SAVING LIVES BY KEEPING DRIVERS FOCUSED

Noise from Centerline Rumble Strips

On just one stretch of 2-lane highway in rural Minnesota from 1986-2011

25 PEOPLE WERE KILLED IN HEAD-ON CRASHES

Overal head-on crash statistics found in the reports
Posted here: https://dps.mn.gov/divisions/ots/reports-statistics/Pages/crash-facts.aspx

this averages out to **one person killed per YEAR**

What is a rumble strip?

Rumble Strips are indentations in the road surface – usually on the shoulders or along the centerline – that cause noise and vibration when a vehicle drives over them.

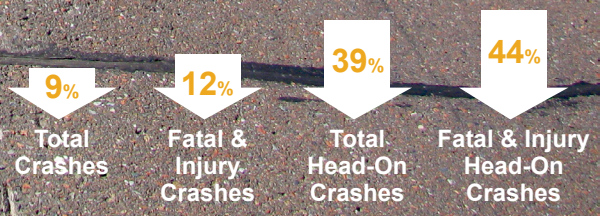
Drivers who are:

- ***distracted***
- ***speeding***
- ***tired***
- ***inexperienced***

can unintentionally drift over the centerline and cause crashes.

How do rumble strips help?

The "rumble" alerts motorists that are straying from the travel lane, prompting them to correct their steering and stay in their lane or on the road. Centerline rumble strips reduce crashes significantly:



Based on multi-state data from NCHRP Report 641, 2009.

"Toward Zero Deaths" Initiative

The Toward Zero Deaths (TZD) approach is based on the belief that even one traffic-related death on our roads is unacceptable. The MnDOT TZD mission of zero traffic fatalities has identified centerline rumbles as an effective way to reduce crashes.

ON AVERAGE, MORE THAN **60** **People are killed** AND **600** **injured** in head-on type crashes **EVERY YEAR** on Minnesota roads and highways

THE ONLY ACCEPTABLE NUMBER IS

About Rumble Strips

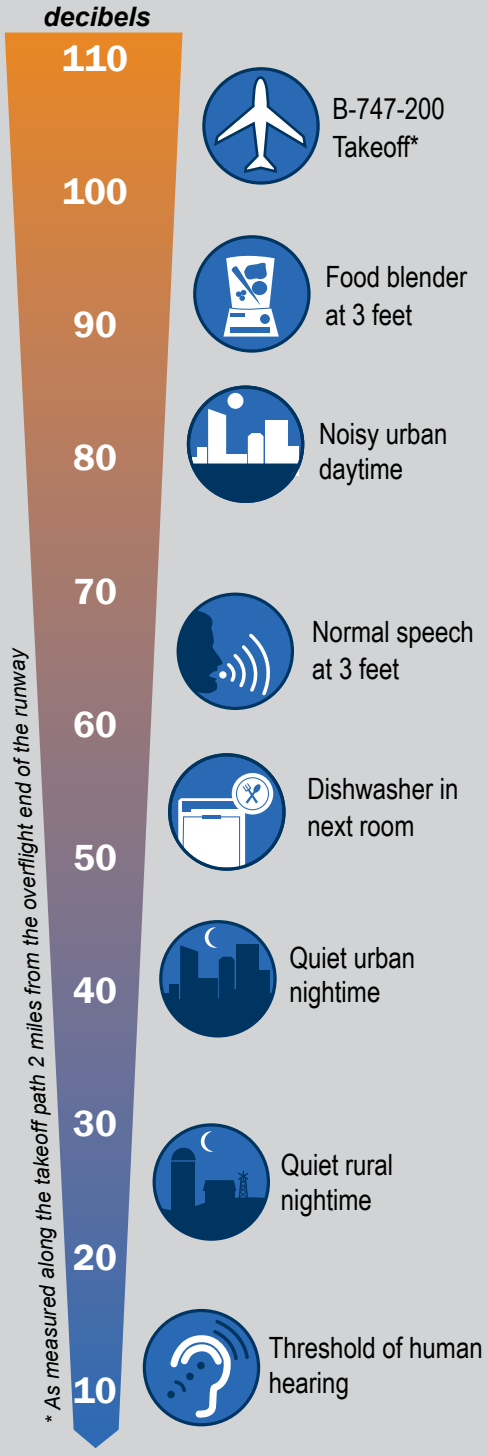
Some may find the intermittent noise made when a car drives on a rumble strip annoying. However, that same noise may prevent injury or save a life.

While our primary objective is the safety of drivers and passengers on Minnesota roadways, MnDOT takes concerns about noise impacts seriously.

To evaluate the noise impacts made by the centerline rumble strips on communities along highways, MnDOT works closely with traffic noise experts to monitor, measure, and analyze the noise made by traffic passing over rumble strips.

