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QUIET HMA PAVEMENTS

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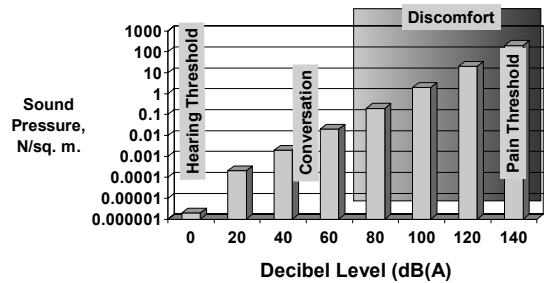
Outline

- What is the problem?
- How are we planning on solving it?
- Interesting things we have learned!

The Problem

- Sound caused by transportation systems is the number one noise complaint. 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.

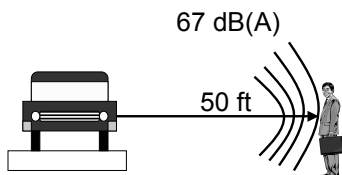
The Decibel Scale



THE GOAL – 67 dB or less

The Decibel Scale

A reduction of 3 dB(A) is like doubling the distance from the noise.



To put noise in perspective

- A decrease of
 - 1 dB means a 12 % decrease in noise
 - 3 dB means a 40 % decrease in noise
 - 6 dB means a 200 % decrease in noise

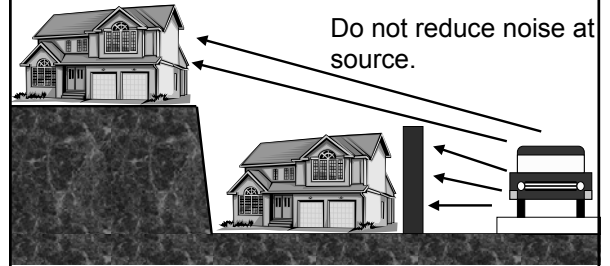
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A solution

- **Noise walls**
 - Good protection – 10dB reduction
 - Excellent protection – 20dB reduction
 - No wall unless you get a 5 dB reduction
 - The Traffic Noise Model (TNM) uses an average value for tire/pavement noise
 - Little or no help out 400 to 500 feet from the roadway

Noise Walls

Effective only for those not in line-of-sight.



Another solution

- A smooth surface texture with small small aggregate
- An open structure with an high built in air void
- A thick porous pavement
- An elastic pavement
- At the same time fulfilling requirements for:
 - Durability
 - Maintenance
 - Traffic safety
 - Costs

Is it cost effective?

- It can be
 - A decrease of 2 dB means a reduction of five feet in wall height or for a mile of pavement a reduction of \$528,000 (Average of \$20/sf)
 - A 2 lane miles of OGFC – 1 inch thick will cost about \$50,000

But !

FHWA Position

"Additional research is needed to determine to what extent different types of pavements and tires contribute to traffic noise. It is very difficult to forecast pavement surface condition into the future. . . . Unless **definite knowledge** is available on the pavement type and condition and its noise generating characteristics, no adjustments should be made for pavement type in the prediction of highway traffic noise levels. . . . **The use of specific pavement types or surface textures must not be considered as a noise abatement measure.**"

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What do we need to do!

- We need to quantify the benefit of different surface types from a noise and safety standpoint.
- We need to look for and try new techniques on various classes and types of roads.
- If we find a significant reduction and if we can maintain that reduction over time it could be an alternative that with our limited budgets, can provide improved service
- Times are changing and solutions other than mandated may be found.

