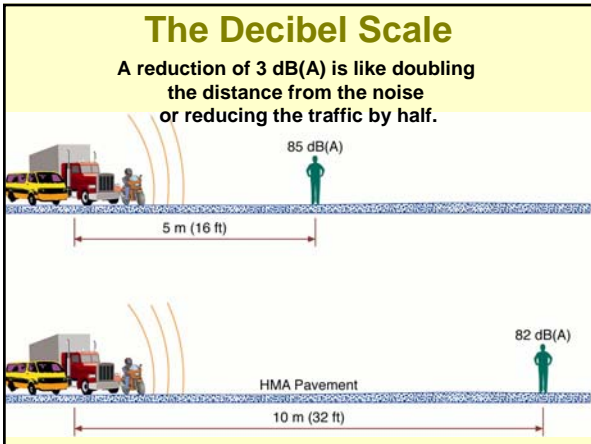
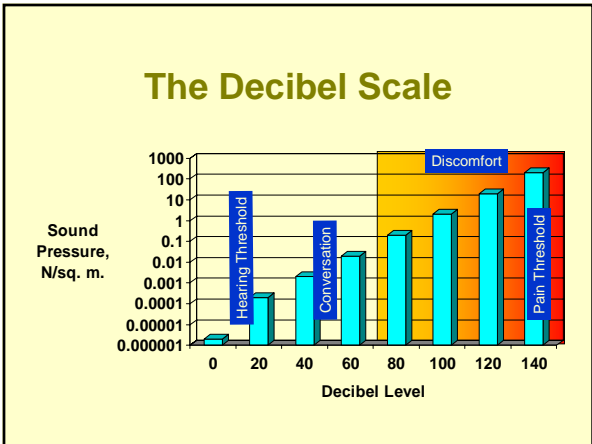
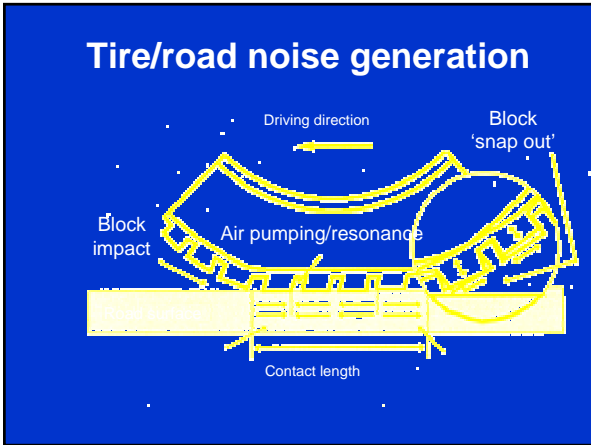