How do we measure and regulate noise?

COMPARISON OF NOISE LEVELS



<3 decibels Changes in noise levels of less than 3 decibels are not typically detectable by the average human ear.

+5 decibels An increase of 5 decibels is generally noticeable by anyone.

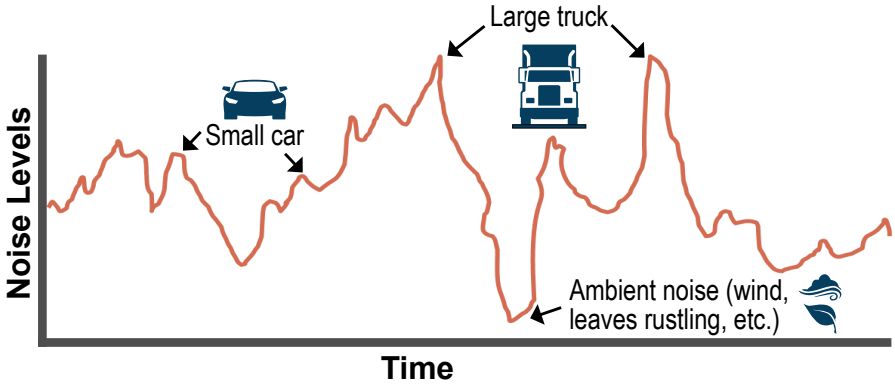
+10 decibels A 10-decibel increase is usually felt to be "twice as loud"

How do we measure noise?

The human range of hearing extends from approximately 3 -140 decibels. The scale to the left shows various noise levels in a real-world context.

Noise levels in outdoor areas can fluctuate widely over time. Noise experts use mathematical models to analyze the noise level data that they gather. These analyses account for noise level variations due to factors like ambient noise, the distance traveled by the noise, multiple noise sources, atmospheric conditions, etc.

The example graph below shows how monitored noise levels can vary substantially in an outdoor setting.



How is noise regulated?

Because outdoor noise levels can fluctuate widely, the Minnesota Pollution Control Agency uses two noise metrics to set limits on outdoor noise levels: L_{10} and L_{50}.

L_{10} represents the noise level exceeded for 10% of the hour (*i.e., noise levels can't exceed 65 decibels for more than 6 minutes of any hour during the day, or 55 decibels at night*).

L_{50} represents the noise level exceeded for 50% of the hour (*i.e., noise levels can't exceed 60 decibels for more than 30 minutes of any hour during the day, or 50 decibels at night*).

Noise Limits for Residential Land Uses

Time of Day	L_{10}	L_{50}
DAYTIME (7am – 10pm)	**65 decibels**	**60 decibels**
NIGHTTIME (10pm – 7am)	**55 decibels**	**50 decibels**

Source: Minnesota Pollution Control Agency (MPCA). 2008. A Guide to Noise Control in Minnesota: Acoustical Properties, Measurement, Analysis, and Regulation.

MnDOT's rumble strip noise study

Collecting noise data

Rumble strip noise events are intermittent and short in duration. In order to account for the sporadic nature of rumble strip noise as well as highway noise and environmental variables, we measured rumble strip noise using two methods:

Method 1:

LONG-TERM MEASUREMENTS

Sound level meters were placed for one week at a location along the road. The meters measured all sound that occured day and night for 7 consecutive days.

Method 2:

PASS-BY MEASUREMENTS

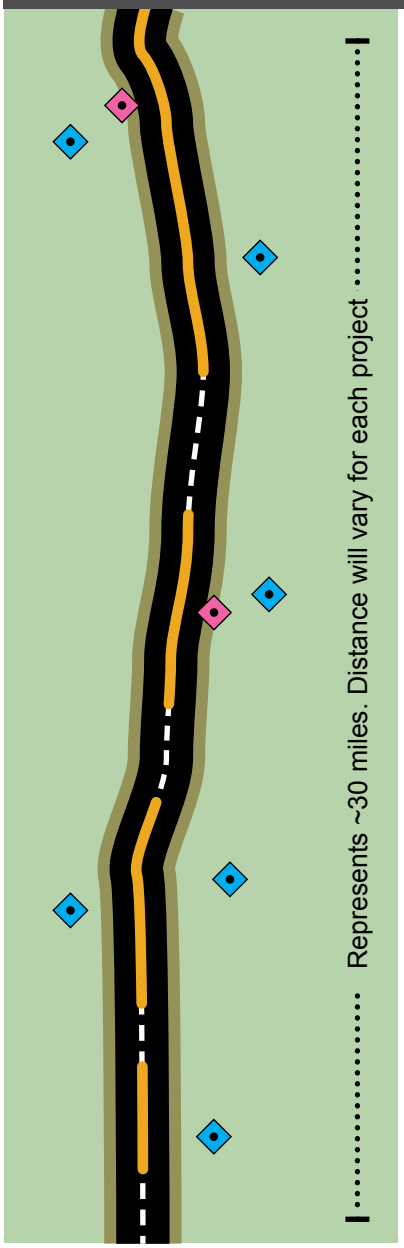
Measured noise from a specific car driving at a known speed in a controlled setting. The test measured the car:

- Driving on the road with no rumble strips
- Driving on the rumble strip like a drifting car would
- Driving on the rumble strip like a passing car would

To gather reliable noise data along a highway, we placed sound level meters at multiple locations to measure noise levels for a week.

