

About This Research

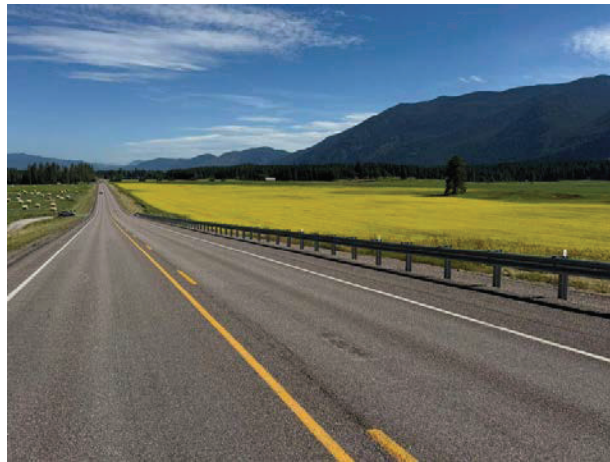
Objectives

- Quantify safety performance of sinusoidal centerline rumble strips (SCLRS).
- Compare safety of SCLRS with conventional centerline rumble strips.
- Assess benefit-cost performance of SCLRS installation to support future implementation.

Benefits

- Supports MDT's Vision Zero and roadway departure safety goals.
- Provides an alternative to use SCLRS in noise-sensitive corridors while maintaining safety performance comparable to conventional centerline rumble strips (CLRS).

MDT RESERCH SAFETY EVALUATION OF SINUSOIDAL CENTERLINE RUMBLE STRIPS



The SCLRS project demonstrates a quieter yet comparably effective safety solution.

About This Project

Project title: Safety Evaluation of Sinusoidal Centerline Rumble Strips

Project number: 09932-820

Technical Panel

Gabe Priebe (Chair, MDT)
Patricia Burke (MDT)
Matthew Collingwood (MDT)
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Research Need

Roadway departure crashes remain a major safety concern on U.S. highways and in Montana, where a large share of fatal crashes involve vehicles leaving their lane or roadway. Centerline rumble strips are a proven, low-cost countermeasure that alert inattentive drivers through vibration and sound before a lane departure becomes a head-on or opposite-direction sideswipe crash.

Conventional CLRS can create exterior noise that affects nearby residents, which can limit their use in some locations. Sinusoidal centerline rumble strips use a continuous wave pattern that is intended to lower exterior noise while still providing in-vehicle noise and vibration. This research evaluates whether their safety performance in real traffic conditions matches that of conventional centerline rumble strips.

The overarching goal of the research is to determine whether sinusoidal centerline rumble strips provide safety performance comparable to conventional centerline rumble strips, so MDT can confidently use either treatment, especially SCLRS in noise-sensitive corridors - without sacrificing safety.

“These results will allow MDT to expand our deployment of centerline rumble strips -- a key tool to reduce fatal and serious injuries on MT’s highways.”

—Gabe Priebe, Project Champion

Research Process

The research evaluated the safety effectiveness of SCLRS using statistical crash analysis and compared their performance with conventional CLRS on rural two-lane undivided roadways. The study developed crash modification factors for total crashes, fatal and injury crashes, head-on and opposite-direction sideswipe crashes, single-vehicle run-off-road crashes, and off-road-left crashes.

The analysis also examined whether different sinusoidal groove depths affected safety outcomes and included a benefit-cost analysis to support implementation decisions. This approach allowed MDT to assess not only whether SCLRS work, but also whether they provide practical value as an alternative treatment in the field.

Research Results

The study found that SCLRS and conventional CLRS produced similar safety performance overall, with no statistically significant differences in crash rates identified between the two treatments. For most crash types, both treatments were associated with fewer expected crashes at treated sites than would be expected without rumble strips.

Key findings included:

- At locations without shoulder rumble strips during the evaluation period, SCLRS were associated with a 39.7 percent reduction in head-on and opposite-direction sideswipe crashes.
- At those same locations, SCLRS were associated with a 53.7 percent reduction in fatal and injury head-on and opposite-direction sideswipe crashes.
- Benefit-cost ratios were 47.93 for conventional CLRS and 20.10 for SCLRS, indicating strong economic value for both treatments.
- The safety performance of the 5/8-inch sinusoidal groove pattern could not yet be determined conclusively because of limited mileage and a small number of observed crashes.

Research Implementation

The findings support continued use of either conventional or sinusoidal centerline rumble strips on two-lane undivided roadways when geometric and operational conditions are appropriate. Because the safety effects were comparable, MDT can consider SCLRS in noise-sensitive corridors where conventional rumble strips may create greater exterior noise impacts.

MDT also plans to continue evaluating sites with the deeper 5/8-inch groove pattern as additional post-installation crash data become available. This will help determine whether groove depth influences long-term safety, noise propagation, or maintenance performance enough to refine future design guidance.

MDT Research would like to thank the Project Champion and Technical Panel

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Learn More About This Project

Final report is available in [ROSA P.](#)