A marriage is proposed



Of the acoustician

and



The Pavement Engineer

Desired outcome

- Test procedures that can be used to measure the noise properties of in-service pavements
- A understanding of the fundamental tire/pavement noise generation with application to in-service pavements
- A design manual that can be used to design quiet HMA pavements

Study Team

- **Pavement Engineers**
 - NCAT
 - Doug Hanson
 - Robert James
 - Purdue
 - Dr. Rebecca McDaniel
- **Acousticians**
 - Purdue
 - Dr. Robert Bernhard
 - Dr. Stewart
 - U of Central Florida
 - Dr. Roger Wayson
 - Illiworth & Rodman
 - Dr. Paul Donovan
 - Auburn University
 - Dr. Malcolm Crocker

Status

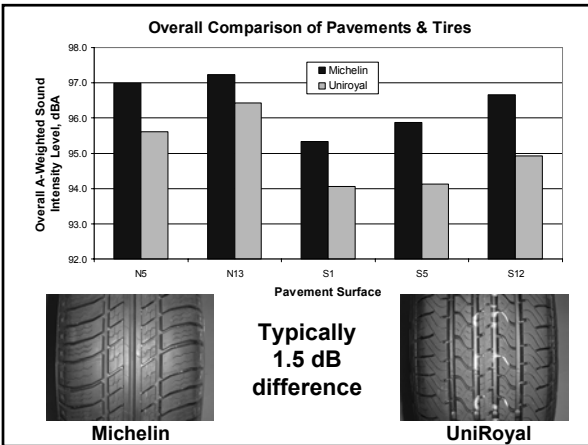
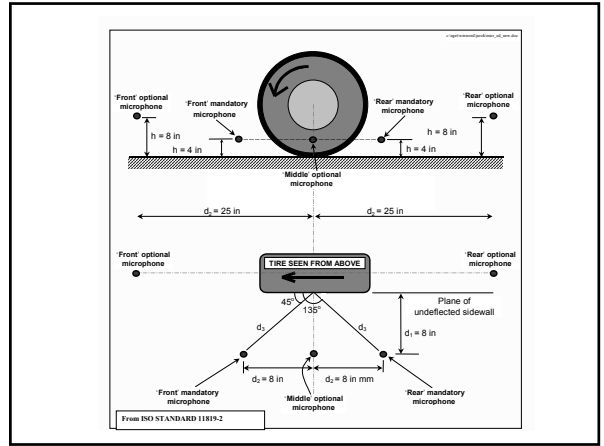
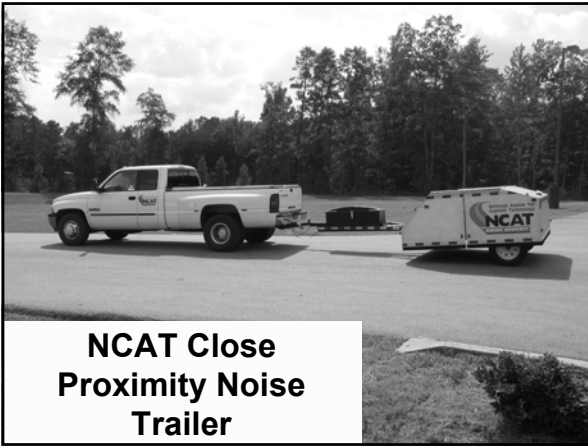
- Project team is developing a comprehensive work plan – will be completed this winter
- Currently NCAT
 - Is working on the development of the field test procedure
 - Is evaluating the noise characteristics of the surfaces at the test track
 - Has done a small testing study for the Michigan DOT
 - Will do a survey project for Alabama DOT this winter

Side-Line Measurements

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

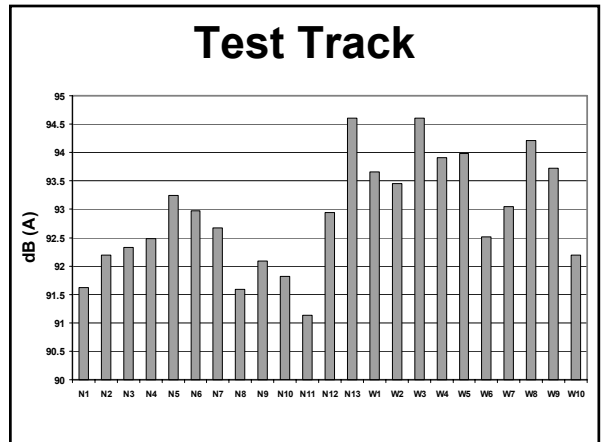
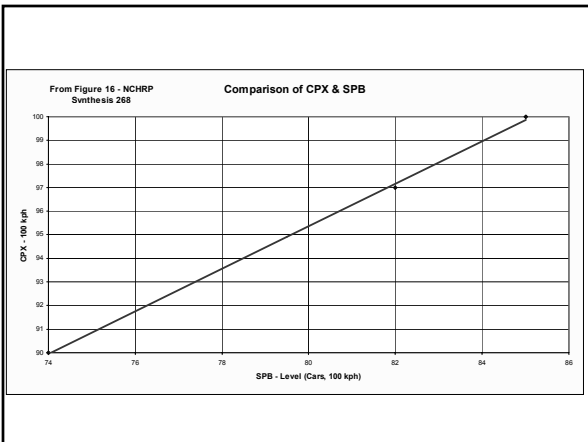