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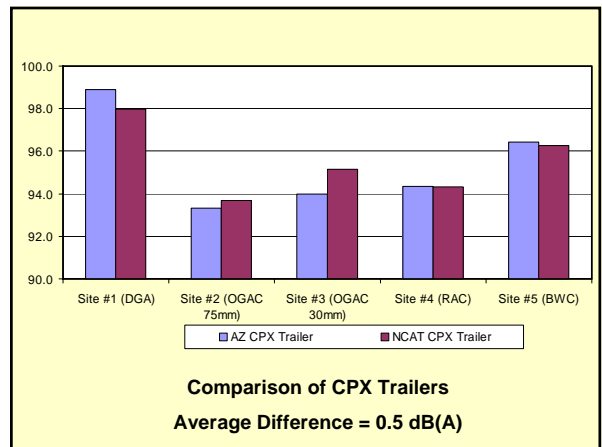
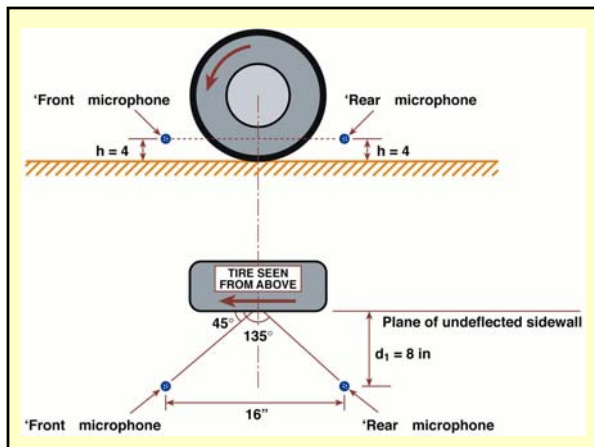
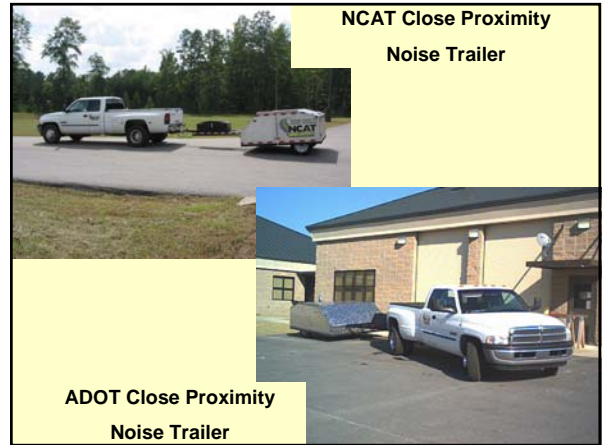
NCAT'S QUIET PAVEMENT STUDY

The Problem

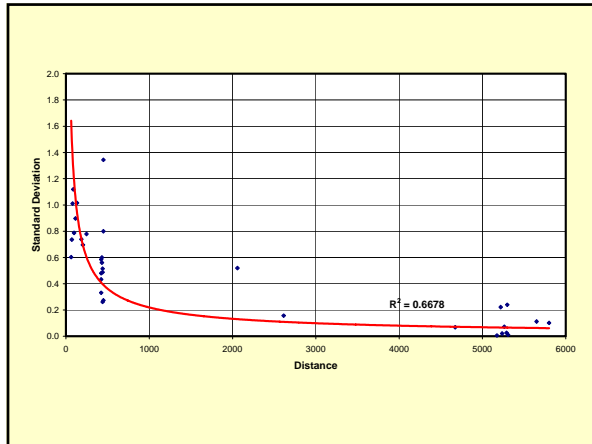
- Sound caused by transportation systems is the number one noise complaint in many locals. Engine (power train), exhaust, aerodynamic and pavement/tire noise all contribute to traffic noise.
- Above 30 mph for cars and 45 mph for trucks – the primary cause of traffic noise is the noise created at the tire/pavement interface.



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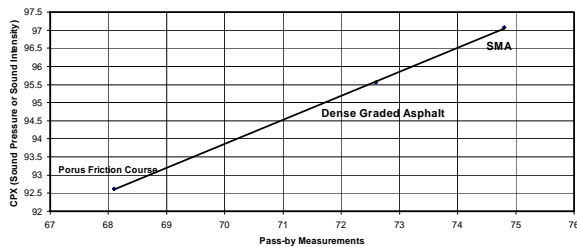


Side-Line Measurements

- Statistical By-pass Method (ISO 11819-1)
- Coast By



Comparison of CPX Vs Pass-by Measurements Indianapolis - September 2003



Offset: 23 dB(A)

