

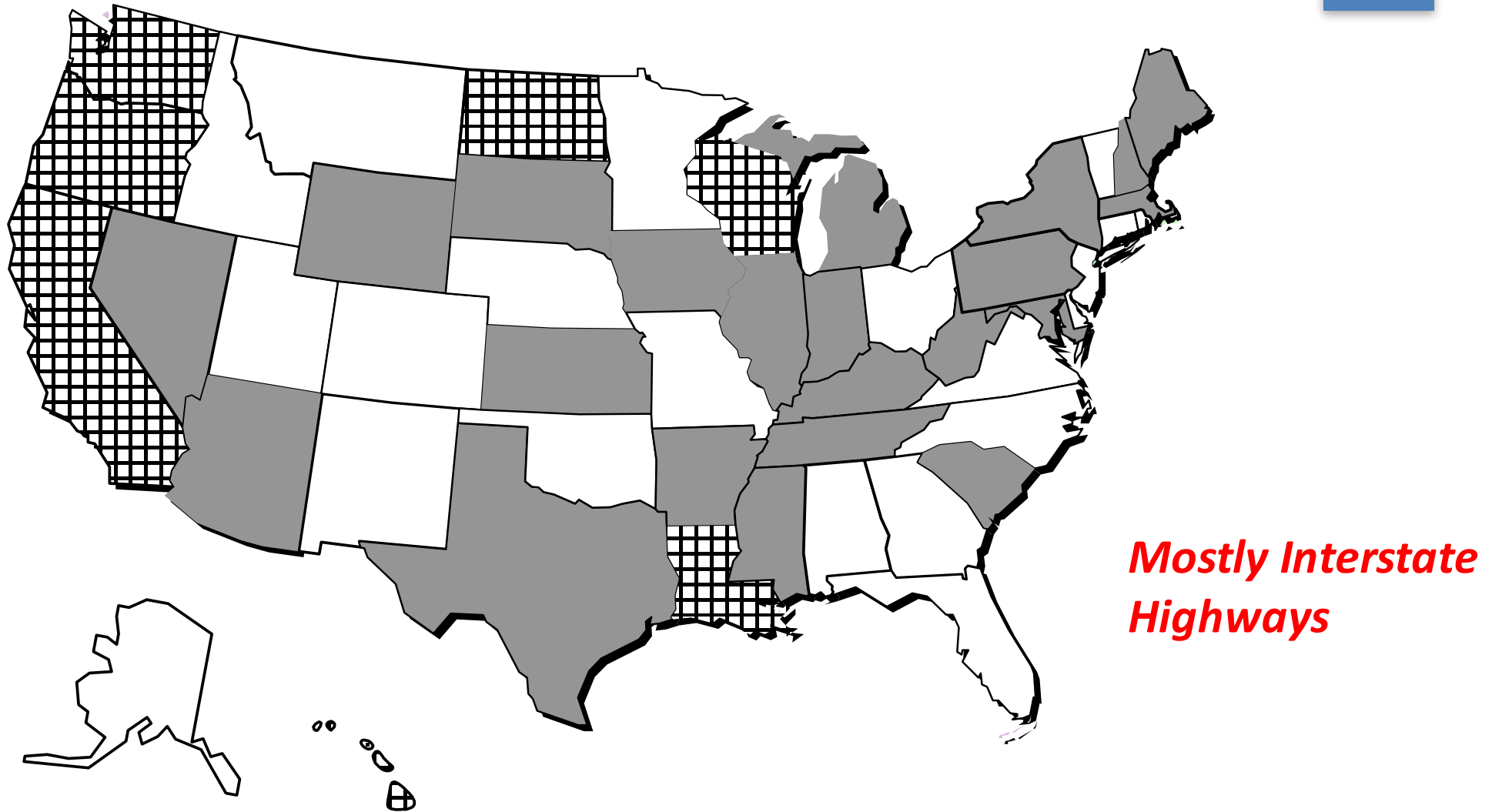
6-inch Edge Lines



10 years ago...

