



# Laboratory Design of Quieter Asphalt Surfaces

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# Introduction

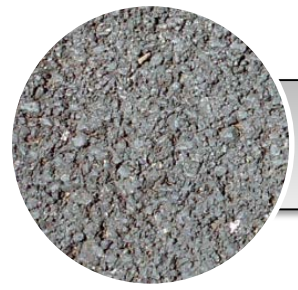
- **Objective: Develop laboratory procedures to measure noise generated by surfacing materials.**
- **Low-noise pavement surfaces are a cost-effective option to reduce traffic noise.**





# Highway Traffic Noise Tire-Pavement Noise

Pavements in noise mitigations.



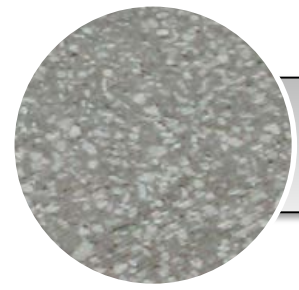
Flexible  
Pavement

Surface  
Texture

Surface  
Porosity

Surface  
Stiffness

Other  
Factors



Rigid  
Pavement

Surface  
Texture



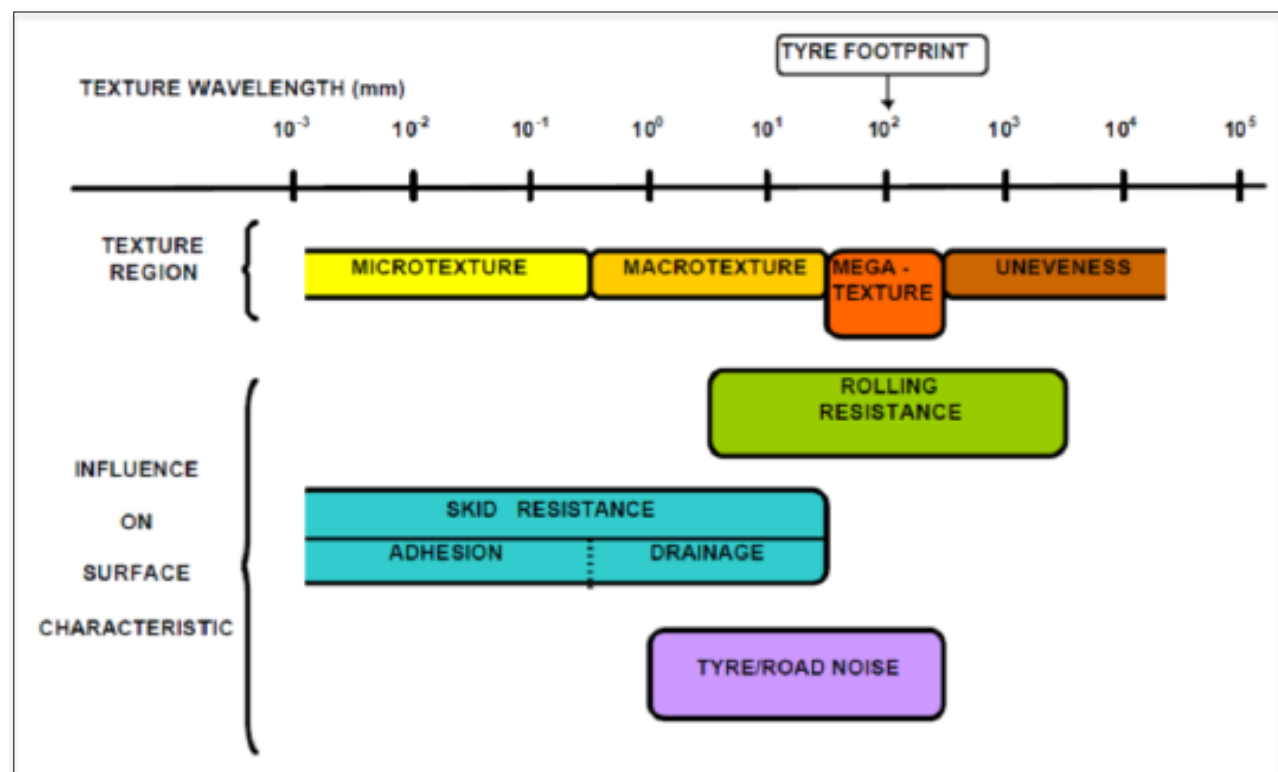
Finishing



# Tire-Pavement Noise

## Surface texture

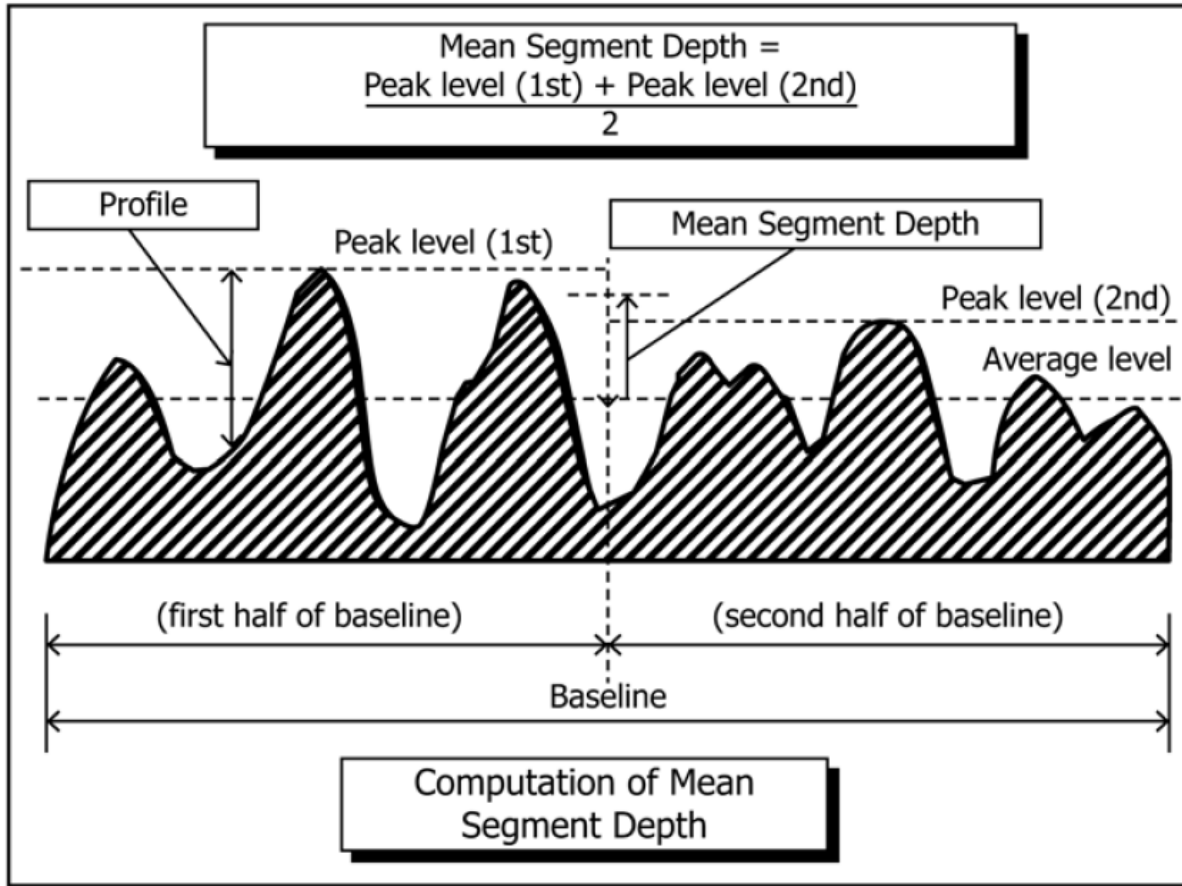
- Both macrotexture and megatexture influence in road noise.
- Macrotexture is mainly influenced by:
  - Gradation
  - Degree of compaction





