

# SURFACE CHARACTERISTICS AND TIRE-PAVEMENT NOISE

National Concrete Pavement  
Technology Center



National Road Profilers Group  
Paul D. Wiegand, P.E.  
September 21, 2006

# HIGHWAY NOISE

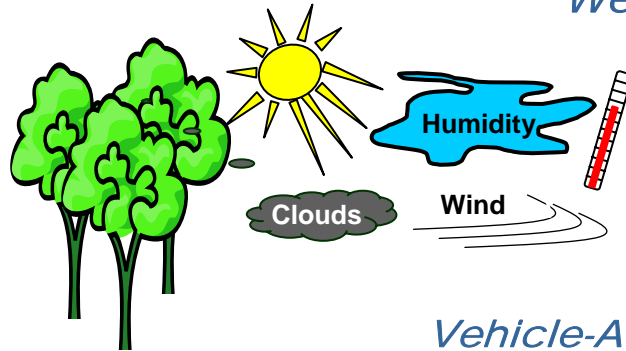
- Public demands quieter environments on and around highway facilities
- Safety and smoothness can't be compromised
- Has both rural and urban elements
- One of the most important issues to the concrete paving industry

# SURFACE CHARACTERISTICS PROPERTIES

- Noise
- Smoothness
- Friction
- Drainage/ Splash and Spray
- Rolling Resistance
- Reflectance

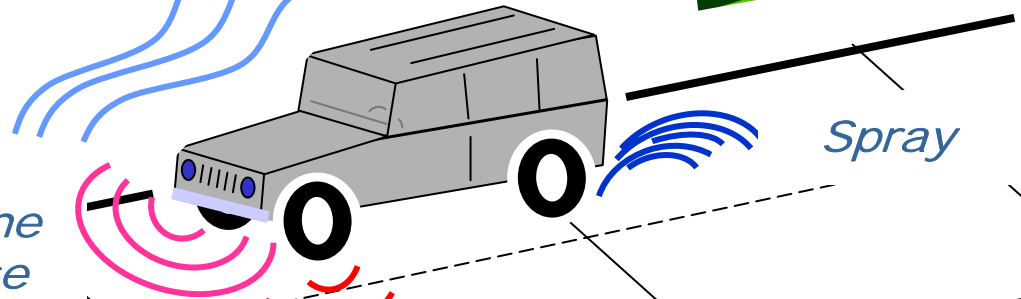
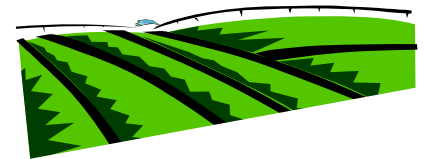
# Surface Characteristic and other Noise Factors

Reflective Structures



Weather

Vehicle-Air Noise



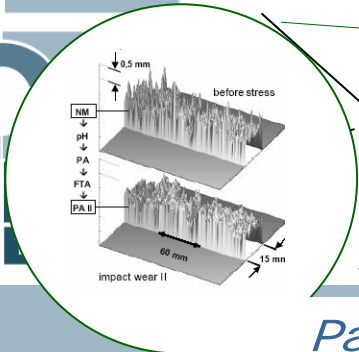
Engine Noise

Spray

Tires/Pavement Noise

Pavement Smoothness

Pavement Friction



# Pavement Texture Links Properties



# SURFACE CHARACTERISTICS PROJECT TEAM

- **CP Tech Center/ISU**
  - Tom Cackler, Paul Wiegand, Dale Harrington, Jim Cable
- **TDC Partners**
  - Ted Ferragut
- **The Transtec Group**
  - Rob Rasmussen, Eric Mun, Robert Light, George Chang, Bebe Resendez



# PROJECT TEAM (cont.)

- **Expert consultants**
  - Steve Karamihas, Bob Bernhard, Ulf Sandberg, Judy Rochat, Bob Prisby, Gary Fick
- **FHWA**
  - Mark Swanlund
- **ACPA/IGGA**
  - Jerry Voigt, Larry Scofield, John Roberts

