

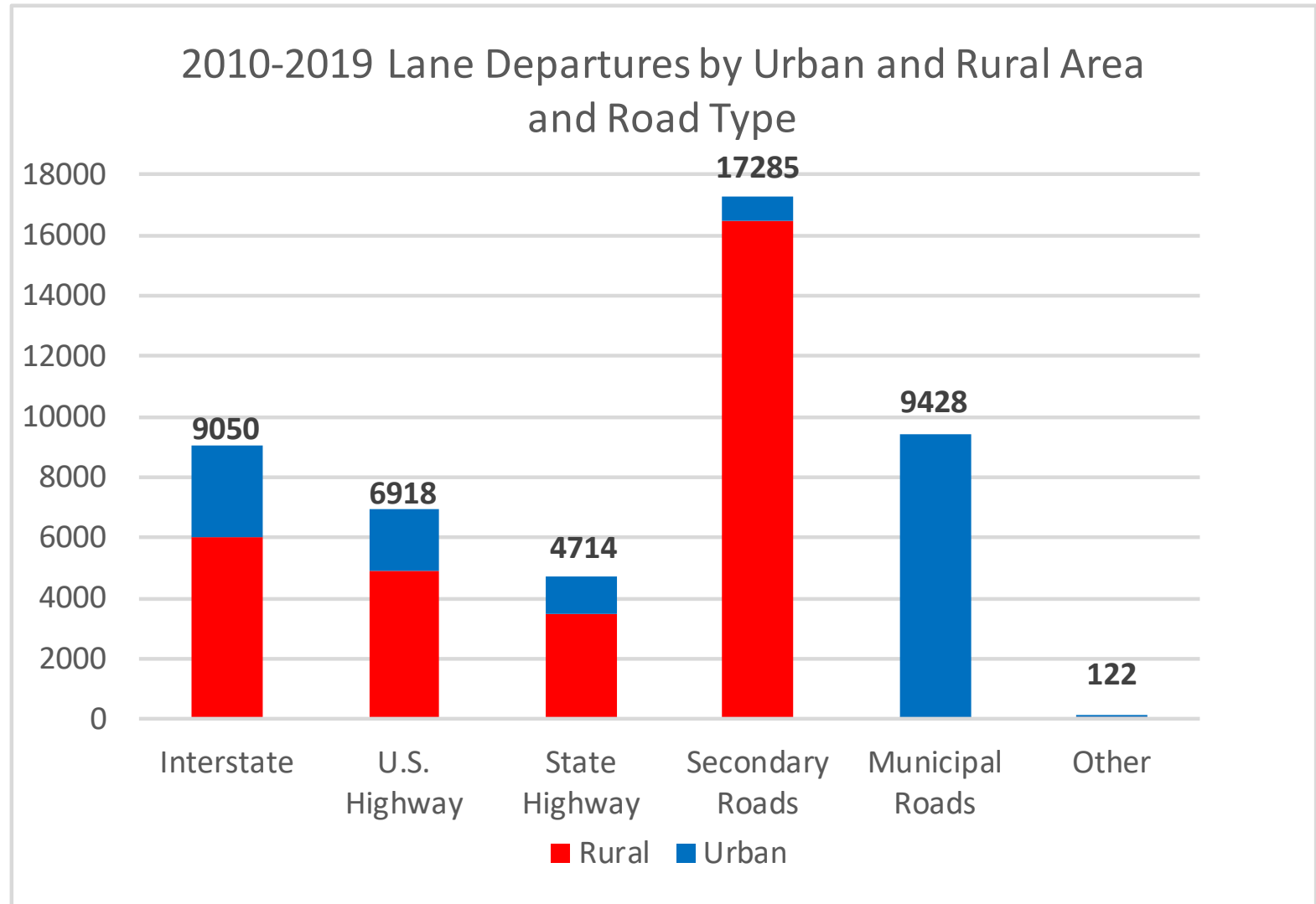
# Roadside Safety and Countermeasures

## Keeping Vehicles on the Roadway



**David Veneziano**  
**Iowa Local Technical**  
**Assistance Program**  
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# Iowa Lane Departure Data (2010-2019)



# So, why do drivers leave the road?

- **Roadway Condition**
- **Collision Avoidance**
- **Vehicle Component Failure**
- **Driver Error**