# Tire-Pavement Noise Macrotexture

- **Mean Profile Depth MPD - ASTM E1845**

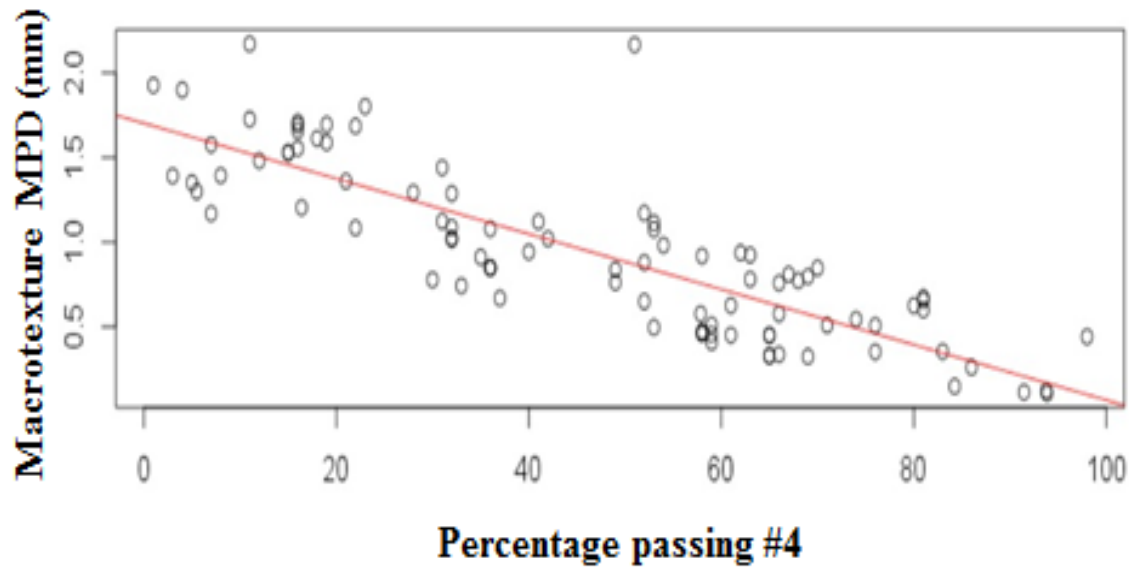




# Tire-Pavement Noise

## Macrotexture 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

## Macrotexture 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.

$$\text{MPD} = 1.7 - 0.0164 * P_4$$



# Laboratory Procedure

## Test implementation

- **Developed specifically to allow the design of quieter pavement surfaces in the laboratory before applying these in the field.**
- **Modification of the standard ASTM E303 procedure: Measuring Surface Frictional Properties Using the British Pendulum Tester (BPT).**
- **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**





