Cold Weather Paving

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Chris Boom, Morris, Inc.
• Brosz Engineering, Inc.
  • Pierre, SD
    • Eagle Butte
    • Winner
    • White Lake
  • Sturgis, SD
  • Sioux Falls, SD
  • Stanley, ND
  • Bowman, ND

• Morris, Inc.
  • Fort Pierre, SD
Cold Weather / Late Season Paving

- Fort Pierre flood damage repair
  - Process, Prime, Chip & Seal (17 – 7)
  - Mill & Overlay, (11 – 6)
  - Reconstruct, (17 – 5)
  - Patching, (21 – 7)
Reconstruction

- Process in place (by City)
- Subgrade removal
- Material laydown
- Incorporate or cap with new aggregate
- 2 – 2” lifts Class E
Mill & Overlay

- Milling
  - Edge mill
  - Center mill
  - Full width mill
- 2” Class E overlay
Patching

- Remove distressed surfacing
- Remove aggregate base
- Remove subbase to achieve 12” full depth section
- 8” new aggregate base
- 2 – 2” lifts Class E asphalt
- Soft / wet areas
  - Excavate 24” full depth
  - Woven geotextile for reinforcement and separation
  - 12” screened aggregate, 8” aggregate base, 2-2” lifts
Here Comes Winter

- Switch from HMA to WMA
  - ZycoTherm by Zydex
    - Reduce mix temperature to 250° to 260°
    - Reduce receiving surface temperature to 35°
    - Increase compaction/consolidation
PaveCool 2.4 - Simulation Results

Input File: PaveCool
Project: Ft. Pierre Streets

<table>
<thead>
<tr>
<th>Project Date &amp; Time</th>
<th>Start Rolling*</th>
<th>Stop Rolling*</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/15/12 1:08 PM</td>
<td>5 min. (248 °F)</td>
<td>46 min. (175 °F)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HMA Mix Type</th>
<th>Binder Grade</th>
<th>Thickness</th>
<th>Delivery Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FINE/DENSE GRADED</td>
<td>PG 58-28</td>
<td>2.00 in.</td>
<td>285 °F</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air Temp.</th>
<th>Wind Speed</th>
<th>Sky</th>
<th>Latitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>80.0 °F</td>
<td>5 mph</td>
<td>Clear &amp; Dry</td>
<td>44.4 ° North</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Existing Surface</th>
<th>Moisture</th>
<th>State</th>
<th>Surface Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNBOUND - COARSE</td>
<td>Dry</td>
<td>Unfrozen</td>
<td>85.0 °F</td>
</tr>
</tbody>
</table>

* Some input elements will require significant time and may have different times than those presented for this report. All input, grades and factors shown, unless otherwise noted, are model input parameter values. In this case, performance predictions should supersede expectations noted for this project. Consult the PaveCool Data User Manual for more details. As always, visit the Software Development or Technical Support website for changes or updates during the life of this project.

Simulation Time: 03/28/13 1:36 PM

Cooling Curve

HMA Temperature, °F

- Cooling Curve
- Start Temp/Time
- Stop Temp/Time
PaveCool 2.4 - Simulation Results

Input File: PaveCool
Project: Ft. Pierre Streets

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<tr>
<th>Project Date &amp; Time</th>
<th>Start Rolling*</th>
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<tbody>
<tr>
<td>10/15/12 1:08 PM</td>
<td>3 min. (248 °F)</td>
<td>26 min. (175 °F)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>HMA Mix Type</th>
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<td>Fine/Dense Graded</td>
<td>PG 58-28</td>
<td>2.00 in.</td>
<td>285 °F</td>
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<tr>
<th>Air Temp.</th>
<th>Wind Speed</th>
<th>Sky</th>
<th>Latitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.0 °F</td>
<td>5 mph</td>
<td>Clear &amp; Dry</td>
<td>44.4 ° North</td>
</tr>
</tbody>
</table>

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<th>Surface Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unbound - Coarse</td>
<td>Dry</td>
<td>Unfrozen</td>
<td>50.0 °F</td>
</tr>
</tbody>
</table>

* Some asphalt mixtures will require construction start and stop times different than those recommended by this program. Always, good judgement must be exercised in order to ensure a proper compaction outcome. Special circumstances should be used in making any asphalt paving decisions. In this case, recommendations shall override recommendations made by this program. Consult the Help file for further details. As an Elan client, the Minnesota Department of Transportation, the University of Minnesota or their suppliers take no responsibility for damages or expenses arising out of the use of this program.

