Informal document No. **GRB-47-06**
(47th GRB, 19-21 February 2008,
agenda item 8.)

# US Pavement Noise Research

47th GRB, February 2008

# Background

- US Pavement research has focused on building the necessary tools and knowledge to allow pavements to be designed and constructed for reduced noise.
- With this knowledge, pavements can be part of the environmental toolbox and policy options of road authorities to provide environmental benefits.
- US road authorities are using quiet pavement for noise abatement today and research continues to improve technology and compliment other global pavement noise research
- The results presented are the work of Dr. Robert Rasmussen and Dr. Paul Donavan under contract to the US Federal Highway Administration (FHWA) and various US State departments of Transportation (DOT).

# Overview

- Motivation
- Research Tools
- Pavement Noise Results
- Implications to Real Traffic Noise

# Motivation

- In the US, various state Departments of Transportation (DOT) desire to use pavement as noise mitigation tool.
  - Federal policy requires proven performance of mitigation tools for funding.
  - Current low noise pavement projects need to quantify and certify acoustic performance.
- Understanding of noise performance of pavements:
  - dB=***f*** (*texture, age, wear, design, construction, etc*.)
- Need measurement techniques and apparatus useful in field work.

# Research Tools

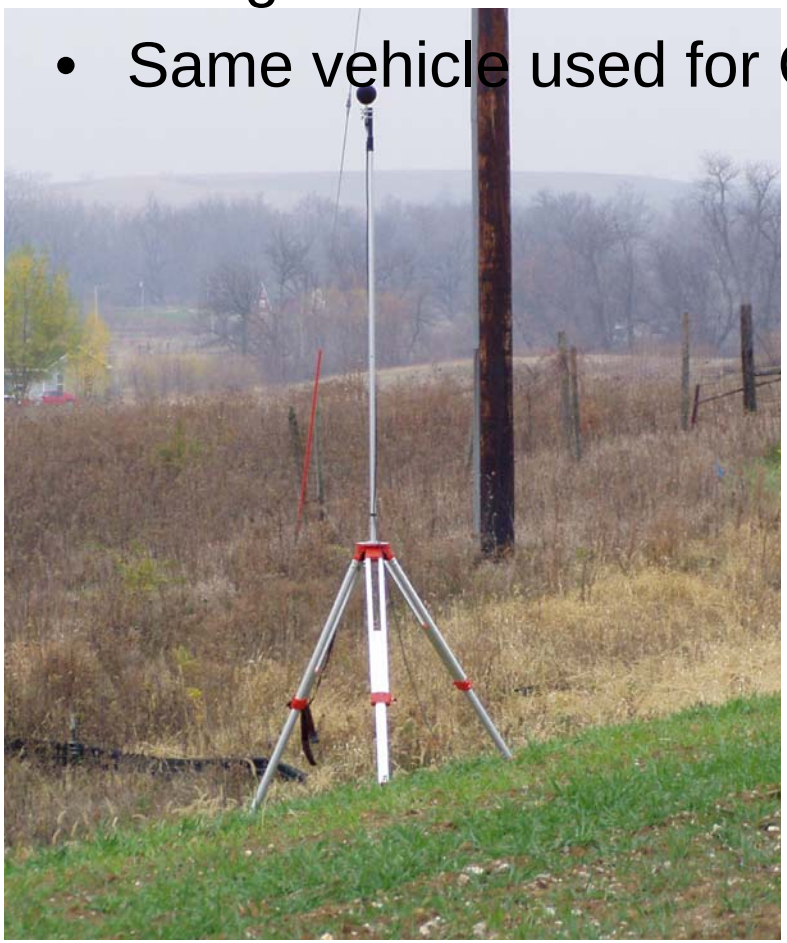
- On-board Tire / Road Noise Measurement
- Roadside (traffic) Noise Measurement
- Road Texture Measurement
- Road Friction Measurement
- US Research Projects
  - NCHRP 1-44: On vehicle tire/road noise measurement
  - NCHRP 8-56: Truck noise source identification
  - NCHRP 10-76: Methodologies for assessing pavement and barriers for noise abatement

