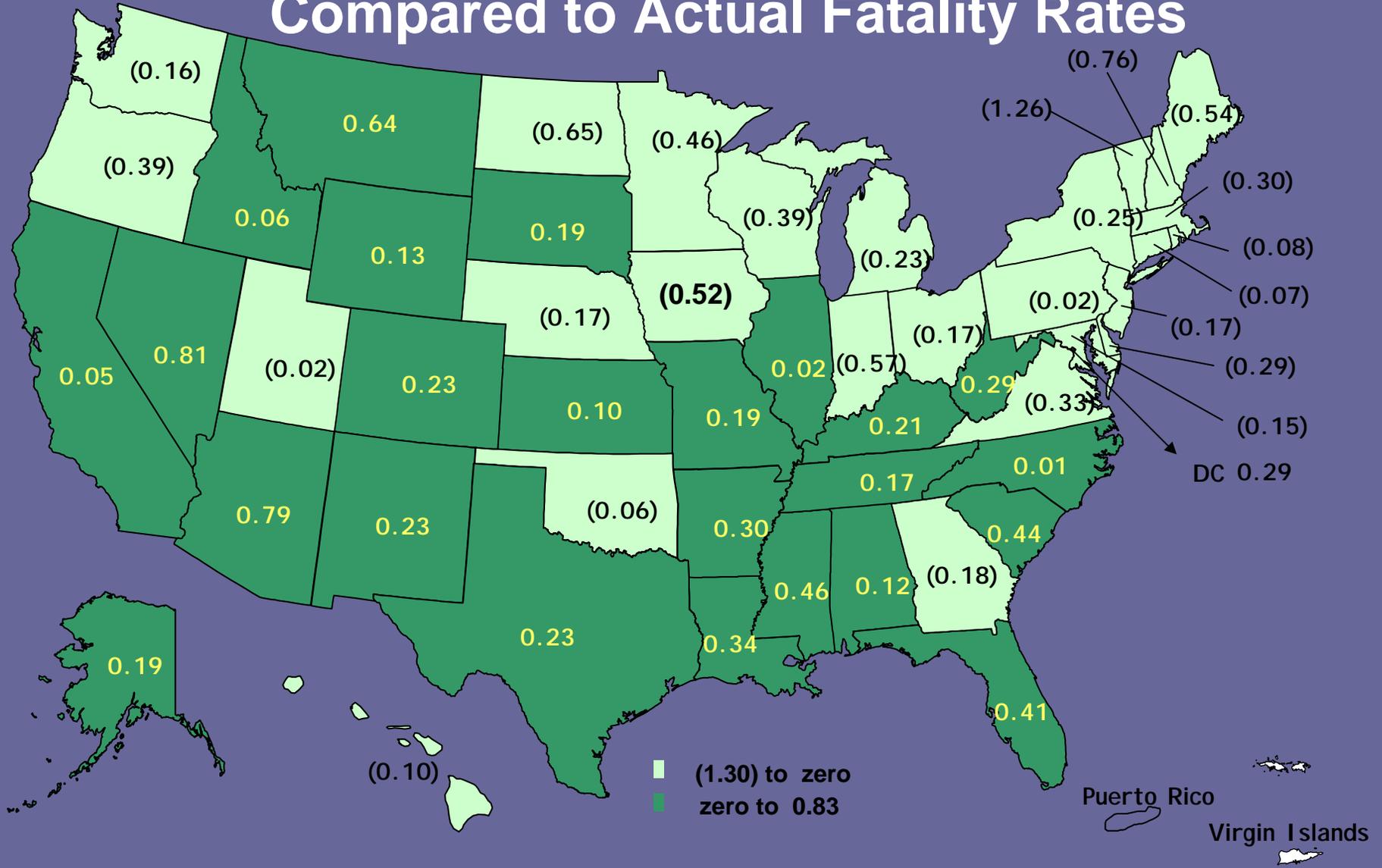


# Return on Investment?

## *Iowa Highway Fatalities Five Year Average*

- 1995 -1999      480
- 2000 - 2004      420

# Expected Fatality Rates (Weighted by Distribution of VMT) Compared to Actual Fatality Rates



# DESIGNING TO “STANDARD” MAY NOT BE GOOD ENOUGH

- Standards may not address everything
- Combination of elements may not “fit”
  - i.e.: downhill to a left-hand curve

# Curve Enhancement Beyond “Standard”





Meets Clear Zone  
and Design Standards

# Intersection Location Relative To Horizontal or Vertical Curve “Standards”



# Enhance Edge Rut Maintenance Standards





# *Do RSAs expose agencies to more legal liability?*

- Agencies should seek legal advice.
- Agencies can be taken to court with or without a road safety audit.
- RSAs can be part of a safety management system.

# ***Do RSAs expose agencies to more legal liability?***

***“[RSAs] demonstrate a proactive approach to identifying and mitigating safety concerns.”***

***“Our attorneys say that once safety issues are identified, and if we have financial limitations on how much and how fast we can correct the issues, then the audit will help them in defense of liability.”***

# Liability Issues

- Safety Audits will help create a safer road environment
- Audits should not be discouraged by legal system
- Benefits outweigh the costs



## *Will an RSA drive up costs?*

**The audit team provides suggestions only.**

**The road agency or designer remains responsible for design decisions.**

# *Will an RSA drive up costs?*

## **Audit suggestions:**

- **can focus on low-cost safety improvements,**
- **can be pre-screened with the road agency and designer,**
- **must be consistent with the design stage.**

# Keys to Success

- Top-Down Support
- Adapt to Fit Local Needs
- Institutionalize the Process
- Focus on What is Doable
- Train Key Players, OJT for Team Members
- Utilize Multi-Discipline Approach
- Note Life Cycle Savings Far Outweigh Costs

Rte. 137, Freedom

***“The Road Safety Audit process is valuable from a perspective of identifying deficiencies, developing mitigative strategies, improving public relations, and enhancing our agency’s credibility.”***

Bernie Arseneau,  
Director, Office of Traffic, Security, and Operations, Minnesota DOT