



Improving Concrete Pavement Surface Characteristics

Pooled Fund TPF-5(139)

National Concrete Consortium
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Savannah, GA

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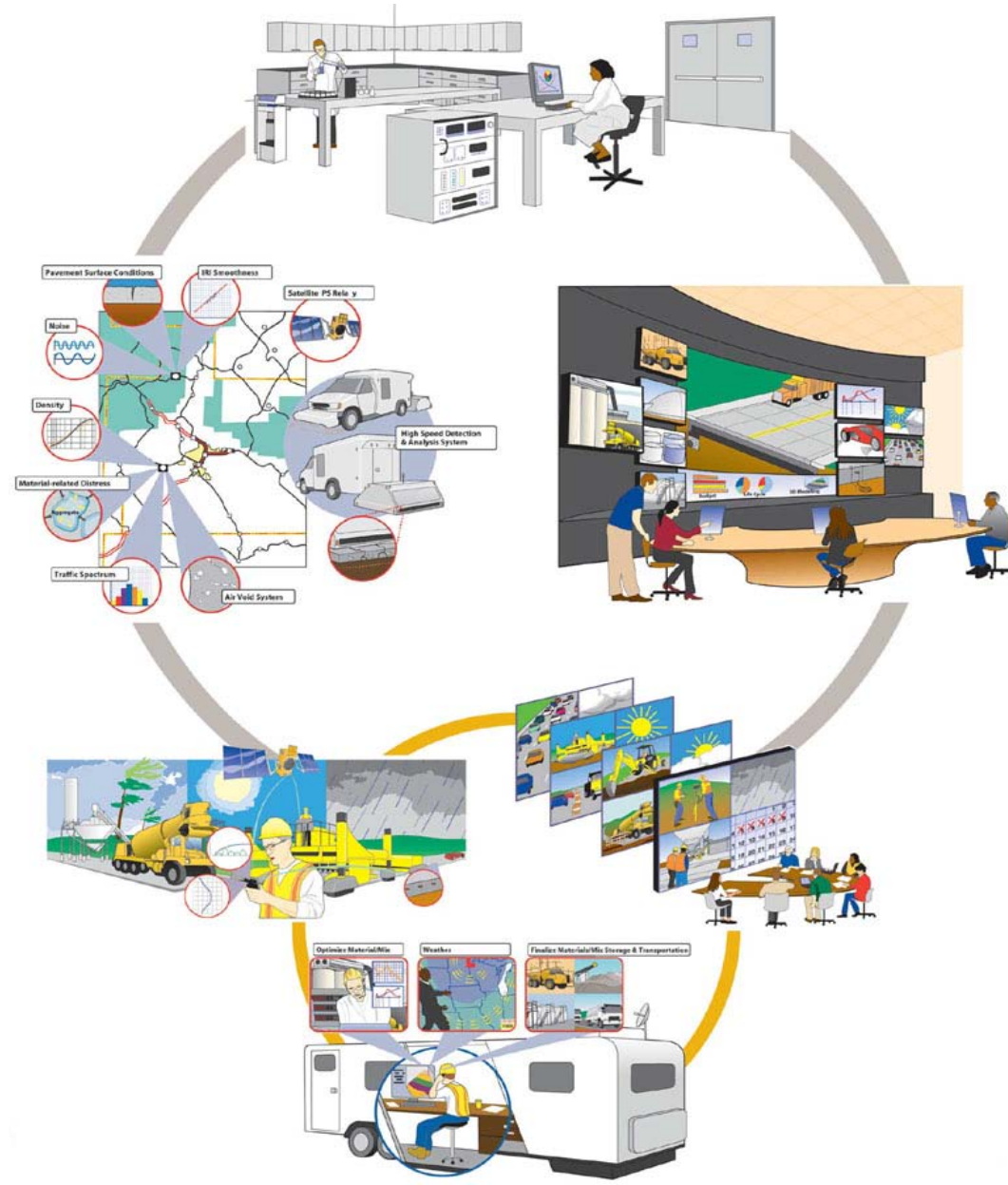
THE
TRANSTEC GROUP

National Concrete Pavement
Technology Center



Uniting agencies, industry, and researchers
to advance concrete pavement technology

