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.

Hwy 61 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 Hwy 61 from Two Harbors to the Canadian border, MnDOT hired traffic noise experts at HDR Engineering Inc. to monitor, measure, and analyze the noise made by traffic passing over rumble strips.
How do we measure and regulate noise?

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**

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>( L_{10} )</th>
<th>( L_{50} )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DAYTIME</strong> (7am – 10pm)</td>
<td>65 decibels</td>
<td>60 decibels</td>
</tr>
<tr>
<td><strong>NIGHTTIME</strong> (10pm – 7am)</td>
<td>55 decibels</td>
<td>50 decibels</td>
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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, the project team measured rumble strip noise using two methods:

**Method 1:**
**LONG-TERM MEASUREMENTS**
Sound level meters are placed for one week at a location along the road. The meters measure all sound that occurs day and night for 7 consecutive days.

**Method 2:**
**PASS-BY MEASUREMENTS**
Measures noise from a specific car driving at a known speed in a controlled setting. The test measures 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 the Hwy 61 corridor, we placed sound level meters at nine locations to measure noise levels for a week. We also conducted pass-by tests at four 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 Hwy 61 for the long-term measurements (see below).
Hwy 61 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 is not causing a substantial increase in the $L_{10}$ and $L_{50}$ values.

Hourly $L_{10}$ and $L_{50}$ at a residence 60 feet from Hwy 61

Hwy 61 Rumble Strip Noise Levels

Modeled Rumble Strip Noise (single rumble-strip event)

- $L_{10}$, daytime noise limit (65 decibels)
- $L_{10}$, nighttime noise limit (55 decibels)
- $L_{50}$, daytime noise limit (60 decibels)
- $L_{50}$, nighttime noise limit (50 decibels)

Individual Vehicle Noise (with no rumble strip events)
- Represents a single vehicle driving at 55 MPH on Hwy 61 with no rumble strip events.

Total Noise (with intermittent rumble strip events)
- 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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Toward Zero Deaths: www.minnesotazd.org

To view the full report: www.dot.state.mn.us/trafficeng/safety/rumble/techreportfinal.pdf