Measure Name: Transverse rumble strips

Definition: Intermittent areas of rough-textured, raised, or depressed road surface placed in the travel lane perpendicular to the direction of travel to alert motor vehicle operators of an impending traffic feature such as a stop, change in alignment, etc.

Tags:

Type of Incident:

- ☐ Non-Motorized Users Only
- ☒ Motor Vehicles Only
- ☐ Both

Intervention Strategy:

- ☐ Data: application and planning
- ☐ Education: outreach and messaging
- ☐ Enforcement: policy development and rulemaking
- ☒ Engineering: technological and physical deterrents

Type of Problem:

- ☐ Non-Motorized Users Violating Warning Devices
- ☒ Motor Vehicles Violating Warning Devices
- ☐ Vehicle ROW Incursion
- ☐ Vehicle Congestion
- ☐ Blocked Crossing
- ☐ Vehicle Hang-up

Measure Category:

- ☐ Risk Assessment
- ☐ Policy and Enforcement
- ☐ Collaboration, Training, and Education
- ☐ Public Communication
- ☐ Physical Barriers
- ☐ Detection and Lighting
- ☒ Infrastructure Modification
- ☐ Post-Incident Management
- ☒ Warning Devices

Description

Transverse rumble strips, also known as in-lane rumble strips, refer to intermittent areas of rough-textured, raised, or depressed road surface installed in the travel lane perpendicular to the direction of travel. This measure provides audible and tactile feedback when driven over, which can warn drivers of an impending traffic feature that may require special attention. Transverse rumble strips can reduce the risk of accidents in high-risk areas. Installation near highway-rail grade crossings, especially those with compromised visibility, can improve safety for drivers.

Research has demonstrated that transverse rumble strips are effective in increasing the rate of compliance with traffic control devices at stop-controlled intersections such as STOP signed intersections, T intersections, and four-way intersections [1]. Transverse rumble strips tend to cause drivers to brake earlier and with more force when approaching a stop-controlled intersection [2]. Several studies have also reported significant reductions in correctable accidents (40 percent to 100 percent) after installing transverse rumble strips near stop-controlled intersections [3].

Studies have also indicated an induced reduction in driver speeds when appropriately designed [4][5]. However, there is not sufficient evidence indicating that rumble strips alone make drivers directly watch out for an oncoming train; therefore, additional measures should be considered to clearly indicate a crossing or the recommended behavior [6].

Common types of rumble strips include milled, rolled, formed, and raised. Milled and raised rumble strips can be retroactively installed onto pavement, while rolled and formed rumble strips generally must be installed during the construction of a new pavement surface [1]. Each type of rumble strip has different installation costs, advantages, and drawbacks. Transverse rumble strips are often used in conjunction with signage to indicate what the traffic feature is (e.g. STOP AHEAD, speed limit sign, etc.) [3].

This body of research indicates that transverse rumble strips provide a safety benefit to drivers. This research may be applicable to improving driver compliance when approaching highway-rail grade crossings.

Additional search terms: *traffic calming, speed reduction*

Advantages

- Increases driver compliance with traffic control devices such as STOP signs and at intersections. [1]
- Reduces rate of accidents at STOP-controlled intersections. [3]
- Induces speed reduction.
- Can be installed either during or after construction of a roadway, depending on the type of rumble strip. [1]

Drawbacks

- Some designs may require regular maintenance. Raised rumble strips are susceptible to damage from snowplowing. [3]
- Noise of rumble strips can be disruptive to nearby residents. [3]
- Motorists may cross into opposing lane to avoid rumble strips. [3]
- Rumble strips can pose a danger to bicyclists and motorcyclists. [4]

Notable Practices

- The impact of noise pollution towards nearby communities should be considered when determining a traffic calming method. Noise abatement measures may be an option depending on proximity to residential or other noise-sensitive areas. [3]
- Transverse rumble strips should not be overused because they may then lose their ability to gain a motorist's attention. They should only be used where conventional treatments are ineffective and there is a high risk of accidents. [3]
- Transverse rumble strips should be configured so that drivers are discouraged from driving around the rumble strip. Common practices including extending the rumble strip over both directions, by using a discontinuous rumble strip design, or by implementing physical lane separation. [3][4]
- Rumble strips can pose a danger to bicyclists. They should either be avoided or designed accordingly on pathways where bicyclists commonly ride. [3]
- The connection between the rumble strip and the relevant hazard (grade crossing) should be unambiguous. Rumble strips can be installed in conjunction with other explanatory measures to clearly indicate the hazard and/or recommended behavior. [4]

References

[1] Carlson, J. P., & Miles, D. M. (2003). Effectiveness of Rumble Strips on Texas Highways: First Year Report.