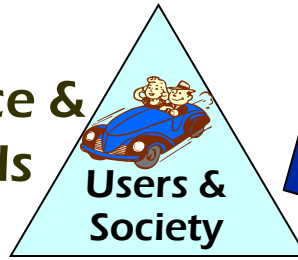
CP Road Map



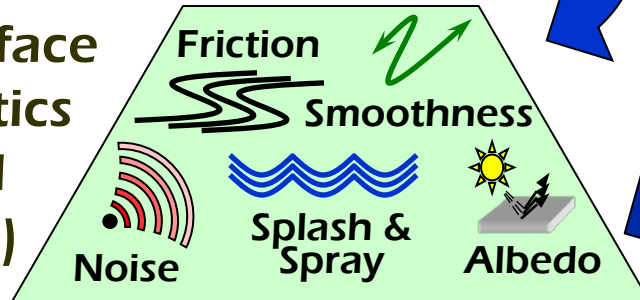
Surface
Characteristics
Track

Functional Performance

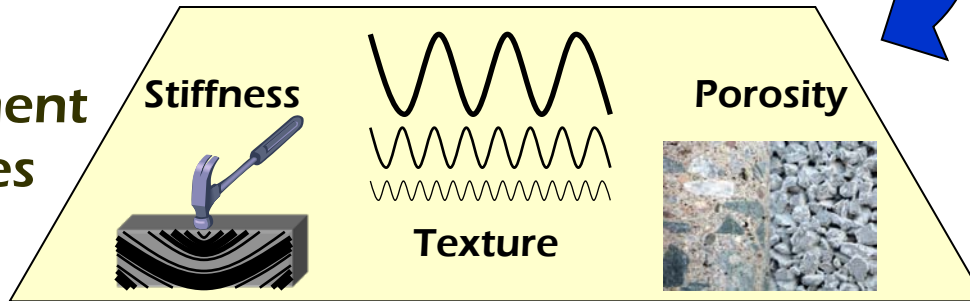
Human Experience & Societal Demands



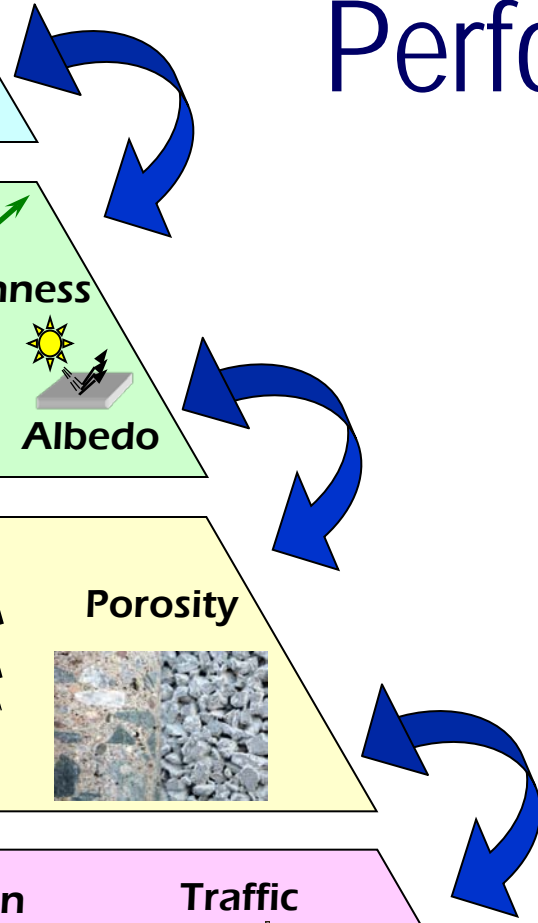
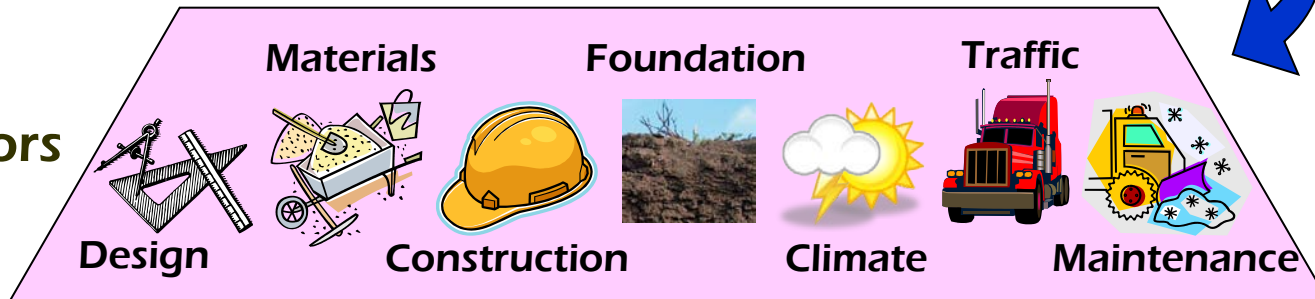
Pavement Surface Characteristics (Functional Performance)



Pavement Properties



Factors



**Before we get
started...**

2 key concepts!

Key Concept #1

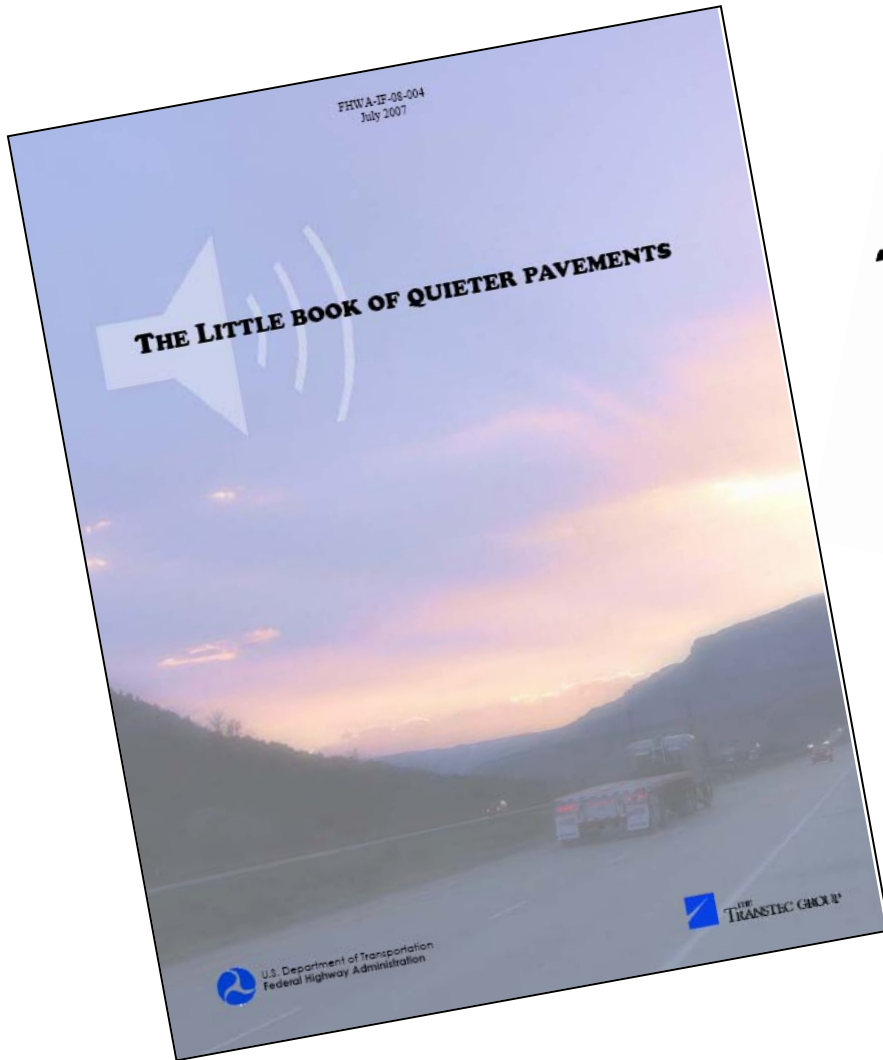
**Better practices to
improve surface properties
are really about establishing a
higher order of control
over the texture and other surface
properties.**

Key Concept #2

**It is not about designing or building
“innovative” surfaces,
but rather the control of
conventional texturing techniques.**

**What have we
learned in recent
years?**

First... some fundamentals



Tire-Pavement Noise 101



Download from

www.TCPSC.com/LittleBookQuieterPavements.pdf



3
Commandments

...for a Quieter Pavement



Thou shalt have Texture...

be it small and negative!