- Agencies “liked” the looks of wider edge lines but did not have evidence to support broad implementation.
- Implemented mostly on Interstate and similar highways
- Limited operations-based research results were inconsistent
 - Speed, lateral position
- Human factors studies were simulator-based studies not transferable
- Safety impacts were not well understood
 - Until now, no significant results
 - Naïve before-after crash studies
 - Insufficient data and lack of experimental control

Wide Pavement Markings (2006)



White = no response, Grey = implemented, Grid = not implemented

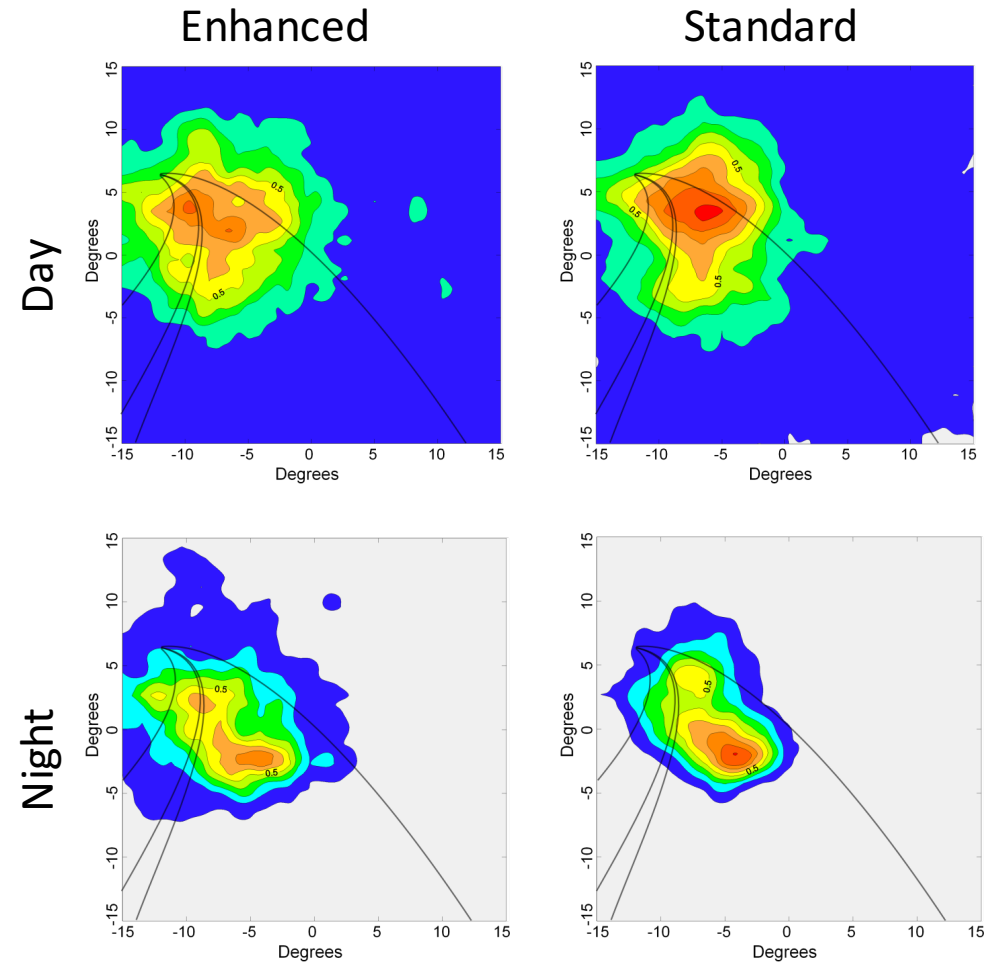
Fresh Insights

- A compilation of new data since 2006 provides evidence that wider edge lines increase safety
- FHWA has completed a 5 year study that included a safety evaluation of wide edge line markings
- Follow up research was also conducted to fill in the gaps
- Confirmation through case study



