Federally Funded Project Using Dense Graded Cold Mix Asphalt Cortland County, NY

TRUXTON TULLY ROAD REHABILITATION PROJECT
Highway Characteristics

- Rural Major Collector
- Length 5.8 miles
- AADT = 300
- DHV = 28
- Speed Limit = 55 mph
- Operating = 50 mph
- LOS = A
- Accident History – 30% less than SWA
EXITING ROAD CONDITIONS

- Narrow Pavement Width
- Inadequate Pavement Structure
- Pavement Condition (Rideability)
- Drainage Inefficiencies
- Roadside Safety Features
Original Project Scope

- Full Depth Reconstruction
- Increase Roadway Width
- Improve Drainage
- Obtain Right-of-Way
- Replace Guiderail and Signs
TYPICAL SECTION

TRUXTON-TULLY ROAD TWO COURSE OVERLAY SECTION - NORMAL CROWN

NOT TO SCALE
PROJECT HISTORY

- **2010** - IPP Approved as Reconstruction
  - Project Cost - $4.6 million
- **2011** - Preservation – Funding Reduced
  - Revised Project Cost - $2.02 million
- **2013** - 7” Base Stabilization Project
  - County Cost - $100,000 (using County forces)
- **2014** – Advanced Detail Plans Completed
  - Engineer’s Estimate = $2.717 million
  - $3.667 million (Alt. #1)
ALTERNATIVES CONSIDERED

- Reduce length of project (25%)
  Politically Undesirable
- Reduce pavement thickness
  Significantly shorten pavement life
- Eliminate Project Improvements
  Drainage, guiderail, signs, etc.
- Need another alternative!
NYSDOT Forward Four Approach

- Preservation First
- System Not Projects
- Optimize Return On Investment
- Make it Sustainable
What is Dense Graded Cold Mix Asphalt?

Cold mixture produced by emulsifying the asphalt in water with “soap” prior to mixing with aggregate. It is less viscous in its emulsified state, and easy to work and compact.

Emulsion breaks after sufficient water evaporation, and cold mix becomes similar to HMA.
Benefits of Dense Graded Cold Mix Asphalt

- Less Expensive than HMA
- Requires Less Energy to Produce than HMA or WMA
- Tends to Be “Self-Healing”
Limitations of Cold Mix Asphalt

- Use on Low-Medium Volume Roads
- Recommend up to 10 Days between Lifts—or sooner if ambient conditions allow
- Preferable to Limit Heavy Truck Traffic until cured
- Wearing Surface
OBSTACLES

- Dense Graded Cold Mix Asphalt not approved by NYSDOT for this type of application
- Never used on a federally funded project in New York State
- Need to develop a Spec that would be acceptable to NYSDOT
- Time Constraints – need to start construction by August
SOLUTIONS

- Suit-Kote - extensive experience with producing/placing dense graded cold mix asphalt
- Cortland County – experience using dense graded cold mix on County roads
- Collaboration with NYSDOT, Cortland County, and Suit-Kote
ELEMENTS OF THE DENSE GRADED COLD MIX
## Current NYSDOT Standard Cold Mix Gradation

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Mixes</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type 1 General Limits % passing</td>
<td>Type 2 General Limits % passing</td>
<td>Type 3 General Limits % passing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 in</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 1/2 in</td>
<td>-</td>
<td>100</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 in</td>
<td>100</td>
<td>90-100</td>
<td>75-100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2 in</td>
<td>90-100</td>
<td>15-45</td>
<td>50-80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/4 in</td>
<td>15-45</td>
<td>0-10</td>
<td>0-15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/8 in</td>
<td>0-10</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>No. 200</td>
<td>0-1.0</td>
<td>0-1.0</td>
<td>0-1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bituminous Material²³</td>
<td>4.7-7.0</td>
<td>4.0-6.0</td>
<td>3.5-5.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Open, Coarse Texture</td>
<td>Open, Coarse Texture</td>
<td>Open, Coarse Texture</td>
<td></td>
<td></td>
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<tr>
<td>Typical Uses</td>
<td>Surface Course</td>
<td>Intermediate</td>
<td>Base Course</td>
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</table>