Bad

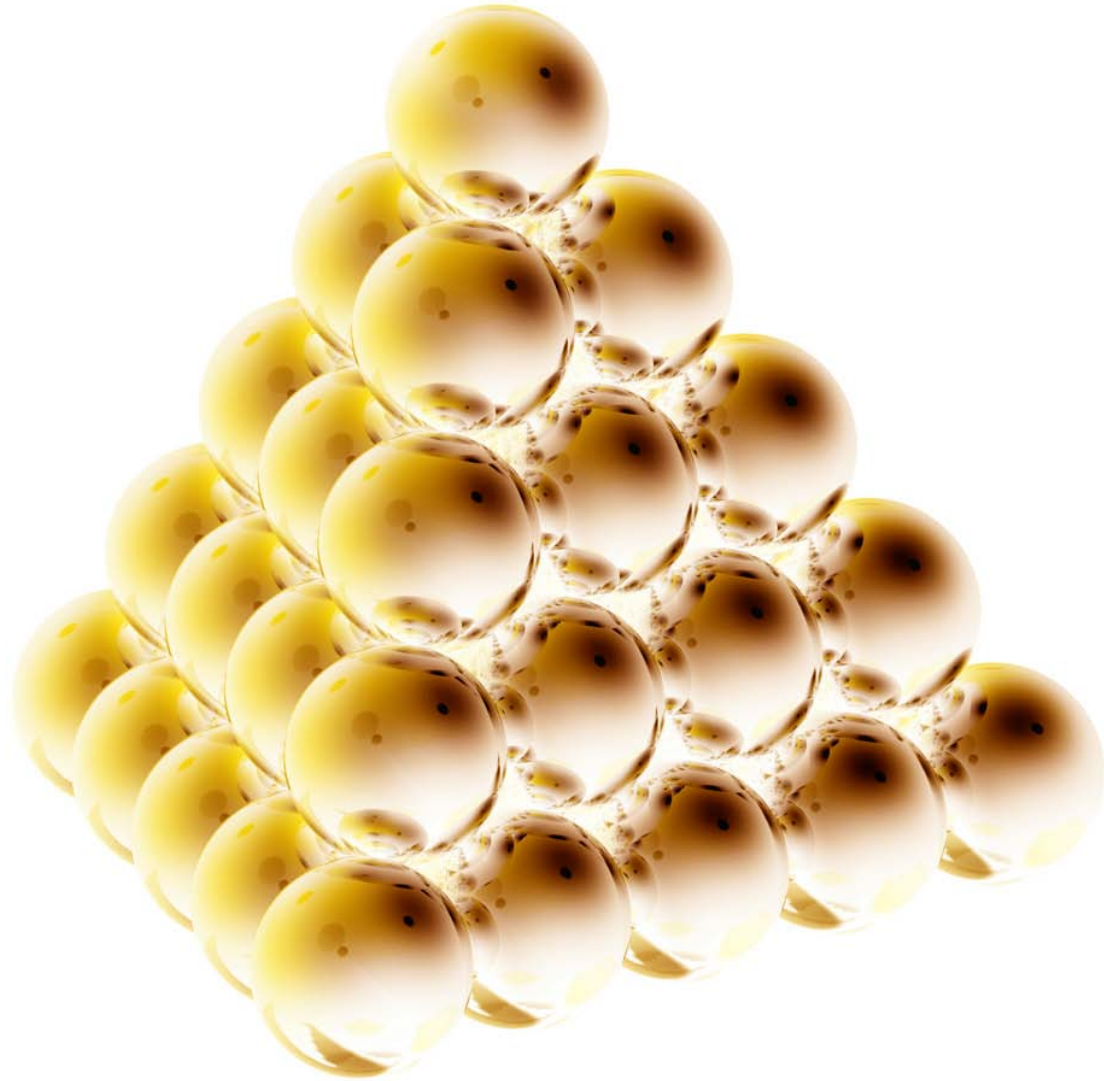


Good



2

Thou shalt have High Porosity!



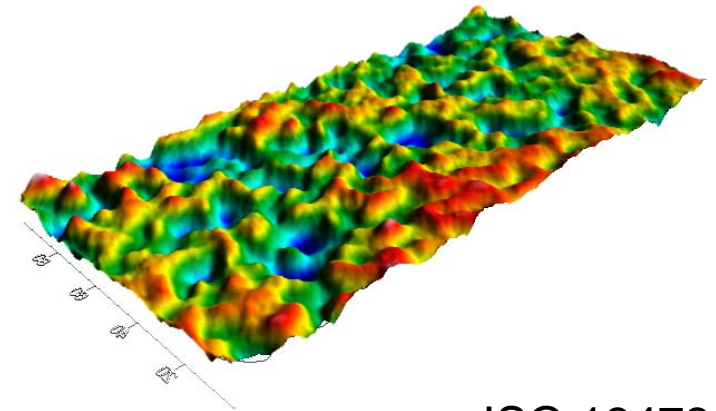
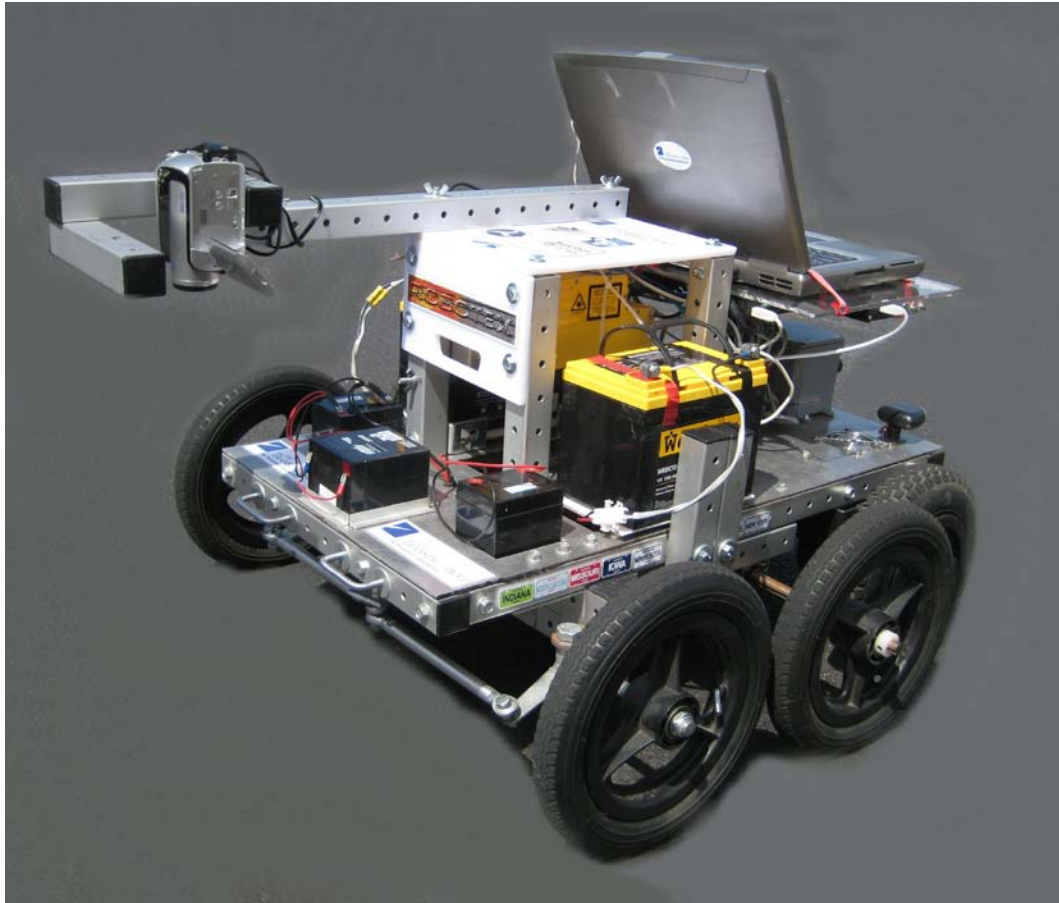


Thou shalt have Low Stiffness!