# Noise Testing: OBSI

- On-Board Sound Intensity (OBSI)
- Standardization underway via AASHTO and SAE

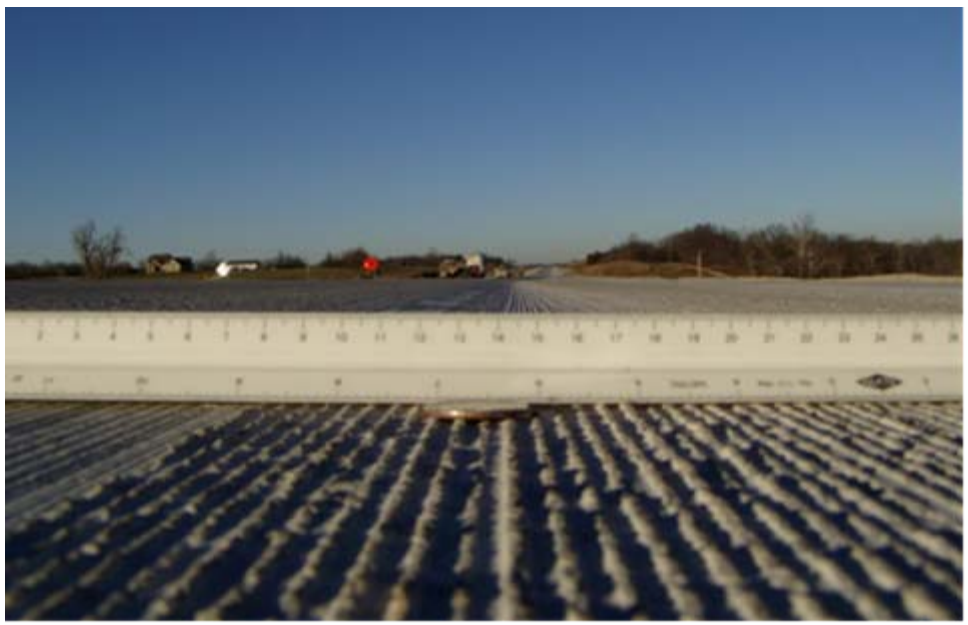
# Noise Testing: Wayside

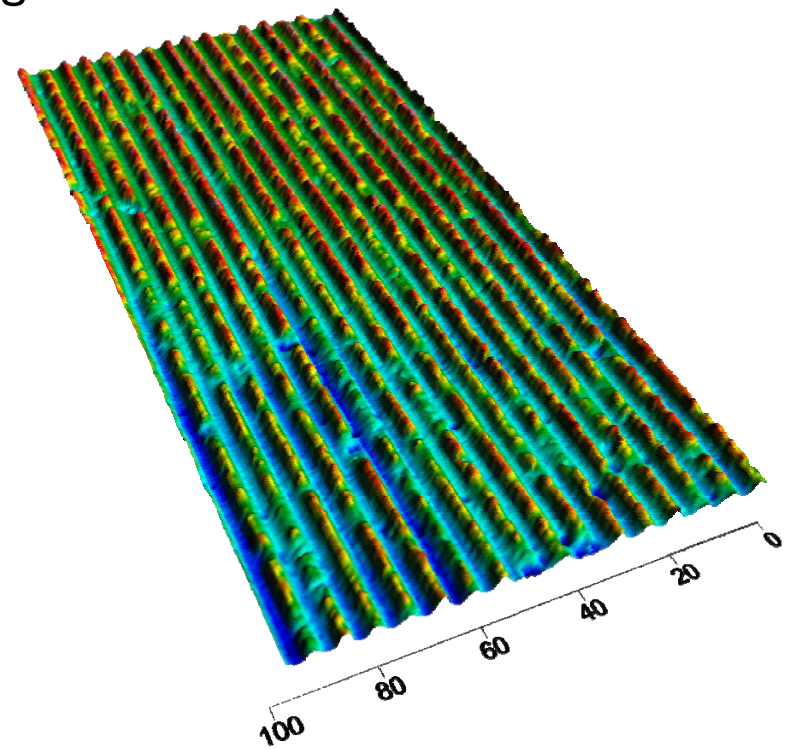
- Controlled pass-by (CPB) measures noise “roadside” using test vehicle under controlled conditions
- Same vehicle used for OBSI and CPB noise testing



# Texture Testing: RoboTex

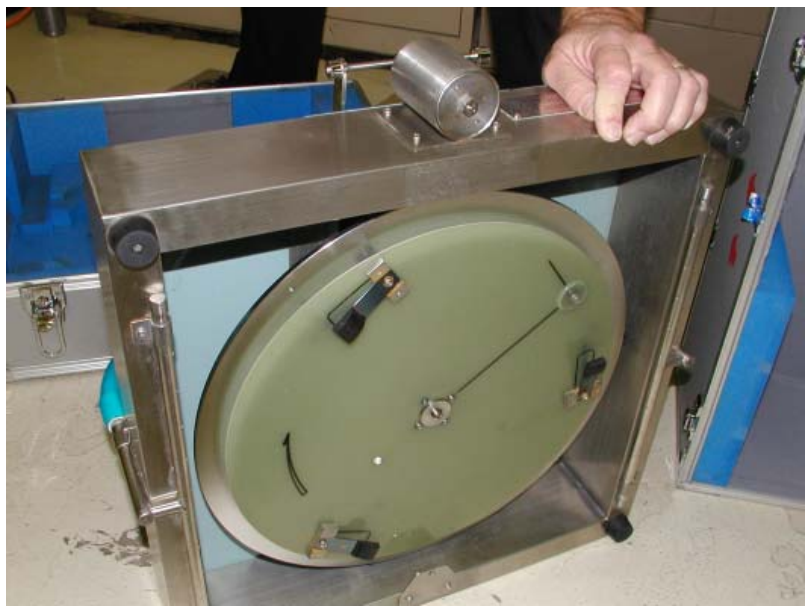
- Robotic Texture (RoboTex) Measurement System
- Built on LMI-Selcom RoLine sensor
- 3-D texture profiling at 1 mm × 0.5 mm sample interval
- Height sensor resolution is 0.01 mm (accuracy ~ 0.05 mm)
- Same line laser sensor currently being used by some profiler vendors to help solve “footprint” issues





# Friction Testing: Skid Trailer and DFT

- Measures wet friction
- Smooth tire allows on trailer to account for micro- and macrotexture effects on friction
- Standardized in ASTM E 274 (ASTM E 524 tire) and ASTM E 1911



# OBSI Noise Catalog

**Aquatred**

- Diamond Grinding
- Drag
- Longitudinal Tining
- Transverse Tining
- Longitudinal Grooving
- Transverse Grooving
- Exposed Aggregate
- Shot Peened
- Other

