Laboratory Design of Quieter Asphalt Surfaces

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Nov., 2015
Introduction

- **Objective:** Develop laboratory procedures to measure noise generated by surfacing materials.

- **Low-noise pavement surfaces are a cost-effective option to reduce traffic noise.**
Highway Traffic Noise
Tire-Pavement Noise

Pavements in noise mitigations.

Flexible Pavement
Surface Texture
Surface Porosity
Surface Stiffness
Other Factors

Rigid Pavement
Surface Texture
Finishing
Tire-Pavement Noise
Surface texture

- Both macrotexture and megatexture influence in road noise.
- Macrotexture is mainly influenced by:
  - Gradation
  - Degree of compaction
Tire-Pavement Noise Macrotexture

- Mean Profile Depth MPD - ASTM E1845

![Diagram of Mean Segment Depth Calculation](image)
Tire-Pavement Noise
Macrotexuture and Gradation

- A noise database was established from data collected on asphalt pavements tested in Texas and at the National Center for Asphalt Technology (NCAT) test track.
- The best correlation was found between MPD and percentage passing the #4 sieve (4.75 mm).
Tire-Pavement Noise
Macrotecture and Gradation

• This relation provides a simple estimation of surface macrotexture in terms of mixture gradation and suggests an increase for coarser mixes and a decrease as the fines in the mix increase.

\[ MPD=1.7-0.0164 \times P4 \]
Laboratory Procedure

Test implementation

- Developed specifically to allow the design of quieter pavement surfaces in the laboratory before applying these in the field.
- A sound pressure level meter is placed 4 inches from the contact of the rubber slider and the surface, and 3 inches above the surface of the specimen.
Laboratory Procedure
Test implementation
Laboratory Procedure

Macrotecture Measurement
a) TOM
- MPD: 0.578 mm
- Noise: 83.7 dBA

b) PFC
- MPD: 2.010 mm
- Noise: 84.2 dBA

c) Concrete pavement
   transverse tinning
- MPD: 1.001 mm
- Noise: 91.9 dBA

d) Concrete
   Smooth surface
- MPD: 0.038 mm
- Noise: 88.5 dBA
Laboratory Test Results

- Samples of Texas gyratory compacted TOM specimens were fabricated.
- Mixture related parameters were varied to observe its influence in noise generating.
Laboratory Test Results

- Gradation

![Gradation Curves](image1)

![Noise vs. Gradation](image2)
Laboratory Test Results

- Asphalt Content

- MPD
Conclusions

• In contrast to PFC, TOM mixtures are not overly sensitive to variations in aggregate gradation or asphalt content.

• TOM has a proven record of excellent performance as a surface overlay mixture in Texas.

• PFC has been the low noise mixture of choice.

• Evidence from field trials indicates that PFC mixtures in Texas become significantly louder with time.