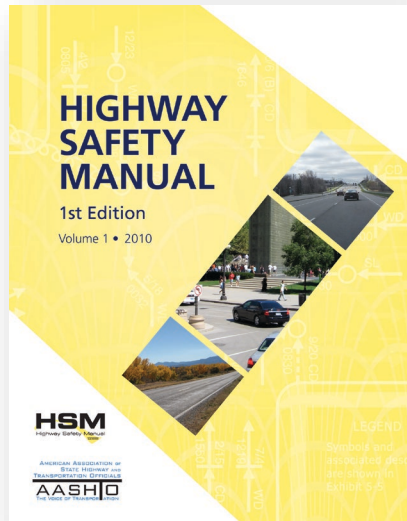
# Keep Vehicles on the Roadway

- Edge and Centerline Pavement Markings
- Reflective Barrier Delineation
- Curve Signing and Maintenance
- Rumble Strips and Stripes
- High Friction Surface Treatments

# Crash Types Addressed by Pavement Markings & Delineation

- Curve Crashes
- Head-on Collisions
- Night Time Crashes
- Other Run-off-Road Crashes

# Edge and Centerline Markings



**Edge lines**

**Centerlines**



**Table 13-39. Potential Crash Effects of Placing Edgeline and Centerline Markings (8)**

Treatment	Setting (Road Type)	Traffic Volume	Crash Type (Severity)	CMF	Std. Error
Place edgeline and centerline markings	Rural (Two-lane/ Multilane undivided)	Unspecified	All types (Injury)	0.76	0.1

Base Condition: Absence of markings.

# Are Wider Edge Lines Better?



**4-inch Width**



**6-inch Width**

- Iowa Planning-Level CRFs:
  - 4 inch = 10%
  - 6 inch = 7%

# Reflective Barrier Delineation

- Concrete Barrier Rail



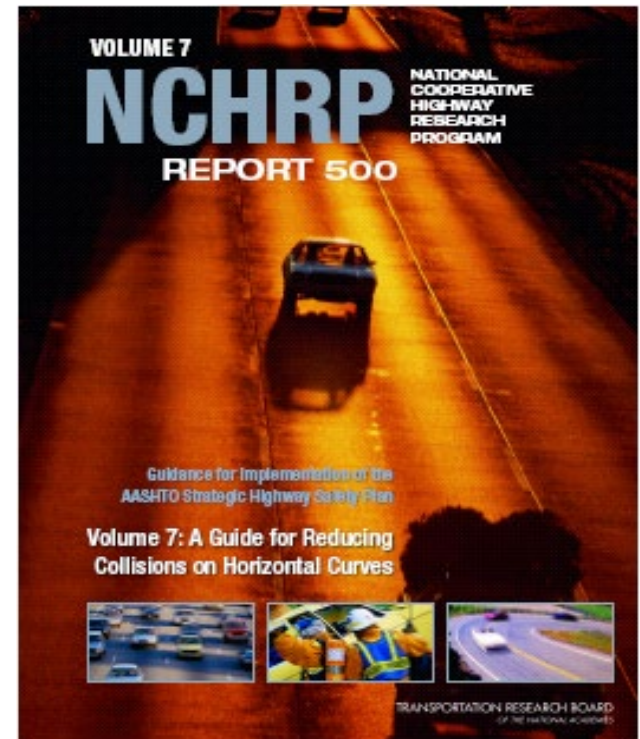
- Metal Guardrail





# Signing

- Crash types addressed:
  - Curve Crashes:  
Including in the head-on  
and run-off-road (ROR)  
categories
  - Nighttime Crashes:  
Mostly ROR



W1-8

What is your expectation for the alignment of the roadway beyond the crest ?



# Enhancing Warning Signing for Curves

## Doubled-Up



# Enhancing Warning Signing for Curves

## Doubled-Up & Yellow Flashers



# Warning Signing for Curves

## Daytime

Many cues available  
Driver task relatively easy



## Nighttime

Few cues remain  
Task more difficult



**Retroreflectivity provides nighttime guidance**

# Sheeting and Orientation

**Daytime:**



**Nighttime:**



# Post Delineation



# Rumbles

- Shoulder
- Edge Line / Rumble Stripe
- Centerline





# Rumble Strip Installations

- Primarily address roadway departure crashes resulting from **Distracted or Drowsy Drivers**
- Can help driver with **proper lane placement** on roads with snow cover on the markings
- Iowa Planning-Level CRFs:
  - Centerline = 10%
  - Edgeline or Shoulder = 15%
  - Centerline and Edgeline/Shoulder = 20%

