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Evaluation of Rumble Stripes on Low-Volume Rural Roads in Iowa—Phase I

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Evaluation of Rumble Stripes on Low-Volume Rural Roads in Iowa—Phase I

Abstract

Single-vehicle run-off-road crashes are the most common crash type on rural two-lane Iowa roads. Rumble strips have been proven effective in mitigating these crashes, but these strips are commonly installed in paved shoulders adjacent to higher-volume roads owned by the State of Iowa. Lower-volume paved rural roads owned by local agencies do not commonly feature paved shoulders but frequently experience run-off-road crashes. This project involved installing “rumble stripes,” which are a combination of conventional rumble strips with a painted edge line placed on the surface of the milled area, along the edge of the travel lanes but at a narrow width to avoid possible intrusion into the normal vehicle travel paths. Candidate locations were selected from a list of paved local rural roads that were most recently listed in the top 5% of roads for run-off-road crashes in Iowa. Horizontal curves were the most favored locations for rumble stripe installation because they commonly experience roadway departure crashes. The research described in this report was part of a project funded by the Federal Highway Administration, Iowa Highway Research Board, and Iowa Department of Transportation to evaluate the effectiveness of edge line rumble strips in Iowa. The project evaluated the effectiveness of “rumble stripes” in reducing run-off-road crashes and in improving the longevity and wet weather visibility of edge line markings. This project consists of two phases. The first phase was to select pilot study locations, select a set of test sites, install rumble stripes, summarize lessons learned during installation, and provide a preliminary assessment of the rumble stripes’ performance. This information is summarized in this report. The purpose of the second phase is to provide a more long-term assessment of the performance of the pavement markings, conduct preliminary crash assessments, and evaluate lane keeping. This will result in a forthcoming second report.

Keywords

Edge lines; Evaluation and assessment; Field tests; Low volume roads; Ran off road crashes; Rumble strips; Rural highways; Single vehicle crashes

Disciplines

Civil Engineering

Evaluation of Rumble Stripes on Low-Volume Rural Roads in Iowa—Phase I

tech transfer summary

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RESEARCH PROJECT TITLE

Evaluation of Rumble Stripes on Low-Volume Rural Road in Iowa—Phase I

SPONSORS

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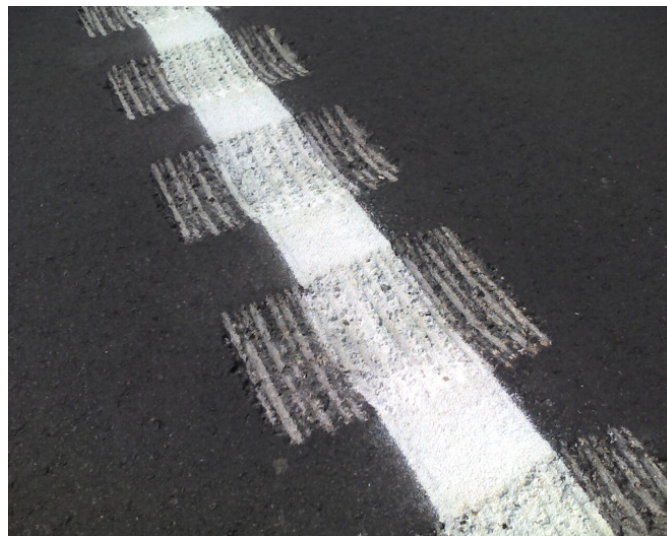
Edge line rumble stripes may help reduce the number of run-off-road crashes on low-volume Iowa rural roads.

Objectives

- Determine if rumble stripes can be used as a strategy to combat roadway departures and reduce the number of run-off-road (ROR) crashes.
- Install edge line rumble stripes along the lane edge at a narrow width to avoid intruding on the normal vehicle travel path.
- Evaluate and provide a preliminary assessment of the edge line rumble stripes' performance.
- Evaluate the effectiveness of the rumble stripes for improving the longevity of the edge line markings.

Problem Statement

Single-vehicle ROR crashes are the most common crash type on rural two-lane Iowa roads. Rumble strips have been proven effective in mitigating these crashes, but these strips are commonly installed in paved shoulders adjacent to higher-volume roads owned by the State of Iowa. Edge “Rumble stripes,” which are a combination of conventional rumble strips with a painted edge line placed on the surface of the milled area, along the lane edge, may be an effective, relatively low-cost method that can be used to reduce the number of ROR crashes on lower-volume paved rural roads owned by local agencies that commonly do not have paved shoulders.



A four-inch edge line rumble stripe placed on a rural highway in Iowa

Research Description

Phase I of this project involved installing rumble stripes on five sites. An additional site was added where the county had implemented the rumble stripes independently of this project. All sites were analyzed for their effectiveness.

The true benefits of edge line rumble stripes (reduction in ROR crashes) cannot be determined until a crash analysis is completed. For the analysis to be statistically valid, several years of before and after data are required. In order to evaluate the first phase, three interim measures were used: (1) wear of pavement markings in terms of visibility and general wear, (2) vehicle lane keeping and lateral position, and (3) initial user group assessment of the impact of the rumble stripes.

Key Findings

- In general, the wear of the paint markings in the rumble stripes' grooves was similar to the wear on regular surfaces. The rumble stripes did not appear to improve the longevity of the painted edge line.
- The milling machine became unstable and tipped on the low side of elevated horizontal curves because of its high center of gravity. Milling on curves was suspended until the machine was modified.
- Millings had to be blown out with an air compressor before edge lines could be applied.
- There was not enough downward pressure on the milling head, so it was difficult to mill portland cement concrete to the desired depth of 5/8 inch.
- Milling had to be omitted in areas near mailboxes to avoid damage.
- Aligning the painted edge line with the rumble strip was difficult but necessary for maximum effectiveness.

- In some areas, debris collected in the grooved part of the rumble strip and reduced visibility of the painted edge line.
- Preliminary results showed that the number of vehicles within 1 and 2 feet of the lane edge decreased by approximately 2% and 7%, respectively.
- The public and special user groups, including the Amish and bicyclists, had few complaints about the rumble stripes.

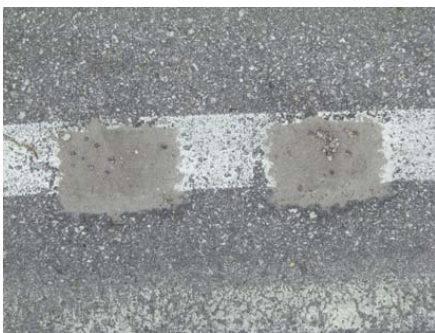
Implementation Recommendations

While the results of this project won't be known for several years, preliminary results indicate that local agencies could install narrow-width rumble stripes as feasible and relatively low-cost mitigation for lower-volume paved rural road sections with a history of or potential for lane departure crashes.

The following activities and future research can help implementation efforts:

- Modify the design of the milling machine to allow for use on horizontal curves and to ensure predictable alignment and milling depth.
- Investigate why some milled areas fill with debris more than others.
- Continue to monitor the reaction to rumble stripes from special road users, including bicyclists, horse-drawn vehicles users, and agricultural equipment operators.

Phase II of this project will include a long-term assessment of pavement marking performance, preliminary crash assessments, and an evaluation of lane keeping.



Rumble stripe with caked material and debris in the bottom



Milling machine tipping on low side of elevated horizontal curve



Similar wear for edge line in rumble stripe and flat section