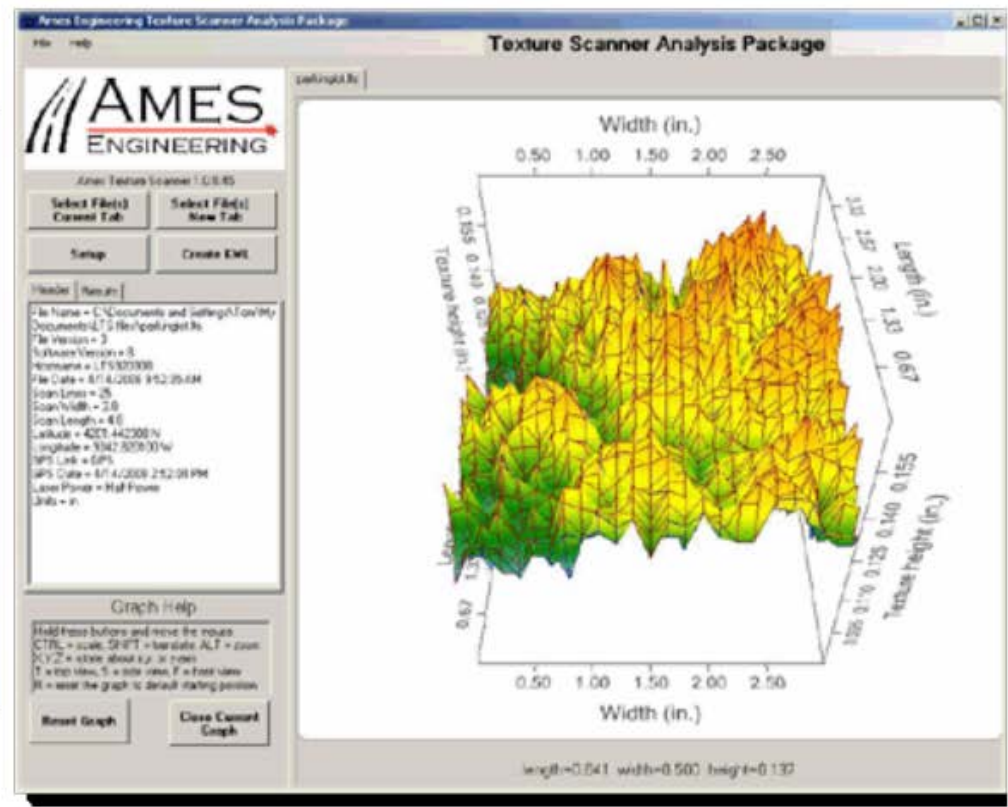
# Laboratory Procedure

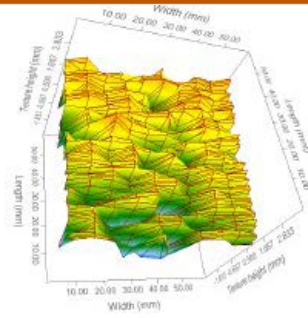
## Test implementation



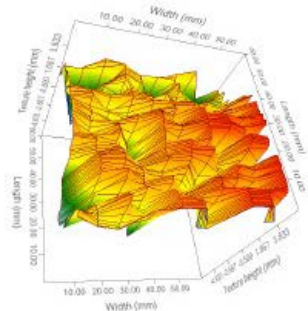


# Laboratory Procedure Macrotexture Measurement

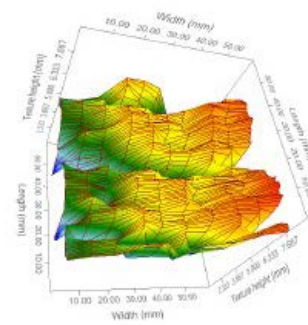




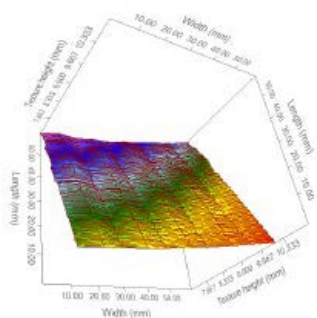
a) TOM  
MPD: 0.578 mm  
Noise: 83.7 dBA



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.



