



Kansas LTAP Fact Sheet

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Center Line Rumble Strips

By Lisa Harris and Aliza Chudnow

A low-cost way to alert drivers they have crossed the line.

Head-on crashes are particularly deadly, and especially on two-lane roads. In Kansas almost one quarter of all fatalities in the last five years have been opposite-direction crashes and 79 percent of those have been on two-lane roads. **A center line rumble strip** is a low-cost safety treatment that can help keep an inattentive driver safely in the driving lane to avoid such a crash. Installed at or near the center line of a paved roadway, it is made of a series of milled or raised elements that alerts a driver through vibration and sound that the vehicle has traveled left of the travel lane. These strips have been in use for the past 20 years or so on two-lane roads and are considered an FHWA-designated proven countermeasure to reduce cross-center line crashes on any road with marked center lines. Currently there are 36 states using center line rumble strips and 17 states have written policies or guidelines for their installation, including Kansas.

This article will describe research on center line rumble strips, including research conducted in Kansas, and potential advantages and disadvantages of using the strips.

Effectiveness

Center line rumble strips have been found to be among the most cost-effective safety measures for these situations:

Head-on and opposite-direction sideswipe collisions:

According to the NCHRP's Report 641, sites with center line rumble strips had significant reductions for these two types of crashes; 38 to 50 percent fewer crashes on rural two-lane roads and 37 to 91 percent fewer crashes on urban two-lane roads.

Navigational aid in bad weather: Poor weather



Painted center line rumble strips are especially helpful in conditions of low visibility. Besides creating noise and vibration, the strips are more visible than typical painted lines because of the raised surface.



The information for the bulk of this article comes from a November 2011 technical advisory from FHWA that summarizes research findings to date on center line rumble strips. **FHWA technical advisories** are good sources of information on the current state of research on a particular topic. They are updated as new research is published; sometimes more than once per year. You can find them at <http://safety.fhwa.dot.gov>. Click on one of the major emphasis areas in the left column, like "Roadway Departure Safety," and then look on that page under "What's New." The link for the center line technical advisory is http://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/t504040/. FHWA also has a 2011 technical advisory on shoulder and edge line rumble strips.

conditions, such as snow, rain and fog, can make it difficult to see painted center lines. Center line rumble strips can help drivers locate the travel lane during inclement weather. The vibration provided by rumble strips can assist drivers from unintentionally crossing the center line. Along with the vibration, there is also improved visibility of the painted stripe when the pavement marking is painted on top of the rumble strip. The vertical ridges of the center line will often still be visible under poor weather conditions.



Research in Kansas on Center Line Rumble Strips

Are you interested in reading more about research on center line rumble strips? Start in Kansas. Kansas State University has conducted three K-TRAN research projects for KDOT on center line rumble strips since 2006.

■ **Reducing Crossover Accidents on Kansas Highways Using Milled Centerline Rumble Strips** (September 2006). The researchers surveyed other states on their experiences using center line rumble strips and developed a research design to evaluate KDOT test installations.

■ **Promoting Centerline Rumble Strips to Increase Rural, Two-Lane Safety** (December 2010). This research had several components and findings. The researchers found that:

- Installing center line rumble strips reduced head-on and opposite-direction side swipe types of accidents and reduced the total number of crashes.
- The level of noise generated by traveling over center line rumble strips depends on speed (the lower the speed, the lower the noise), type of vehicles (heavier vehicles tend to produce more noise), and distance the vehicle is traveling (the greater the distance, the lower the noise).
- Retroreflectivity of painted stripes over center line rumble strips decreases over time in a linear manner and not faster than typical pavement markings.
- Both patterns for milled center line rumble strips tested in the study performed well. They were tolerably loud and provided plenty of vibration to drivers. (The report shows photographs of the patterns.)

■ **Study of Kansas Department of Transportation Policy on Lane and Shoulder Minimum Width for Application of Centerline Rumble Strips**. (August 2012). This project also had several components. The researchers found that:

- In a before-and-after safety effectiveness study of center line rumble strip installations in Kansas, cross-over crashes were reduced by 67 percent and correctable crashes involving fatalities and injuries were reduced by 34 percent.
- Drivers tend to drive CLOSER to rumble strips (center line or edge) than when the lines are not milled. These findings contradict other research on this topic, and suggest that installation of centerline rumble strips would not pose an added danger for narrower roads.
- 200 ft. should be the minimum distance from buildings for installation of centerline rumble strips (because of noise).