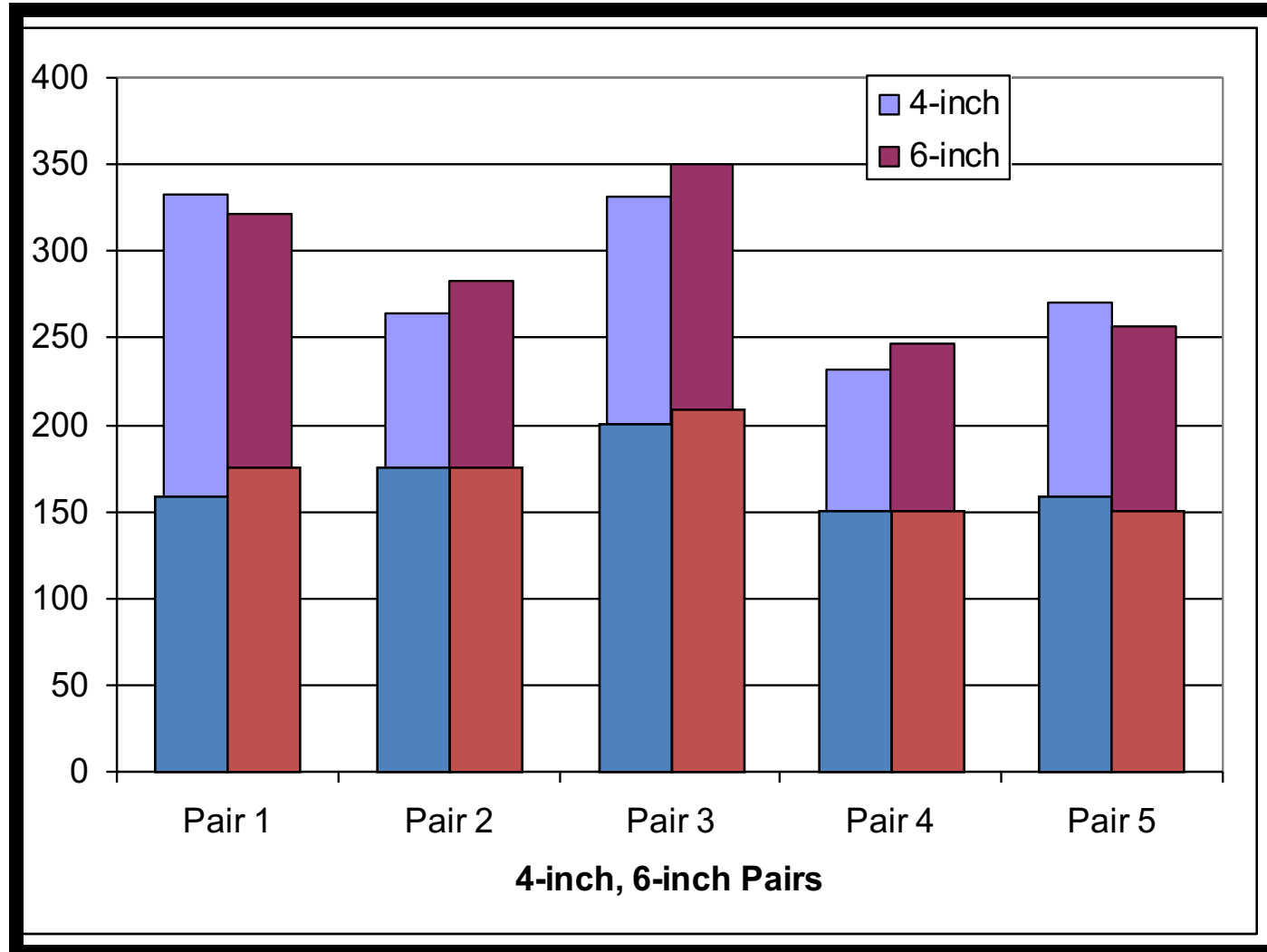
Wider Lines v. Brighter Lines

- Wider edge lines provide more benefit than very high retro levels
- “wider edge lines provide a more comfortable driving environment for drivers”
- “wider edge lines provide more time for drivers to focus on critical driving tasks”
- [FHWA/TX-10/5862-1](https://www.fhwa.dot.gov/ohp/tx-10/5862-1/)



TTI Eye-Tracking Research

Detection Distances



SAFETEA-LU Study



U.S. Department
of Transportation

**Federal Highway
Administration**



Department of
CIVIL & ENVIRONMENTAL ENGINEERING
COLLEGE OF ENGINEERING | THE UNIVERSITY OF UTAH

Safety Effects of Wider Edge Lines on Rural, Two-Lane Roads

2006-2011

Statewide Retrospective Crash Analysis of Wider Edge Lines

- Nationwide survey
 - Do you use wider edge lines?
 - Where?
 - When?
 - Available crash data?
- Michigan, Illinois, Kansas



Summary of Safety Effects

- For Two-Lane Rural Highways

Crash Type	Percent Reduction
Total	15.0 – 30.1
Fatal and Injury	15.4 – 37.7
Day	12.0 – 29.1
Night	-2.4 – 30.7

- Based on data from 3 states:
 - Kansas from 2001-2007, 1300 miles
 - Michigan from 2001-2009, 788 miles
 - Illinois from 2001-2006, 287 miles
- References:
 - Full: [FHWA-HRT-12-048](#)
 - Summary: [AAP 2012](#)

FHWA CMF Clearinghouse



Install Wider Edge Lines (4 to 6 inches)

CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type
0.635	36.5	★★★★☆	All	Fatal, Serious injury, Minor injury	Rural
0.585	41.5	★★★★☆	Day time	Fatal, Serious injury, Minor injury	Rural
0.873	12.7	★★★★☆	Nighttime	Fatal, Serious injury, Minor injury	Rural

Comparative B/C Analysis

- Crash data from Kansas DOT
 - fatal and injury crash data
- Crash cost data from NHTSA's *Economical & Societal Impact of Motor Vehicle Crashes*
 - *Fatal = \$9,145,998*
 - *Injury = \$1,573,306*
 - *PDO = \$3,862*
- Pavement markings
 - waterborne paint
 - \$0.15 per foot for 6-in markings
 - 2 year service life

