NYSDOT APPROACH FOR DECK PRESERVATION

National Bridge Conference
St. Louis, 2011
Pete Weykamp
BACKGROUND

Count of Bridges:
  State – 7, 863
  Local – 11,898

Sq Ft of Deck
  State – $83.8M
  Local – $94.6M
DESIGN

4-#5(E) BARS IN THE SLAB TOP MAT

*4(E) BARS @ 8" SPACING. PLACE ADDITIONAL *6(E) BARS @ 8" IN OVERHANG, HOOKED AT THE FASCIA, ALTERNATING WITH *4(E) BARS.

3" COV.

1 1/2" COV.

2'-6" MIN., 4'-0" MAX.

2 SPACES @ 8"
CONDITION ASSESSMENT

- Visual
- Sounding
- Ground Penetrating Radar
- Thermographic Inspection
OBJECTIVE

• Structural Deck Preservation
• Maintain Structural Deck Rating
• Minimize Deck Replacement Projects
• Extend Service Life of Existing Decks
• Maintain Mobility
### TODAY’S SITUATION

#### DECK DATA

<table>
<thead>
<tr>
<th></th>
<th>Rated 5</th>
<th>Rated 4</th>
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<tbody>
<tr>
<td>Number BINs</td>
<td>4,819</td>
<td>1,957</td>
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<tr>
<td>Square Footage</td>
<td>19.5M</td>
<td>6.9M</td>
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DECK CRACKING
We, the bridge maintenance engineers of New York hold these truths to be self-evident: all joints leak, all concrete cracks, and rust never sleeps. We will strive to capitalize our way out of maintenance and maintain our way out of capital. It is our endeavor to educate others that a bridge is as important to a highway as a diamond is to a ring.
DECK PATCHING

• Minimal Bond
• Cold Joint
  – Not waterproof
• Temporary Fix
  – All material
  – All techniques
• Future Problems
OPTIONS
CRACK FILLING

“Healer/Sealer”

• Ultra-low Viscosity Polymers
• Gravity Feed
• No Aggregates
• Sacrificial W S
WATERPROOFING MEMBRANES

• If They Work:
  – Block Salts from Bare Reinforcing Bars to Prevent
    • Expanding steel volume
    • Concrete pops
    • Concrete cracks
    • Accelerated corrosion

• If They Leak:
  – Trap Salts Near Bare Reinforcing Bars to Promote
    • Expanding steel volume
    • Concrete pops
    • Concrete cracks
    • Accelerated corrosion
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<tr>
<th>Condition State</th>
<th>POTENTIAL RESULT TO NBI</th>
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<tr>
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<tr>
<td>NBI = 4 or 5</td>
<td>15% to 30%</td>
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<tr>
<td>NBI = 5 or 6, &gt;10%</td>
<td>NBI = 2 or 3</td>
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<tr>
<td>NBI ≤ 4</td>
<td>&gt;30%</td>
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<td>&gt;30%</td>
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<tr>
<td>NBI = 2 or 3</td>
<td>NBI = 2 or 3</td>
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POLYMERS IN MAINTENANCE

SHRP Task Force 34

Rapid Cure
Good Bond Strength
Flexural, Tensile Strength
Negligible Perm.
Good Freeze-Thaw
Low Dead Load
High Friction
Resistant to Salts

Bond Critical
Costly
Labor Intensive
NYSDOT W.S. AGGREGATE

- Gap Graded
- Hard
  - Mohrs >= 7
- Acid Insoluble Residue
  - >20%

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<th>Sieve Size</th>
<th>#4</th>
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## Comparisons

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<td>Wt (lb/ft²)</td>
<td>20</td>
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<td>4</td>
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<tr>
<td>Cost ($/ft²)</td>
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<td>Delay (d)</td>
<td>21</td>
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<tr>
<td>Service (yr)</td>
<td>20</td>
<td>12</td>
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WHAT ELSE

BETTER
QUICKER
CHEAPER
ASPHALT RUBBER PAVING PLACED SURFACE TREATMENT?
PAVEMENT PLACED SURFACE TREATMENT

• **Benefits**
  – Rapid Placement
  – Minimal Surface Prep
  – Polymer Modified Emulsion Bond Coat
  – High Quality Gap Graded Mix
  – Less Labor

• **Unknowns**
  – Waterproofness
  – Performance on Bridge Decks
  – Service Life on Bridge Decks
ASPHALT RUBBER

Rubber contains polymers which...

- Raises softening point to above 140º F.
  - Resistance to rutting and shoving
  - Resistance to asphalt migration and drain-down

- Increases low temperature flexibility of residue.
  - Resistance to cracking

- Increases high temperature viscosity
  - Thicker film coatings on aggregate particles
  - Higher asphalt content mixes / applications
  - More asphalt = greater resistance to oxidation
  - Increased long term durability
  - Top PG Grading above 80

- Contains no water.
RUBBERIZED ASHALT PRODUCTS

Asphalt-Rubber Binder  Terminal Blend Binder
# ASPHALT COMPARISON

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<th>Criteria</th>
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<td>% Crumb Rubber</td>
<td>15+</td>
<td>NY: 12+/- 3 Others: 5-10</td>
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<td>cP@375 F</td>
<td>1500-5000</td>
<td>500-</td>
<td>100-</td>
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<td>Softening Pt. F</td>
<td>140+</td>
<td>130+</td>
<td>115- Typical</td>
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<td>ALF Cycles</td>
<td>300,000+</td>
<td>100,000</td>
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Percentage of Area Cracked vs. ALF Wheel Load Passes
HOW IT WORKS

22,937,600 rubber particles per ton of mix helps fight cracking

www.rubberpavements.org
GREEN TECHNOLOGY

Turning this... ➔ Into this...
NYSDOT Project – D261765
PRE-EXISTING CONDITINS
AR PPST APPLICATION
AR PPST APPLICATION
AR PPST APPLICATION
AR PPST APPLICATION
AR PPST APPLICATION
AR PPST APPLICATION
AR PPST APPLICATION
WATERPROOFING

• Reduce water intrusion
• Reduce chlorides
• Contaminated
  – Chlorides
  – Moisture
• Will the deterioration rate be reduced?

WILL IT WORK?
PROGRAM OBJECTIVES

• Verify the Effectiveness of Various Membranes
  – Various superstructure types
  – Various traffic conditions
  – Various Regional locations

• Determine Areas Most Prone to Failure

• Long-Term Monitoring
  – May be years for complete study: Failures reported immediately

• Correspond to Condition Rating
Conventional Moisture Measurement

- Probing Methods
  - test probes
  - surface
  - drill hole
- RF Field Methods
  - gross assessment
  - surface sensitive
Wireless Sensor

RedTenna
How Long Will They Last?

• No Batteries
• No Moving Parts
• Stainless Steel Contacts
• Sensor Should Outlast the Structure
WHAT IS MEASURED

- Conductivity is $1/R$

\[ R = \frac{\rho L}{A} \]

- \( \rho \) = resistivity
- \( L \) = length
- \( A \) = cross sectional area
PLACING, LOCATING,& INTERROGATING
# HYDRO TRACKER DATA

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ANTICIPATED RESULTS

• Various Types of Membranes Evaluated
• Measure Effectiveness of Waterproofing
  – Moisture Sensors
  – GPR Surveys
  – Inspection Ratings
• Mainstream Use of Alternative Systems
  – Develop/Modify Specifications
  – Increase the Overlay Program
RECOMMENDATION

Continue with Trials using Innovative Materials

Review Evaluation Criteria

Develop Candidate Selection Guidelines

Develop Design and Material Specs
THANK YOU