# Rumble Strip Guidance



Iowa Department of Transportation  
Office of Design

3C-5

## Milled Rumble Strips

Design Manual

Chapter 3

Cross Sections

Originally Issued: 01-23-04

Revised: 07-18-13

This section was created using information provided by NCHRP Report 641, "Guidance for the Design and Application of Shoulder and Centerline Rumble Strips", as well as recommendations made by Intrans report "Iowa Lane Departure Strategic Plan, Chapter 2: Centerline Rumble Strips" approved at the Highway Management Team (HDMT) meeting on February 25, 2010.

### Rumble Strips versus Rumble Stripes

Rumble stripes are rumble strips that have pavement markings over them. In Iowa, rumble strips placed in the shoulder are generally offset enough from the edge line to stay rumble strips, while rumble strips placed in the centerline are placed such that they become rumble stripes. For purposes of general discussion, this section will refer to both as rumble strips.

### Milled Centerline Rumble Strips

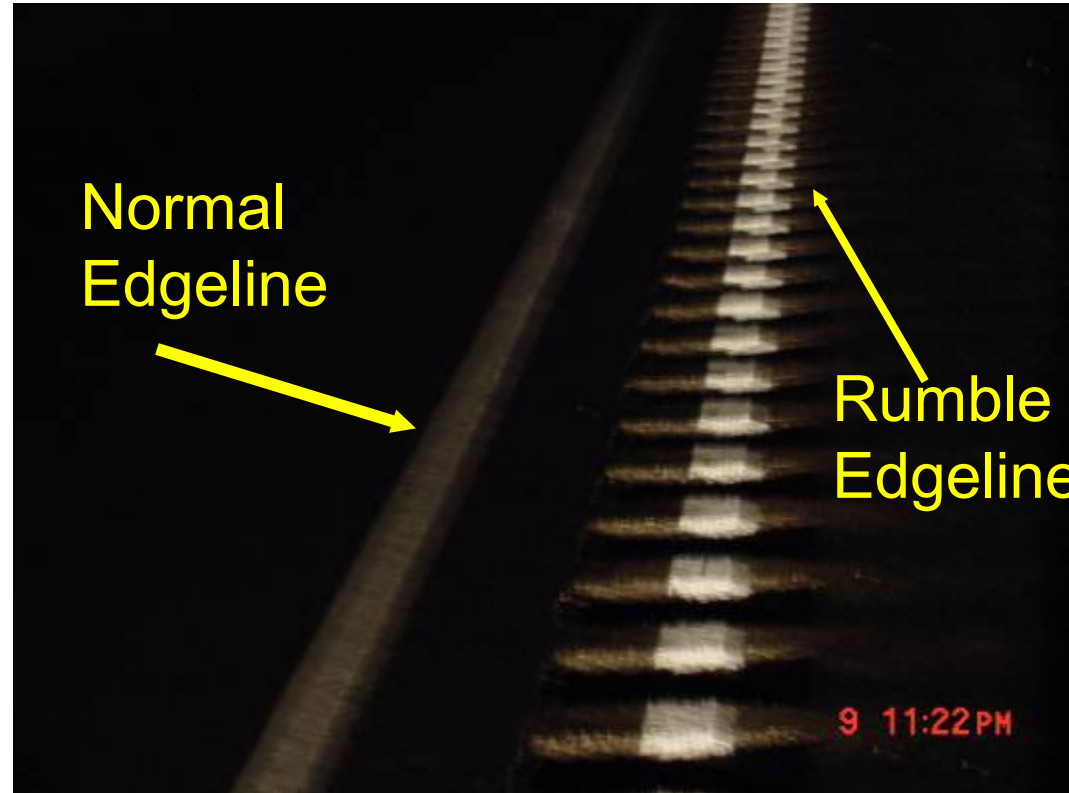
Milled centerline rumble strips are transverse grooves that are placed along the centerline of an undivided roadway. These devices can be installed on new or existing HMA or PCC pavements. Using noise and vibrations, centerline rumble strips alert drivers whose vehicles are crossing the centerline that corrective action is needed. Centerline rumble strips have demonstrated the ability to reduce multi-vehicle crossed centerline (MVCC) and single-vehicle run-off-road left (SVROR Left) crashes. Figure 1 is a photograph of milled centerline rumble strips.