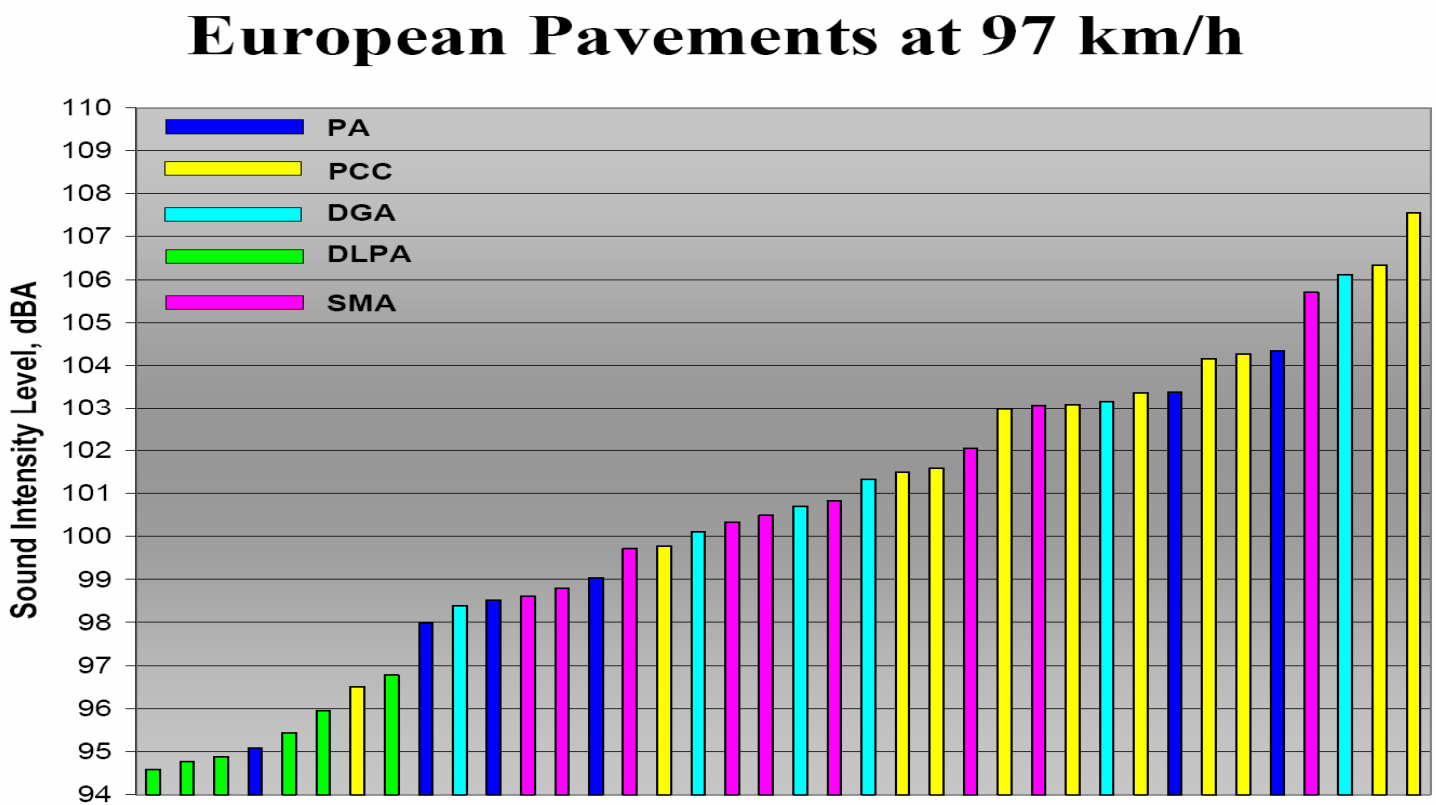
Average OBSI Level and Variability(44-ft Avg, PWL=95%) (dBA)

