

# Research Spotlight

## Project Information

**REPORT NAME:** Evaluation of Non-Freeway Rumble Strips—Phase 2

**START DATE:** February 2013

**REPORT DATE:** March 2015

**RESEARCH REPORT NUMBER:**  
RC-1627

**TOTAL COST:** \$257,000

**COST SHARING:** 20% MDOT, 80% FHWA through the SPR, Part II, Program

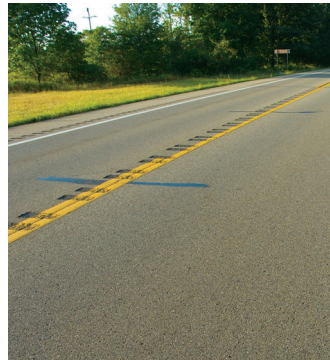
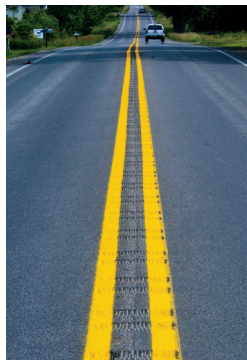
## MDOT Project Manager Mary Bramble, P.E.

Pavement Marking and Delineation  
Engineer  
Traffic and Safety Section, Design  
Division  
Michigan Department of  
Transportation  
425 West Ottawa St.  
Lansing, MI 48933  
[bramblem1@michigan.gov](mailto:bramblem1@michigan.gov)  
517-335-2837



## Centerline rumble strips on rural highways shown to cut crashes by half

In 2008, Michigan launched a major systemwide installation of both centerline and shoulder rumble strips on 5,400 miles of its rural, non-freeway highway system. This unprecedented initiative was accomplished during a three-year period ending in 2010. A two-phase evaluation study focused on the crash reduction benefits of centerline rumble strips, which have not been studied as extensively as shoulder rumble strips. The just-completed Phase 2 study included an analysis of before-and-after crash data, a cost-benefit study, surveys of drivers and MDOT personnel, and guidelines for local road agency implementation of rumble strips.



Researchers found that centerline rumble strips installed on state highways significantly reduced crashes and saved lives.

## Problem

Fatigue or distraction can lead drivers to drift out of their lane, potentially leading to collisions that may result in death or serious injury. In an effort to reduce such crashes, MDOT installed centerline rumble strips systemwide on all rural, non-freeway highways in Michigan with posted speed limits of 55 mph and appropriate paved width. Researchers then conducted a two-phase study to evaluate the safety effectiveness of the rumble strips. In the [Phase 1 study](#), completed in 2012, they analyzed three years of crash data gathered before rumble strips were installed, as well as before-and-after data on driver behavior,

*“This initiative gave MDOT a unique opportunity to study the impact of rumble strips implemented throughout the state. We were confident that we were going to see lives saved and crashes reduced.”*

**Mary Bramble, P.E.**

MDOT Project Manager

noise propagation and short-term pavement performance. In this final phase of the project, researchers evaluated the program’s overall effectiveness, including the safety gains and cost benefits of rumble strips.

## Research

Researchers collected and analyzed three years of after-installation crash data from 5,400 miles of two-lane, high-speed state highways. They reviewed data from crashes during the before and after periods to identify target crashes of interest—crashes that involved at least one vehicle crossing or encroaching on the centerline—to determine crash avoidance and severity reductions as a result of the centerline rumble strips. They also estimated crash reduction factors for using rumble strips as a treatment for lane-departure crashes.

To analyze the cost benefits of the rumble strips, researchers used the total target crashes identified in the before and after periods along with the cost per crash.

Another key element of the final analysis was the perceived effectiveness of the rumble strips. To better understand the impact on driver safety, researchers conducted an online road user survey to gain input from the driving public. MDOT pavement design and maintenance personnel were also surveyed to gather

feedback about rumble strip effectiveness and potential impacts on pavement maintenance.

## Results

The safety performance analysis indicated statistically significant reductions in the range of 50 percent in all types of target crashes after centerline rumble strips were installed. Researchers identified 2,488 target crashes in the three years before installation of centerline rumble strips and 1,306 in the three years after installation. They noted a 43 percent to 55 percent reduction in head-on, sideswipe opposite and single-vehicle run-off-the-road crashes. Overall fatal and injury crashes were cut in half, with a 51 percent reduction in fatal crashes and a 47 percent reduction in injury crashes.

The economic analysis produced equally significant results. Researchers estimated a cost benefit of nearly \$80 million over three years as a result of the crash reductions from centerline rumble strip installation. They estimated that centerline rumble strips on two-lane rural highways will produce benefit-to-cost ratios between 58:1 and 18:1, depending on how the cost is spread out over time. Researchers performed a sensitivity analysis that produced a range of benefit-cost ratio data for state and local agency use.

The online road user survey drew responses from 380 drivers, ranging in age from under 20 to over 60. Of these respondents, 79 percent strongly agreed or agreed that centerline rumble strips are an effective safety measure, and the majority would recommend installing rumble strips on additional state roadways.

Fifteen MDOT pavement design and maintenance personnel, including field engineers, responded to the internal survey, and the majority strongly agreed or agreed that centerline rumble strips improve safety. Respondents noted potential

pavement distress related to the rumble strips, including premature surface failure, longitudinal cracks, potholes, spalling and raveling. More than half of the respondents reported changing pavement design or maintenance strategies to address concerns.

## Value

Rumble strips are proving to be a cost-effective countermeasure to lane-departure crashes on Michigan’s state highways. MDOT is reaching out to local agencies to increase their understanding of the benefits of rumble strips and to encourage interest in installing them on county, city and township roads either systemwide or at specific sites. To support this effort, MDOT has developed concise, user-friendly design and installation [guidelines](#) for use by local agencies.

## Research Administration

### Principal Investigator

Tapan Datta, Ph.D., P.E.

Wayne State University  
5050 Anthony Wayne Drive  
Detroit, MI 48202  
[tdatta@eng.wayne.edu](mailto:tdatta@eng.wayne.edu)  
313-577-9154

### Contact Us

PHONE: 517-636-4555

E-MAIL: [mdot-research@michigan.gov](mailto:mdot-research@michigan.gov)

WEB SITE: [www.michigan.gov/  
mdotresearch](http://www.michigan.gov/mdotresearch)

### This final report is available online at

[www.michigan.gov/mdot/0,4616,7-151-9622\\_11045\\_24249\\_63936-354486--,00.html](http://www.michigan.gov/mdot/0,4616,7-151-9622_11045_24249_63936-354486--,00.html)

Research Spotlight produced by  
CTC & Associates LLC.