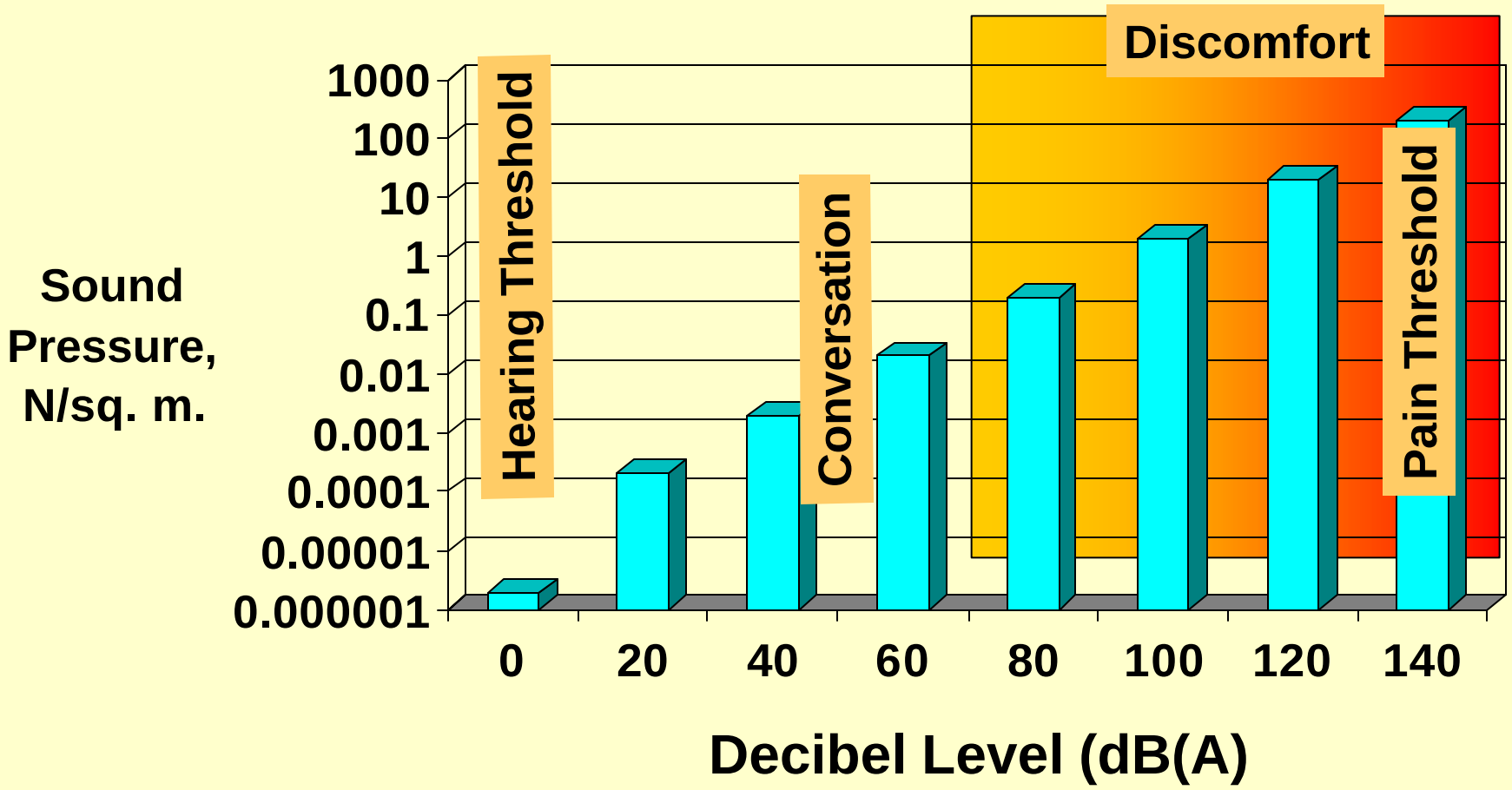
QUIET HMA PAVEMENTS

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.**

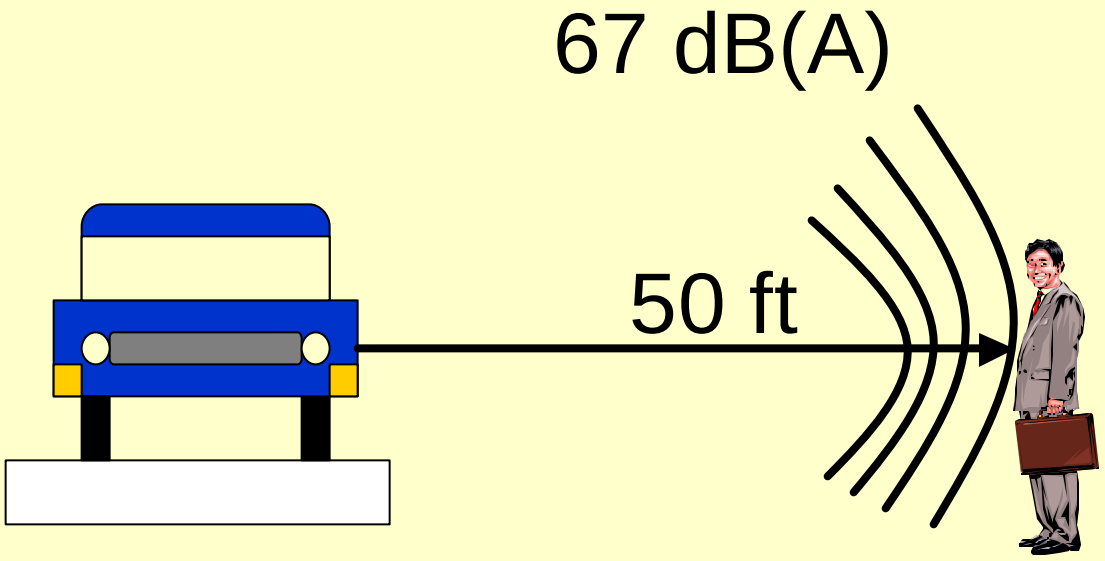
The Decibel Scale



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**

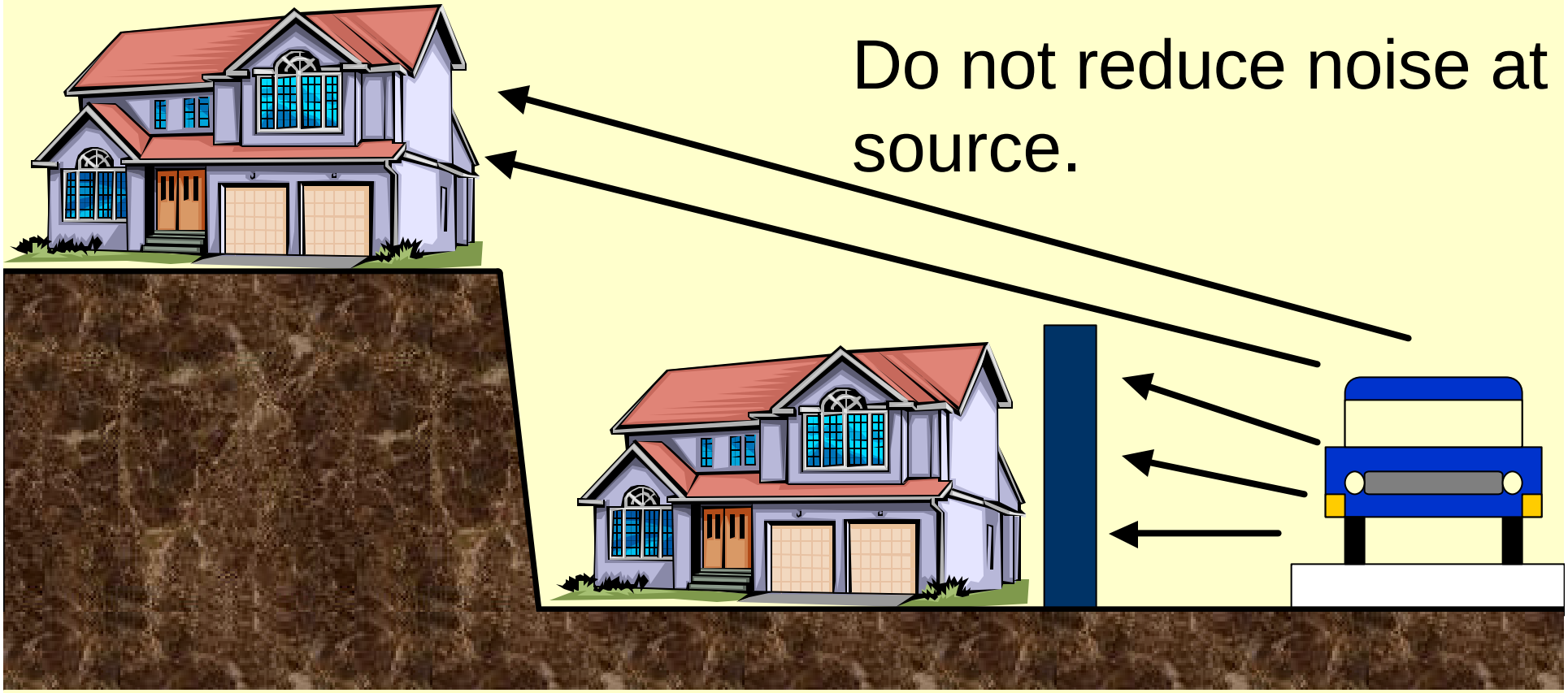
A solution

- **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.

Do not reduce noise at source.



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 !

How do we measure sound in the field?