Comparative B/C Findings

(Two-Lane Highways)

Treatment	B/C Ratio
Wider Edge Lines	\$33 - \$55 per \$1
Rumble Strips	\$37 - \$46 per \$1
Chevrons	\$9 - \$46 per \$1
RRPMs	\$13 per \$1

- Reference: [AGBMA 2012](#)

SAFETY COMPASS

NEWSLETTER



A Message from FHWA Associate Administrator for Safety, Tony Furst



Anthony T. Furst
Associate Administrator,
Office of Safety

I'd like to take this opportunity to remind the safety community of the incredible research potential that will be provided by the Strategic Highway Research Program's (SHRP2) efforts to compile the largest, most comprehensive naturalistic driving study (NDS) ever.

Initiated several years back, the SHRP2 NDS collects data on trips taken by over 3,000 volunteers whose vehicles are instrumented to record vehicle location, forward radar, video of the forward roadway, and the driver's face and hands. This information will be coupled with data provided by the vehicle itself, such as braking, speed, acceleration rate, brake, gear position, seat belt use, and air bag deployment. When the data collection is complete at the end of 2013, the database will include information on more than 5 million trips, 30 million travel miles, and 1 million driving hours.

This database will be linked by GIS to a Roadway Information Database

In This Issue:

- New Study Finds Overall Reduction in Crashes Due to Improvements Implemented From RSAs2
- Missouri Implements Systematic Lane Departure Countermeasures to Combat Fatalities on State Roads.....3
- ConnDOT Overhauls Crash Data Program, Partners with UConn to Establish Transportation Safety Research Center.....4
- Report Proves Rural Two-Lane Highways See Safety Benefits from Wider Edge Lines5
- New Jersey LTAP Conducts Engineering Symposium to Promote Safety in Pedestrian Design6

- Reference: [FHWA Safety 2013](#)

Summary

- Eye-Tracking: wide edge lines provide “safer” driver conditions (more time for driver to focus on other critical tasks)
- Speeds: Negligible
- Lane position: Negligible
- Safety: 4 star CMFs ranging from 0.585 to 0.873
- Cost: 15% more
- Cost effectiveness: \$1 spent → \$33 to \$55 benefits
- Automated vehicles: easier detection and tracking for lane departure warning (LDW) and lane keeping assistance (LKA)

Case Study: Missouri DOT

- Smooth Roads Initiative (2005-2006)
 - 2,300 miles of roadways were improved
 - Focus: Rideability and Visibility
 - Visibility → Striping & Delineation
 - Wider markings
 - Rumble strips with wider markings
 - Barrier delineators
 - Reference markers on Interstates

Analysis

- Empirical Bayes (EB) method employed using 3 years before (2002-2004) and 3 years after (2007-2009)
- Effectiveness of Striping & Delineation programs:
 - 16% reduction in fatal and disabling injury crashes
 - 11% reduction in fatal and all injury crashes
- Report: Benefit/Cost Evaluation of MoDOT's Total Striping and Delineation Program: Phase II, MRIGlobal, June 2011

Missouri B/C Findings

- Wider markings (6-inch)
 - urban multilane divided highways (B/C = 29)
 - rural freeways (B/C = 24)
 - urban multilane undivided highways (B/C = 22)
- Wider markings (6-inch) w/ resurfacing
 - rural multilane undivided highways (B/C = 146)
 - urban two-lane highways (B/C = 118)
 - Center line and edge line rumble strips on rural two-lane highways (B/C = 36)

Reference Materials

- Evaluation of Potential Benefits of Wider and Brighter Edge Line Pavement Markings, FHWA/TX-10/5862-1, July 2010
- Benefit/Cost Evaluation of MoDOT's Total Striping and Delineation Program: Phase II, MRIGlobal, Report CM 12-002, June 2011
- Safety Effects of Wider Edge Lines on Rural Two-Lane Highways, Accident & Analysis Prevention, January 2012.
- An Evaluation of the Effectiveness of Wider Edge Pavement Markings, American Glass Bead Association, February 2012.
- Pavement Marking Demonstration Projects: State of Alaska and State of Tennessee, FHWA-HRT-12-048, November 2013.
- FHWA Safety Newsletter, 2013, Volume 7, Issue 1
- Synthesis of Pavement Marking Research, FHWA-SA-15-063, June 2015.

Status of Wide Markings



- Since 2016
 - Statewide: Arkansas, West Virginia, California
 - Partial: Louisiana, Nevada
 - Considering: Colorado, New Hampshire
 - Under Study: North Carolina