A Comprehensive Study on Pavement Edge Line Implementation

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Problem Statement

Problem: Will complying with the MUTCD 2000 regarding edge line implementation increase head on collisions on narrow rural roads in Louisiana.

- 5,600 miles of narrow, rural two-lane highways in Louisiana (20-22 feet width)
- Majority of accidents: Vehicle left the roadway to roll over or impact objects, such as trees, utility poles, bridge walls, embankments, or guardrails.
- Almost **60 percent** of total fatal crashes occurred when their vehicles veered from the lane. In some cases, the vehicle crossed the centerline and was involved in a **head-on crash or opposite direction sideswipe**.

Project Goals/ Objectives

Impact of Edge Lines on Safety of Rural Two-Lane Highways

2005

Goal: To investigate if marking edge lines would have any negative effect on **drivers behavior** that could in turn decrease highway safety

Safety Improvement from Edge Lines on Rural Two-Lane Highways

2012

Goal: To investigate the **safety impact** of edge lines on narrow, rural two-lane highways by analyzing crash frequencies **before and after** edge line implementations on a group of selected narrow, rural two-lane highways from **all LADOTD districts**.

Study on Pavement Edge Line Implementation

2014

Goal: To **validate** 2012 study and perform **cost benefit analysis** of implementing the safety impact of pavement markings on rural two-lane highways in Louisiana.

Research Performed

2005

- Documented the results of past and present research and the current practices
- Investigated driver behavior under various roadway alignment and traffic conditions
- Examined the potential tort liability
- Developed a recommended guideline

2012

- Implement pavement edge lines at selected locations (lane widths 20-22 feet)
  - Nine districts
  - 28 control sections
  - 109 miles
- Conduct a before-and-after study at these locations to estimate the crash reduction factors
  - Crash data available for only one year after

2014

- Validated crash results with additional two years of crash data on edge line projects
- Update crash reduction factors using Empirical Bayes (EB) method
- Conducted crash characteristics analysis
- Conducted cost-benefit analysis

Research Results

- Placing pavement edge lines on rural two-lane highways can not only change vehicle lateral positions but can also reduce crashes.
- Estimated crash modification factor (CMF) is 0.85, which means there is a 15% expected crash reduction in edge line implementation. (estimated standard deviation for the CMF is 0.039)
- The crash reduction is consistent in all crash types and particularly significant in single vehicle crashes.
- Most of single vehicle crashes are Run off Road crashes which is the specific target group for the edge line implementation.

Research Recommendations

- Use of edge lines on narrow, rural two-lane highways whenever it is financially and operationally feasible.

- Since each LADOTD district bears the responsibility of implementing pavement markings, LADOTD may want to establish a policy asking each district to implement edge lines if sufficient resources are available.

- Under financial or operational constraints, roadways with higher traffic volumes and higher crash frequencies should have priority to have edge lines implemented.

Implementation Strateg

- DOTD's **future plan** on improving the safety of rural two-lane highways includes the application of edge lines.

- LADOTD Traffic Engineering Management to **update** the LADOTD's PM **standards**

- DOTD Safety Management is actively **seeking more safety funds** for each district to conduct systematic edge line striping projects on narrow rural two-lane highways

Value of Implementing Research

15% reduction is crashes : conservative benefit/cost = 19:1

	Fatal Crash	Injury Crash	Property Damage Only
Crash Reduction	-1	83	52
Cost including loss of quality of life*	$4,376,304	$137,670	$3,292
Total Benefit**		$11,597,794	

	Paint (DOTD)	Paint (Contractor)	Thermoplastic (Contractor)
Cost per lane mile	$450	$700	$2800
Total cost	$98,676	$153,496	$613,984
Benefit-cost ratio	117	75	**19**

* LA Safety Annual Report

** Statistical increase in the fatalities due to a high number in 2010 considered a rare event and excluded from calculation

Return on Investment

	Research Project Cost
Impact of Edge Lines on Safety of Rural Two-Lane Highways	$125,000
Safety Improvement from Edge Lines on Rural Two-Lane Highways	*$107,060*
Study on Pavement Edge Line Implementation	*$54,214*
Total Research costs	$286,274
Total Benefit	$11,597,794
Return on Investment	**40 : 1**

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