113
112
111
110
109
108
107
106
105
104
103
102
101
100

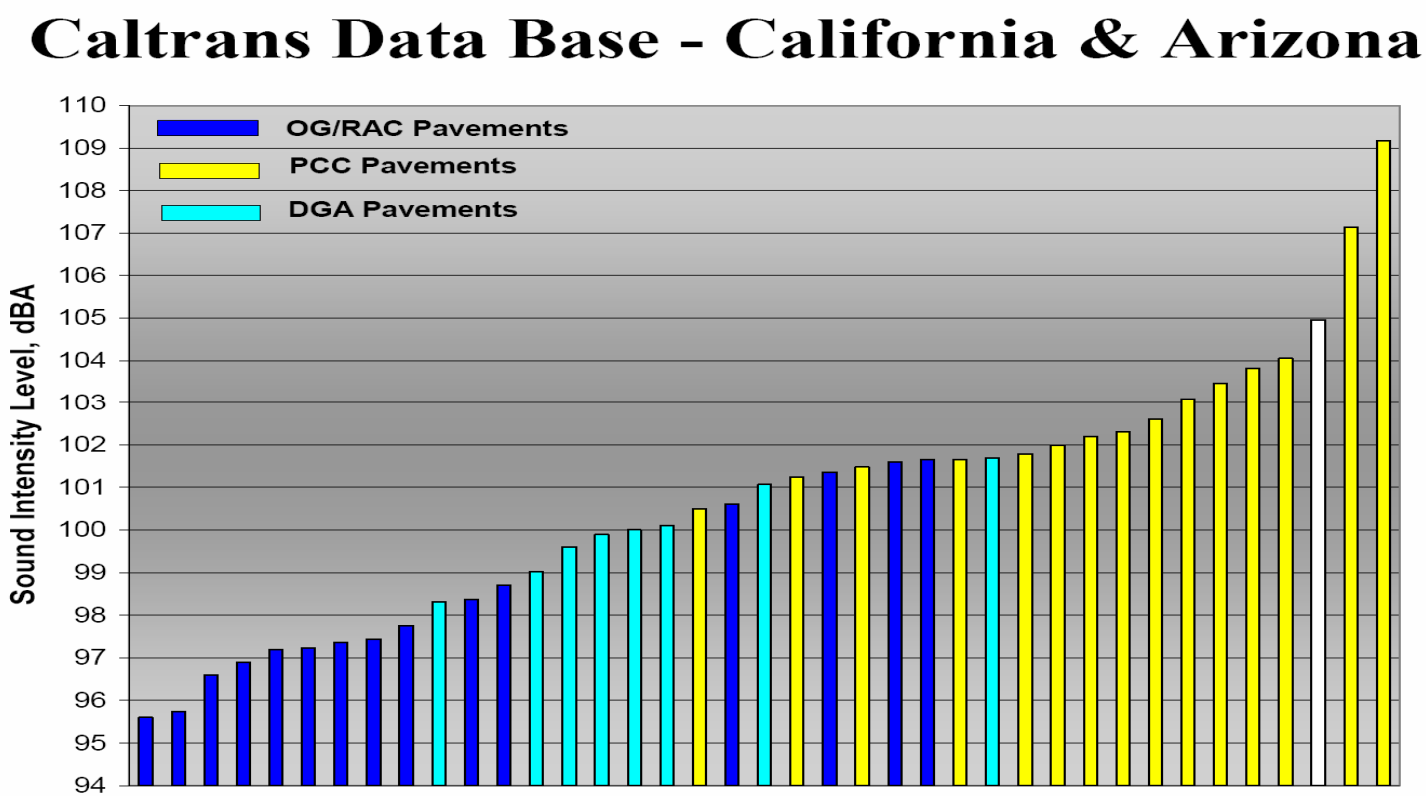
Nominal Texture

**Full Range of Concrete Pavements 100 to 111 dB**

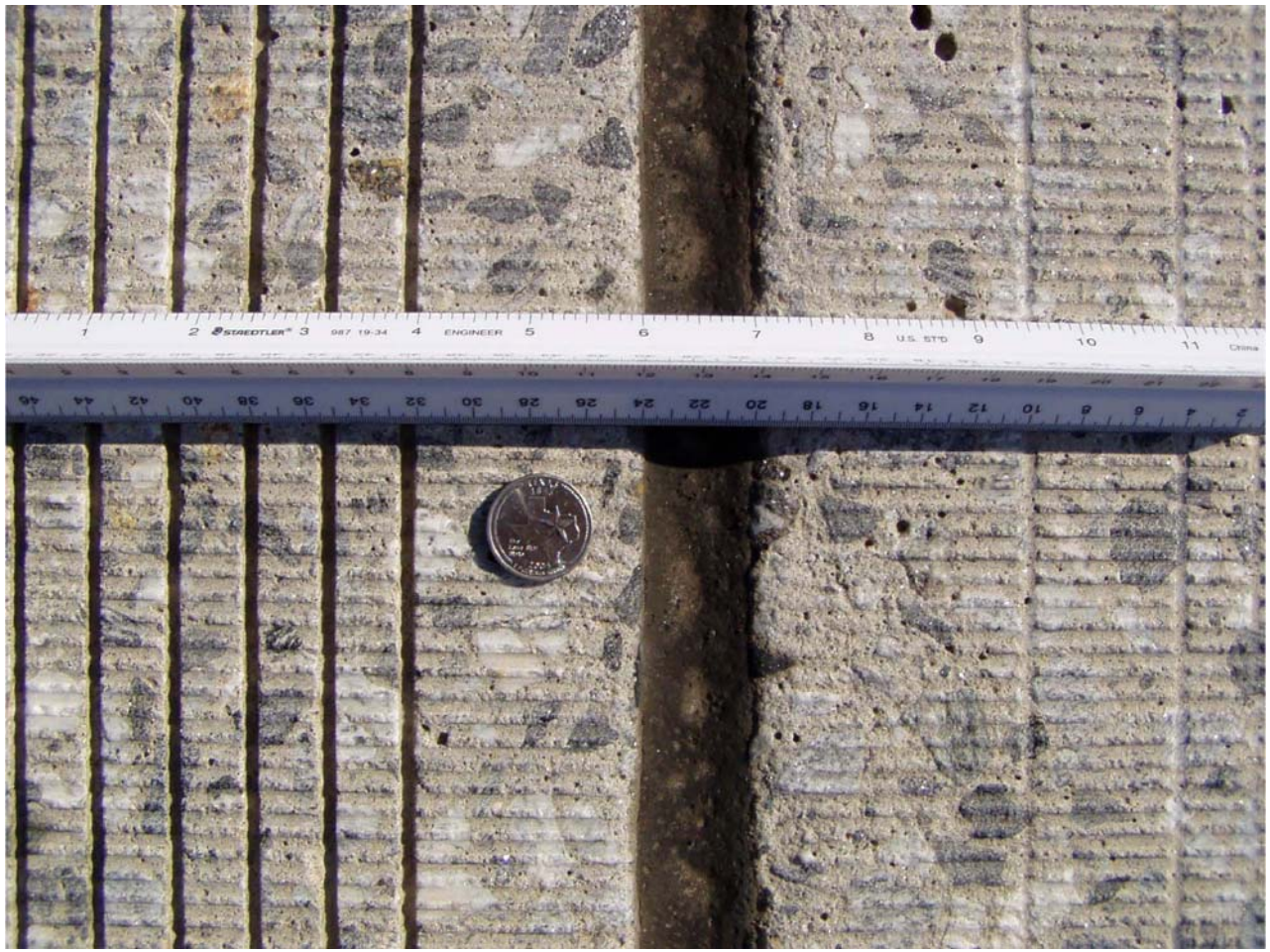
# European Asphalt Pavements



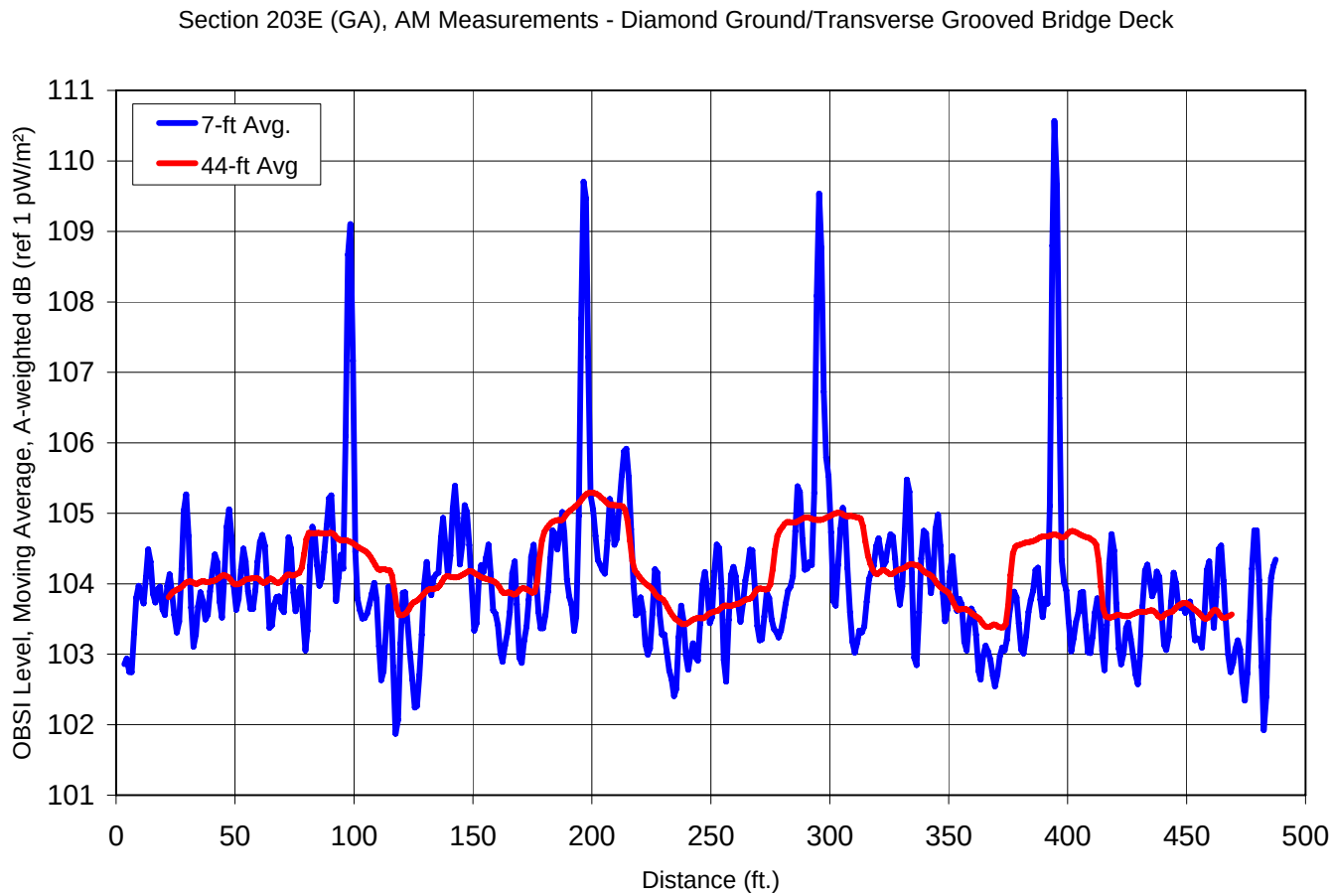
# US Asphalt Pavements



# Construction Quality – “Joint Slap”



# Measurement of “Joint Slap”



# www.SurfaceCharacteristics.com

CPSCT Blog - Mozilla Firefox

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http://www.surfacecharacteristics.com/

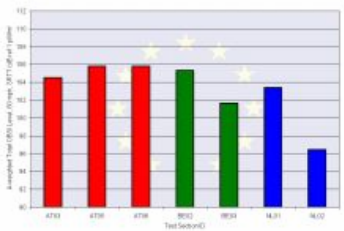
## Hearing is Believing

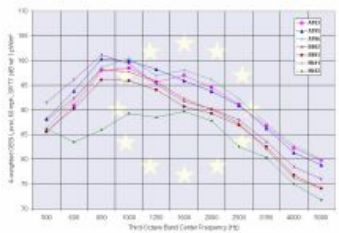
Submitted by RobRasmussen on Wed, 11/07/2007 - 12:26.

With a number of comments received so far on the posts from the European testing being conducted by the National CP Tech Center, it seemed appropriate to fulfill another (quite logical) human sense... hearing.

From the results posted so far, 7 sound clips have been prepared to form a "listening experience" of some of the European pavements: 3 from Austria, 2 from Belgium, and 2 from the Netherlands.