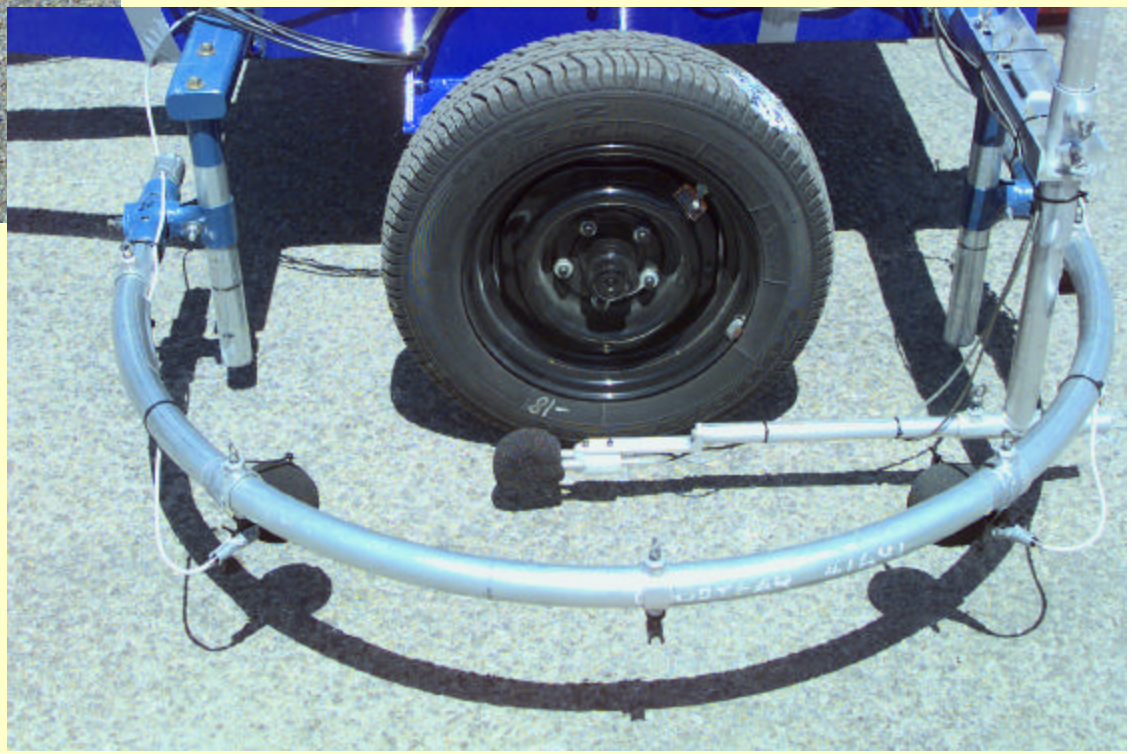
Side-Line Measurements

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

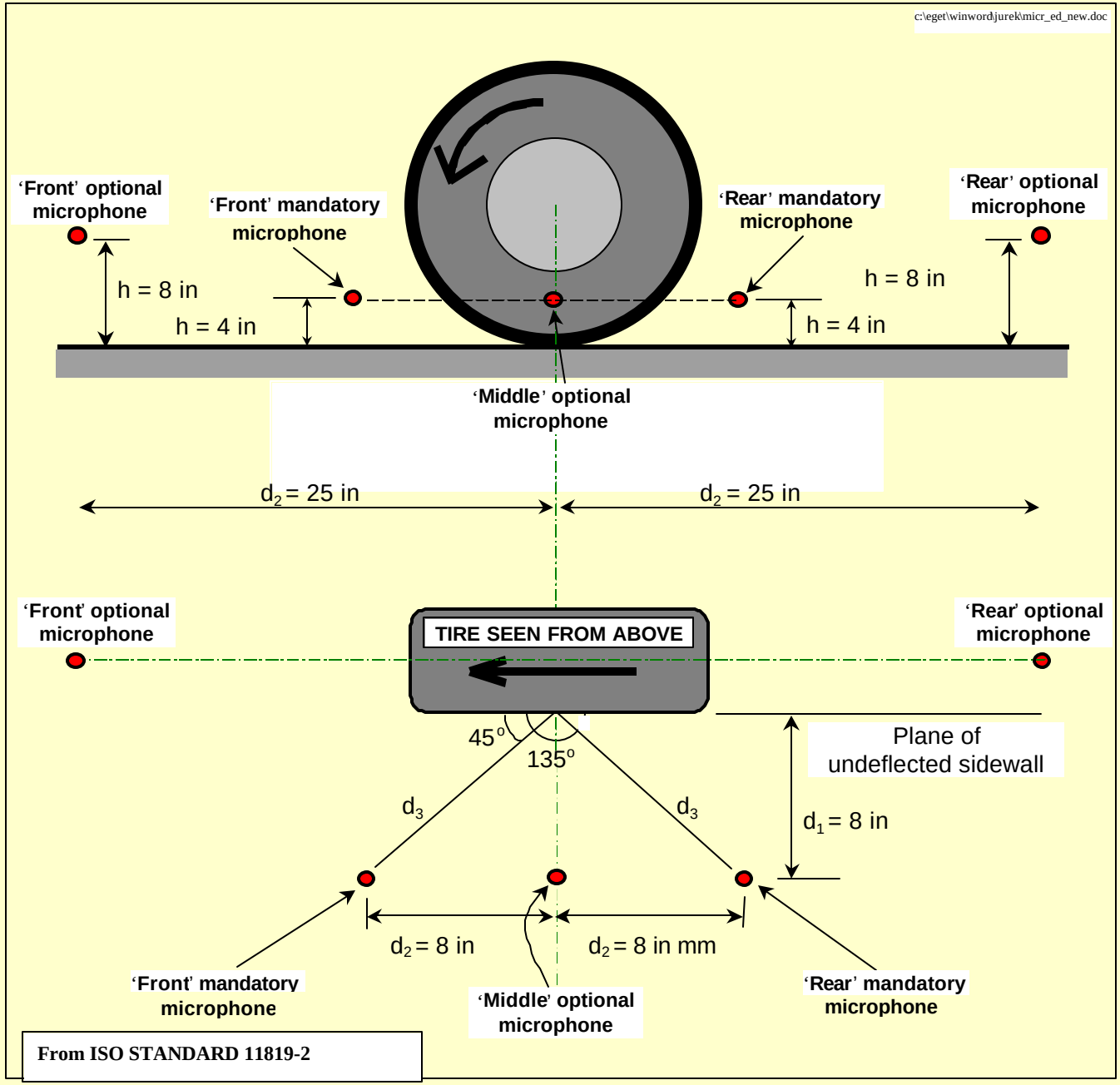
D - dynamic
R - roadway
I - interactive
F - facility
T - to
E - evaluate
R - rideability


