UDOT STONE MATRIX ASPHALT (SMA) CONSTRUCTION AND PERFORMANCE

• History of SMA use in Utah
• Where we use SMA
• SMA Specification
• Important things to watch

HISTORY

First SMA project in 2003 on I-70 by Salina. Project was 4" Rotomill, 2.5" HMA, 1.5" SMA.

AADT 6558
42.72 % Trucks
Preservation:
Chip seal in 2013
Micro Surface planned 2025.

Ride 93
Fatigue Cracking 100
Rutting 76
Environmental Cracking 95
HISTORY

Since 2003 SMA has been used on all roads both high and low volume.

Right now 1455 miles 5047 surface areas of road top surface is SMA

Does not include SMA sections that have been chipped, micro surfaced, or overlayed.

Average environmental cracking index 89

Average rutting index 88

Lane Level / 1.5” SMA overlay

Condition Index Values

- Small Cracking
- Environmental/Cracking
- Rutting
- Small
- Concrete
- Large
- Joint Spalling
WHERE IS SMA USED

- Usually 1.5” to 2” thick for the wearing surface
- High Volume Roads
- Low Volume Roads
- Urban Roads
- Rural Roads
- Reconstruction Projects
- Preservation Projects
- To Help Solve Rutting Problems
- In Place of an HMA Chip Seal
- To Seal the Road
- To Slow Down Cracking Problems
- To Improve Friction
**Rural Roadway**

- Fatigue Cracking >80 (Seal)
  - ENV > 50 and Rutting > 70
  - Ride > 70
  - Chip Seal

- Fatigue Cracking 50-80 (Minor Rehab)
  - 2" - 4" Overlay with SMA surface
  - Microwave Concrete Corridor
  - 1.5” or 2” SMA* (Functional Repair)

- Fatigue Cracking <50 (Major Rehab)
  - Asphalt Corridor
  - Concrete Overlay
  - 4” Asphalt Overlay**

**Interstate / Freeway**

- Fatigue Cracking >80 (Seal)
  - Rural or Small Urban Area
  - Env Cracking and Rutting > 70
  - Env Cracking or Rutting <70
  - Chip Seal with profile correction

- Fatigue Cracking 50-80 (Minor Rehab)
  - Large Urban Area
  - 2" - 4” Overlay with SMA surface
  - Microwave Concrete Corridor
  - 1.5” - 3” SMA (Functional Repair)

- Fatigue Cracking <50 (Major Rehab)
  - Concrete Corridor
  - Concrete Overlay (Major Rehab)
  - 4” Overlay***

**Concrete Corridor**

- Concrete Overlay

**Asphalt Corridor**

- >4” Overlay***

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**SMA SPECIFICATION**

02744S Stone Matrix Asphalt (SMA)

- Has been adjusted several times
- Last major change 2019
- Changed to closer match the HMA specification
- Fixed problems with low oil content
- Now in the process of combining our HMA and SMA Materials Manual of Instruction

960 Volumetric Mix Design and Verification

962 Guidelines for Stone Matrix Asphalt (SMA) Mix Design and Verification
SPECIFICATION HIGHLIGHTS

Table 5  Aggregate Properties – SMA

<table>
<thead>
<tr>
<th>Test Method</th>
<th>Test No.</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Fractured Face</td>
<td>AASHTO T 335</td>
<td>100% minimum</td>
</tr>
<tr>
<td>Two Fractured Face</td>
<td>AASHTO T 335</td>
<td>90% minimum</td>
</tr>
<tr>
<td>Fine Aggregate</td>
<td>AASHTO T 304</td>
<td>45 minimum</td>
</tr>
<tr>
<td>Angularity</td>
<td>UDOT MOI 933</td>
<td>17% maximum</td>
</tr>
<tr>
<td>Flakiness Index</td>
<td>UDOT MOI 933</td>
<td>17% maximum</td>
</tr>
<tr>
<td>(Based on 3/8 inch sieve and above)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L.A. Wear</td>
<td>AASHTO T 96</td>
<td>28% maximum</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>AASHTO T 176 (Pre-wet method)</td>
<td>60 minimum</td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>AASHTO T 89 and T 90</td>
<td>0 maximum</td>
</tr>
<tr>
<td>(Does not apply to Mineral Filler)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Weight</td>
<td>AASHTO T 19</td>
<td>75 lb/cu. ft. minimum</td>
</tr>
<tr>
<td>Polishing</td>
<td>AASHTO T 278 and T 279</td>
<td>31 min.</td>
</tr>
<tr>
<td>Soundness (sodium sulfate)</td>
<td>AASHTO T 104</td>
<td>10% maximum loss</td>
</tr>
<tr>
<td>Clay Lumps and Friable Particles</td>
<td>AASHTO T 112</td>
<td>2% maximum</td>
</tr>
<tr>
<td>Natural Fines</td>
<td>N/A</td>
<td>0% maximum</td>
</tr>
</tbody>
</table>