We also conducted pass-by tests at multiple locations along the highway. The sound level meters were placed as close as 25-feet from the centerline for the pass-by measurements, and as far as 900-feet from the centerline for the long-term measurements (*see below*).

Rumble Strip and Monitoring Locations Along a Roadway



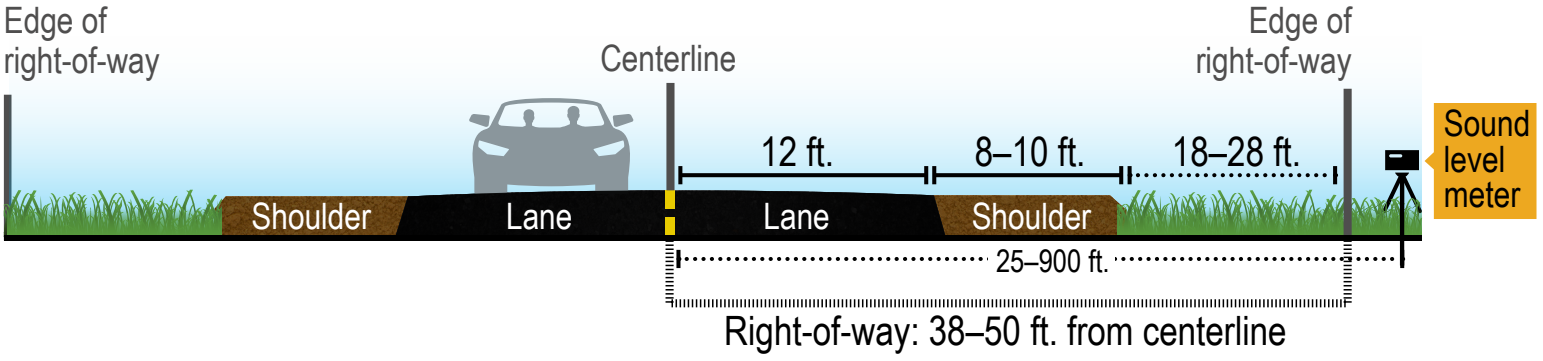
The diagram to the left shows placement of both long-term and pass-by monitoring locations during an actual study along a stretch of roadway in rural Minnesota with centerline rumble strips installed.

The placement of the monitoring locations, as well as the distance of each monitoring location from the centerline of the roadway, varies based on land use in the study area.

Map Key

- Rumble Strip Location
- Pass-by monitoring location
- Long-term monitoring location