**PFC**

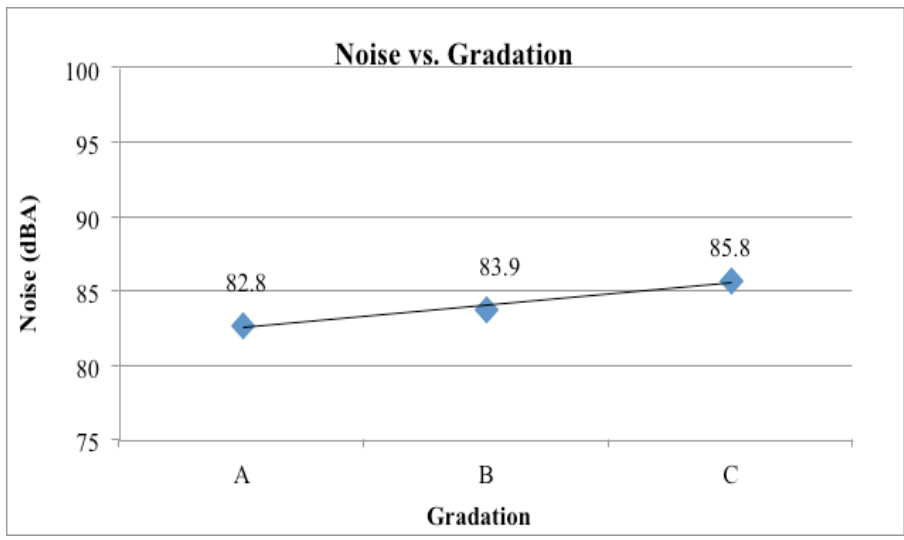
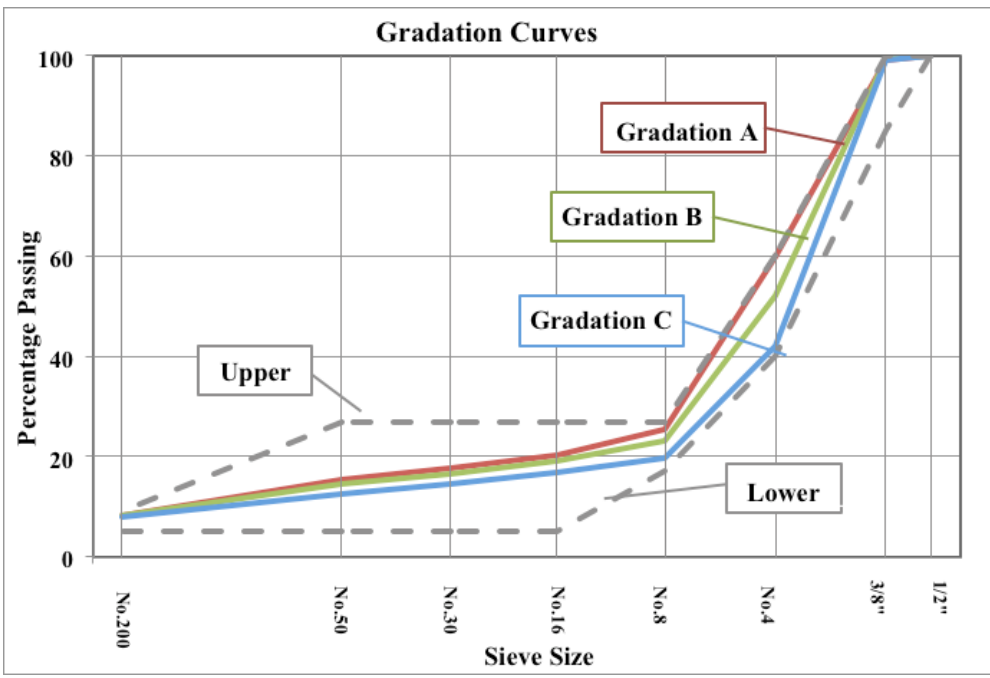


