NJDOT HMA/Pavement Research Program

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Burlington, VT

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Presentation Overview

- Reflective Cracking
- Implementation of MEPDG
- FHWA Quiet Pavement Pilot Program
- Winter Maintenance of Friction Course Mixes
- Pavement Preservation Program

Flexible Overlays for Rigid Pavements

- 2 year study to evaluate use of HMA overlays on rigid/composite pavements to minimize reflective cracking
  - Extensive material testing and FEM modeling
    - Performance-based HMA design

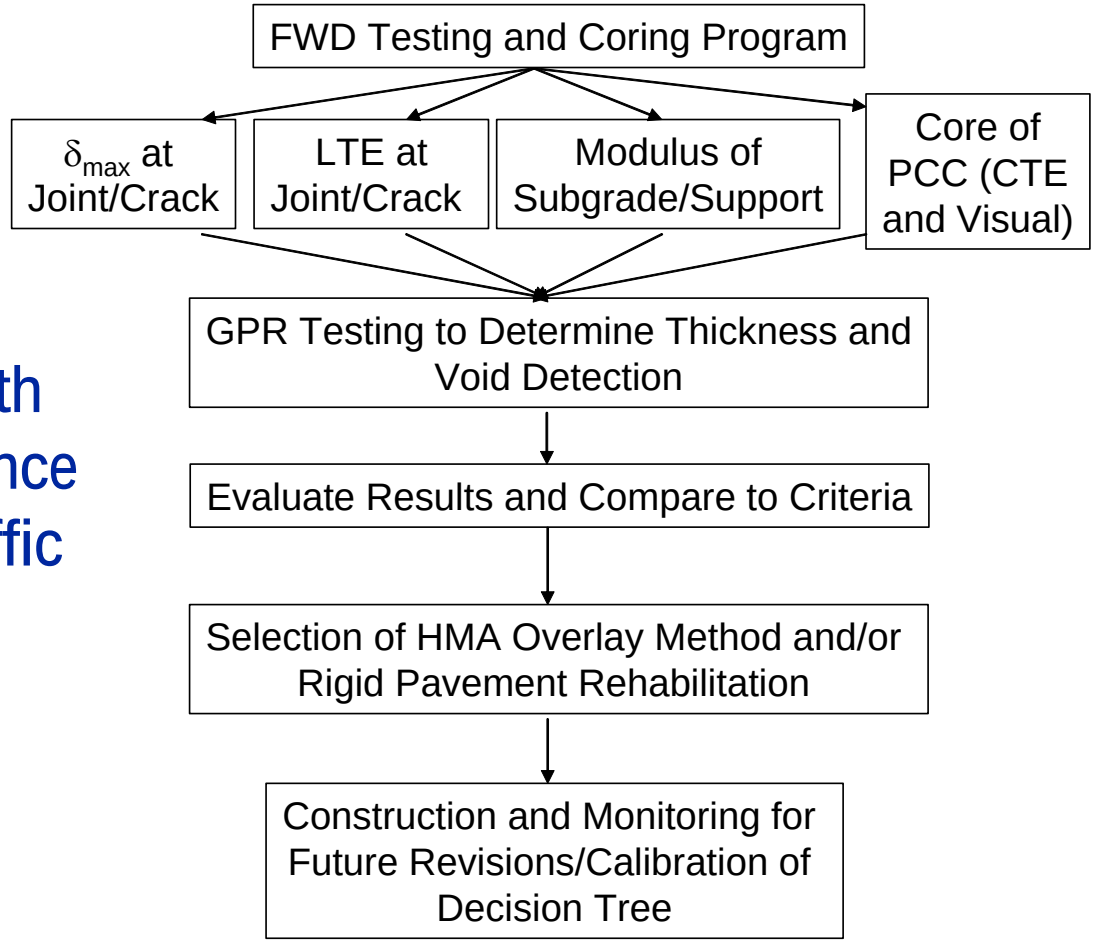
      (Balancing rutting and fatigue performance)
    - Optimizing forensic evaluation of PCC/composite pavements
    - Development of “Decision Tree” to select appropriate rehabilitation strategy