Control Sieve Size  | ⅛ inch | ¼ inch | ⅜ inch |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>⅛ inch</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>¼ inch</td>
<td>90 - 100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>⅜ inch</td>
<td>45 - 78</td>
<td>90 - 100</td>
<td></td>
</tr>
<tr>
<td>No. 4</td>
<td>20 - 28</td>
<td>26 - 50</td>
<td></td>
</tr>
<tr>
<td>No. 8</td>
<td>16 - 24</td>
<td>20 - 28</td>
<td></td>
</tr>
<tr>
<td>No. 16</td>
<td>13 - 21</td>
<td>13 - 21</td>
<td></td>
</tr>
<tr>
<td>No. 30</td>
<td>12 - 18</td>
<td>12 - 18</td>
<td></td>
</tr>
<tr>
<td>No. 50</td>
<td>12 - 15</td>
<td>12 - 15</td>
<td></td>
</tr>
<tr>
<td>No. 200</td>
<td>8 - 10</td>
<td>8 - 10</td>
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</tbody>
</table>

Minimum Asphalt Binder Content

<table>
<thead>
<tr>
<th>Combined Aggregate Bulk Specific Gravity Gba</th>
<th>Minimum Asphalt Binder Content, %</th>
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<tbody>
<tr>
<td>2.375 - 2.424</td>
<td>6.8</td>
</tr>
<tr>
<td>2.425 - 2.474</td>
<td>6.7</td>
</tr>
<tr>
<td>2.475 - 2.524</td>
<td>6.6</td>
</tr>
<tr>
<td>2.525 - 2.574</td>
<td>6.5</td>
</tr>
<tr>
<td>2.575 - 2.624</td>
<td>6.3</td>
</tr>
<tr>
<td>2.625 - 2.674</td>
<td>6.2</td>
</tr>
<tr>
<td>2.675 - 2.724</td>
<td>6.1</td>
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<tr>
<td>&gt; 2.724</td>
<td>6.0</td>
</tr>
</tbody>
</table>

* Percent of total mix.
SPECIFICATION HIGHLIGHTS

- Additives / Stabilizers
- Hydrated Lime
- Stabilizing additive: Mineral Fiber or Cellulose Fiber
- Mineral Filler: Consists of finely divided mineral matter such as rock dust, slag dust, hydrated lime, hydraulic cement, fly ash, or other suitable mineral matter. Free flowing and free of lumps.

<table>
<thead>
<tr>
<th>Table 7: Sieve Size</th>
<th>Percent Passing</th>
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<tr>
<td>No. 30</td>
<td>100</td>
</tr>
<tr>
<td>No. 50</td>
<td>95 – 100</td>
</tr>
<tr>
<td>No. 200</td>
<td>55 – 100</td>
</tr>
<tr>
<td>No. 450</td>
<td>40 max.</td>
</tr>
</tbody>
</table>

IMPORTANT THINGS TO WATCH

- Oil content and VMA 17.5 minimum if they are not high then we have had cracking problems
- Compaction target 94%, 9 ton minimum roller; stay close to the lay-down machine, full pneumatic tire rollers not permitted,
- Joint compaction
- Does not fix sub grade problems
- Access and side road radius not ease but constructible
- Added cost because of high oil and no RAP
- High quality material equals high quality product
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- Questions?