Overview

- What is Sasobit?
- How does Sasobit work?
- US Projects
- Summary

Sasobit®

- A high molecular mass synthetic aliphatic hydrocarbon
- Molecule length between C_{48} and C_{120}. It is produced by Fischer-Tropsch synthesis from coal or natural gas.
- High melting - congealing point min. 99°C, melting range 70-115°C
- Hard - needle penetration < 1 dmm at 25°C
- Low viscosity - 12 mPas at 135°C

Solubility of Sasobit® in bitumen

- Sasobit® is completely and homogeneously soluble in bitumen above 115°C
  - decreased binder viscosity
- No high shear mixers required
- No separation, even after solidification and re-heating of the modified bitumen
  - increased binder stiffness

Impact of Sasobit® on needle penetration
**Influence of Sasobit® on softening point**

![Graph showing the influence of Sasobit® on softening point.](image)

**Influence of Sasobit® on viscosity**

![Graph showing the influence of Sasobit® on viscosity.](image)

**How organic additives work…**

![Diagram illustrating how organic additives work.](image)

**NCAT Evaluation**

- Improved compact ability to 190 F
- Did not affect resilient modulus
- Did not increase rutting potential (APA)
- Cure time to open to traffic is not an issue
- Moisture damage with lower temperature may be an issue
- Anti-aging Properties

**Warm Mix Technology**

- Reduce Mixing and Compaction Temperature
- Reduce Fumes
- Reduce Fuel Costs
- Viscosity Reduction
  - Improve Workability
  - Improve Compaction/Density
- Extend Paving Window
- Cold-Weather Paving
- Improve Quality

**Reduce Fuel Costs**

- European and US Studies
  - Indicate up to 30% Reduction in Fuel Costs
  - However…
    - “That Depends”
Reduce Emissions

European and US Studies

Indicate up to 30% Reduction in Emissions

However

“That Depends”
Viscosity Reduction
Improve Workability

19 mm High Rap Base
PG 64-22

Viscosity Reduction
Improve Workability

9.5 mm High Rap
PG 64-22

Viscosity Reduction
Improve Workability

9.5 mm High Rap
350 °F

Viscosity Reduction
Improve Workability

275 °F with WMA

Viscosity Reduction
Improve Compaction/Density

ICC Draft Report

Stiffness of Conventional Mix and Sasobit were statistically the same with Sasobit being placed 50 °F cooler

Viscosity Reduction
Improve Compaction/Density

Viscosity Reduction
Improve Compaction/Density

Cold-Weather Paving

Location – Parking Lot
Drum Plant
Mix – 25 mm Dense Graded – 25% RAP
Binder – PG 64-22
Depth – 50 MM
Weather – 37 ° F Windy
Sasobit – 1.5% Added to Binder
Control Section – Target temperature 300 ° F.
Sasobit Section – Target temperature 250 ° F

Viscosity Reduction
Cold-Weather Paving

25 mm Dense Graded 25% RAP
Viscosity Reduction
Reduce Emissions/Reduce Fumes

SAM
Stress Absorbing Membrane

1.0 and 1.5% Sasobit added to 20% asphalt rubber blends

SAMI
Stress Absorbing Membrane Interlayer

Reduced Temperature by 75°F

Viscosity Reduction

Asphalt Rubber

Viscosity Reduction Reduced Temperature
Missouri Department of Transportation and Pace Construction

Warm Mix Asphalt Demonstration
May 17-26, 2006

Three Technologies...

Aspha-Min®

Goals:
Reduce or eliminate bumps

Excessive joint sealing material
Wisconsin
Warm Mix Asphalt Open House

June 19-20, 2006
Oak Creek, Wisconsin

Mix Design

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.0mm</td>
<td>100.0</td>
</tr>
<tr>
<td>12.5mm</td>
<td>96.5</td>
</tr>
<tr>
<td>9.5mm</td>
<td>88.5</td>
</tr>
<tr>
<td>4.75mm</td>
<td>68.2</td>
</tr>
<tr>
<td>2.36mm</td>
<td>49.3</td>
</tr>
<tr>
<td>1.18mm</td>
<td>33.9</td>
</tr>
<tr>
<td>0.60mm</td>
<td>21.3</td>
</tr>
<tr>
<td>0.30mm</td>
<td>11.3</td>
</tr>
<tr>
<td>0.15mm</td>
<td>6.6</td>
</tr>
<tr>
<td>0.075mm</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Binder Content: 5.3

Quality Control Test Results

<table>
<thead>
<tr>
<th>Sieve size</th>
<th>Percent Passing</th>
<th>Percent Passing</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>8.1</td>
<td>6.9</td>
<td>6.3</td>
</tr>
<tr>
<td>Gmm</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>19.0mm</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>12.5mm</td>
<td>97.5</td>
<td>68.6</td>
<td>68.7</td>
</tr>
<tr>
<td>9.5mm</td>
<td>96.3</td>
<td>69.5</td>
<td>69.5</td>
</tr>
<tr>
<td>4.75mm</td>
<td>96.3</td>
<td>69.5</td>
<td>69.5</td>
</tr>
<tr>
<td>2.36mm</td>
<td>52.1</td>
<td>50.5</td>
<td>49.7</td>
</tr>
<tr>
<td>1.18mm</td>
<td>24.4</td>
<td>24.2</td>
<td>23.3</td>
</tr>
<tr>
<td>0.60mm</td>
<td>24.4</td>
<td>24.2</td>
<td>23.3</td>
</tr>
<tr>
<td>0.30mm</td>
<td>12.5</td>
<td>12.6</td>
<td>12.1</td>
</tr>
<tr>
<td>0.15mm</td>
<td>8.5</td>
<td>8.5</td>
<td>8.0</td>
</tr>
</tbody>
</table>

Notes:
Pb- Percent Binder
Gmm- Maximum Specific Gravity
Gmb- Bulb Spec Gravity
VTM- Voids Total Mix
VMA- Void Mineral Aggregate
Voids Filled with Asphalt

Why Not Warm Mix?

- Costs
- Testing
- Long-Term Performance
- DOT Acceptance
- AASHTO Provisional Standard
Long Term Performance

- European Experience
  10 Millions Tons, no Failures
- Improved Density
- Reduce Permeability
- Improve Quality

DOT/ Local Government Acceptance

That Depends
- Need
- Environmental Regulations
- Cold-weather Paving
- Workability
- Partnership With Industry
- Why Not?
- We are Here To Help !!!

Questions?

Larry L. Michael
Asphalt Consultant
Hagerstown, MD
301-745-3334