Tentative Performance-Based HMA Design

- Similar to one proposed at TTI
  - Determine optimum AC% (OAC) by Superpave Volumetrics
  - Construct samples at -0.3% OAC, OAC, and +0.3% OAC
  - Perform:
    - APA, Flexural Fatigue, and TTI Overlay
    - Select final AC% by overall performance
      - **HMA placed on PCC (emphasize fatigue performance)**
      - **HMA placed on surface (emphasize rutting performance)**

Tentative Decision Tree Input Parameters

- Used in conjunction with HMA performance design and traffic



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NJDOT Interlayer Mix Specification

- NJDOT thought Route 10 job was successful
  - Had problem with proprietary nature of this application (back in 1997)
- NJDOT Reflective Crack Relief Interlayer (RCRI) Specification
  - Collaboration between Rutgers, SemMaterials and CITGO Asphalt
  - Utilizes performance-based specifications as pass/failure criteria during design and construction
  - Volumetric properties specified to aid in minimizing potential construction/compaction problems and maximize performance

NJDOT RCRI Specifications

- Binder
  - > 7% AC
  - High Temp ≥ PG70 (no low temp required)
  - RTFO Elastic Recovery > 75% @ 25°C
  - Separation Test < 6°C after 4 hrs
- Aggregate blend (NO RAP ALLOWED)

Sieve	% Passing
9.5mm	100
4.75mm	75 – 100
2.36mm	30 – 85
0.075mm	6 - 14

RCI Mix Design Criteria

- N_{design} = 50 gyrations
- Air voids: 1 to 3%
- VMA ≥ 16%
- Performance Criteria
  - Fatigue (AASHTO T321) > 100,000 cycles (ave.)
    - ε_t = 2,000 μ-strain, 15°C, 10 Hz, AV = 3 ± 1.0%
  - Rutting (AASHTO TP63) < 10 mm Rutting
    - 60°C, AV = 3 ± 0.5%, 100 psi hose, 100 lb load

Construction

- Gradation Control
  - 2.36mm (+/- 4.0% tolerance)
  - 0.075mm (+/- 1.4% tolerance)
- Volumetrics
  - Mat compacted between 2 to 4% air voids
    - Minimize compaction issues while maximizing performance
    - Air Voids (+/- 0.8% tolerance)
  - VMA (-1.0% tolerance)
- Performance (min. once per project within 1st 2,000 mix tons, every 600 tons thereafter)
  - Flexural Beam Fatigue (AASHTO T321) – same criteria as before