BigTex
THE ORIGINAL AZ SOUND TRAILER

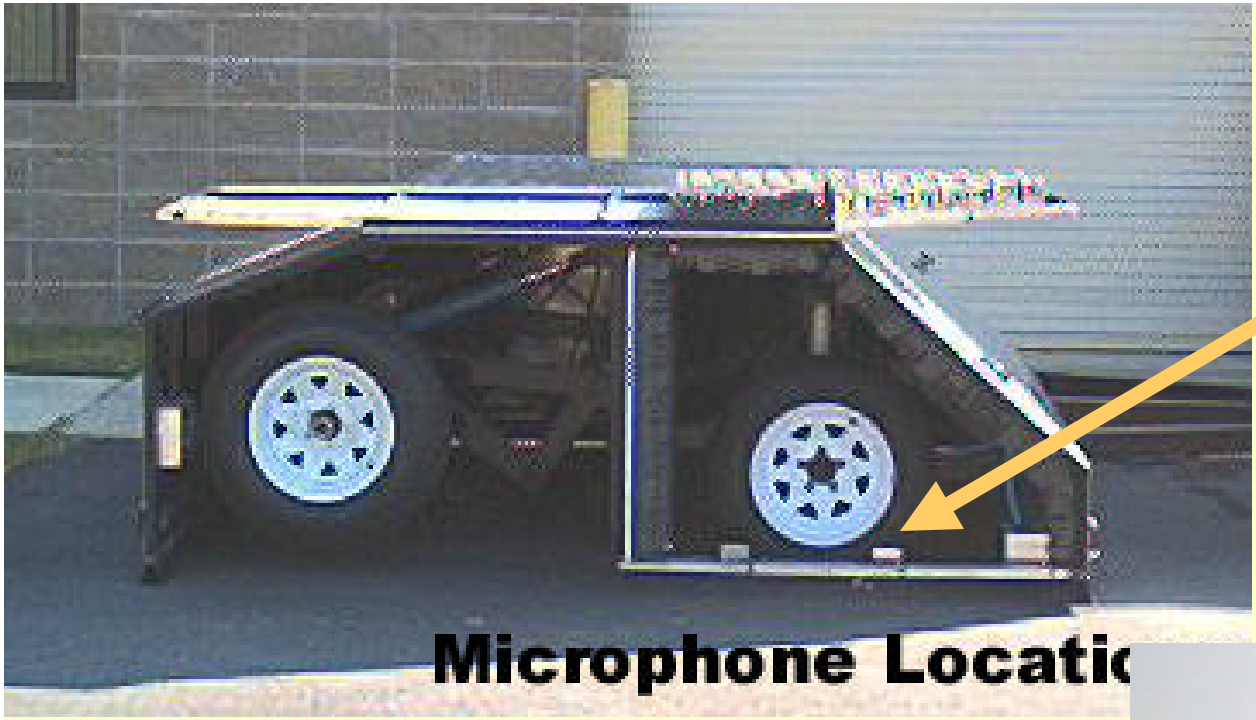
Goodyear Noise Trailer



ISO 11819-2

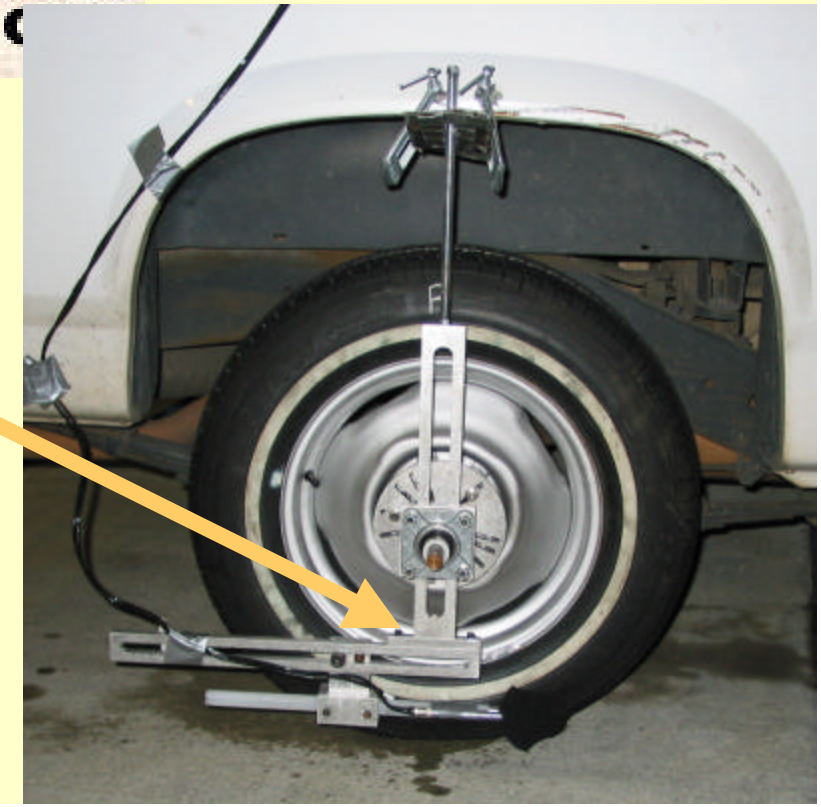

c:\eget\winword\jurek\micr_ed_new.doc
'Front' optional microphone
'Front' mandatory microphone
'Rear' mandatory microphone
'Rear' optional microphone
h = 8 in
h = 4 in
h = 8 in
h = 4 in
'Middle' optional microphone
d_2 = 25 in
d_2 = 25 in
'Front' optional microphone
TIRE SEEN FROM ABOVE
'Rear' optional microphone
45°
135°
Plane of undeflected sidewall
d_3
d_3
d_1 = 8 in
d_2 = 8 in
d_2 = 8 in mm
'Front' mandatory microphone
'Middle' optional microphone
'Rear' mandatory microphone
From ISO STANDARD 11819-2