Total OBSI levels and corresponding third-octave spectra from these sections are summarized together below (click on either image to expand):



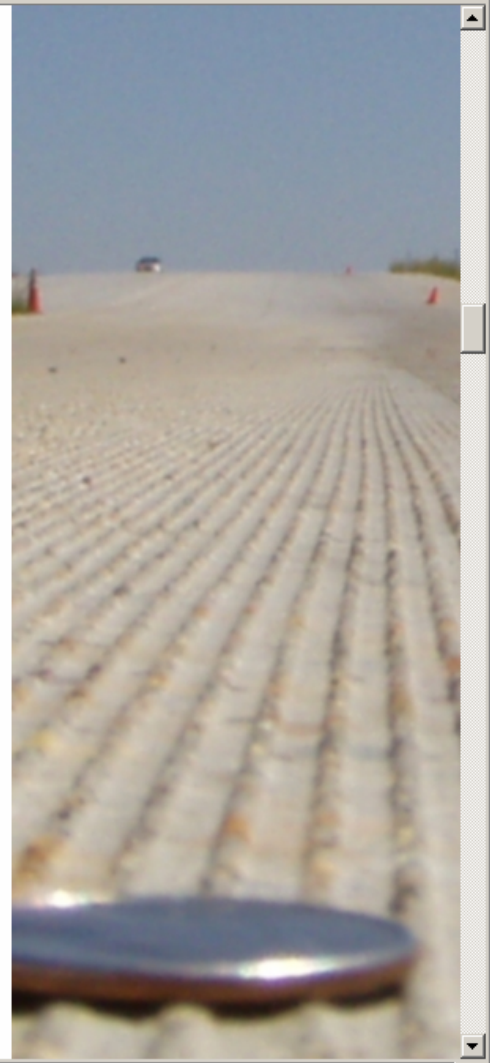


Each sound clip was prepared by sampling approximately 5 seconds of OBSI data. The left channel (ear) is a measurement taken near the leading edge (front) of the test tire. The right ear will hear a measurement from the trailing edge (rear) of the tire. Some filtering has been performed to better reproduce the sound as one might hear it at these locations (and still minimizing the effect of wind noise).

To listen to these sound clips, simply click on the following links. If they do not play, you might need to download them first, and play them seperately.

File AT03.mp3 (Austria, 8 mm Exposed Aggregate, 7 yrs old)

File AT05.mp3 (Austria, 11mm Exposed Aggregate, 6 yrs old)



Done

# Implications to Real Traffic Noise

- Pavements are an important part of the traffic noise system.
  - This includes vehicles, traffic management, land use planning, and enforcement.
- Pavement range of 15-18 dB.
  - Pavement information is necessary to make good policy decisions.

# Thank You

- Questions?