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Implementation of MEPDG

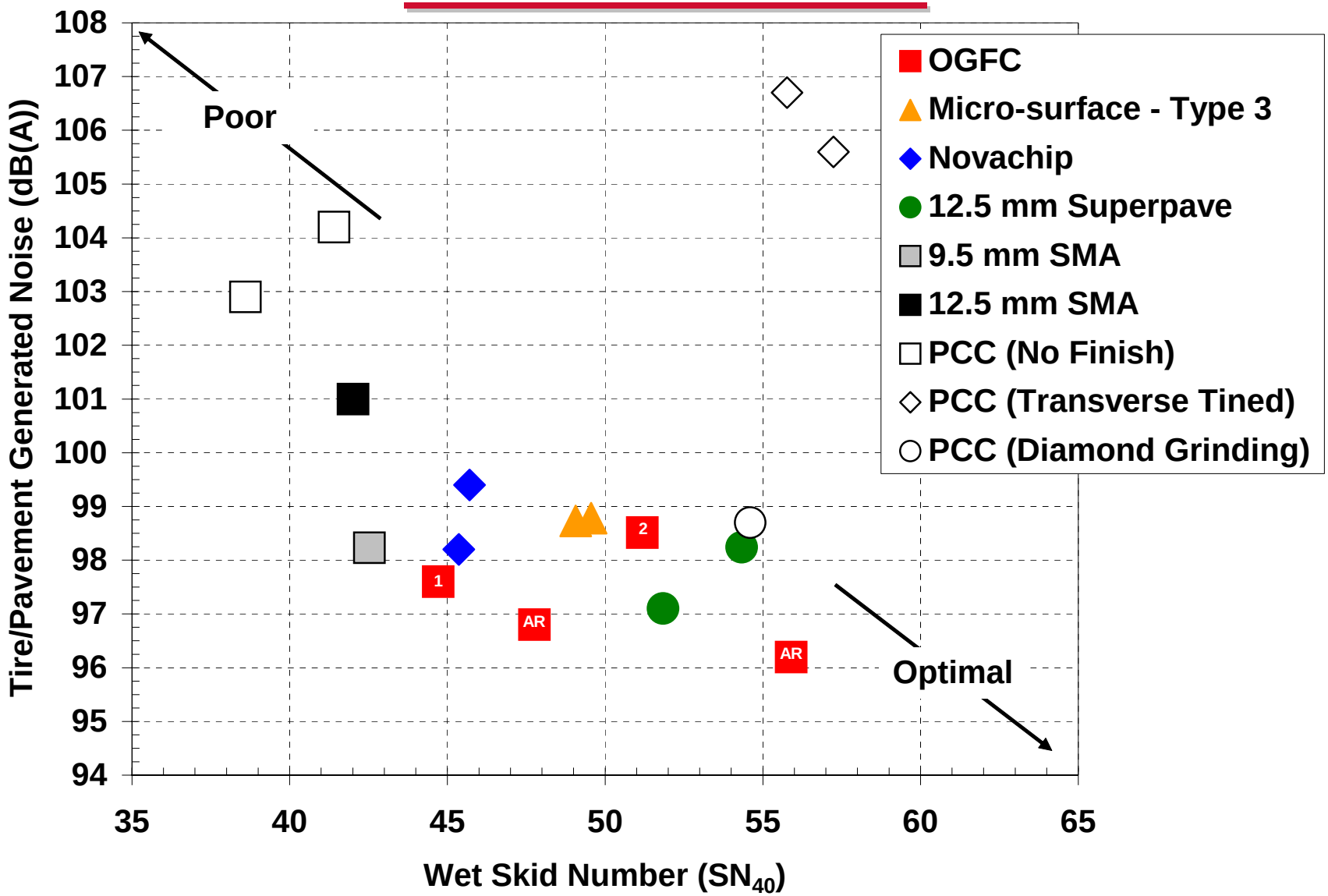
- Developing HMA database of dynamic modulus and IDT/Creep Compliance
  - Utilizing plant produced samples (aging, RAP)
  - Comparing performance using repeated load, SST Repeated Shear and Flexural Beam Fatigue testing
- Completed database for unbound materials
  - Resilient modulus, permeability, CBR
- TRAINING!
  - “Hands on” using software in computer lab
  - Materials and Traffic Inputs

DGIT - Materials Input (May 2005)

