The Institute for Safe, Quiet and Durable Highways

Research Summary

Schools of
Civil and Mechanical Engineering

Purdue University

Field Evaluation of Porous Asphalt Pavement

Background

Tire/pavement noise is a growing concern in urban areas and even suburban or rural areas near housing developments. Noise barrier walls can cost over one million dollars per mile and have limited effectiveness. Quieter pavement surfaces would be less expensive than barrier walls and could offer benefits over a larger area by reducing tire/pavement noise at its source.

The main objective of this research project was to evaluate the performance of Porous Friction Course (PFC) and Stone Matrix Asphalt (SMA) surfaces compared to a conventional hot mix asphalt surface (HMA). Performance was assessed in terms of tire/pavement noise generation as well as other performance measures. Acoustical properties of the pavements were measured, using both sideline noise measurements and the close-proximity trailer method for comparison purposes. The results of these tests allowed comparison of the noise generation and attenuation properties of the various surfaces. These results should be useful for development and verification of models to predict noise attenuation. Splash and spray were assessed qualitatively in the field.

Findings and Conclusions

1. Acceptable PFC mixtures can be designed using Indiana materials and conventional equipment can be used to produce, place and compact the mixes.
2. The PFC had a more open gradation than the SMA. Both mixes were significantly more gap-graded than conventional Superpave HMA mixtures.
3. The surface texture of the PFC is visually more open than the SMA. The HMA exhibited an even more uniform, dense surface by comparison. The differences in texture were confirmed and quantified using a laser-based Circular Texture Meter.
4. Close-proximity testing at two different speeds showed the HMA to produce noise levels that were 3.6 dB higher on average than the PFC, and the SMA produced noise levels that were 4.8 dB higher on average than the PFC.
5. Pass-by noise measurements at 80 kph (50 mph) showed that the HMA produced noise levels that were 4.2 dB higher on average than the PFC, and the SMA produced noise levels that were 5.0 dB higher on average than the PFC.
6. The PFC also provided higher friction than the HMA and SMA in terms of International Friction Index. The PFC and SMA friction values are expected to increase after traffic wears away the binder film coating.
7. Visual observations of splash and spray show that the PFC does significantly reduce water on the pavement surface, resulting in better visibility for drivers.

Conclusion: The PFC section exhibited lower noise levels, improved friction and reduced splash and spray when compared to the SMA and conventional HMA surfaces. PFC may offer an effective and economical way to reduce noise while maintaining, or even improving, friction and visibility. The long term performance of PFC under Indiana conditions should be determined before extensive use is made of this type of mixture, but at this point it appears very promising.

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The Institute for Safe, Quiet and Durable Highways is a joint effort of the Schools of Civil and Mechanical Engineering at Purdue University. This Institute is committed to the development of quiet, safe, durable, and economical highways systems for automobiles, trucks, and highway based transit systems.

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