What have we learned about the pavement

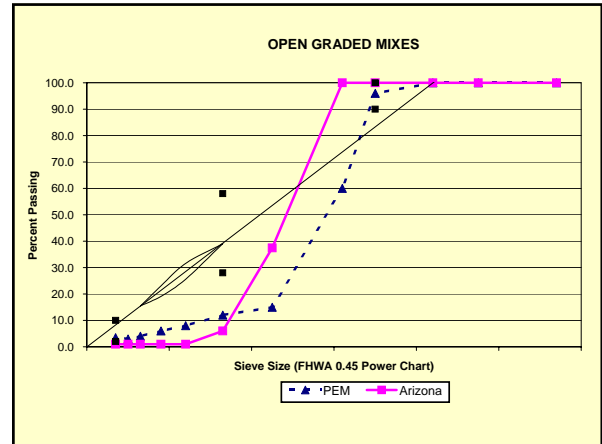
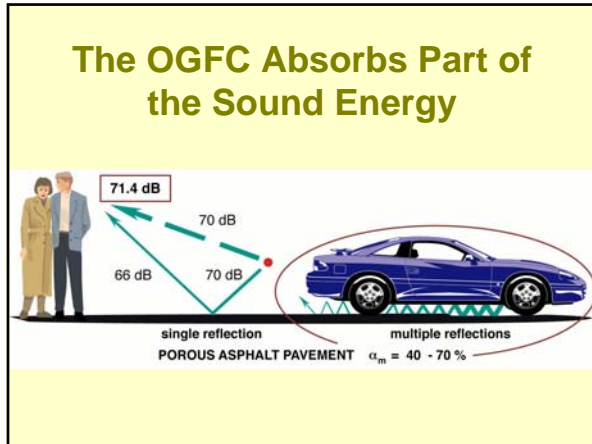
Pavements tested

- Locations
 - NCAT test track, Michigan, Alabama, New Jersey, Maryland, Colorado, Nevada, California, Arizona, Texas
- Numbers of surfaces tested
 - Total – 221 surfaces
 - HMA – 178 surfaces
 - PCCP – 43 surfaces
- Current problem – data overload – report being written

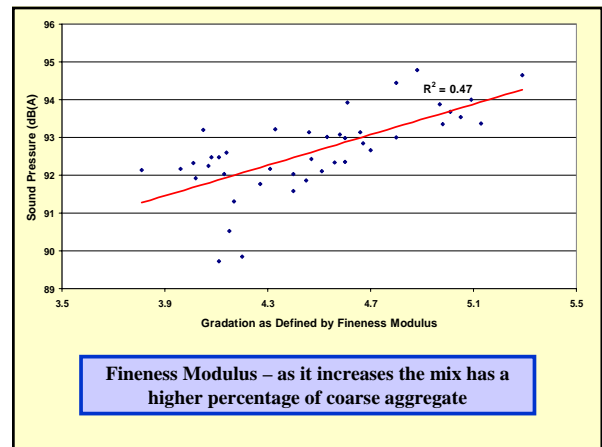
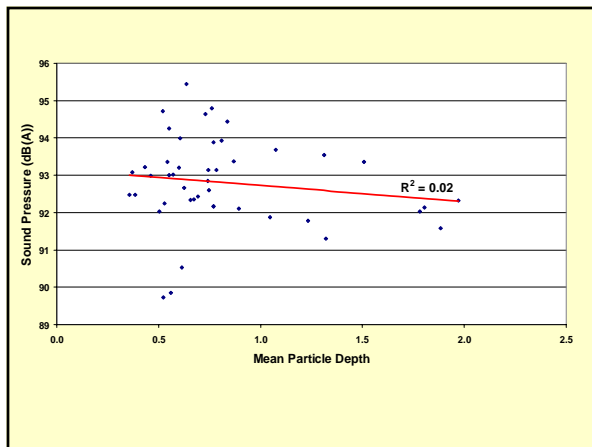
Summary of Data

Wearing Course	Average	Low	High
PCC	101	97	106
AC	98	93	101
SMA	97	93	100
Nova Chip	98	95	99
OGFC – C	97	95	98
OGFC - F	95	93	98