NCAT Close Proximity Noise Trailer



Sound Pressure Microphones

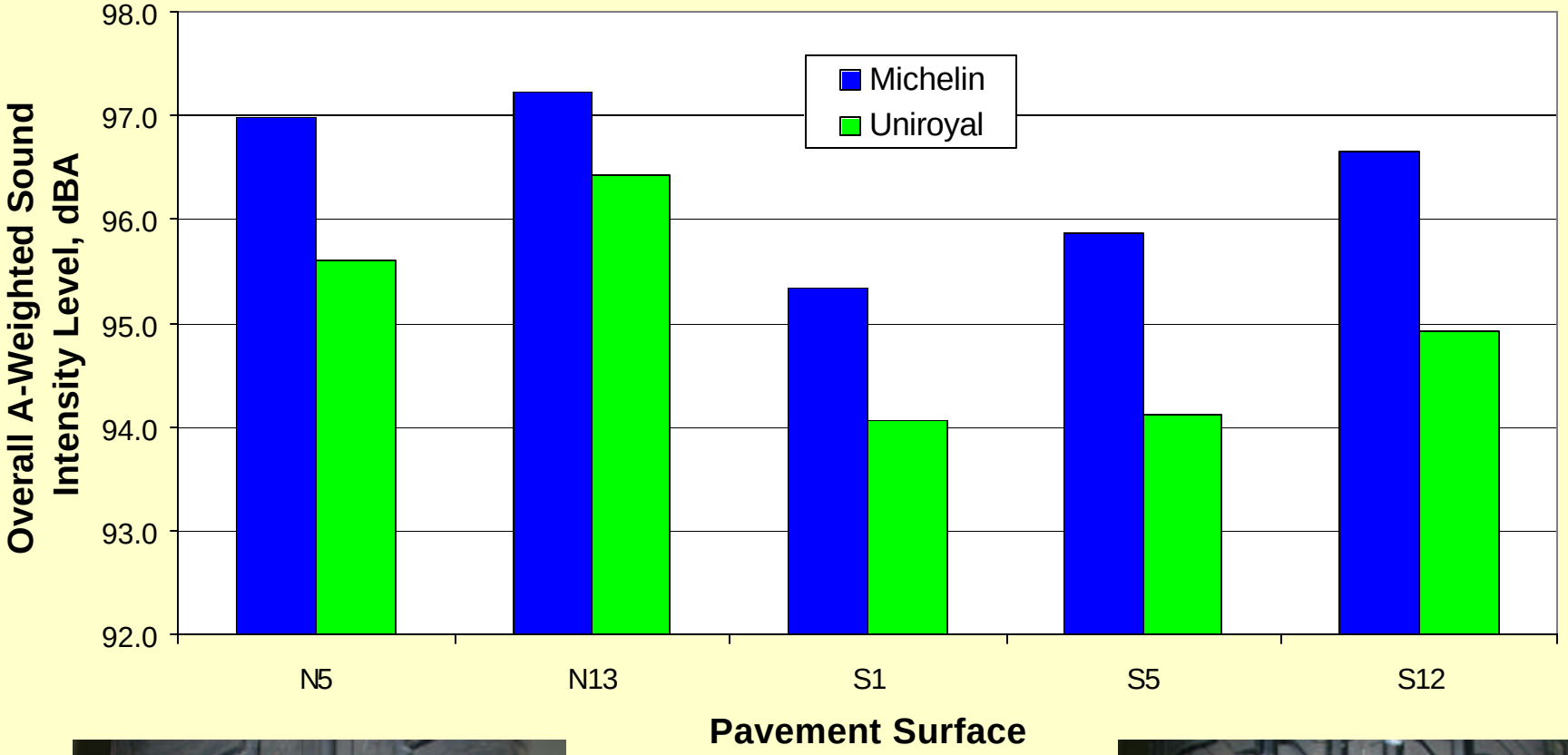
Sound Intensity Microphones



Issues

- **Tire type**
- **Speed for testing**
- **Relationship between CPX & side-line measurements**
- **Relationship between sound-intensity and sound-pressure measurements**