Abstract: This report documents the first year activities of a 30-month project in which the evaluation of various rumble strip applications will be tested. The focus has been on in-lane and centerline rumble strips. The pertinent literature was reviewed. State agencies with significant experience with centerline and in-lane rumble strips were contacted, and their policies were reviewed. The researchers then developed initial application guidelines for these types of rumble strips. The application guidelines were then modified based on the project advisory committee comments. The in-lane rumble strips are currently being evaluated at stop-controlled intersections and horizontal curve locations throughout the state. The researchers plan to be completed with this part of the research by the end of 2003. There are currently no centerline rumble strips installed on TxDOT highways. However, there are currently two districts planning to install centerline rumble strips as part of this research project. Two highway sections in the Brownwood District should have centerline rumble strips by the end of 2003. There has also been

promising discussion to identify sites and have centerline rumble strips installed in various locations in the Austin District. The second year activities of this project will focus on the completion of the in-lane rumble strip analysis. Guidelines for application of in-lane rumble strips will be developed based on the results. Also to be emphasized in the second year will be the installation and study of centerline rumble strips. It is expected that several sites will be installed within the second year, and surrogate safety measures will be studied in order to develop guidelines for the application of centerline rumble strips. Another focus of the second year of this project will be an ad-hoc safety study of profiled pavement markings.

[2] Harder, K. A., et al. (2001). The Effects of In-Lane Rumble Strips on the Stopping Behavior of Attentive Drivers.

Abstract: This project involved investigating the effect, if any, of rumble strips on stopping behavior at simulated rural-controlled intersections. Researchers used the wrap-around driver simulator at the University of Minnesota's Human Factors Research Laboratory for the project. Researchers varied the rumble strip type and the number of rumble strips and tested them on two different types of controlled intersections, two-way or four-way, and in the presence and absence of traffic. Results indicate that none of these manipulations seem to affect the point at which drivers stop at the controlled intersections or the point at which drivers start to slow down at controlled intersections. The research did reveal drivers brake more, earlier, when rumble strips are installed than they do if there are no rumble strips. Although they started to slow down at the same time and finished braking at the same time, there was more use of the brake earlier in the slowing down maneuver in the presence of rumble strips. Results also reveal that drivers brake more and earlier with full coverage rumble strips than they do with wheel track rumble strips.

[3] Harwood, D. W. (1993). NCHRP Synthesis 191: Use of Rumble Strips to Enhance Safety.

Excerpt: The National Cooperative Highway Research Program (NCHRP) Synthesis 191 synthesizes research and highway practices related to rumble strips in the United States. Its contents include safety effects, adverse effects, design considerations, costs, and recommendations regarding the installation of rumble strips.

[4] SAFER-LC. (2020, April 4). Rumble Strips on LC Approach. SAFER-LC Toolbox.

Description: This webpage provides information on implementing rumble strips on the approach of level crossings in Europe, including benefits, criticalities, recommendations, and results of relevant studies.

[5] Hore-Lacy, W. (2008). Rumble strip effectiveness at rural intersections and railway level crossings.

Excerpt: This report details a before and after study of driver behaviour in response to rumble strip installations on approaches to rural railway level crossings and the minor leg of rural road intersections.

[6] Grippenkoven, J., Dietscsh, S. (2015). Gaze direction and driving behavior of drivers at level crossings.

Abstract: International level crossing statistics reveal that the majority of accidents at level crossings occur due to human error on the part of car drivers. Often, the rather unspecific description of "attentional deficits" is given as the cause of most accidents. In this study, driving data and eye-tracking data were collected during a standardized driving study. Using a research vehicle, the behavior of 24 participants was observed while approaching two level crossings (one with passive protection, the other with active light-signal protection). It turned out that on the last 300m of the approach towards level crossings, all of the drivers detected and fixated upon at least parts of the protection layout at both level crossings. Nevertheless, only one third of all participants subsequently derived the right reaction and checked the rails for an oncoming train. Two thirds of the participants did not direct their attention towards the rail

tracks. With such deficient gaze behavior, visual detection of a potentially oncoming train is difficult. In addition to the maladaptive gaze patterns, inattentive drivers decelerated significantly less while approaching both level crossings than attentive drivers.

Additional Resources

Radalj, T., & Kidd, B. A. 2005. A Trial with Rumble Strips as a Means of Alerting Drivers to Hazards at Approaches to Passively Protected Railway Level Crossings on High Speed Western Australian Rural Roads. Research Report. Main Roads Western Australia.

Excerpt: A trial with rumble strips was conducted at 14 railway level crossings protected by passive signs, of which 11 crossings had Give Way signs and 3 crossings had Stop signs. The crossings were located on high speed rural roads within Wheatbelt regions of Western Australia.

Federal Highway Administration – Rumble Strips and Rumble Stripes webpage.

Description: This site contains information about longitudinal center line, edge line, and shoulder rumble strips and stripes.

Related Measures

- Speed hump

Images

- No image available