## Modified Gradation Requirements for Dense Graded Mixes

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Mixes</th>
<th></th>
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<td></td>
<td>Type 1 General Limits % passing</td>
<td>Type 2 General Limits % passing</td>
<td>Type 3 General Limits % passing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 in</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 1/2 in</td>
<td>-</td>
<td>100</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 in</td>
<td>100</td>
<td>90-100</td>
<td>70-90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2 in</td>
<td>90-100</td>
<td>60-90</td>
<td>50-75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/4 in</td>
<td>30-70</td>
<td>30-65</td>
<td>30-60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/8 in</td>
<td>20-50</td>
<td>20-50</td>
<td>20-50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 200</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bituminous Material²³</td>
<td>4.7-7.0</td>
<td>4.0-6.0</td>
<td>3.5-5.5</td>
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</tbody>
</table>
## NYSDOT ENHANCED EMULSION SPECIFICATION

### TABLE 702-4: ANIONIC ASPHALT EMULSIONS

<table>
<thead>
<tr>
<th>MATERIAL DESIGNATION</th>
<th>702-3001</th>
<th>702-3002</th>
<th>702-3011</th>
<th>702-3012</th>
<th>702-3021</th>
<th>702-3031</th>
<th>702-3401</th>
<th>702-3402</th>
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<tbody>
<tr>
<td>GRADE</td>
<td>RS-1</td>
<td>RS-1h</td>
<td>RS-2</td>
<td>HFRS-2</td>
<td>MS-2</td>
<td>HFM-2</td>
<td>HFM-2h</td>
<td>HFM-2s</td>
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<tr>
<td>Emulsion**&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>Viscosity, Saybolt Furol, 77°F (25°C), second</td>
<td>20</td>
<td>100</td>
<td>20</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Viscosity, Saybolt Furol, 122°F (50°C), second</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>400</td>
<td>75</td>
<td>400</td>
</tr>
<tr>
<td>Storage Stability Test, 1 Day</td>
<td>(Difference in % Residue)</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Demulsibility, 35 mL, 0.02 N CaCl₂, %</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cement Mixing Test**&lt;sup&gt;(2)&lt;/sup&gt;, %</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sieve Test, %</td>
<td>-</td>
<td>0.10</td>
<td>-</td>
<td>0.10</td>
<td>-</td>
<td>0.10</td>
<td>-</td>
<td>0.10</td>
</tr>
<tr>
<td>Residue by Distillation, %</td>
<td>55</td>
<td>-</td>
<td>55</td>
<td>-</td>
<td>63</td>
<td>-</td>
<td>63</td>
<td>-</td>
</tr>
<tr>
<td>Oil Distillate, Volume Total Emulsion, %</td>
<td>-</td>
<td>1.5</td>
<td>-</td>
<td>1.5</td>
<td>-</td>
<td>2.5</td>
<td>-</td>
<td>2.5</td>
</tr>
<tr>
<td>Residue from Distillation Test**&lt;sup&gt;(3)&lt;/sup&gt;, Penetration, 77°F (25°C), 100 g, 5 second</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ductility, 77°F (25°C), 5 min, minute, cm</td>
<td>40</td>
<td>-</td>
<td>40</td>
<td>-</td>
<td>40</td>
<td>-</td>
<td>40</td>
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<tr>
<td>Solubility in trichloroethylene, %</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Float Test**&lt;sup&gt;(4)&lt;/sup&gt;, 140°F (60°C), second</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
</tbody>
</table>

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### HFMS-2GH 70% ASPHALT - ENHANCED ASPHALT EMULSION REQUIREMENTS

**MATERIALS**

**Bituminous Material**

Use a medium setting asphalt emulsion meeting the requirements of Section 702 Bituminous Materials with the following exceptions:

- The emulsion will have a minimum asphalt content of 70% and a penetration of 60 – 140.
NYSDOT ENHANCED EMULSION SPECIFICATION

- Standard HFMS-2 Penetration Range
  100-200 or AC 2.5 - AC 5
- Enhanced HFMS-2GH 70% Penetration Range
  60-140 or AC 5 - AC 10
- Standard HFMS-2 Asphalt Content
  65% residual asphalt
- Enhanced HFMS-2GH 70% Asphalt Content
  70% residual asphalt
ESTABLISHING THE JMF