Overall Comparison of Pavements & Tires

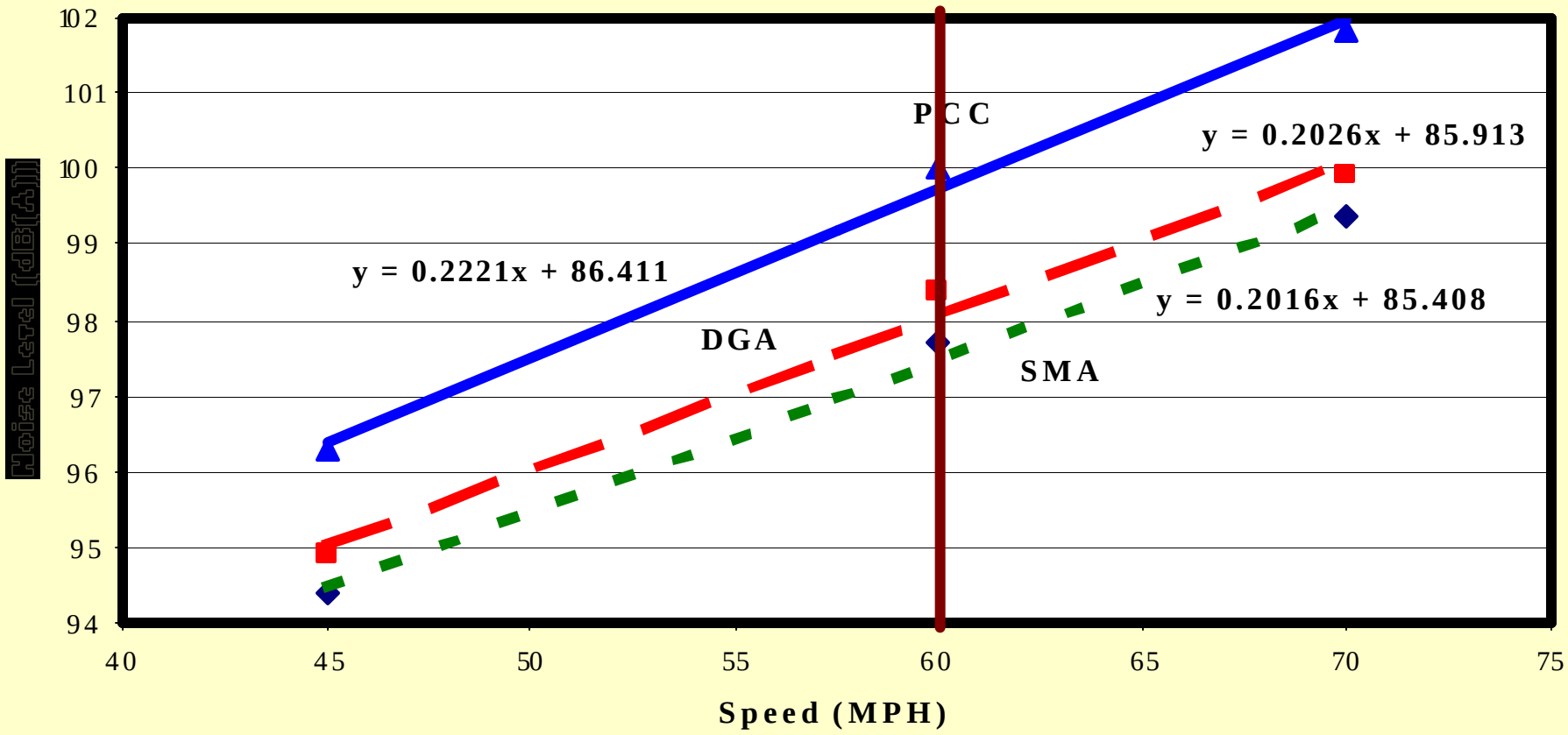


Michelin

About 1.5 dB difference

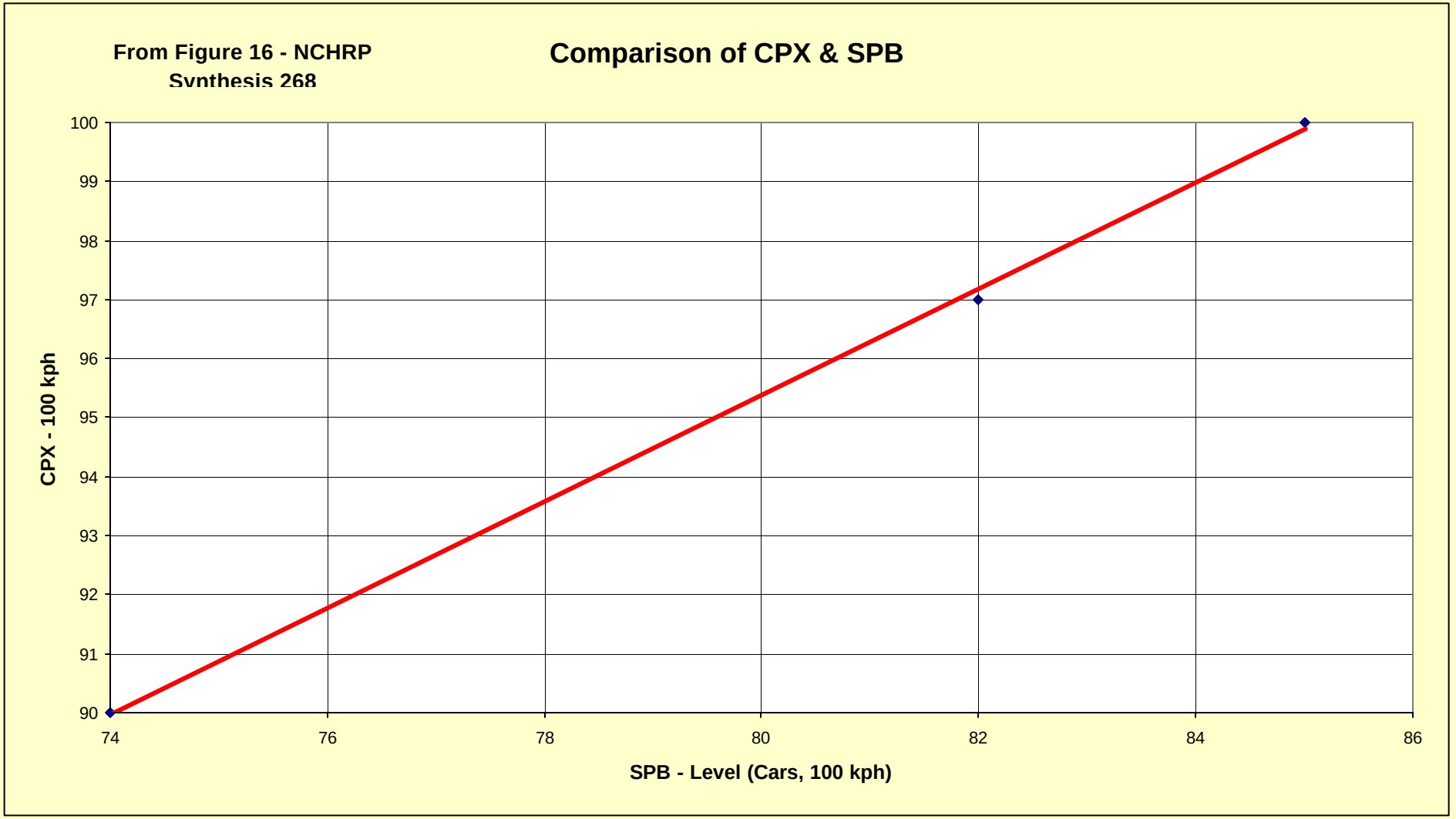
For these tires

UniRoyal



As speed increases so does noise levels

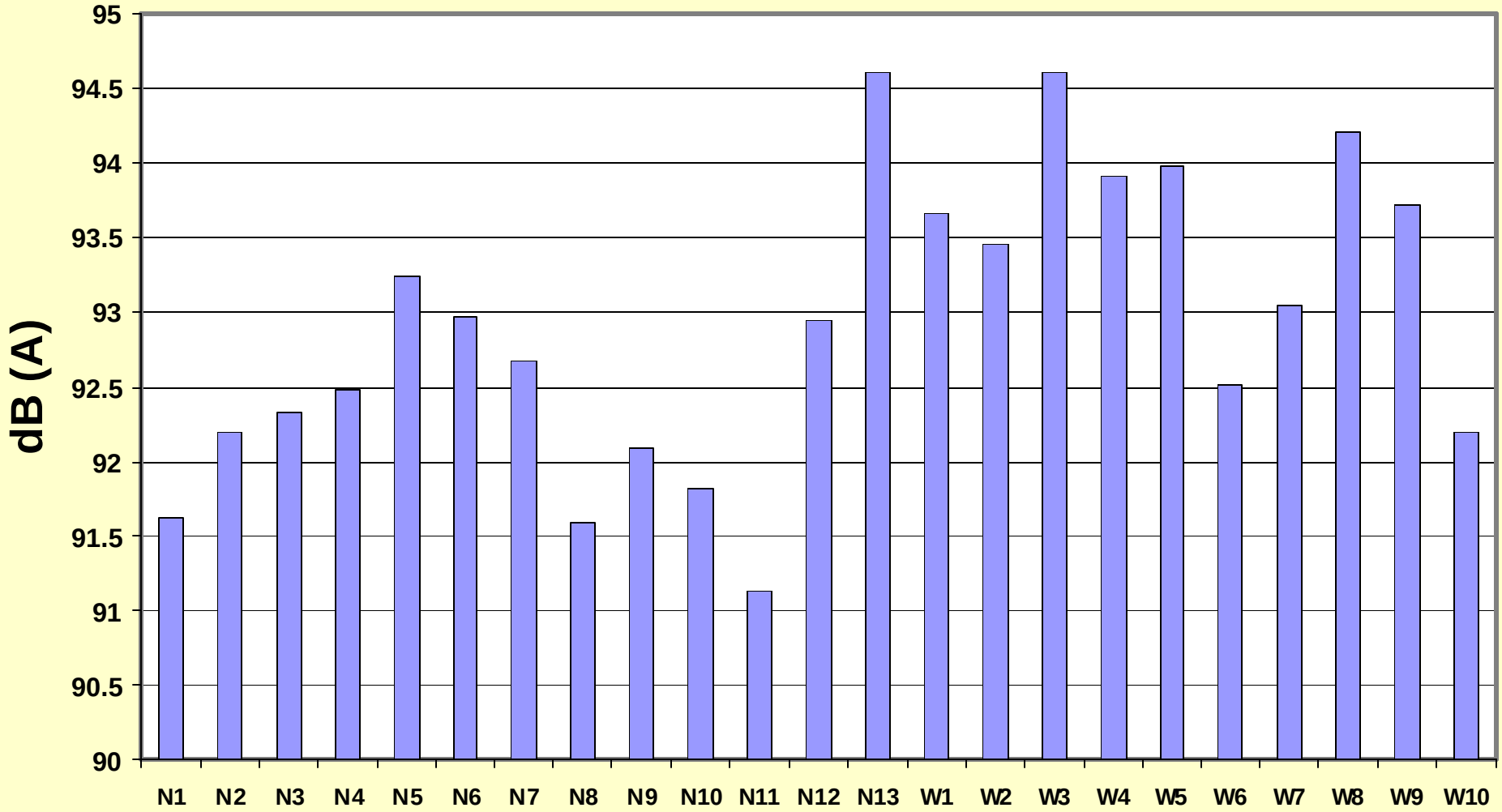
From Figure 16 - NCHRP Synthesis 268