<http://www.iowadot.gov/design/dmanual/03c-05.pdf>

# Rumble StripEs

Enhanced  
Visibility and  
Durability



Comparison of painted edgeline in Rain

# Placement of Centerline Rumble Strips (cont)

Centerline rumble strips  
Milled across markings / joint



Centerline rumble strips on either  
side of pavement markings  
(least common)



Centerline rumble strips  
Variable spacing



# Combining Shoulder and Centerline Rumbles

Bicycle Friendly Shoulder Rumble Strip and Centerline Rumble Stripe



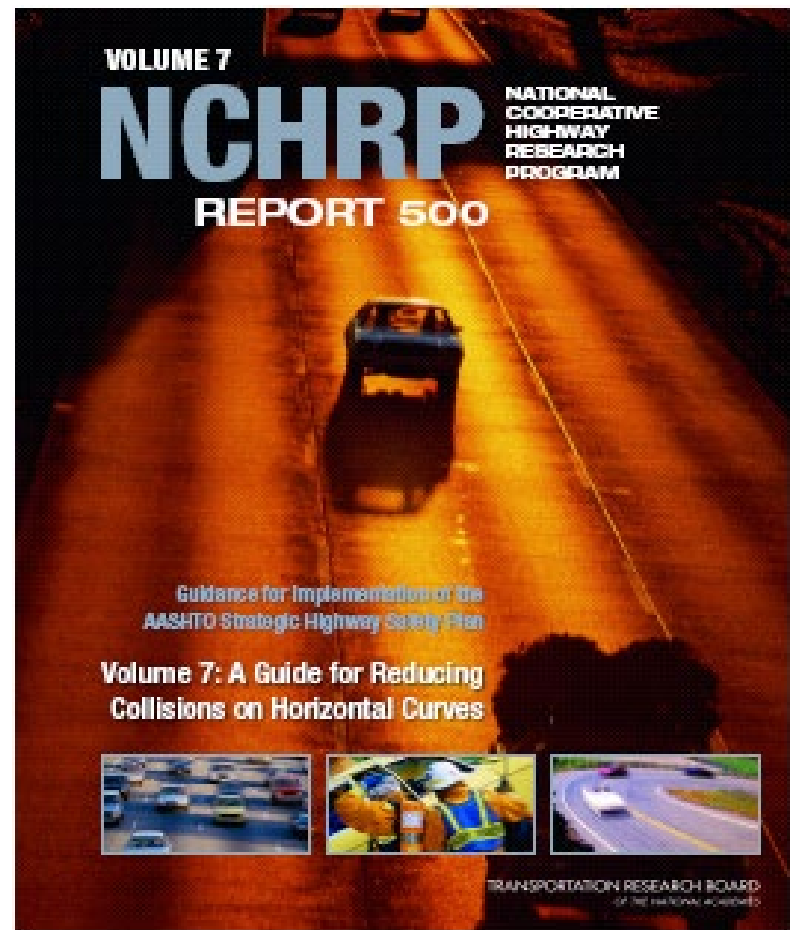
# Rumble Implementation Issues

- Bicycles
- Motorcycles
- Pavement Thickness/Types /Conditions
- Noise



# Provide Skid-Resistant Pavement Surfaces

- Crash Types addressed by improving pavement friction:
  - Wet weather
  - Skidding (e.g. too fast for conditions)
  - Curves



# Skid related crashes are determined by many factors:

- Tire issues
- Weather Conditions
- Friction Demand
  - Road Geometry
  - Vehicle Speeds
  - Driver Actions
  - Vehicle Characteristics





# Some Common Methods to Restore or Add Friction

- Chip Seal (pavement preservation)
- Micro Milling
- Shot Blasting
- Grooving (concrete)
- Resurface with a friction course
  - Nova Chip
  - HFST (critical spot improvement)

**Any of these methods may be an appropriate solution depending on the definition of the problem**

# What is a High Friction Surface Treatment?

- A pavement surfacing overlay system

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# Questions and Discussion



David Veneziano

Iowa LTAP

[dvenez@iastate.edu](mailto:dvenez@iastate.edu)

515-294-5480