AVG UNIT WEIGHT (PCF)/ % Emulsion

Corrected Stability / % Emulsion

% Emulsion
Further JMF Information
Dense Graded Cold Mix Type 1

The sand fractions
Dense Graded Cold Mix Type 2

Type 2 Cold Mix JMF

<table>
<thead>
<tr>
<th>SIEVE SIZE, mm</th>
<th>#200</th>
<th>#80</th>
<th>#40</th>
<th>#20</th>
<th>1/8&quot;</th>
<th>1/4&quot;</th>
<th>1/2&quot;</th>
<th>1&quot;</th>
<th>1 1/2&quot;</th>
<th>2&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>% PASSING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target Value</td>
<td>3</td>
<td>6</td>
<td>11</td>
<td>16</td>
<td>37</td>
<td>56</td>
<td>96</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>General Limit (Low)</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>20</td>
<td>30</td>
<td>90</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>General Limit (High)</td>
<td>5</td>
<td>9</td>
<td>18</td>
<td>25</td>
<td>50</td>
<td>70</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Comments: Truxton-Tully Project
Base Course - Emulsion HFMS-2G 70 @13 gal/ton (5.3%) starting point
RECYCLED MATERIALS

- **NYSDOT #1**
  
  25% Recycled (RAP) – 75% Virgin
  
  Type 1 Dense Graded Cold Mix
  
  Resultant RAP on total mix – 17.5%

  Type 2 Dense Graded Cold Mix
  
  Resultant RAP on total mix – 10.0%
DENSE GRADED COLD MIX CHARACTERISTICS

- **Initial Mix**
  
  Will not be 100% coated

- **Paving Operation**
  
  Conventional paving best practices apply

- **Compaction**
  
  Density is not a controlling factor
  Time is needed to allow mix to break
COMPACTION

- **80 Series** (no target density established)
  - Method Spec approach
  - 2 Rollers
  - Prescribed number of passes
  - Vibratory in and out for Type 1
  - Vibratory in static out for Type 2

- **Timing**
  - Rollers are kept back until curing process starts
  - Visual inspection process

- **2013 - 7” Base Stabilization Project**
  - County Cost - $100,000 (using County forces)

- **2014 – Advanced Detail Plans Completed**
  - Engineer’s Estimate = $2.717 million
  - $3.667 million (Alt. #1)
CURRENT NYSDOT SPEC

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CONSTRUCTION PHASING

- Pavement Repair with HMA
CONSTRUCTION PHASING

- Pavement Repair with HMA
- Drive Culvert Replacements
CULVERT REPLACEMENT
CONSTRUCTION PHASING

- Pavement Repair with HMA
- Drive Culvert Replacements
- 3” Binder Course – Type 2
Type 2 Binder Course
CONSTRUCTION PHASING

- Pavement Repair with HMA
- Drive Culvert Replacements
- 3” Binder Course – Type 2
- 2” Top Course - Type 1
Type 1 Top Course
Type 1 Top Course
Type 1 Top Course
CONSTRUCTION PHASING

- Pavement Repair with HMA
- Drive Culvert Replacements
- 3” Binder Course – Type 2
- 2” Top Course – Type 1
- Chip Seal
Chip Sealing
Chip Sealing
Rubber Tire Rollers
CONSTRUCTION PHASING

- Pavement Repair with HMA
- Drive Culvert Replacements
- 3” Binder Course – Type 2
- 2” Top Course – Type 1
- Chip Seal
- Sand Seal
CONSTRUCTION PHASING

- Pavement Repair with HMA
- Drive Culvert Replacements
- 3” Binder Course – Type 2
- 2” Top Course – Type 1
- Chip Seal
- Sand Seal
- Pavement Markings
QUESTIONS

- Why was this project unique for NY
- What is NYSDOT Forward Four
- What are 3 benefits of Dense Graded Cold Mix
- Disadvantages
- What emulsion residue property effect stability & flexibility
- What emulsion residue property impacts adhesion
QUESTIONS, con’t

- What is the difference between dense graded and open graded
- Rolling dense graded cold mix it is important to have the rollers tight to the paving operation T/F
- With dense graded cold mix aggregate should be 100% coated for optimum performance T/F
- Dense graded cold mix air voids generally less than 5% T/F