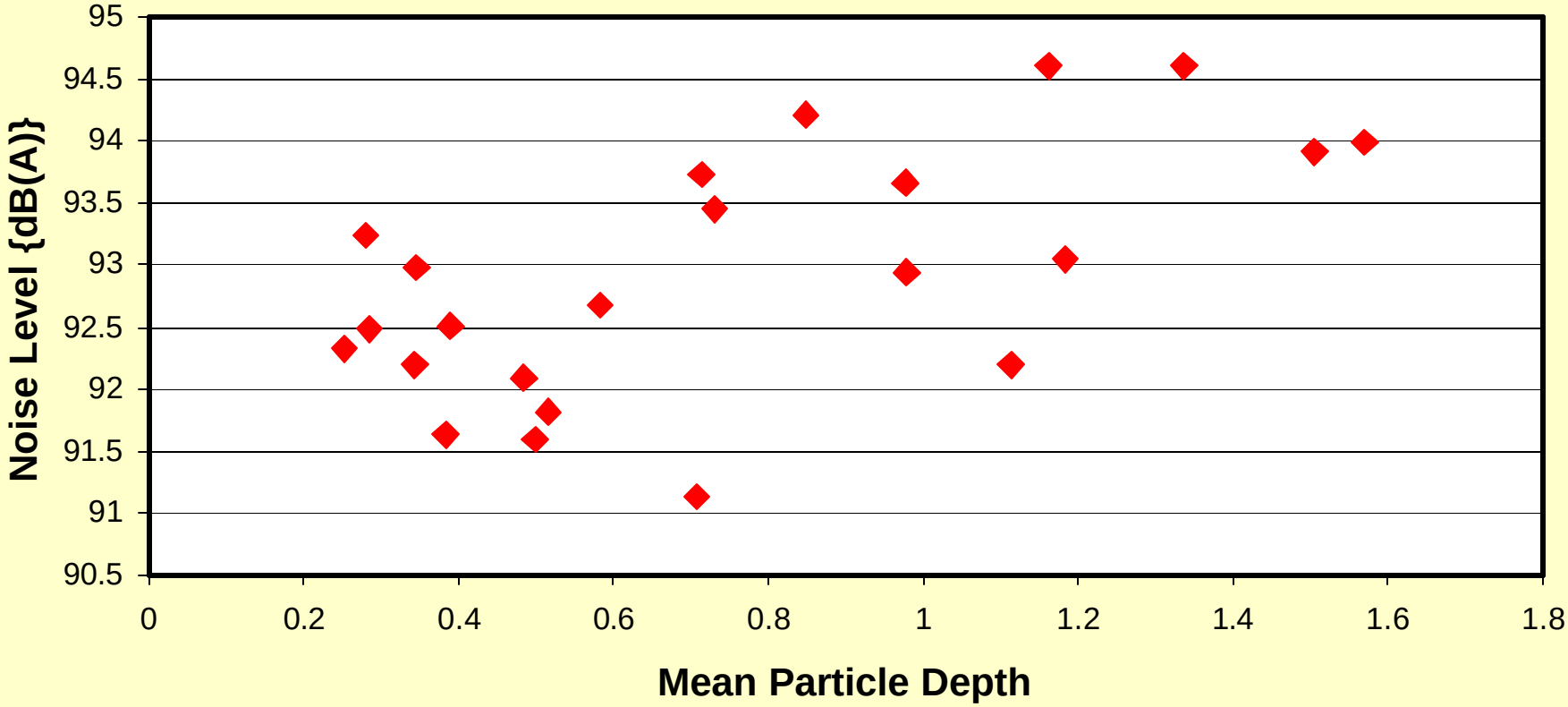
CPX is about 15 dB(A) higher than SPB

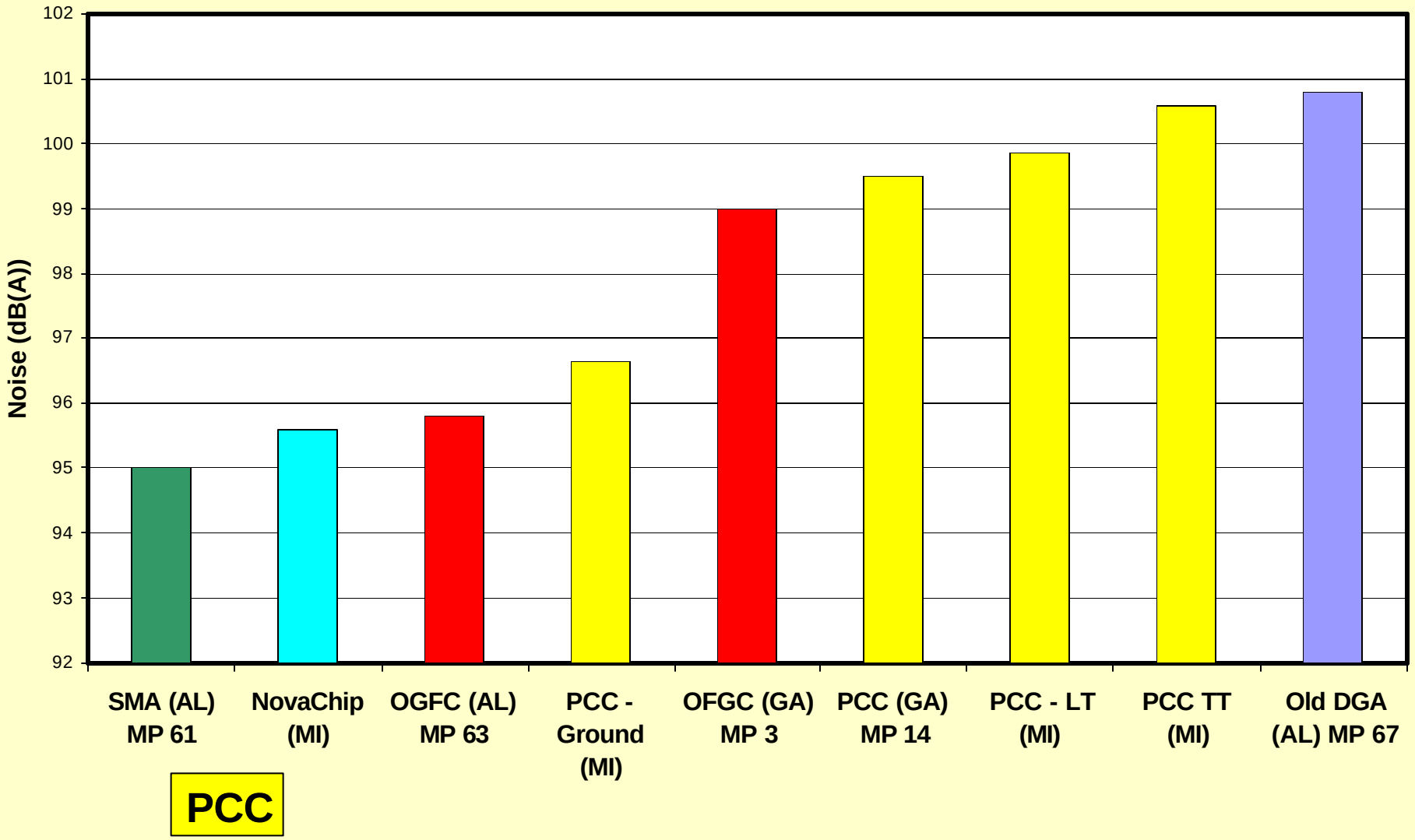
Test Data

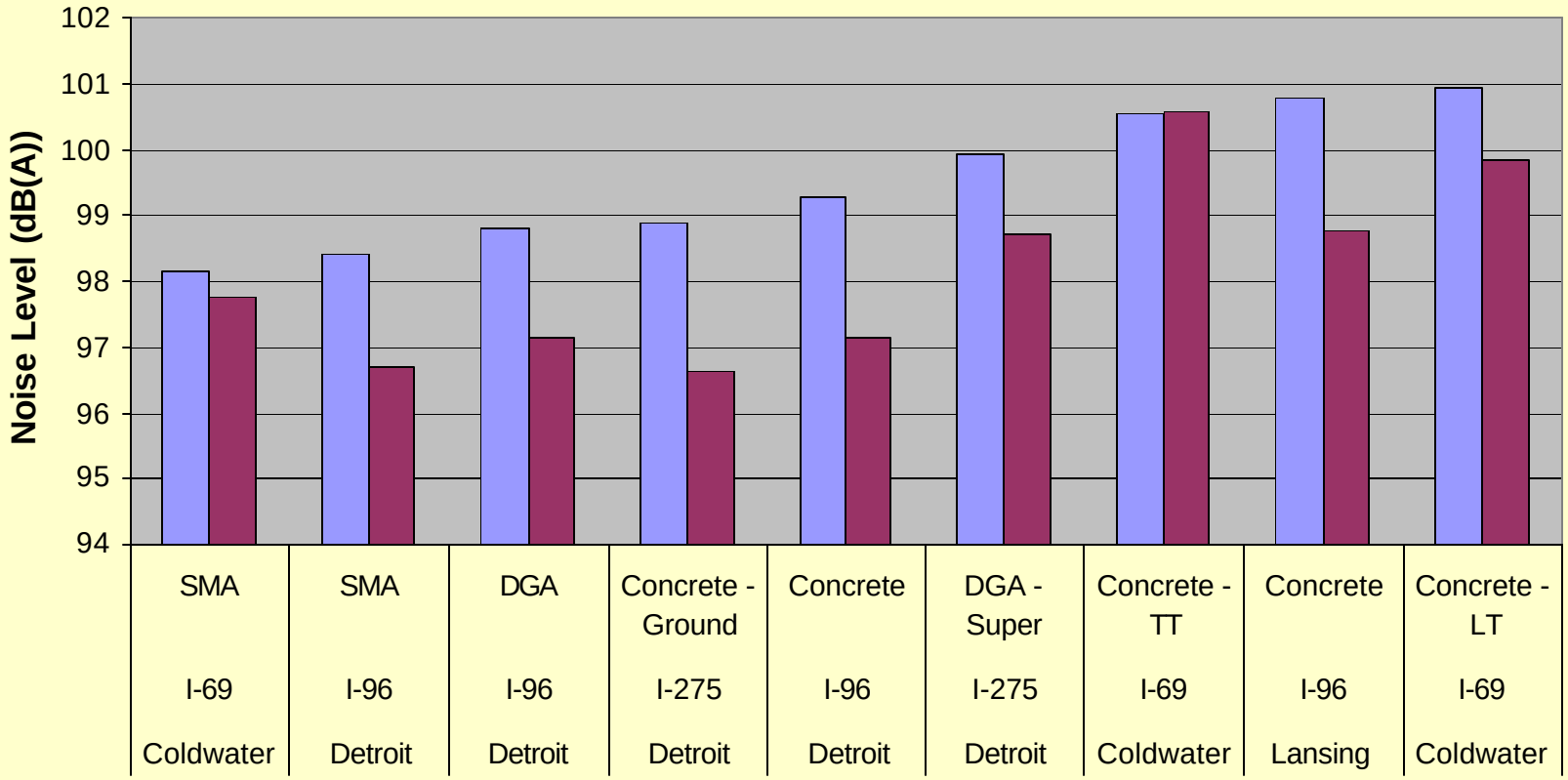
Test Track


dB (A)
95
94.5
94
93.5
93
92.5
92
91.5
91
90.5
90
N1
N2
N3
N4
N5
N6
N7
N8
N9
N10
N11
N12
N13
W1
W2
W3
W4
W5
W6
W7
W8
W9
W10

Noise vs Pavement Texture




Noise (dB(A))
102
101
100
99
98
97
96
95
94
93
92
SMA (AL) MP 61
NovaChip (MI)
OGFC (AL) MP 63
PCC - Ground (MI)
OFGC (GA) MP 3
PCC (GA) MP 14
PCC - LT (MI)
PCC TT (MI)
Old DGA (AL) MP 67
PCC


Noise Level (dB(A))
102
101
100
99
98
97
96
95
94
SMA
I-69
Coldwater
SMA
I-96
Detroit
DGA
I-96
Detroit
Concrete - Ground
I-275
Detroit
Concrete
I-96
Detroit
DGA - Super
I-275
Detroit
Concrete - TT
I-69
Coldwater
Concrete
I-96
Lansing
Concrete - LT
I-69
Coldwater
Pavement Type
MasterCraft
UniRoyal


97.9
UniRoyal


99.4
MasterCraft

QUESTIONS ?