**TOM**



# Laboratory Test Results

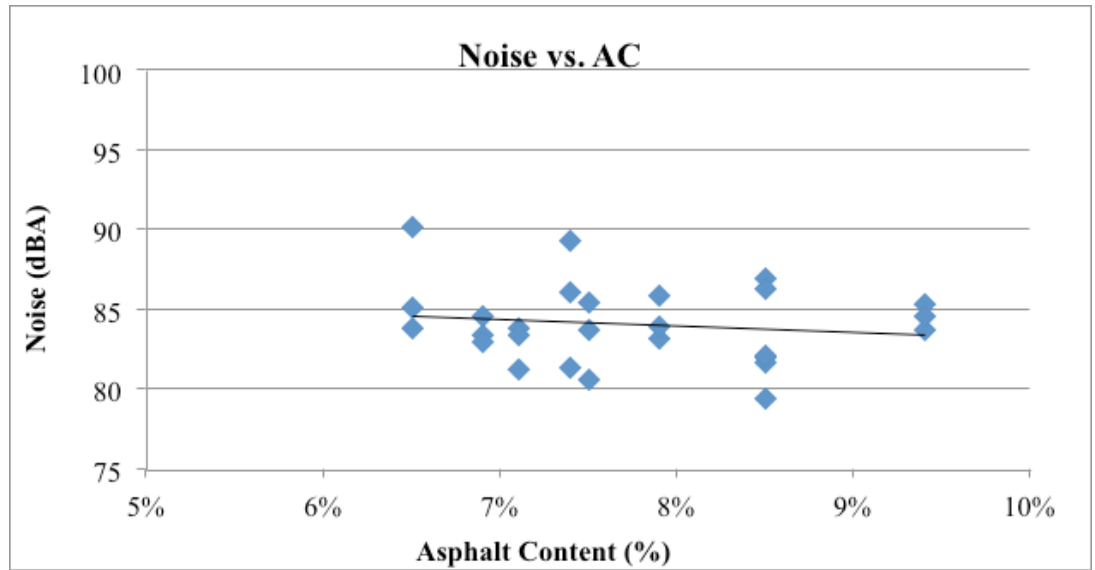
- Gradation



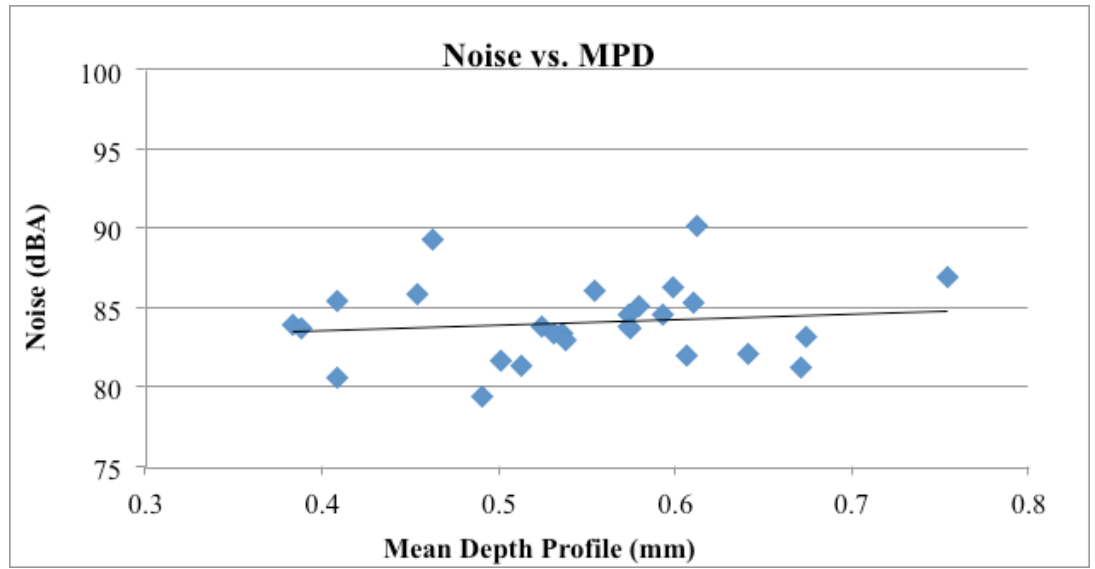


# Laboratory Test Results

- 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.**