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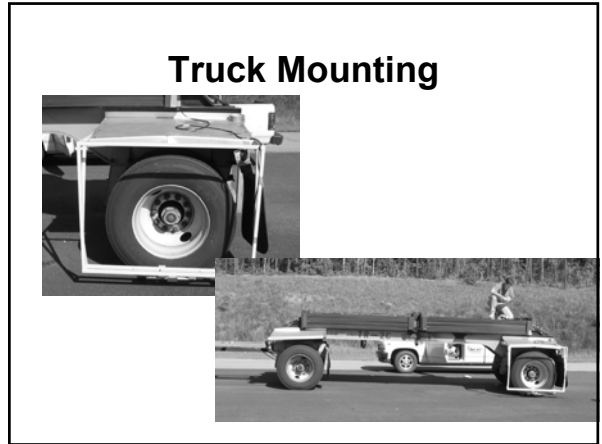
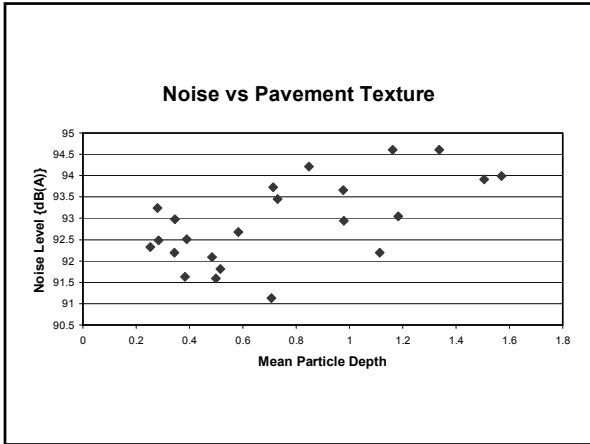


The Next Step

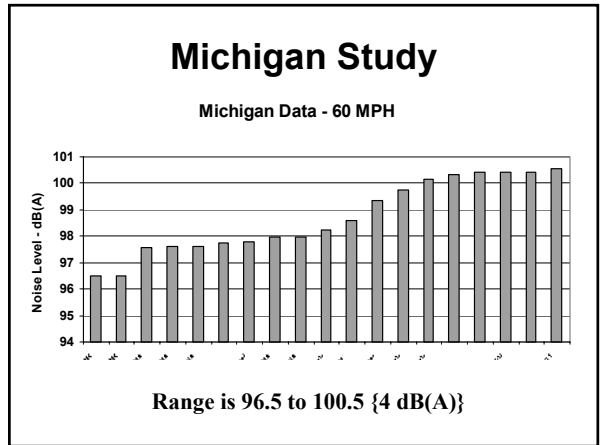
- How do the close proximity test procedures relate to side line procedures?
- Controlled field experiments
 - Purdue
 - NCAT
 - CalTrans
 - Other test roads
 - Different pavement surfaces (SMA, different types of OGFC, Dense graded)



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- ### AL DOT Study
- Survey study
 - Purpose – to develop an understanding of
 - Variability within a highway project
 - Some idea of degradation with time
 - Noise characteristics of pavements not represented on the test track



- ### The plan
- Complete testing at the track by the end of January
 - Do the testing in Alabama this spring
 - Develop the correlation between CPX and sideline measurements by fall
 - Obtain support for the big study (FHWA, Pooled fund and industry)