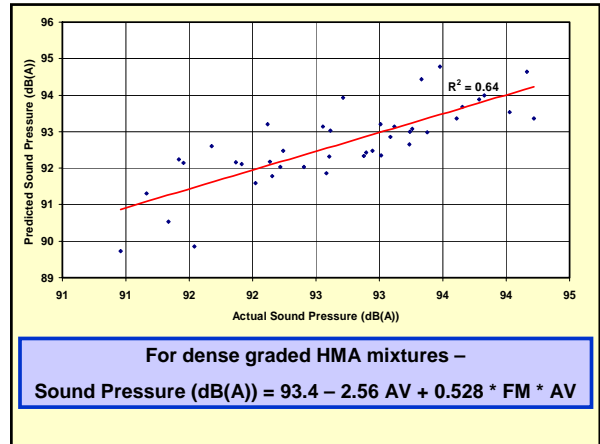
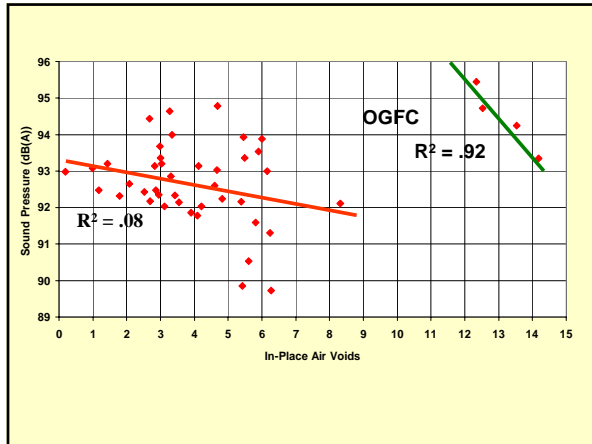
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- ### Test Data
- Looked the relationship between sound and the following HMA properties:
 - Surface texture
 - Gradation as measured by fineness modulus
 - In-place air voids

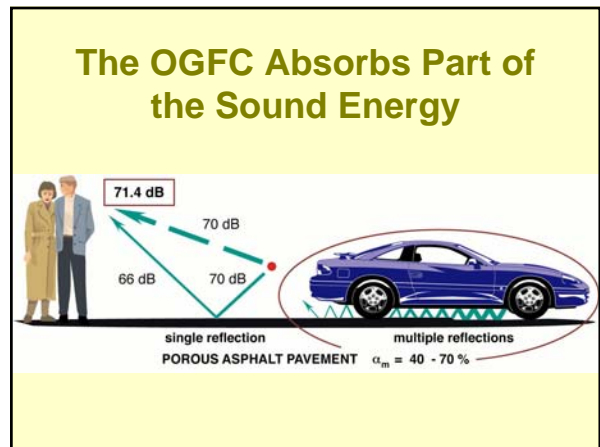
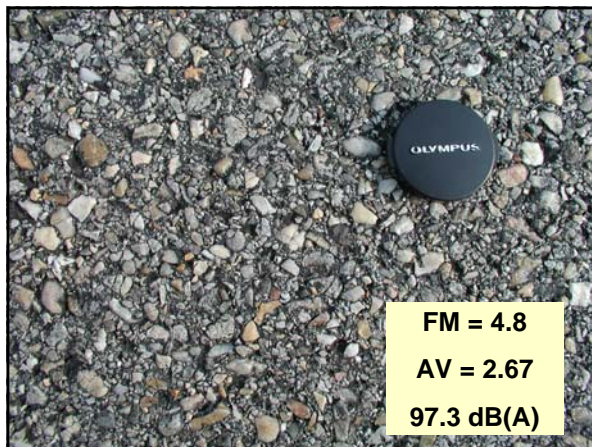
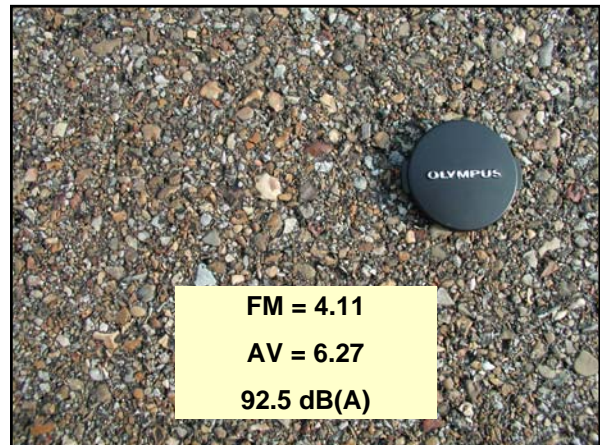