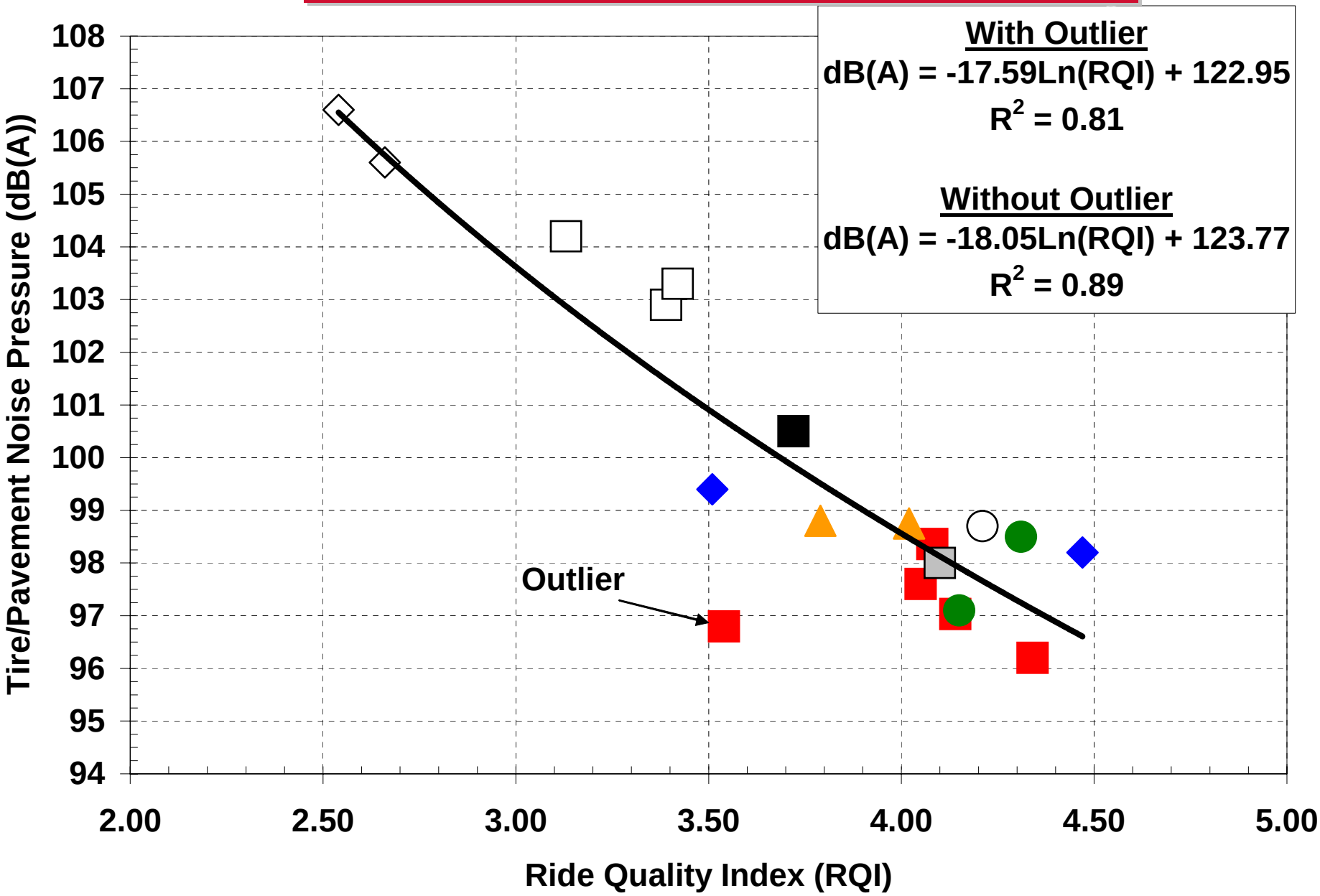
Quiet Pavement Pilot Program (QPPP)

- Main Goal: To allow the use of pavement surface to eliminate or reduce the height of noise walls for highway noise mitigation
- FHWA established program
  - Initiated by Arizona DOT
- Must have noise measurements for minimum of 5 years
  - Must also include texture data, ride quality, skid resistance
  - NJDOT work will also evaluate winter maintenance issues (not included in Arizona and California work)

Relationship Between Noise and Wet Skid Resistance



Tire/Pavement Noise vs RQI



Measurement of Traffic Noise in QPPP

- Wayside measurements
  - Measure the effects of low-noise pavements on communities
  - Vary distance and height from pavement
  - Used in areas of “immediate need”
- Source measurement
  - Measures the effect of low-noise pavements on the tire/pavement interaction at the source
  - Testing on experimental sites and wayside sites
  - Recent NJDOT/Rutgers research used Close Proximity – moving to Sound Intensity for QPPP

