

## 0-7029: Evaluation of the Performance of Rumble Strips on Pavements Where Seal Coats Have Been Applied

### Background

The objective of this study was to determine how many layers of seal coat (i.e., chip seal) can be applied before rumble strip performance is compromised. Seal coat applied for pavement maintenance partially fills existing rumble strips (Figure 1), reducing the levels of noise and vibration and potentially undermining the rumble strip function.

### What the Researchers Did

The team evaluated 54 existing rumble strip installations before and after being covered by seal coat. The sites represented a range of seal coat layers over the rumble strip (i.e., from none to three layers), seal coat types (i.e., Grade 3, Grade 4, and Grade 5), and rumble strip locations (i.e., centerline and edge line). Measurements of noise and vibration were made while driving in the wheel path and over the rumble strip. Two test vehicles (i.e., car and truck) were used at two test speeds (i.e., 55 and 70 mph). Rumble strip performance was evaluated as the change in the overall noise and vibration levels when driving in the lane to over the rumble strip. Additionally, rumble strip performance scores were developed that were sensitive to the change in the noise pitch and vibration frequency.

### What They Found

The effects of the number of seal coats and the seal coat grade type were very significant when controlling for site and test condition variables. The average noise performance score was above 13 dBA (rated as high) with no seal coat covering



Figure 1. Rumble Strip Before and After Seal Coat.

the rumble strip, then 8 dBA (moderate) after one layer, and 5 dBA (low) after two and three layers. Noise performance was lowest for coarse Grade 3 seal coat (5/8 inch) and higher for fine Grade 5 seal coat (3/8 inch). The vibration data identified the same trends. Models relying on these variables, however, were unsuitable for design purposes because the performance varied substantially at each level. In practice, the most influential factor for predicting rumble strip performance after seal coat was the performance in its present condition.

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Three design-focused models were developed to predict rumble strip noise performance after a new seal coat. The Level I model ( $R^2 = 0.72$ ) relies on measuring the noise performance before seal coat, the current rumble strip depth, and a few parameters of the seal coat (Figure 2). The Level II model ( $R^2 = 0.53$ ) only needs the rumble strip depth in the field. The Level III model ( $R^2 = 0.33$ ) does not require any field data. For implementation, each model accounts for the prediction interval with 75 and 95 percent confidence. Guidance on implementing the design models is provided in the document *Guidelines for Seal Coats and Rumble Strips* and in the recommended revisions to the *Seal Coat and Surface Treatment Manual*.

### What This Means

If the existing noise performance is  $\Delta 15$  dBA and the depth is 0.5 inches or greater, it is OK to seal over the rumble strip.

It is OK to seal over a rumble strip milled into asphalt or milled into seal coat if using Grade 4 or Grade 5. If using a Grade 3 seal, first check the Level I or II models.

Do not apply seal coat over an already covered rumble strip without first checking the Level I or II models.

Districts that typically use Grade 3 seal coats may consider installing new rumble strips deeper (i.e., 5/8 inch) or apply Grade 4 seal coat on the shoulders and/or lanes instead.

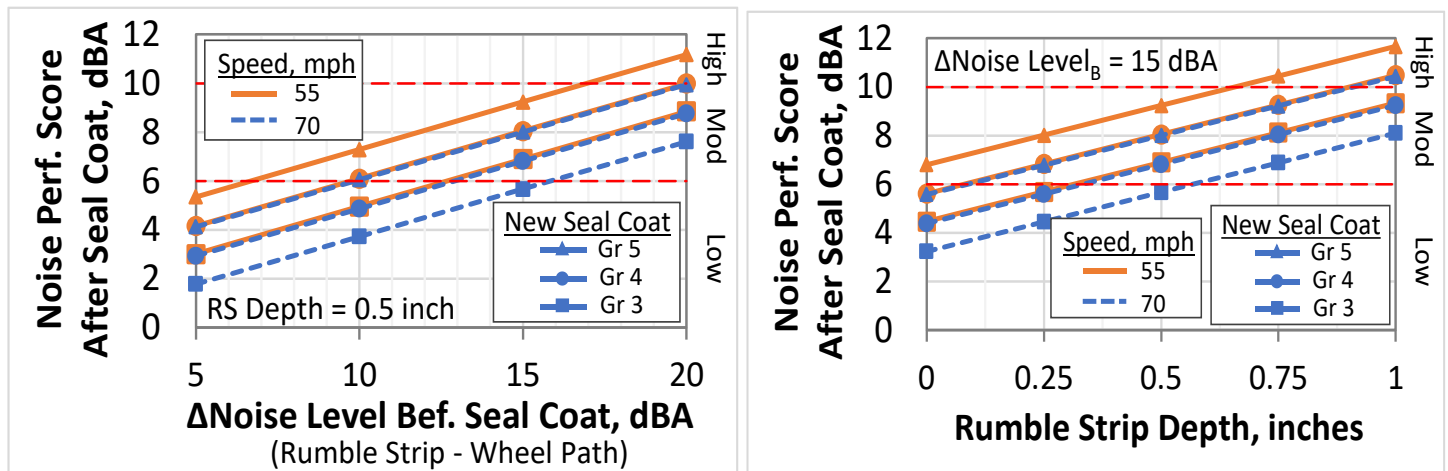


Figure 2. Level I Prediction Model at 75 Percent Prediction Confidence.

### For More Information

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