Putting HiMA to the Test-1st Avenue in NYC

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HiMA Binder in in HPTO Mix on 1st Avenue in NYC (2013)

- 1st Avenue from 72nd Street to 125th Street in Manhattan was a 29 year old 18” thick PCC pavement
- Cost of total replacement far beyond NYC DOT budget
- NYC DOT contacted Associated Asphalt and asked for suggestions
- CITGO Asphalt proposed putting Highly Modified Asphalt (HiMA) binder into High Performance Thin Overlay Mix (HPTO)
1st Avenue in NYC - 2013
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HPTO Mix

- CITGO Asphalt and Rutgers University developed High Performance Thin Overlay (HPTO) mix system using polymer-modified asphalt
  - Finer gradation than 9.5 mm Superpave mix
    - Allows thinner overlays
    - Better workability
  - Slightly gap-graded mix gradation
    - More room in mix for asphalt
    - Minimum 7% asphalt content
    - Higher asphalt content gives better crack resistance and longer pavement life
  - Polymer-modified asphalt formulated for specific application
  - Combination provides better rut and crack resistance and excellent workability
HPTO Mix

- CITGO Asphalt named the mix FlexGard®
- NJDOT adopted the mix as HPTO
- NYS DOT adopted the mix as 6.3mm mix
- PennDOT adopted the mix as 6.3 mm mix
HPTO vs. 9.5 mm Mix Gradation

Gap Grading

Maximum Density Line

- MD FlexGard
- NJ I-5
Performance Testing of the HPTO Mix

- Laboratory Testing
  - Rutting
    - Asphalt Pavement Analyzer (APA)
  - Fatigue Cracking
    - Flexural Beam Fatigue Device
  - Reflective Cracking
    - Texas Overlay Tester
  - Permeability
    - Flexible Wall Permeability Tester
  - Skid Friction
    - Skid Trailer
Asphalt Pavement Analyzer Results

Rutting Comparison

- Standard 9.5 mm Mix
- FlexGard® S

Less than 1/3 rutting of 9.5 mm Mix

Rutting:
- 0 mm
- 2 mm
- 4 mm
- 6 mm
- 8 mm

Contrast in rutting comparison:
- 7 mm
- 2 mm
Flexural Beam Fatigue Results

Fatigue Life Comparison

- Standard 9.5 mm Mix: 3800 cycles
- FlexGard® S: 48,000 cycles

12 X Fatigue Life of 9.5 mm mix
Asphalt Mix Overlaid on Portland Cement Concrete

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

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

Movable plate

Fixed plate

Saw cut gyratory specimen and glue onto both plates
Texas Overlay Tester

- Test developed at Texas A&M University for Texas DOT
- Very severe test – brittle samples do very poorly
- Measures number of cycles to failure
- Texas DOT specification requires > 300 cycles for mixes that have been Short Term Oven Aged (STOA)
Texas Overlay Tester Results

Cycles to Failure

- 9.5 mm mix: 200 cycles
- FlexGard® S with StellarFlex® S: 1500 cycles
- FlexGard® with HiMA: 5000 cycles

7 Times More Cycles Than 9.5 mm Mix

25 Times More Cycles Than 9.5 mm mix
Permeability Testing

• For Pavement Preservation, important to “seal” pavement to limit moisture damage under the surface layer
• Testing in “Flexible Wall” Permeability Set-up to measure mix permeability

Samples cored from 6-inch diameter gyratory sample
Permeability Results

1600 times less permeable than 9.5 mm mix @ 95% field density
Surface (Skid) Friction, SN_{40}

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Skid Number, SN_{40} (NJDOT Data)</th>
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<tbody>
<tr>
<td>FlexGard® S (new)</td>
<td>53</td>
</tr>
<tr>
<td>9.5 mm Mix (new)</td>
<td>51.6</td>
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<tr>
<td>9.5 mm Mix (4 years)</td>
<td>54.3</td>
</tr>
<tr>
<td>19 mm Mix (4 years)</td>
<td>55.7</td>
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<tr>
<td>19 mm Mix (5 years)</td>
<td>47.7</td>
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1st Avenue in NYC - 2013

• Rehabilitation Design
  – Micro-mill existing PCC pavement
  – Patch areas as required with asphalt mix
  – 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

• Project completed by September 2013
1st Avenue – New York City  2013
Micro-mill Existing Pavement
1st Avenue – New York City 2013
Micro-mill Existing Pavement
1st Avenue – New York City  2013
Crack Seal and Patch Existing Pavement
1st Avenue – New York City  2013
Crack Seal and Patch Existing Pavement
1st Avenue – New York City  2013
Apply PG 76-22 Tack Coat and Paving Fabric
1st Avenue – New York City 2013
Apply PG 76-22 Tack Coat and Paving Fabric
1st Avenue – New York City  2013
Pave with 1.5” HPTO Mix
1st Avenue – New York City  2013
Pave with 1.5” HPTO Mix
1\textsuperscript{st} Avenue – New York City  2013
Pave with 1.5” HPTO Mix
1st Avenue – New York City  2013
Finished HPTO Pavement
1<sup>st</sup> Avenue – New York City  2013
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1st Avenue Finished HPTO Pavement – September 2013
NYC DOT Commissioner Sadik-Khan Announces Innovative Resurfacing of 53-block Stretch of First Avenue, the Latest in $6 Billion of State of Good Repair Projects in Just Six Years

New York City Department of Transportation (DOT) Commissioner Janette Sadik-Khan today announced the completion of a $7 million project to resurface First Avenue from 72nd to 125th streets using an innovative, thin-asphalt overlay atop the notoriously uneven concrete road at a fraction of the cost of a complete rebuilding.

“The high-tech asphalt overlay resurfacing of First Avenue will bring relief to residents and businesses who suffered 24/7 from the earth shattering pounding of vehicles barreling up First Avenue on what was previously a concrete roadway,” said Council Member Jessica Lappin.
HPTO Pavement
1st Avenue – October 2022
1st Avenue in NYC - Summary

- NYC DOT stated they would be satisfied if the pavement on 1st Avenue lasted five years.
- After nine years, including two polar vortex winters, it is still in very good condition.
- The combination of HPTO mix and HiMA binder provides a solution to urban pavement problems.
Questions?

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