Sound-Intensity

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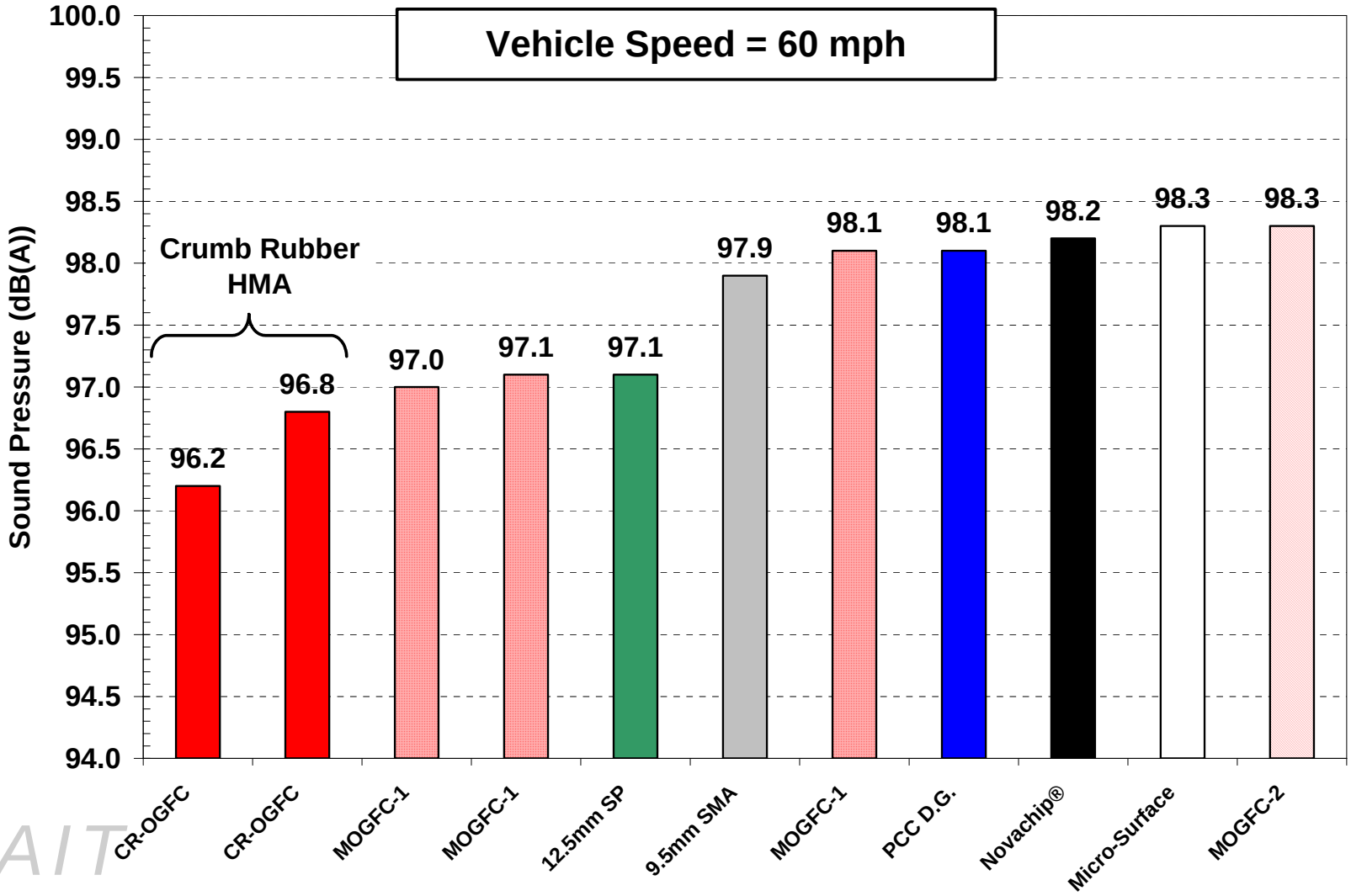
10 Quietest Pavement Surfaces Tested



