Solving a “Hard” Problem For The NYC DOT With a High Performance Thin Overlay

NEAUPG Annual Meeting
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Director- Asphalt Technical Services
NuStar Asphalt LLC
CRUDE

Call it what you will — price adjustments, indexing, or escalators. We call it an outdated bidding policy that subsidizes oil-based asphalt. Asphalt’s slick deals cost DOTs and taxpayers millions when oil prices rise, even when more durable materials like concrete promise affordability and stable pricing. Learn more about asphalt’s raw deals at www.think-harder.org/CRUDE

PCAC
Portland Cement Association
1st Avenue in NYC

- 1st Avenue in Manhattan is 30 year old 18” thick PCC pavement
- Pavement was built with huge fanfare in 1983 projecting 40 year life
- Utilities beneath the pavement
  - Gas lines
  - Water lines
  - Sewer lines
  - Steam line
• Removing the PCC would most likely damage the utilities
  – NYC DOT tries not to use compaction with vibration when paving streets
  – After paving projects are completed NYC DOT tests utilities for leaks
• Funding not available to replace PCC pavement and the utilities
1st Avenue in NYC

- PCC pavement is in very poor condition
- Curb clearances prevent use of a thick overlay
1st Avenue in NYC

- NYC is planning to improve bus service with a new bus lane on 1st Avenue.
- Question – How to Rehabilitate 1st Avenue?
- To come up with an answer you certainly must “Think Harder”
1st Avenue in NYC
1st Avenue in NYC
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1st Avenue in NYC
1st Avenue in NYC

- NYC DOT contacted NuStar Asphalt and asked for suggestions
- Research at Rutgers University had developed a High Performance Thin Overlay (HPTO) Mix
Paulsboro HPTO – 5 years old

Original

After 5 years
NJ I-295 HPTO Project
NJ I-295 HPTO Project
NJ I-295 HPTO Project
1st Avenue in NYC

• Search to improve HPTO performance under severe conditions by beefing up the asphalt binder

• Highly Modified Asphalt (HiMA) developed by Kraton Polymers
  – Specialty SBS material with lower viscosity increase
  – Allows up to 7.5% polymer loading with workability
1st Avenue in NYC

- Research at Rutgers University comparing HPTO mix with conventional PMA binder and Highly Modified Asphalt (HiMA)
1st Avenue in NYC

- Conventional PMA binder had continuous grade of PG 80.4-27.3
- HiMA binder had a continuous grade of PG 95.4-31.03
Flow Number

<table>
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<th>AMPT Flow Number (cycles)</th>
<th>NuStar Flexgard (Unaged)</th>
<th>NuStar HiMA (Unaged)</th>
<th>NuStar Flexgard (Aged)</th>
<th>NuStar HiMA (Aged)</th>
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<td>590</td>
<td>982</td>
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Texas Overlay Tester
Texas Overlay Tester

Hot Mix Asphalt Overlaid on PCC

Horizontal Tensile Stress due to Expansion/Contraction of PCC from Temperature

Horizontal Stress/Strain is modeled using Overlay Tester
Texas Overlay Tester

Overlay Tester Fatigue Life (cycles)

- HiMA
- Flexgard

Binder and Aging Condition

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<th>LTOA</th>
<th>STOA</th>
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<tr>
<td>HiMA</td>
<td>&gt;5,000</td>
<td>4,750</td>
<td>2,541</td>
<td>1,665</td>
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<tr>
<td>Flexgard</td>
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</table>
Flexural Beam Fatigue

- Flexural Beam Fatigue Testing
  - Measure number of cycles to failure
Flexural Beam Fatigue

\[ N_{f,50\%} = k_1 \left( \frac{1}{\varepsilon_t} \right)^{k_2} \left( \frac{1}{E_0} \right)^{k_3} \]

- Flexgard - LTOA
- HiMA - LTOA
- 12.5mm PG76-22 - LTOA
1st Avenue in NYC

- HPTO mix containing each binder was placed on 1st Avenue on September 25, 2012
  - HiMA placed between 100th and 101st Street
  - Conventional PMA placed between 101st and 102nd Street
- 1 1/2” thick overlay
1st Avenue in NYC
1st Avenue in NYC
1st Avenue in NYC

- Both sections performed well through August 2013
- NYC DOT selected HiMA based on laboratory testing and field performance
1st Avenue in NYC

- Rehabilitation Design
  - Micro-mill existing PCC pavement
  - Patch areas as required
  - Crack seal as required
  - Place PG 76-22 tack coat and Mirafi PGMG4 fabric
  - Overlay with 1 ½” HPTO mix with HiMA asphalt binder
    - Added Evotherm warm mix additive to lower mix temperatures and improve workability
    - Produced mix at 300 °F
1st Avenue Micro-Milling
1st Avenue Micro-Milling
1st Avenue Micro-Milling
1st Avenue Crack Sealing and Patching
1st Avenue Crack Sealing and Patching
1st Avenue Tack Coat and Fabric
1st Avenue Tack Coat and Fabric
1st Avenue Paving
1st Avenue Paving
1st Avenue Paving
1st Avenue Finished Pavement
1st Avenue Finished Pavement
1\textsuperscript{st} Avenue Finished Pavement
1st Avenue Finished Pavement
Summary

- Combination of HPTO mix and HiMA gives a thin overlay solution for “hard” pavement rehabilitations
- NYC DOT and NuStar Asphalt will monitor pavement performance
Questions?