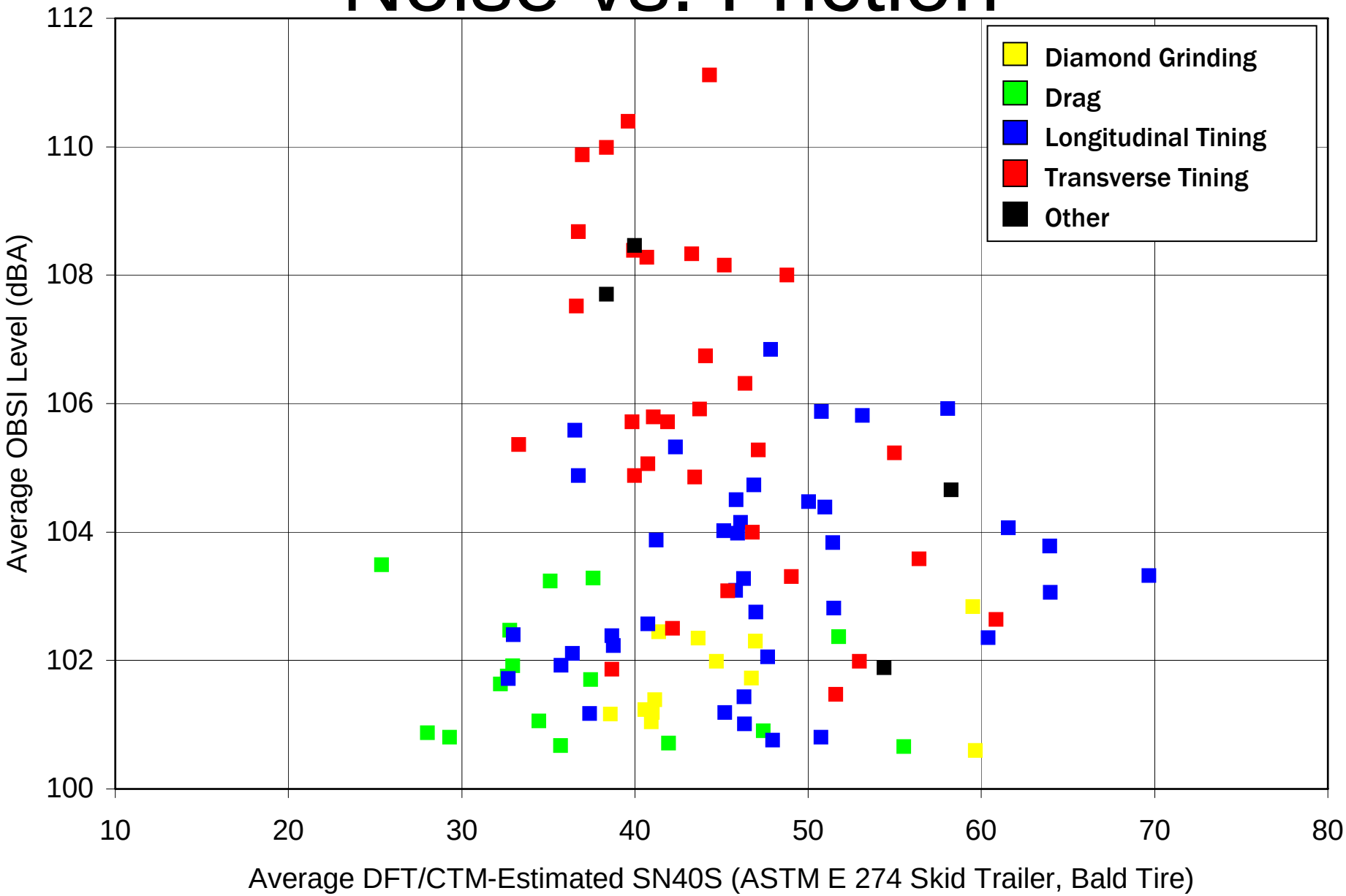
# Background Information

# Background

## Nomenclature

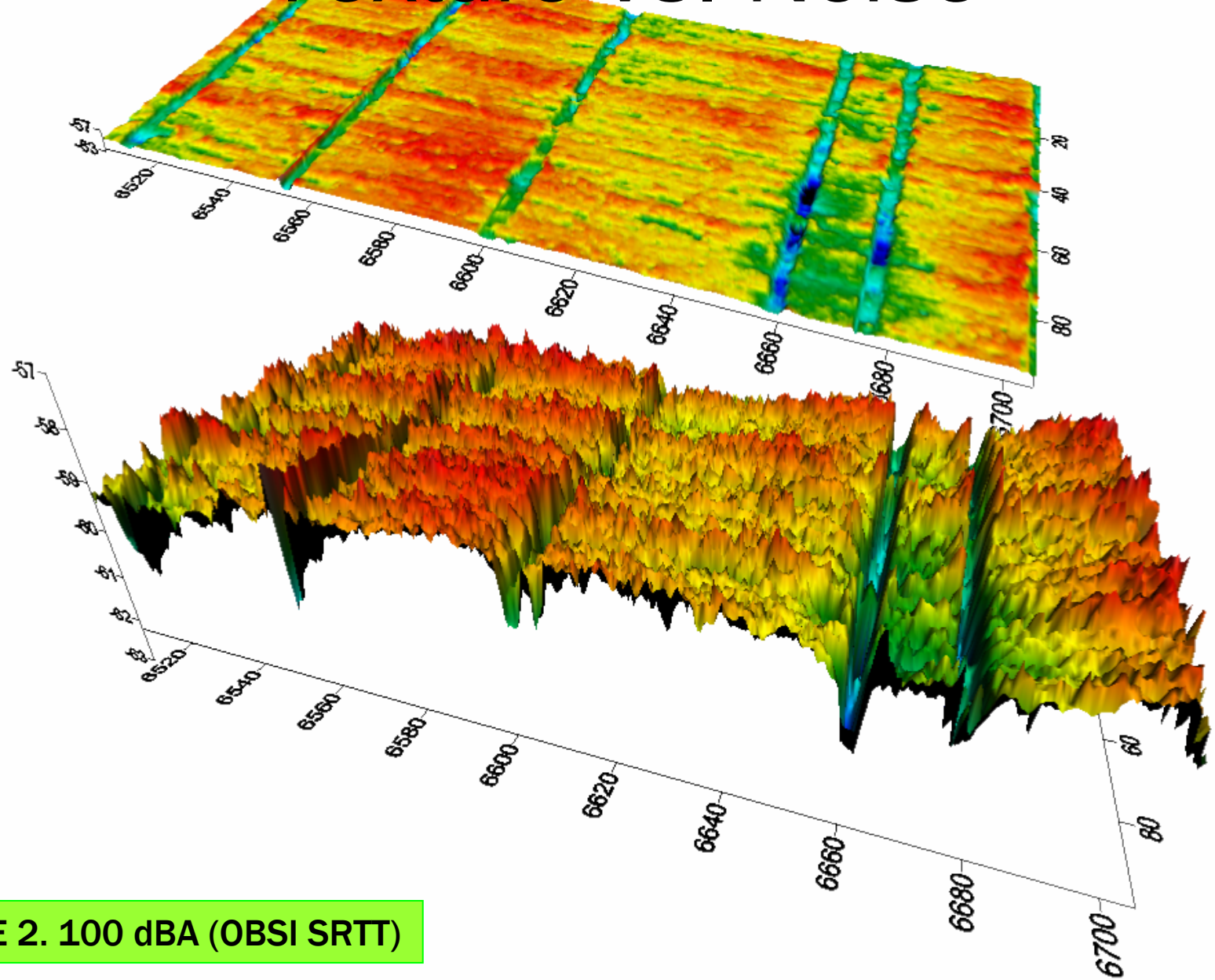
- PCC – Portland Cement Concrete
- DGA – Dense Graded Asphalt (non-porous)
- OGAC/RAC – Open Graded/Rubber Asphalt
- PA – Porous Asphalt
- DLPA – Double Layer Porous Asphalt
- SMA – Stone Mastic (Matrix) Asphalt