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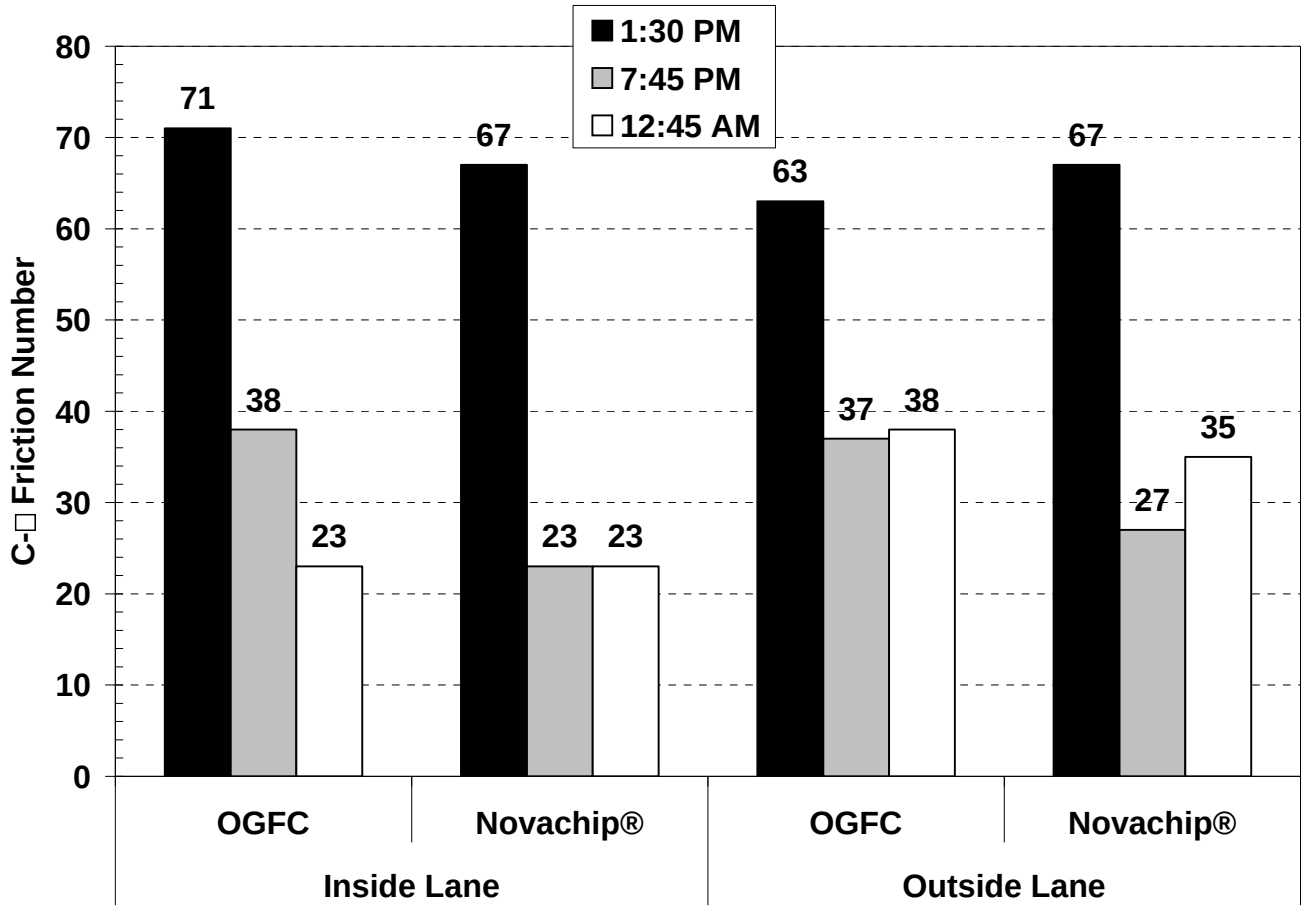
NJ's Winter Maintenance Issues

- NJDOT
  - Rock salt is predominant method
  - Found OGFC significantly more difficult to maintain ice-free
    - More frequent applications and still tends to be icier
  - 2005 began the use of brine solution
- NJ Garden State Parkway (NJGSP)
  - 100 of 1,200 lane miles OGFC
  - Uses liquid magnesium-chloride for de-icing
  - Combines surface temperature measurements and weather forecasts to know when to treat
    - Pre-treats OGFC surfaces (If too late, magnesium-chloride washes off)
    - OGFC requires twice the total application as other DGA

Winter Maintenance of Friction Course Surfaces

- Meeting in November to discuss research/testing plan
- If OGFC to be selected as “Quiet Pavement”, must improve winter maintenance
- Purpose is to optimize de-icing methods for friction course mixes
- Focusing on:
  - De-icing materials
  - Application rates
  - Measuring friction during storm event
    - Deceleration device (Coralba Cμ-meter)
    - NJDOT Skid Trailer