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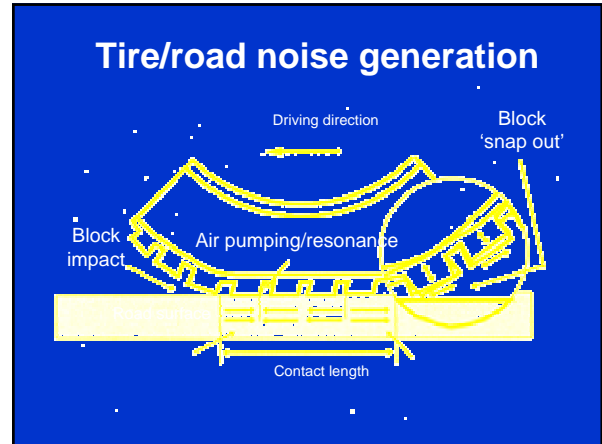
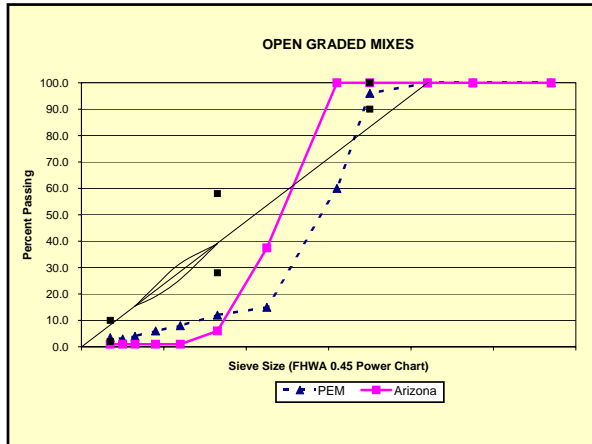


FM Numbers for Various Types of Surfaces

Summary	
ARZ	4.07
TRZ	4.48
BRZ	4.61
SMA	5.13
OGFC	5.59

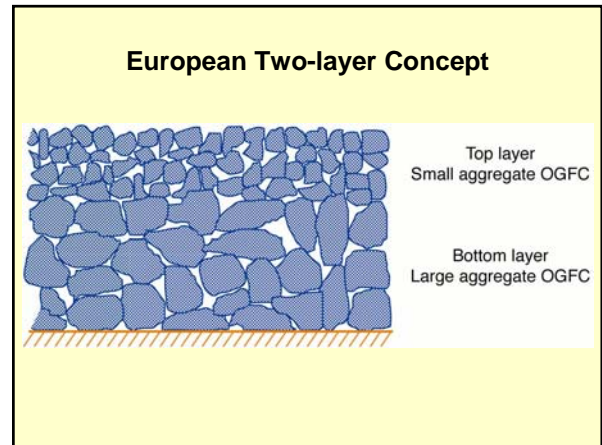


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IF I HAD TO DESIGN A QUIET PAVEMENT

- An open graded mix with more that 15% air voids
- Would use a fine graded mix with 90 to 100 % passing the 3/8 inch sieve
- Would think about using a two layer concept
 - 3/4 inches of a fine graded OGFC
 - 1 1/2 inches of a coarse graded OGFC
- Would think about using asphalt rubber



Planned Program

- Continue survey of current HMA pavement noise levels
 - Florida (OGFC with rubber)
- Develop additional data comparing CPX data to side-line noise – using sites in California & Arizona and the test track
- Build a quiet pavement test section or sections.



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