Binder Selection Process

Andy Cascione
Flint Hills Resources, LP
How to Prevent Your Roads From Becoming the Next Ice Cream Flavor

1) Proper Aggregate
2) Mix Design
3) Good Compaction
4) Select the Right Asphalt Binder
Evolution of Asphalt Specifications

- Elastic
- Hard
- Strong
- Weak
- Viscous
- Soft

From H. Bahia - Modified Asphalt Research Center
Distresses to Consider When Selecting a Binder

Thermal Cracking
- Correlates most significantly with the binder properties

Rutting
- More related to mixture shear strength
- Binder can still contribute

Fatigue Cracking
- Affected by pavement structure and traffic
- PG Specs promote compliant/elastic binders

Photos from the MnDOT Website & Maintenance Manual
What the Numbers Mean

PG 58V - 34

- Average 7-day max pavement design temp (Resist Rutting)
- Traffic Level (Rutting Resistance)
- Min pavement design temp (Thermal Cracking)
Selecting the Right Low Temperature PG to Prevent Thermal Cracking

-22°C
-28°C
-34°C
-40°C

Performance Grades Available
LTPPBind Online – Low PG

- FHWA web-based tool to help select the asphalt binder PG for a particular site.
- Uses climate data collected by NASA

<table>
<thead>
<tr>
<th></th>
<th>Fargo</th>
<th>Bismarck</th>
<th>Minot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest Yearly Air Temp, °C:</td>
<td>-43.1</td>
<td>-40</td>
<td>-42</td>
</tr>
<tr>
<td>Low Air Temp Standard Dev, °C:</td>
<td>5.11</td>
<td>4.75</td>
<td>5.06</td>
</tr>
<tr>
<td>Low Pavement Temp 50% Reliability:</td>
<td>-32.49</td>
<td>-30.44</td>
<td>-32.26</td>
</tr>
<tr>
<td>Low Pavement Temp 98% Reliability:</td>
<td>-41.2</td>
<td>-38.7</td>
<td>-40.9</td>
</tr>
</tbody>
</table>
Selecting the Right High Temperature PG to Prevent Rutting

52°C -34
58°C -34
64°C -34
70°C -34

Performance Grades Available
LTPPBind Online – High PG

- FHWA web-based tool to help select the asphalt binder PG for a particular site.
- Uses climate data collected by NASA

<table>
<thead>
<tr>
<th></th>
<th>Fargo</th>
<th>Bismarck</th>
<th>Minot</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Air Temperature of high 7 days:</td>
<td>34.27</td>
<td>34.29</td>
<td>33.11</td>
</tr>
<tr>
<td>Standard Dev. of the high 7 days:</td>
<td>2.9</td>
<td>2.36</td>
<td>2.36</td>
</tr>
<tr>
<td>High Avg Pavement Temp of 7 Days 50%:</td>
<td>55.12</td>
<td>55</td>
<td>53.73</td>
</tr>
<tr>
<td>High Avg Pavement Temp of 7 Days 98%:</td>
<td>59.72</td>
<td>59.34</td>
<td>58.08</td>
</tr>
</tbody>
</table>
Selecting the Right Traffic Level to Prevent Rutting

MSCR Grades Available

S - Standard Traffic
H - Heavy Traffic
V - Very Heavy Traffic
E - Extremely Heavy Traffic
Difference Between MSCR Traffic Levels

58 S - 34  0% Recovery
58 H - 34  30% Recovery
58 V - 34  55% Recovery
58 E - 34  75% Recovery

Neat Asphalt
Air Blown/Oxidized
Chemical Modification
Plastomers

Elastomeric Polymer
What About those Old PG Products?

Polymer Modified MSCR Grades

58H - 34 ≈ 58 - 34
58V - 34 ≈ 64 - 34
58E - 34 ≈ 70 - 34

Same PG Temp Spread, but an elastomeric polymer isn’t required
Difference Between Polymer Modified and Non-polymer Modified Binder (Video Stills)

Elastic Recovery
AASHTO T301

PG 58V-34 vs PG 64-34
Polymer Modified vs No Polymer

Both binders pass PG 64 specs
But have very different properties...

PG 64-34
21% Recovery

PG 58V-34
89% Recovery
Comparative Performance of Elastomer Modified and Unmodified Binders

Figure 8: Comparison of the predicted and measured fatigue cracking for the companion sites and those sections with PMA mixtures.
Expected Performance of Elastomer Modified versus Unmodified Binders

"Harold von Quintus, “Polymer-Modified Asphalts—Enhancing HMA Performance,” AMAP Annual Meeting, February 10, 2004"
Summary

- Select PG -34’s to reduce the risk of thermal cracking in North Dakota

- Select PG 58’s to reduce the risk of rutting in North Dakota

- Select H, V, & E grades for improved pavement performance from polymer modified asphalt

- Follow this selection process and the next ice cream flavor will be.....
Questions?

Andy Cascione
Flint Hills Resources, LP