Skid Friction – Deceleration Method



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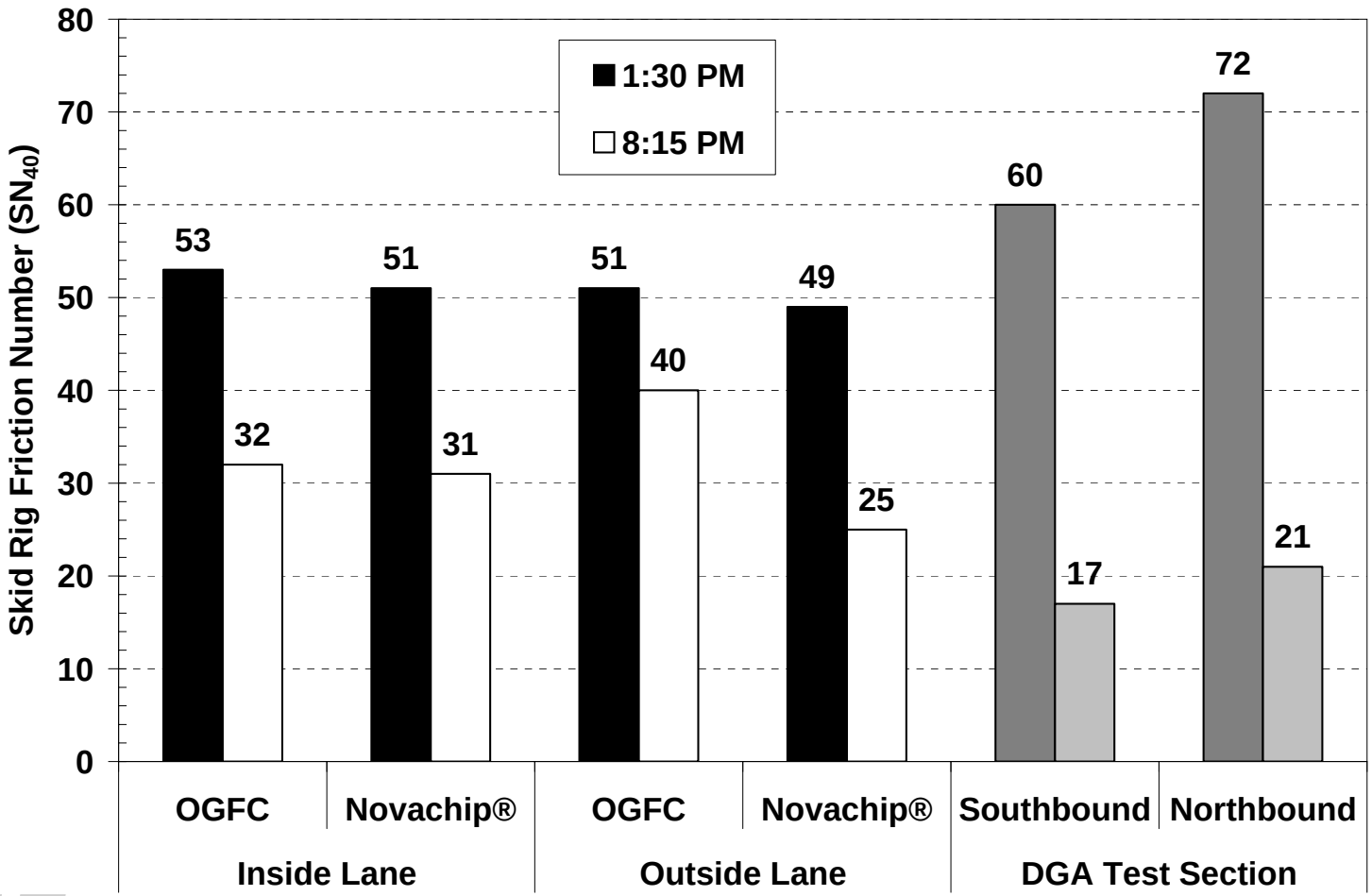
Skid Friction – Skid Trailer