# Noise vs. Friction



1/8" Deep Random
Transverse Tining

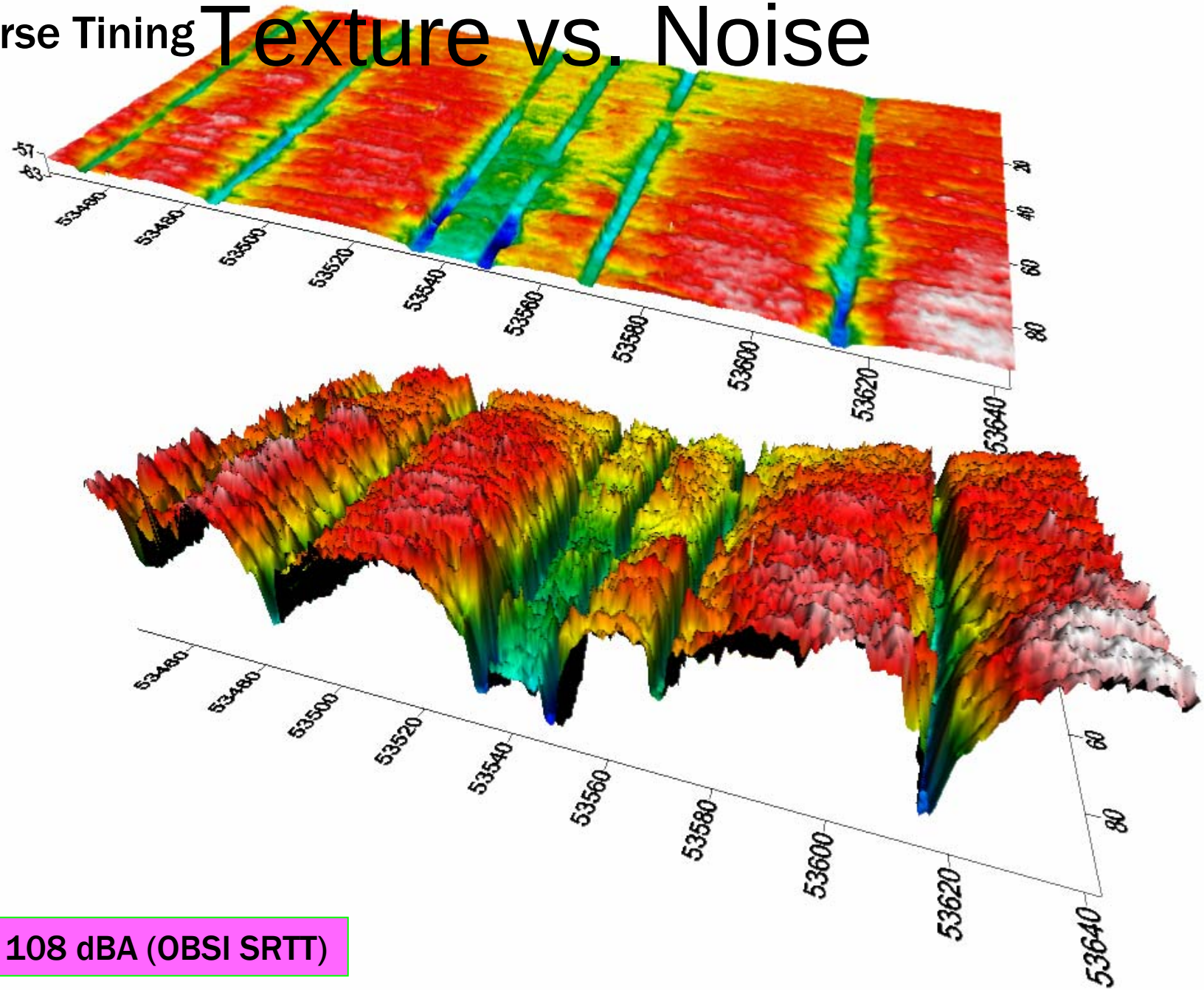
# Texture vs. Noise



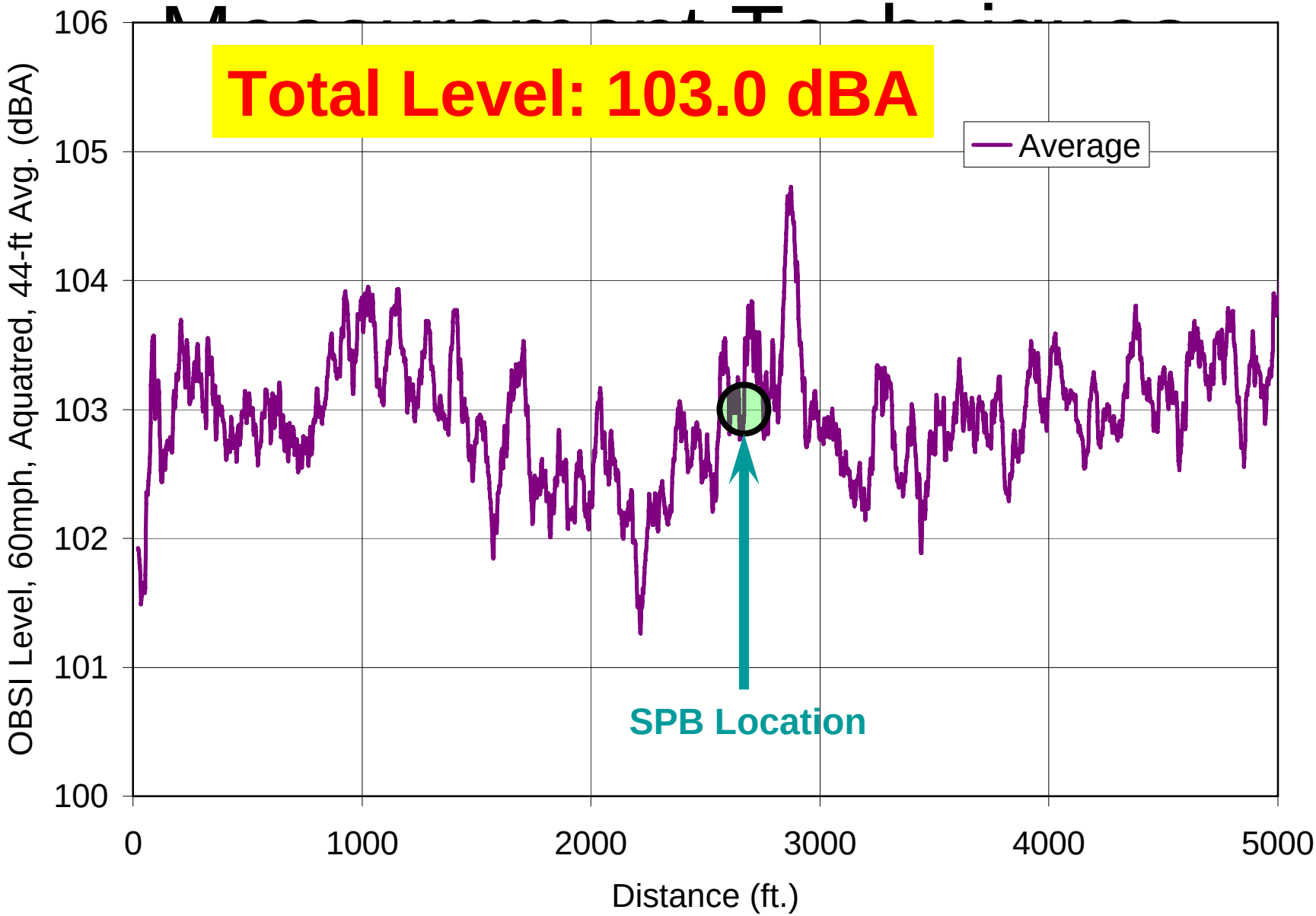

ZONE 2. 100 dBA (OBSI SRTT)