Typical Cross-Section Along Highway

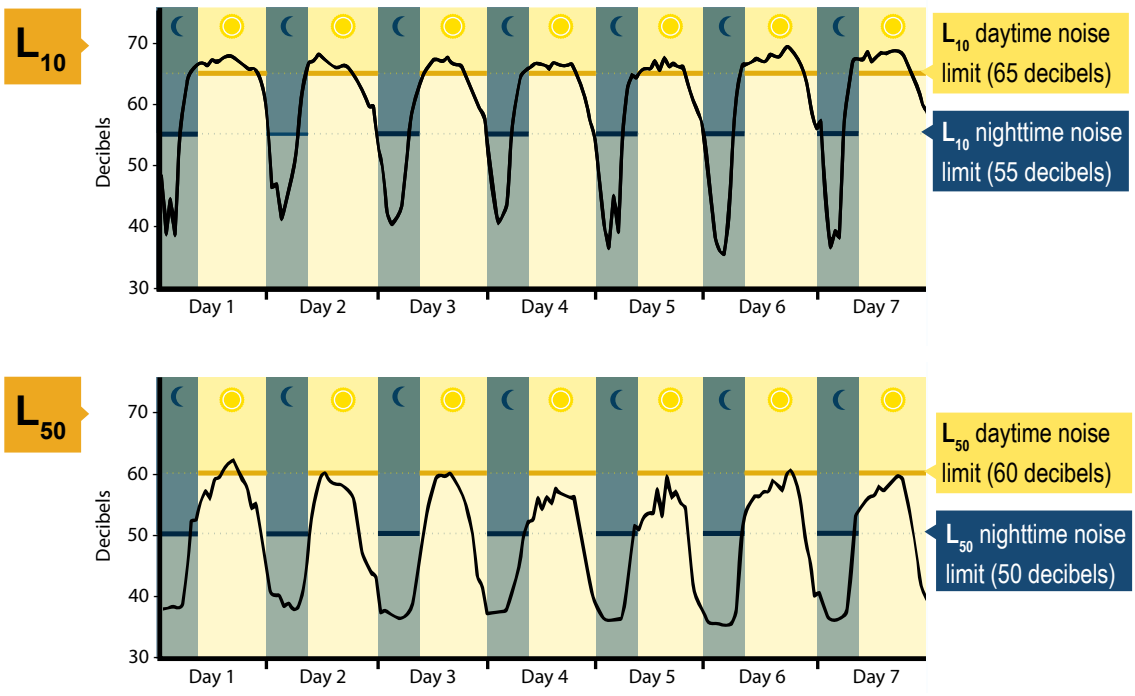


Rumble Strip Noise Study Results

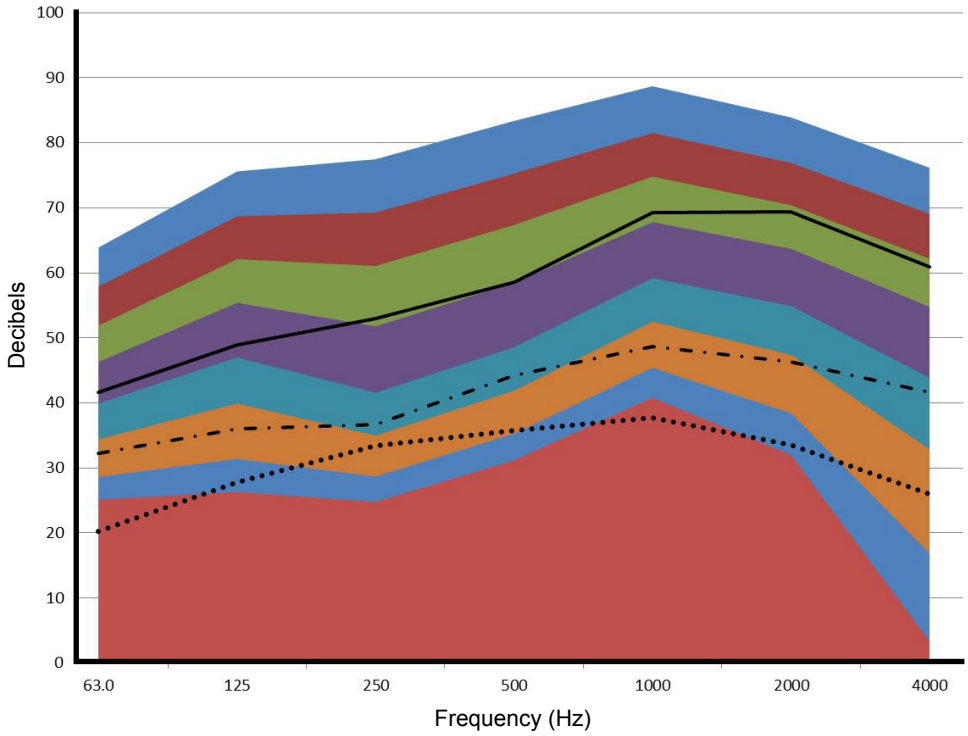
What do these results mean?

Noise from traffic driving on rumble strips is distinctly different from typical traffic noise. The results from the long-term measurements show that rumble strip noise does not cause a substantial increase in the L_{10} and L_{50} values.

Hourly L_{10} and L_{50} at a residence 60 feet from roadway



Rumble Strip Noise Levels



Modeled Rumble Strip Noise (single rumble-strip event)

Level	Distance from road
	25 ft.
	50 ft.
	100 ft.
	200 ft.
	500 ft.
	1000 ft.
	2000 ft.
	3000 ft.

These modeled noise levels each illustrate a single rumble strip event at varying distances. They are based upon actual roadway noise data.

Individual Vehicle Noise (with no rumble strip events)

Level	Distance from road
	50 ft.

Represents a single vehicle driving at 55 MPH on a roadway with no rumble strip events.

Total Noise (with intermittent rumble strip events)

Level	Distance from road
	130 ft.
	900 ft.

These levels represent the total average noise measured at residences, including background and traffic noise, and occasional rumble strip events.

Have questions? Contact the project team:

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More information:

Rumble strips: www.dot.state.mn.us/trafficeng/safety/rumble **Toward Zero Deaths:** www.minnesotatzd.org