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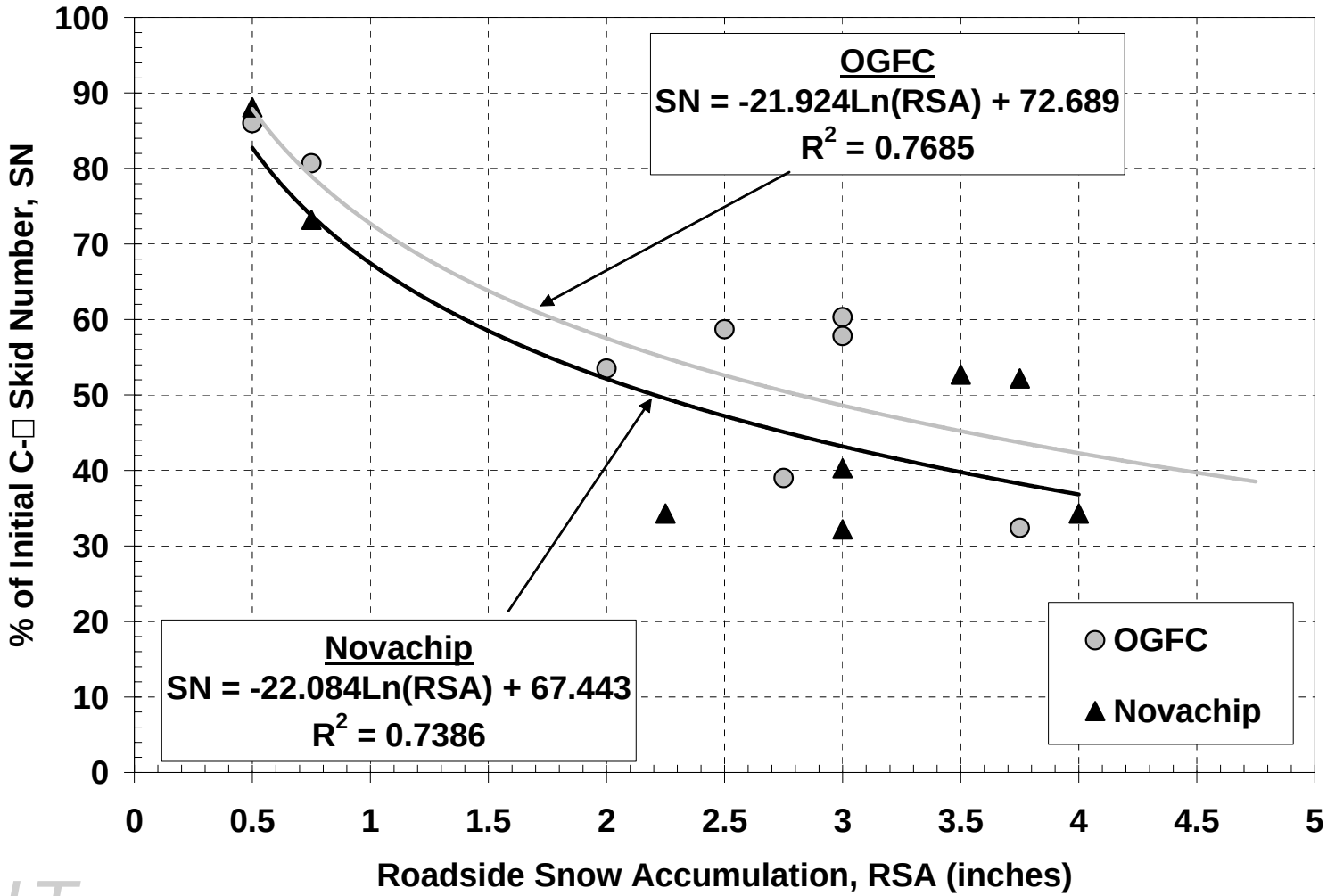
OGFC vs Novachip ®



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QPPP and Pavement Preservation

- Data developed during QPPP will also be used to optimize NJDOT's Pavement Preservation Plan
  - NJDOT initiating "new" Pavement Preservation Plan for 2006
  - Utilizing "thin-lift" mixes (< 1.0 inches)
    - Fine-graded OGFC, 9.5mm SMA, micro-surfacing, Novachip®
  - Looking to place 1,000 lane miles per year of "thin-lift" HMA for Pavement Preservation
    - Currently only doing 500 lane miles

Other HMA-Related Research

- Influence of RAP % on HMA performance
  - PG64-22 and PG76-22 (0, 15, and 30% RAP) – Plant Produced
  - E*, Flexural Fatigue, Low Temp, Rutting
- Fatigue Properties of PPA Modified HMA
  - Compare SBS, SBS+PPA, and PPA modified
- Optimizing RCI Mixture and Design
  - Vary gradations, aggregate sources, volumetrics to optimize fatigue, permeability, permanent deformation

Thank You for Your Attention!

Contact Information

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