Go online to the KDOT Research Reports Catalog and search for “centerline” to view the reports described above. The link is <http://www.ksdot.org/burmatres/kdotlib2.asp>.

KDOT’s specs for center line rumble strips are in Section 813 of their Standard Specifications. For more information on KDOT’s use of center line rumble strips, contact Steven Buckley, state highway safety engineer, at (785) 296-1148 or buckley@ksdot.org.

Placement considerations

Research cited by FHWA on effective placement of center line rumble strips identified the following best practices and policies for installation.

Corridor vs. spot treatment. It is recommended that center line rumble strips be installed along corridors rather than in spot locations because of the difficulty in determining where a driver could become distracted or drowsy. Corridors can be prioritized by the frequency of opposite-direction crashes and certain crash predictors (e.g., shift workers, younger drivers).

Pavement width. Some studies have shown that the presence of center line rumble strips can result in vehicles traveling slightly further away from the center line than they would otherwise. As a result of this, the FHWA states that the strips may not be appropriate to install on very narrow pavements. However, a 2012 study at Kansas State University found otherwise—see sidebar.

Co-installation with shoulder rumble strips. Some agencies are installing both center line and shoulder rumble strips along the same segments of road. Total pavement width will affect a decision to install both. It’s important to be able to accommodate and serve all road users, particularly in no-passing zones. A comparative study of the installation of different combinations of rumble strips with wider pavement markings during resurfacing showed the greatest reduction in serious injury crashes when both center line and edge line rumble strips were installed on the same segment of roadway.

Complications caused by normal crown. When milling into crowned pavements, agencies should be aware of several challenges. First, the milling machine should be equipped with a vertical alignment guide to orient the rumbles on the horizontal rather than tilted level with the crown on one side of the joint or the other. Second, because the rumble strip depth will vary transverse to the roadway, an agency should specify the desired maximum and minimum depth. Project documents should clearly indicate where the rumble strip depth will be measured, and acceptable tolerances.

Types of road users. When considering using center line rumble strips, it is important to keep in mind other types of vehicles such as bicycles, motorcycles and larger trucks.



Although bicyclists will rarely cross a center line rumble strip, the presence of these strips can cause vehicles passing bicyclists in the same lane to stay to the right of center to avoid driving on the rumble strip and thereby travel closer to the bicyclist. If a bicycle and vehicle are to share a lane, it is recommended that 14 feet of pavement beyond the edge of the center line strips be maintained so both the car and bicycle can travel safely.

Awareness of the rumble strip by the motorcyclist is important for maintaining control of the motorcycle.

To alert a truck driver crossing the center line, the length, width and depth of the rumble strip is critical and should not be reduced. Consideration of noise also should be taken into account at curves or at segments with both center line and edge rumble strips due to the potential for off-tracking.

Potential limitations

Characteristics that can limit the desirability or effectiveness of rumble strips include low average speeds, noise for adjacent residences, and significant amounts of turning movements across the center line (creating noise and driver discomfort).

The noise that comes from crossing over a center line rumble strip can be very loud. See the sidebar on previous

page for research conducted by Kansas State on noise and recommended distance of the strips from residences.

Maintenance is also a concern. Center line rumble strips are typically milled over a longitudinal joint. If the joint is poorly constructed, milled strips can sometimes allow water to pool and penetrate the pavement which can lead to early pavement deterioration. The potential for this can be mitigated by placing an asphalt fog seal over the milled strips.

Conclusion

Center line rumble strips are a proven measure to reduce the risks of cross center line crashes, keep vehicles on the roadway, and reduce the severity of the crashes that do occur. Compared to shoulder rumble strips, they are a newer technology, and research continues to prove their effectiveness and refine best practices for installation.

To learn more information about center line rumble strips, visit the links listed below. The FHWA Technical Advisory also lists several other research reports on the topic. ■

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Sources:

- FHWA Technical Advisory: Center Line Rumble Strips, November 7, 2011.
http://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/t504040/
- Evaluating the benefits of centerline rumble strips on rural highways. Research Spotlight. Michigan DOT Research Administration.
http://www.michigan.gov/documents/mdot/MDOT_Research_Administration_Non-Freeway_Rumble_Strips_397765_7.pdf