The Ohio Department of Transportation
Office of Research & Development
Executive Summary Report

Effectiveness of Tire/Road Noise Abatement through Surface Retexturing by Diamond Grinding for Project SUM-76-15.40

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Problem

A portion of I-76, near Akron, OH, had been reconstructed by the Ohio Department of Transportation (ODOT) using concrete pavement to replace the previous asphalt surface. In the process of reconstruction, the concrete surface was textured with random transverse grooves to comply with the current ODOT specification (451.09).

Subsequent to construction, residents living in the project area as far as 2600 ft (800 m) from the roadway, perceived an unfavorable difference in their noise environment, which they attributed to the new concrete pavement used on the reconstruction project. Highway engineers in District 4, being aware that pavement materials and especially pavement surface textures have a significant effect on tire/road noise, established a plan to change the surface texture from transverse grooves to longitudinal grooves as a means to alleviate the objectionable differences perceived by residents.

The Ohio Department of Transportation initiated this research project to quantify noise differences due to the pavement re-texturing.

Objectives

The goal of the research project, to quantify traffic noise differences due to re-texturing the concrete pavement surface through diamond grinding, will be reached by completing the following objectives:

1. Collect traffic noise level and frequency data, at a series of positions, to characterize the traffic noise sound field between the roadway and the most distant residence of interest, both before and after diamond grinding of the pavement.

2. Identify traffic noise level and frequency differences due to the re-texturing of the pavement surface.

3. Identify any traffic noise level and frequency differences due to the re-texturing of the pavement surface that correlate with distance from the source.

Description

Five sites were selected within the project area for traffic noise level measurements. Microphones were located at 24.6 ft (7.5 m) and/or 49.2 ft (15 m) from the centerline of the near travel lane at each site, both before and after the diamond grinding, to gage the effect on traffic noise levels. At three of the sites microphones were also located at distances of 98.4 ft (30 m), 196.9 ft (60 m), and 393.7 ft (120 m) from the roadway to determine the influence of the pavement re-texturing with distance.

The procedure provided measurements of both overall noise levels and noise levels by frequency band from 50 Hz to 10 kHz. Traffic data and atmospheric data were collected during the measurements to ensure valid comparisons between "before" and "after" measurements.

Conclusions & Recommendations

Conclusions:
The reduction in broadband noise at the 24.6 ft (7.5 m) distance ranged from 3.2 dB to 4.2 dB, while the range for the 49.2 ft (15 m) distance was 2.0 dB to 4.9 dB.

The average reduction in broadband noise for 4 test sites at the 24.6 ft (7.5 m) distance was 3.5 dB, and the average reduction for the 49.2 ft (15 m) distance for 5 sites was 3.1 dB.

Spectrum analysis showed the greatest reduction in noise occurred at frequencies above 1 kHz and that the retexturing had little to no effect on frequencies less than 200 Hz.

Recommendations:
1. Consider diamond grinding as a mitigation strategy where there are concerns about traffic noise levels at sites with concrete pavements having the 451.09 surface specification.
2. Develop a new surface texture specification for concrete pavements to replace the current specification (451.09) in order to reduce tire/pavement noise levels while maintaining or improving safety and durability characteristics.

Implementation Potential

Implementation may involve a feasibility study of the widespread use of diamond grinding, and a study of projects where asphalt pavements have been replaced with concrete pavements at the same time as noise barriers were installed.