1/8" Deep Random
Transverse Tining

# Texture vs. Noise

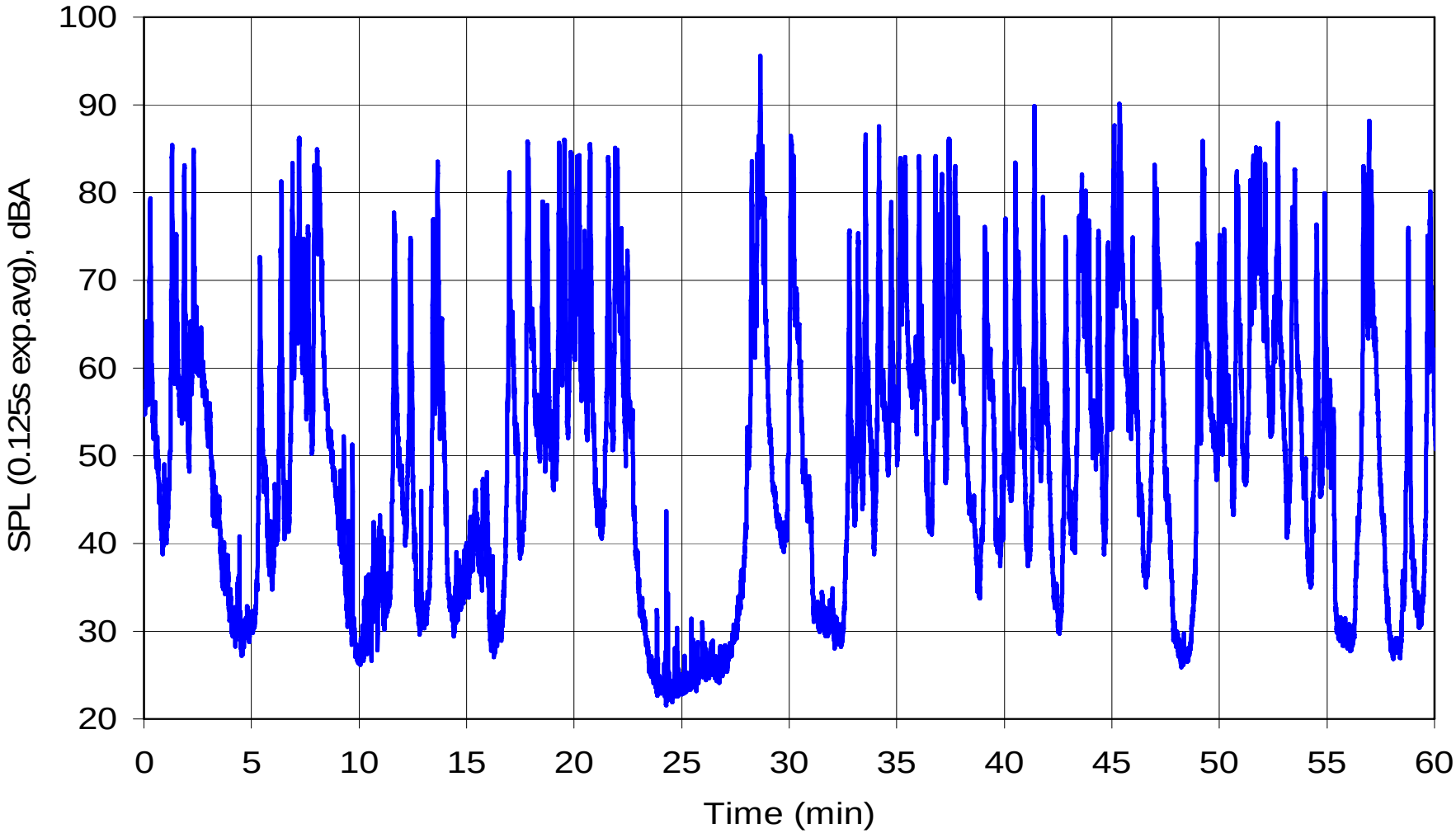



ZONE 3. 108 dBA (OBSI SRTT)




# Near Field – OBSI

# Measurement Techniques




Wayside – SPB