WMA Project 301-06

- The HMA Mix Types of Material – Medium Traffic
  - 3545 CU YD 448 Type 1 Intermediate – PG 64-22
  - 1602 CU YD 448 Type 1 “Control Mix” w/PG 70-22M
  - 1155 CU YD 448 Type 1 w/Ashpa-Min, PG 70-22M
  - 1339 CU YD 448 Type 1 w/Sasaobit, PG 70-22M
  - 1155 CU YD 448 Type 1 w/Evotherm, PG 70-22M

Shelly and Sands, Inc.
Mix Design

- 57% Limestone 8’s
- 28% Natural Sand
- 15% RAP – by proposal note
- 6.1% Total Binder

Shelly and Sands, Inc.
Control Mix

- Test Section constructed at ODOT Outpost located in Kimbolton, Oh.
- All 3 WMA mixtures sent to O.U. Lancaster
- CM placed first to verify design criteria
- Cos. 541-31.87 to 34.90 (3.03 miles) Western most end of project
- Density gauge used to establish roller pattern

Shelly and Sands, Inc.
Evotherm

- Emulsion mixed at AMI, Marietta, Oh.
- Adjust at plant to achieve optimum binder content
- Gue.- 541-0.00 to 2.70 Bridge Rd.
- 2.70 miles

Shelly and Sands, Inc.
Aspha-Min

- Added at the HMA plant
- Sodium Aluminum Silicate or Zeolite
- 0.3% of the total Mix
- Feed method furnished by supplier
- Calibrated w/plant
Sasobit

- Added at the plant
- Paraffin-wax compound extracted from coal gasification
- 1.5% of the total binder
- Gue. 541-5.40 to 8.47 (Eastern most Ramps of I-77)

Shelly and Sands, Inc.
Environmental Testing

- Stack Tests performed on All 4 mixes by Certified Mar-Zane Environmental Group
- Environmental testing performed at job site by a Certified Industrial Hygienist - EES Group

Shelly and Sands, Inc.
Evotherm Stack Results

- Stack Test Results – USEPA Protocol
  - Slightly higher emissions for Nox, SO2 and VOC than the control mix.
  - 20.2% less CO emissions.
- Paver Test Results – NIOSH Method 5024
  - 77% < TP Total Particulate (Asphalt Fume)
  - 72% < BSM Benzene Soluble Matter

Shelly and Sands, Inc.
Aspha-Min

- Stack Test Results
  - 83.1% < SO2
  - 29.7% < NOX
  - 62.8% < VOC’s
  - 61.9% < CO

- Paver Test Results
  - 67% < TP
  - 81% < BSM

Shelly and Sands, Inc.
Sasobit

- Stack Test Results
  - 83.1% < SO2
  - 21.3% < NOX
  - 50.9% < VOC’s
  - 63.2% < CO
- Paver Test Results
  - 74% < TP
  - 81% < BSM

Shelly and Sands, Inc.
Stack Emissions Sampling Results
(Chief Environmental Group, Zanesville, OH)

<table>
<thead>
<tr>
<th>Mix Type</th>
<th>SO₂ (lb/hr)</th>
<th>NOₓ (lb/hr)</th>
<th>CO (lb/hr)</th>
<th>VOC (lb/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional HMA</td>
<td>0.24</td>
<td>5.2</td>
<td>63.1</td>
<td>7.8</td>
</tr>
<tr>
<td>Evotherm WMA</td>
<td>0.37 (+54.2%)</td>
<td>5.1 (-1.9%)</td>
<td>50.3 (-20.2%)</td>
<td>20.2 (+159%)</td>
</tr>
<tr>
<td>Aspha-Min WMA</td>
<td>0.04 (-83.1%)</td>
<td>3.6 (-29.7%)</td>
<td>24.0 (-61.9%)</td>
<td>2.9 (-63.2%)</td>
</tr>
<tr>
<td>Sasobit WMA</td>
<td>0.04 (-83.1%)</td>
<td>4.1 (-21.3%)</td>
<td>23.2 (-63.2%)</td>
<td>3.8 (-50.9%)</td>
</tr>
</tbody>
</table>

SO₂ Sulfur Dioxide
NOₓ Nitric Oxide
CO Carbon Monoxide
VOC Volatile Organic Compound
Summary

- Avg. Mat Temperature behind paver
  - Hot Mix - 309°F
  - WMA - 245°F
- Lower emissions at the plant
- All WMA’s < the TP NIOSH Limit of 5mg/m3
- Compaction
  - Evotherm seemed easiest 95.5% Avg. Density
  - Aspha-Min seemed most difficult 91-92% Avg. Density

Shelly and Sands, Inc.
Information

- NAPA website
  - www.hotmix.org

- EES Group
  - www.eesinc.cc
    - User name: Shelly ; Password: Sands06

- Ohio University
  - www.ohio.edu