Rural Polk County Testing of the California Mumble Strip

Transportation Research Conference

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Study Goals and Objectives

**Purpose**: Respond to objections raised by landowners about unwanted noise caused by vehicles traveling over rumble strips when they drift over the edge or centerline.

**Goal**: Identify a design that provides maximum safety by capturing the driver’s attention through tactile and sound levels while minimizing the external noise generated.

**Objective**: Study sound levels from three types of longitudinal rumble strips installed along the edge of two-lane rural roads in Polk County, Minnesota, and to identify one that best satisfies the goal above.
Monitoring Setup

June 5, 2014
Example Measurement Setup – Pennsylvania Strip Tests
One meter at 50’, one at 100’ from strip
Video Camera at 50’ location
Rumble Strip Types Tested
Vehicle Types
and
Interior Meter Location
Passenger Sedan
Passenger Sedan – Meter Location
Pickup Truck
Pickup Truck – Meter Location
Semi-Trailer Truck
Semi-Trailer Truck – Meter Location
Comparison of
Outside Maximum and Inside Sound Levels
Monitoring Results
Some selected data comparisons
Car - California Strip and None - Max dBA - 50 ft

<table>
<thead>
<tr>
<th>Speed</th>
<th>Sound Level (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strip</td>
<td>C-Car30-Av</td>
</tr>
<tr>
<td></td>
<td>C-Car45-Av</td>
</tr>
<tr>
<td></td>
<td>C-Car60-Av</td>
</tr>
<tr>
<td>NoStrip</td>
<td></td>
</tr>
</tbody>
</table>

The graph shows the sound levels in dBA for different speeds and conditions.
Car - Pennsylvania Strip and None - Max dBA - 50 ft

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<tr>
<td>Strip</td>
<td>NoStrip</td>
</tr>
<tr>
<td>30</td>
<td>P-Car30-Av</td>
</tr>
<tr>
<td>45</td>
<td>P-Car45-Av</td>
</tr>
<tr>
<td>60</td>
<td>P-Car60-Av</td>
</tr>
</tbody>
</table>

- Strip: 
  - P-Car30-Av: 55.0 dBA
  - P-Car45-Av: 65.0 dBA
  - P-Car60-Av: 75.0 dBA

- NoStrip: 
  - P-Car30-Av: 45.0 dBA
  - P-Car45-Av: 55.0 dBA
  - P-Car60-Av: 65.0 dBA
Monitoring Results
Selected Spectral Levels
Car 60 mph Passby Max Spectra

Note strong tonal peak for MN, smaller double peaks for CA
Car Spectra (50 ft) MN Strip

Note increasing frequency and level with speed

Sound Level (dB)
- Car 30 mph
- Car 45 mph
- Car 60 mph

Frequency (Hz)
- 31.5
- 40.0
- 50.0
- 63.0
- 80.0
- 100
- 125
- 160
- 200
- 250
- 315
- 400
- 500
- 630
- 800
- 1000
- 1250
- 1600
- 2000
- 2500
- 3150
- 4000
- 5000
- 6300
- 8000

Car 30 mph
Car 45 mph
Car 60 mph
Rumble Strip Detectability – Theoretical

The following slide shows the estimated change in detectability with distance for a car traveling at 60 mph.
Conclusions:

• California strip provided adequate driver feedback while generating less exterior noise than the Minnesota strip.
• Pennsylvania strip did not provide much driver feedback, although it did generate less exterior noise than either the California or Minnesota strips.
• Based on the study results, potential future studies could include wider strips to address the heavy commercial tire bridging that occurred with the 8-inch strips.
• Additional studies could also evaluate different width centerline strips and other vehicle types.
Questions?