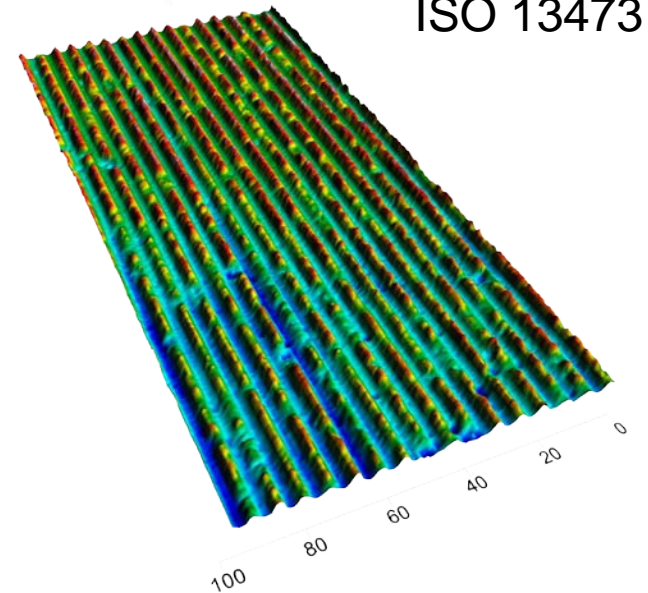


Texture Testing: RoboTex 2.0

- Built around LMI-Selcom RoLine Sensor
- Laser height sensor, inertial referencing
- GPS, DMI encoder, video log



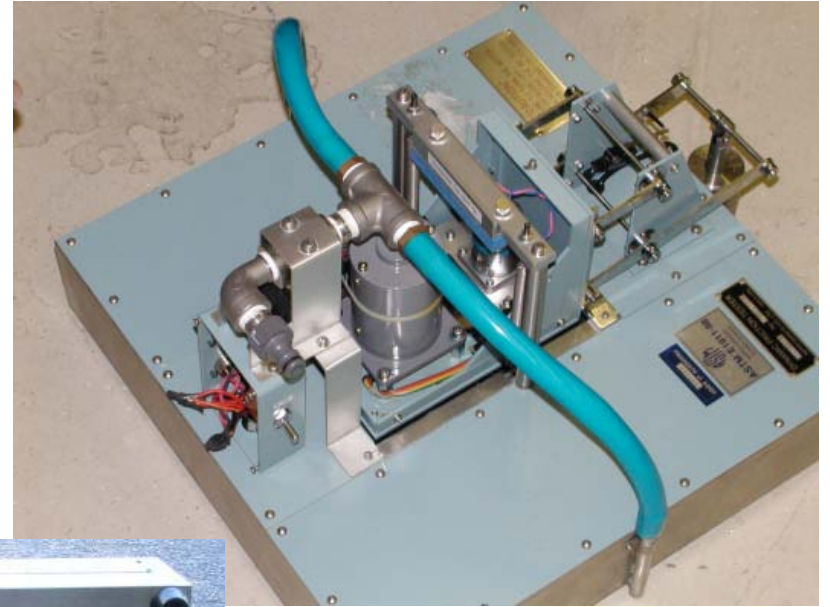
ISO 13473



Friction Testing: DFT and Skid Trailer



ASTM E 274



ASTM E 1911

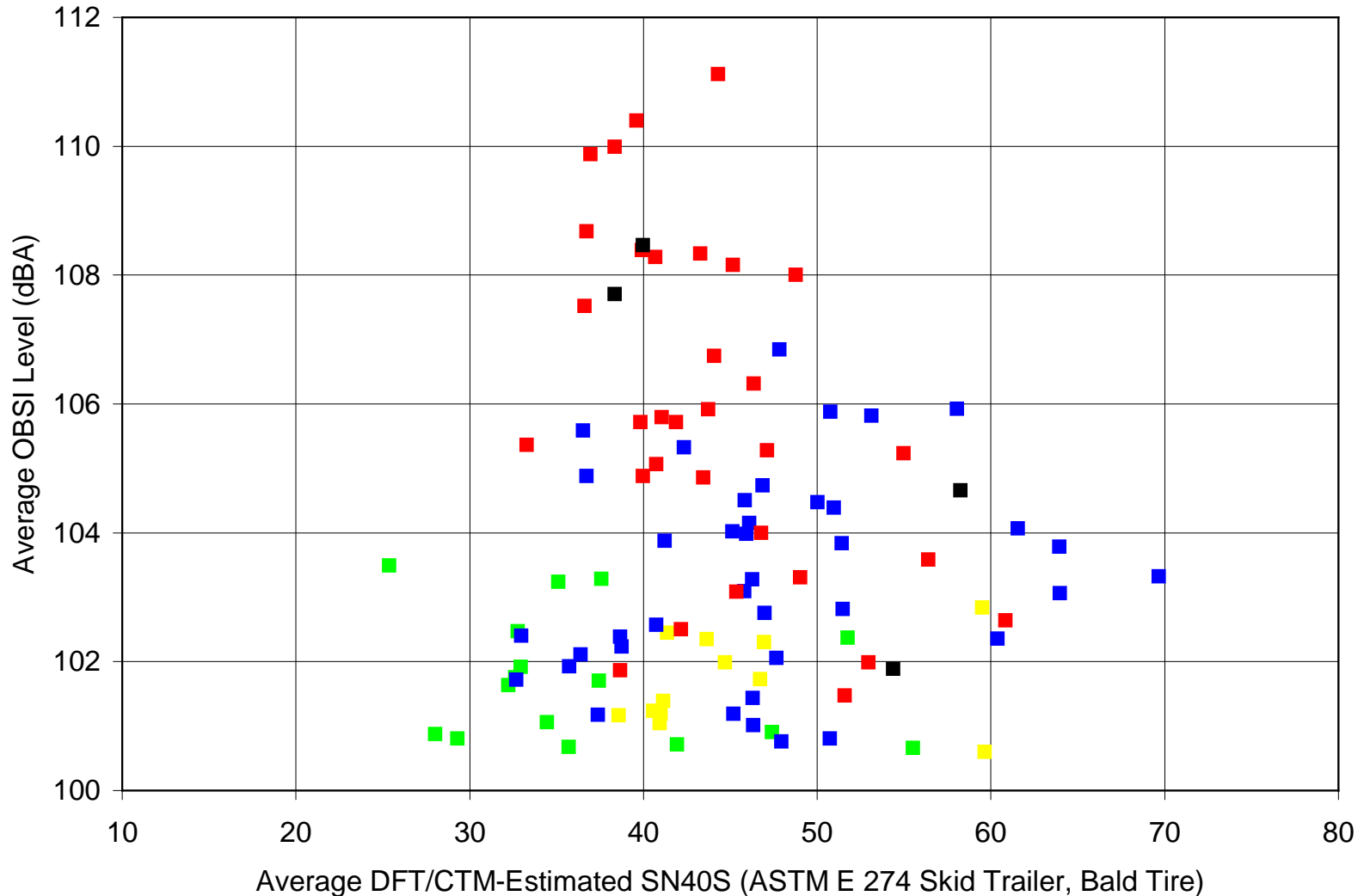
Noise Testing: OBSI



AASHTO TP 76

Friction vs. Noise

Do Friction and Noise Relate?