Simulation Time: 03/28/13 1:12 PM

Cooling Curve

HMA Temperature, °F

- Cooling Curve
- Start Temp/Time
- Stop Temp/Time
PaveCool 2.4 - Simulation Results

Input File: PaveCool
Project: Ft. Pierre Streets

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<tr>
<th>Project Date &amp; Time</th>
<th>Start Rolling*</th>
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<tbody>
<tr>
<td>12/03/12 1:08 PM</td>
<td>3 min. (248 °F)</td>
<td>22 min. (175 °F)</td>
</tr>
</tbody>
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<th>Air Temp.</th>
<th>Wind Speed</th>
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</thead>
<tbody>
<tr>
<td>25.0 °F</td>
<td>5 mph</td>
<td>Clear &amp; Dry</td>
<td>44.4 ° North</td>
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<th>State</th>
<th>Surface Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unbound - Coarse</td>
<td>Dry</td>
<td>Unfrozen</td>
<td>40.0 °F</td>
</tr>
</tbody>
</table>

* Some results obtained will require consultation with a PaveCool expert to validate. A PaveCool expert must examine the results to assess the program's recommendations. All recommendations should be reviewed in the context of the program's limitations. This report is for information purposes only and should not be used as a substitute for professional consultation or engineering judgment. Always consult the latest version of the program before using the results. Always follow the guidance provided by the program and any relevant codes or standards.
ZycoTherm

- Terminally Blendable
- Fuel Savings 11-14%
- Salt Resistance
- Compatible with all grades of asphalt binder
- Moisture Resistance, High TSR
- No Odor
Low Mixing & Compaction Temperatures

Higher Tensile Strength Ratios

AASHTO T283

*Conditioning for 2 Hrs
Improved Rut Resistance

Rut depth, less than 5 mm as per AASHTO T340-10

Highly Resistant to Salt Action

ASTM D3625 4% Salt Water Boil Test
**ZycoTherm** nanotechnology substantially improves coating of asphalt binder on aggregates, ensures consistent and higher compaction and eliminates stripping for making durable asphalt pavements over the service life.

**ZYCOThERM BENEFITS**

- **Improves coating upto 120 °C**
  Wets & spreads better even at lower bitumen content to give blacker looking mix

- **Reduces stickiness on trucks and compaction roller upto 90 °C**
  Captures sticky asphalt in nano cages of ZycoTherm for improved free flow and reduced stickiness to trucks or paver and compaction roller

- **Improves field compaction upto 90 °C**
  Uniform flow ensures consistent densities at same number of passes

- **Eliminates stripping**
  Residual water in aggregate at lower mix temperature helps to promote reactivity with aggregate to withstand six hours boil test with 95% retained coating

- **Eliminates odor**
  Captures all odorous compounds in nano cages of ZycoTherm

- **Reduces fuel consumption**
  Lowers mixing temperature by 35 °C, saves fuel by 20-25% OR Helps in longer hauls OR Allows paving in cold conditions 0-5 °C

- **Stable to storage**
  Stable for 15 days and more, suitable for terminal blending

- **Improves TSR values 80 – 90 °C**

- **Melts and mixes hardened asphalt**
  Improves melting and mixing of hardened asphalt from RAP / RAS to reduce / eliminate raveling

- **Marinates aggregates as alternative to lime**
  ZycoTherm dissolved in water (ZycoTherm 1 kg : Water 400 liters) is sprayed on aggregates (5% by weight of aggregates) and left to dry before processing for asphalt mixes

**DOSAGE**

- Unmodified asphalt binders at 0.1% by weight of asphalt binder
- Modified binders PMB / CRMB, RAP / RAS mixes at 0.125-0.15% by weight of asphalt binder

**STORAGE AND SHELF LIFE**

ZycoTherm should be stored between 5 – 45 °C (41 – 113 °F) in a shaded, dry area away from sunlight, heat, ignition, source of sparks, rain and standing water. The container lid should be securely fastened every time it is used. Its shelf life is 24 months.

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**ZYDEX : SUSTAINABILITY THROUGH INNOVATION**

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Zydex Industries
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Paving Considerations

- **Pace / Speed**
  - Knockdown roller on the pavers
  - Knockdown by 235°

- **Timing**
  - Space the trucks for continuous paver operation
    - 1.5 – 2 MPH
  - When the paver did stop, noticeable segregation
Results

- Deterrents
  - Still needs to be 35°
  - Only 3 to 4 hours of paving time per day
  - Unable to flush
    - Will complete this spring
  - Need to tack the day before paving
    - Traffic control
Results

- Overall, Successful
- Density range from 93% to 95%
- Air voids from 3% to 5%
- Completed projects for the Owner
Questions?