# RESEARCH PLAN

- Part 1: Strategic Plan (Completed)
- Part 2: Field Experiments (November, 2006)
- Part 3: Continued Field Experiments and Innovative Surfaces (2006 – 2010)
- ***One goal is to determine texture/noise relationship, not eliminate texture types***



# PART 1 STRATEGIC PLAN

- Comprehensive plan funded by FHWA and the NCPTC
- Documentation of current practice
  - Design
  - Bidding
  - Construction
  - Quality control
  - Maintenance
  - Field Evaluations

## PART 1 STRATEGIC PLAN (cont.)

- Specific focus on European methods from Quiet Pavements International Scan (2004)
- Develop Experimental plans
  - Texturing
  - Grinding
  - Pervious pavement
  - Exposed aggregate

## PART 2 FIELD DATA COLLECTION

- Partnership with FHWA, NCPTC, ACPA, and the Iowa Highway Research Board
- Three types of data
  - Type 1: New construction & Grinding (1-3)
  - Type 2: Existing, but relatively new (6 to 7)
  - Type 3: Existing, all ages (21-28)

# Site Selection

Type 1 New	<u>IA</u>
Type 2 Existing	<u>CO, ND, KS, IA, GA, WI</u>
Type 3 Existing	<u>CO, MN, IA, ND, KS, AL, GA, NC, VA,</u> <u>IN, OH, MI, MO, CA, AZ, TX, Quebec</u>

# PART 2 FIELD DATA COLLECTION (cont.)

## Key Study Points

1. Study all types of textures
2. Study noise vs. texture vs. friction vs...
3. Relative ranking, not elimination
4. Sophisticated modeling not viable at this time
5. Control construction variability without heavy capital expenditure

## PART 2 FIELD DATA COLLECTION (cont.)

- Type 1 Goals:
  - Define the interrelationships with noise and texture
  - Define the interrelationships between fiction and texture
  - Define the rate of change in texture, smoothness, friction, and noise over time

## PART 2 FIELD DATA COLLECTION (cont.)

- Type 1 Data collection Techniques:
  - On-Board Sound Intensity
  - In-Vehicle noise
  - Wayside (pass-by)
  - Texture (Robotex)
  - Friction
    - Dynamic friction Tester
    - Circular Texture Meter
    - Skid Trailer

## PART 2 FIELD DATA COLLECTION (cont.)

- Type 1 Data collection Frequency:
  - Just before traffic (pre broom)
  - Just after opening to traffic
  - At 60-90 days
  - Annually, until rate of changes stabilize



## PART 2 FIELD DATA COLLECTION (cont.)

- **Type 2 Data collection:**
  - **Locations of promising noise and texture characteristics**
  - **Same tests as for Type 1 locations**
  - **Measure rate of change from test forward in time**

# PART 2 FIELD DATA COLLECTION (cont.)

- Type 3 Data collection:
  - One time visits
  - Catalog current situation
  - Multitude of configurations

# PART 3 INNOVATIVE SURFACE CHARACTERISTICS

- Pooled fund
  - California; Iowa; New York; Texas; Washington; Minnesota; Wisconsin
  - FHWA
  - NCPTC
  - ACPA/IGGA

## PART 3 INNOVATIVE SURFACE CHARACTERISTICS (cont.)

- Continue testing of Type 1 and Type 2 sites
- Influence construction of sites utilizing early results
- Build and Evaluate innovative surfaces
  - Pervious
  - Exposed Aggregate
  - Two-lift construction
  - Stamped/brushed

# FUTURE INITIATIVES

- Determine best practices for consistent texturing
- Develop specifications/controls for use by highway agencies
- Determine methods to monitor plastic concrete texturing for compliance with specifications
- Work with equipment manufacturers to develop equipment that will consistently meet the specified texture requirement and thus the “design noise”

# ASSOCIATED STUDIES

- Pervious Concrete
- Exposed Aggregate
- Splash and Spray
- Traffic Noise Model

# National Concrete Pavement Technology Center



For more information,  
please contact:

Paul D. Wiegand, P.E.  
Research Engineer  
[pwiegand@iastate.edu](mailto:pwiegand@iastate.edu)  
515-294-7082