CP Tech Center Test Sections

■ In 4 years, Over 1200 Unique Textures Tested

- Transverse Tining (incl. skewed and cross-tined)
- Longitudinal Tining (incl. sinusoidal)
- Diamond Ground
- Grooved (longitudinal, transverse)
- Drag (Burlap, Turf, Broom, Belt, Carpet)
- Shot Peened
- Exposed Aggregate
- Porous (Pervious) Concrete
- Milled
- HMA and Surface Treatments

■ 170 miles of test surface in 20 States and 6 Countries

What we've learned

There is a lot of:

VARIABILITY

**Variability from project to project, and
variability within a given project.**

Texture: Diamond Grinding



Diamond Grinding

98 dBA
Kansas



98 dBA
Colorado



101 dBA
Minnesota



104 dBA
New York



Texture: Drag



Drag

99 dBA
Iowa



99 dBA
Kansas



103 dBA
Minnesota



103 dBA
New York



Texture: Longitudinal Tining



Long. Tining

99 dBA
Colorado

99 dBA
Iowa



105 dBA
New York

104 dBA
Iowa



Texture: Transverse Tining



Trans. Tining

99 dBA
Iowa

100 dBA
Georgia

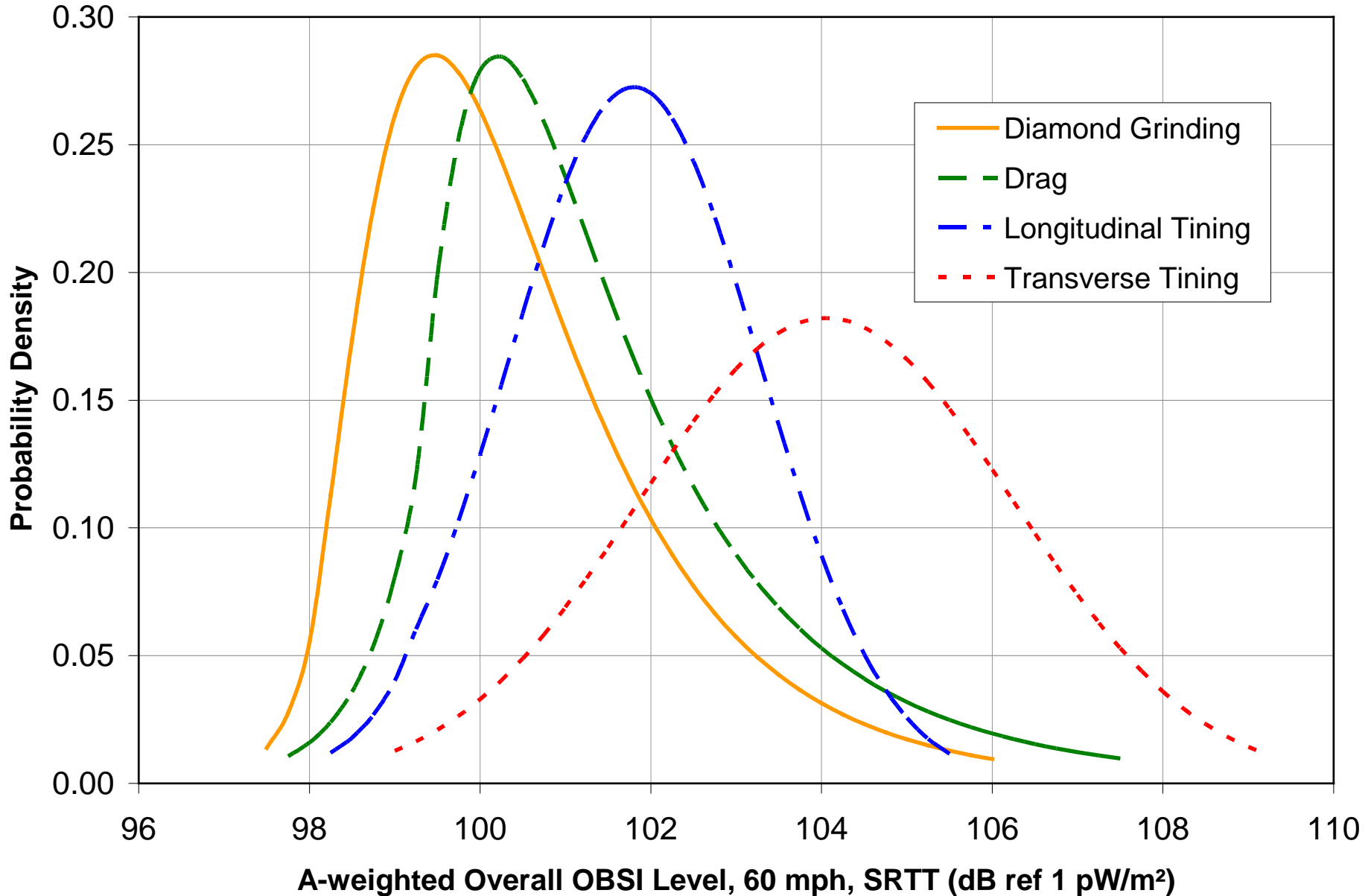


108 dBA
Georgia

108 dBA
North Dakota

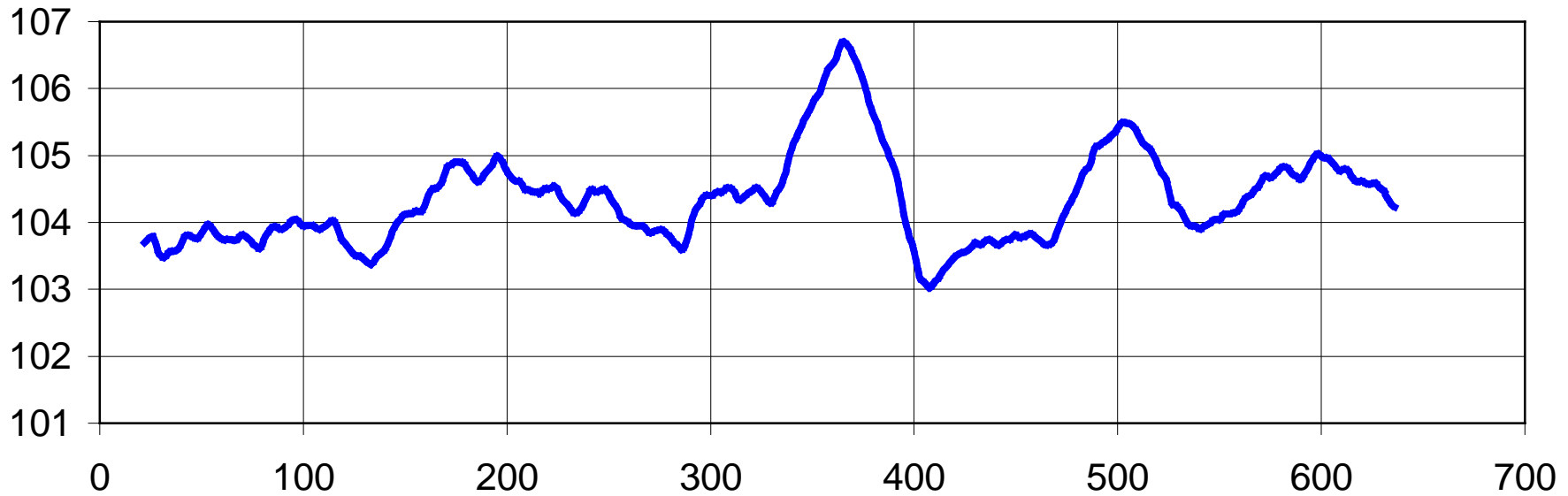


CP Tech Center OBSI Noise Catalog



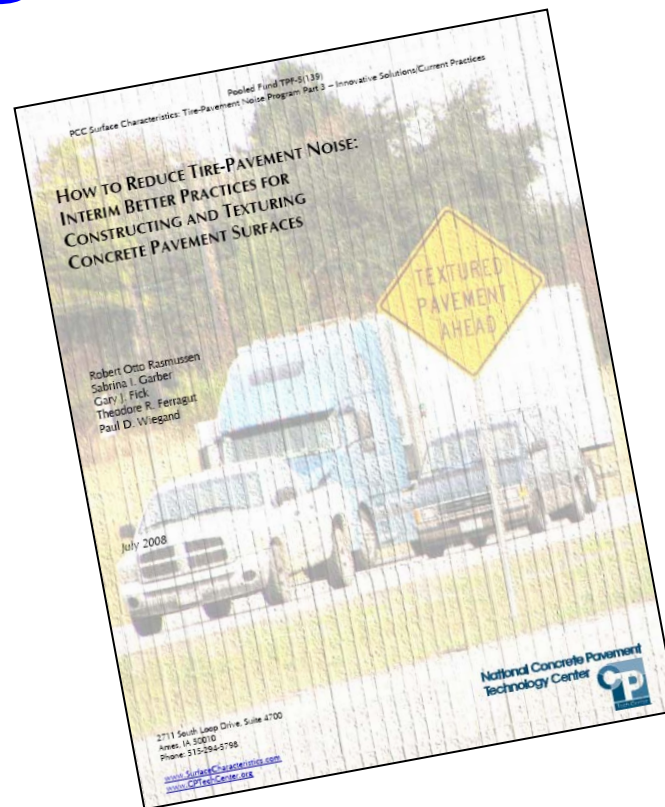
Variability within a Project

On-Board Sound Intensity Level (dBA)
44-ft. Moving Average



**What can we do
with this
knowledge?**

Better Design and Construction Practices for Texturing Concrete Pavement



Properties of a Quieter Pavement

Surface Texture

- Avoid (flatten) texture at intervals > 1 inch
- Avoid smooth (floated or polished) surfaces
 - Some fine texture (< 0.25 inch) required
- Texture should be negative
 - Point down (grooves), not up (fins)
- Texture should be oriented longitudinally
- If transverse, texture should be closely spaced and randomized

Properties of a Quieter Pavement

Concrete

- Strong and durable mortar
 - Mix optimized for placement, finishing, curing
- Siliceous sands for durability and friction
- For diamond grinding: hard, durable, and polish resistant coarse aggregate is ideal
- For tined and drag textures: adequate and consistent depth of mortar near the surface

Properties of a Quieter Pavement

Joints

- Can affect noise levels and annoyance
- Narrow, single-cut joints preferred
 - Avoid widened (reservoir) cuts
- Avoid faulted joints
 - Design or retrofit adequate load transfer
- Avoid protruding joint sealant
- Avoid spalled joints
 - Design, materials selection, and construction

Better Practices For Texturing

Paving Equipment



Better Practices For Texturing

Concrete Materials Selection and Proportioning



Louder – 106 dBA



Quieter – 100 dBA



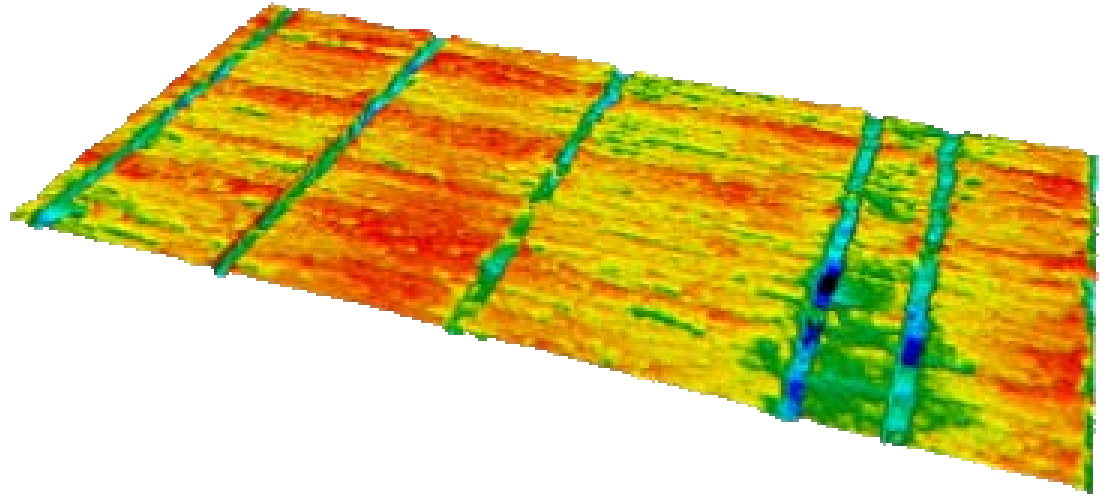
Louder – 111 dBA



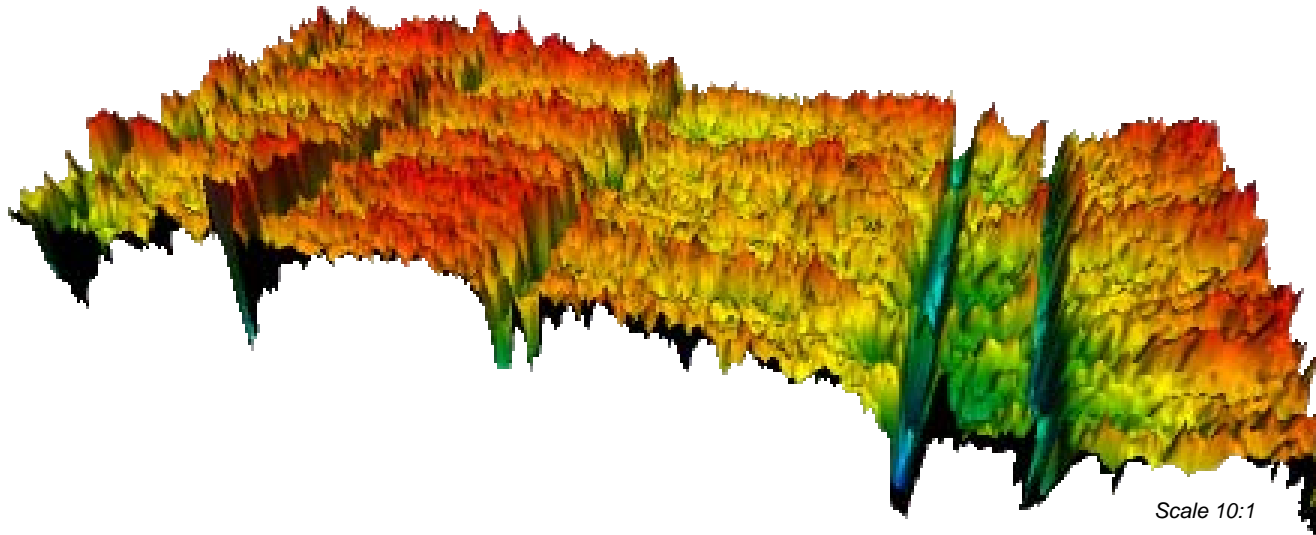
Quieter – 103 dBA



Tined Concrete



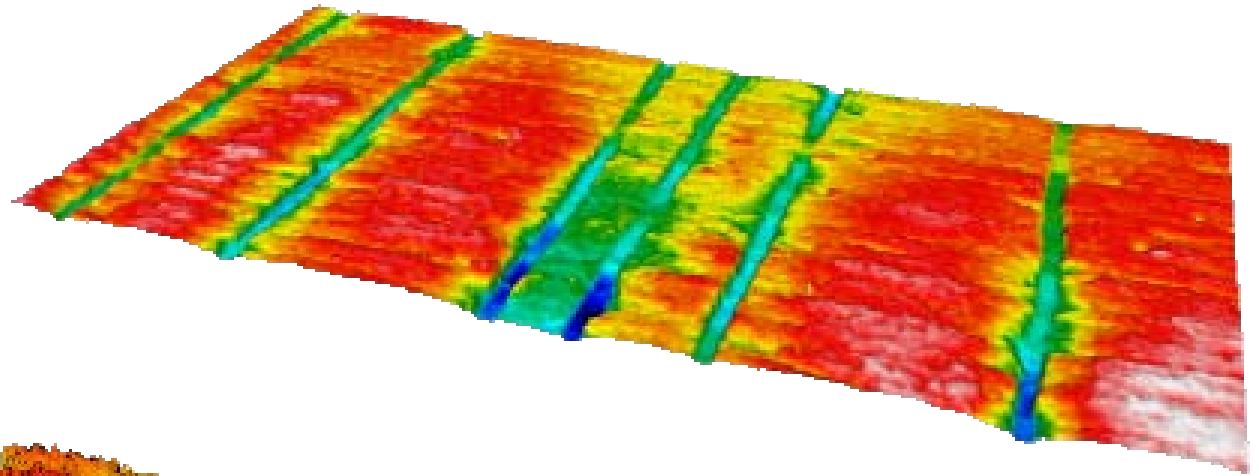
Scale 1:1



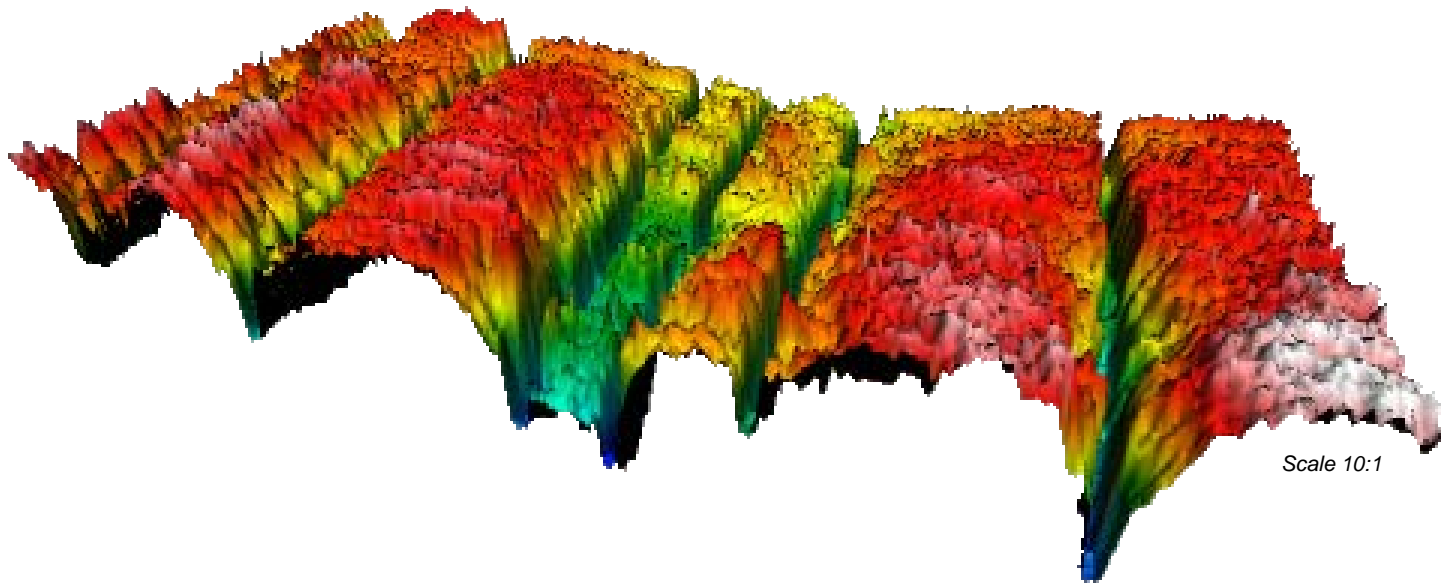
Scale 10:1

Quieter – 103 dBA

Tined Concrete



Scale 1:1



Scale 10:1

Louder – 111 dBA

**What remains to be
understood?**

Monitor Construction Operations

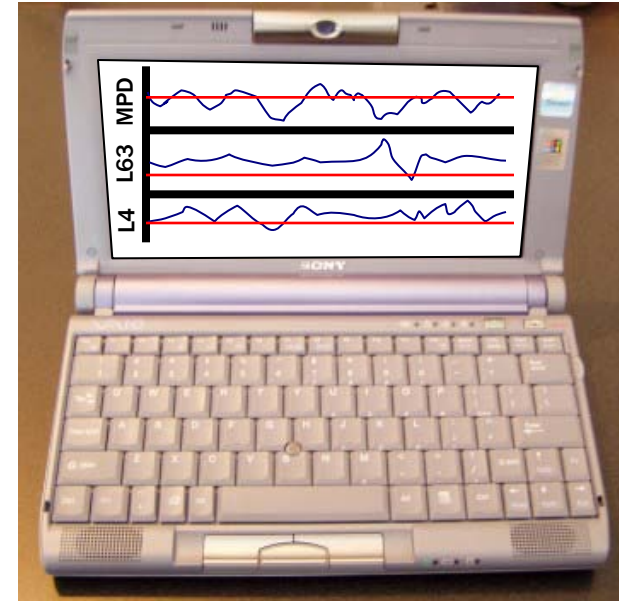
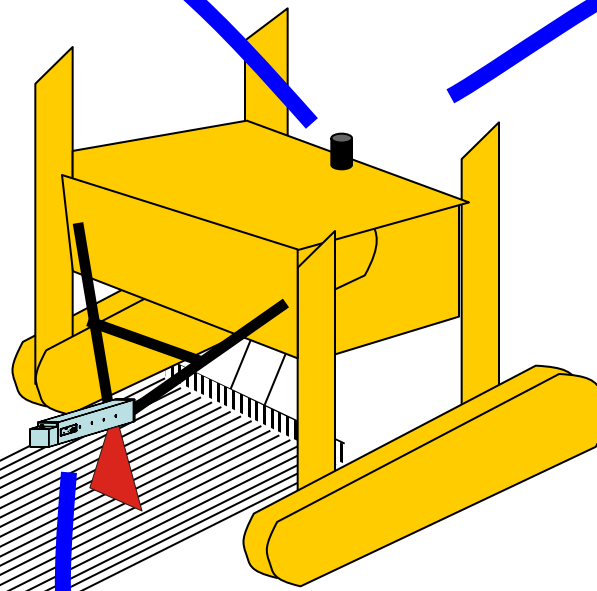


Monitor Construction Operations

Accelerometers



Texture Machine and Paver



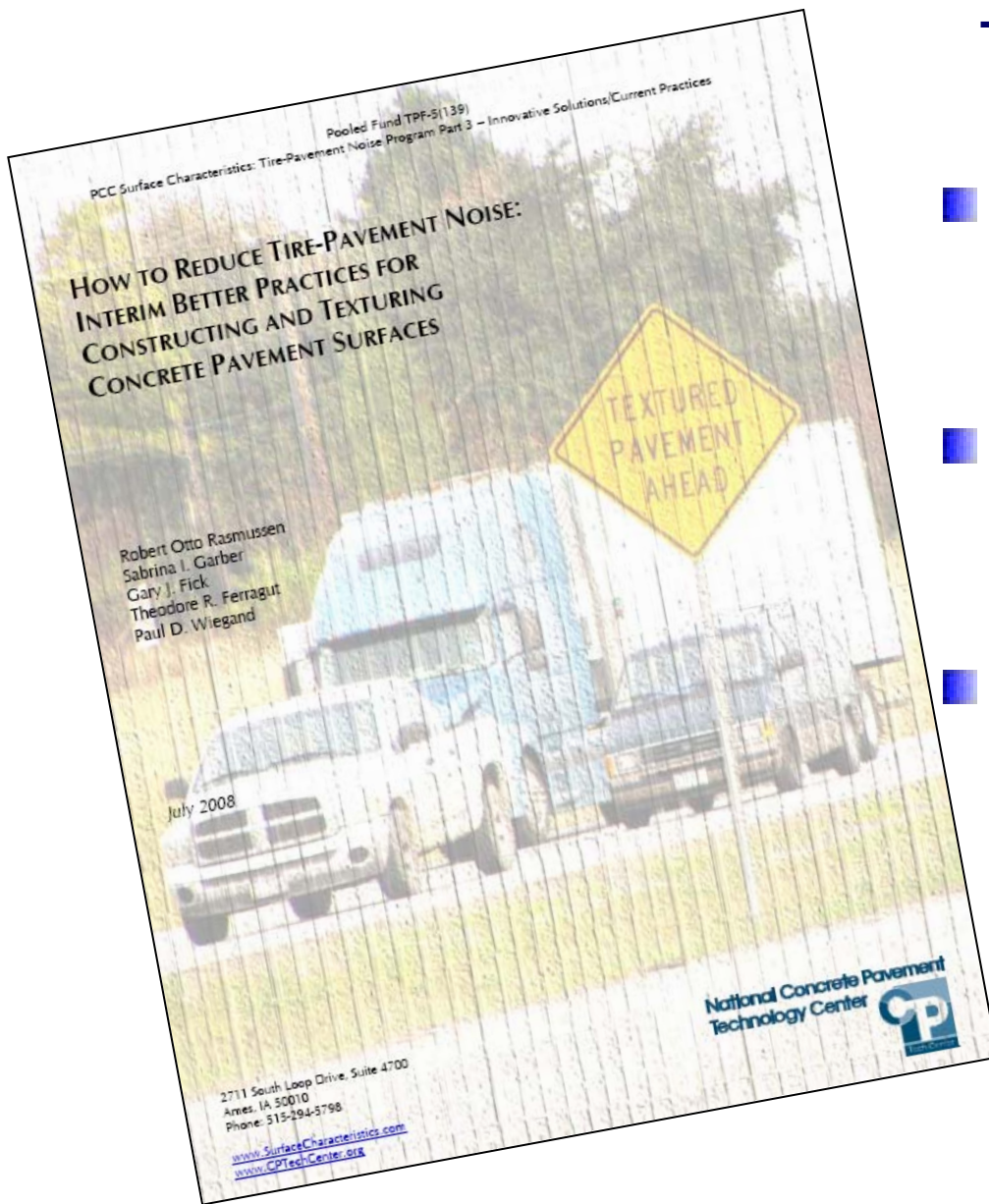
Texture and Vibration Feedback



LMI-Selcom
RoLine
Line Laser

Texturing Guidelines

- A “how to” guide for designing and constructing quieter concrete pavements
- Addresses all conventional concrete pavement texture types
- Simple and practical guidance



Download from www.CPTechCenter.org

For more information, visit:

www.CP Tech Center.org

or

www.CP Road Map.org