Getting started with warm mix asphalt

WMA Technology Production, Testing and Compaction
Contractors are able to pave at temperatures of 60°–90°F lower than your conventional hot mix asphalt. Evotherm’s comprehensive chemical additive package can help you do just that. Designed to allow the production and compaction of high quality asphalt pavements at much lower temperatures, Evotherm allows you to achieve more than ever before.

Contractors have paved over 50,000 miles of Evotherm around the world with all types of asphalt pavement, including heavily traveled interstates, urban streets, and rural roads. Our technical service engineers work with both plant and field laydown crews assisting with everything from mix design to rolling patterns. Getting started with WMA has never been easier.

1. Warm up the mix plant to normal production temperatures. This insures that all the plant's material handling equipment is at appropriate operating temperatures.

2. Begin warm mix asphalt (WMA) production gradually and lower the mix temperature to within +10°F of the WMA target temperature.

3. Check loaded transports to assure that the mix temperature has stabilized and proceed to reduce to target WMA temperature.

4. Monitor conveyor and mixing motors for power demand. If indicators of power demand rise above acceptable levels, take appropriate action—e.g. raise the mix temperature or divert material if necessary.

5. Visually monitor coating of the aggregate at the bottom of the drag slat conveyor or at the pug mill discharge. If visual evaluation shows less than 95% coating, slightly increase the mix temperature to achieve > 95% coating.

6. Monitor baghouse temperatures and maintain above the dew point, typically > 180°F.

<table>
<thead>
<tr>
<th>Dosage rate (by wt% total asphalt binder)</th>
<th>Unmodified Asphalt</th>
<th>Polymer Modified Asphalt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixing temperature range</td>
<td>&gt; 220°F (&gt;104°C)</td>
<td>&gt; 235°F (&gt;118°C)</td>
</tr>
<tr>
<td>Initial (breakdown) compaction range</td>
<td>&gt; 210°F (&gt;99°C)</td>
<td>&gt; 220°F (&gt;104°C)</td>
</tr>
<tr>
<td>Finish rolling compaction range</td>
<td>&gt; 140°F (&gt;60°C)</td>
<td>&gt; 150°F (&gt;66°C)</td>
</tr>
</tbody>
</table>

At the asphalt terminal
Evotherm can be pre-mixed by your liquid asphalt suppliers at the asphalt terminal and delivered ready to use.

At the mix plant
Bulk Evotherm can be delivered directly to the asphalt mix plant. An existing tank, such as one used for anti-strip, can store bulk Evotherm. We can also provide iso-tainers or vendor managed inventory.

Just getting started?
Evotherm is available in intermediate bulk storage units. Add a port to the asphalt cement line or weigh hopper to start making warm mix asphalt.
One of Evotherm WMA’s benefits is its ease of use in the QC lab. Ingevity can supply sample quantities of Evotherm that can be “dropped into” your standard Job Mix Formulation (JMF).

**Evotherm dosage**
You can determine minimum production and compaction temperatures in the laboratory by producing and compacting mixes using the JMF over a range of temperatures. This approach identifies a range of production and compaction temperature where a given Evotherm dosage gives 100% coated mix having target air voids at N-design. The range of production and compaction temperatures provides a starting point in field operation at the mix plant.

Evotherm 3G dosage typically ranges from 0.25% to 0.75% by weight of total binder. Emphasis is placed on the phrase “total binder” because the Evotherm additive dosage is calculated based on the total binder in the mix, that is the sum of virgin binder plus binder derived from recycled materials, such as a Reclaimed Asphalt Pavement (RAP) and/or Reclaimed Asphalt Shingles (RAS).

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**For example**
Consider a mix with a target Evotherm chemical additive dosage of 0.5% by weight total binder. The total binder content of the mix is 5% but 0.8% of the binder comes from RAP added to the mix.

Working with recycled materials.

\[
\text{(% Target Evotherm Dosage) (\% Total Asphalt Binder)} / \text{(\% Total Asphalt Binder - \% Binder from Recycled)} = \% \text{Adjusted Evotherm Dosage}
\]

In this example:

\[
(0.5) (5) / (5-0.8) = 0.595 \approx 0.6\% \text{ Adjusted Evotherm Dosage Rate}
\]

<table>
<thead>
<tr>
<th>Material Used</th>
<th>Typical Starting Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virgin Mix</td>
<td>0.4%</td>
</tr>
<tr>
<td>PMA</td>
<td>0.5%</td>
</tr>
<tr>
<td>RAP 10% or less</td>
<td>0.4% of total binder content</td>
</tr>
<tr>
<td>RAP more than 10%</td>
<td>0.4% of total binder content</td>
</tr>
<tr>
<td>RAP 10% or less/PMA</td>
<td>0.5% of total binder content</td>
</tr>
<tr>
<td>RAP more than 10%/PMA</td>
<td>0.5% of total binder content</td>
</tr>
<tr>
<td>RAP/RAS</td>
<td>0.4% of total binder content</td>
</tr>
<tr>
<td>RAP/RAS/PMA</td>
<td>0.5% of total binder content</td>
</tr>
</tbody>
</table>

*These recommended typical starting dosages will vary due to production temperatures, weather conditions and haul distances among other variables.*

**Mechanical performance testing**
While the QC laboratory should treat loose Evotherm warm mix as it treats samples of loose HMA, the following steps are recommended when conducting volumetric analyses:

1. Loose Evotherm mix is placed in a pan to an even thickness 1-2 inches deep.

2. The loose mix is conditioned in a forced-draft oven for 2 hours +/- 5 minutes at the field compaction temperature.

3. The conditioned loose mix is placed in a compaction mold, heated to the field compaction temperature, and subjected to the specified N-design gyration (or blows per side if Marshall design).

This procedure compiles with AASHTO R 30.
Field compaction processes for WMA are identical to good practices currently employed in the construction of hot mix pavements. A sufficient number of rollers should be on site to ensure compaction at a speed compatible with the forward velocity of the paver. As in conventional asphalt pavement construction, it is recommended that a pavement density gauge be employed to determine the percent of compaction with roller passes during breakdown rolling as well as the effect of intermediate and finish rolling. Roller passes and pavement coverage patterns should be uniform throughout the project unless density readings indicate a modification is needed. Cores should be obtained from the first day of paving and correlated to the pavement density gauge.

For support, please contact our technical service and field engineering teams at 843.740.2314.

Step 1
Drop mix into trucks in a way that minimizes aggregate segregation and haul with full tarps.

Step 2
Don’t lift or fold the wings of the hopper between loads and keep the hopper at least a quarter full.

Step 3
Keep a consistent head of material so half of the auger box is covered with mix.

Step 4
Heat the screed and elevate it to a height appropriate to deliver a loose mat that is thick enough to lead to the target thickness after rolling.

Step 5
If the compacted mat is exhibiting signs of tenderness, allow mat to drop 10-15°F and resume rolling.

Step 6
Keep the breakdown roller close to the paver. The breakdown roller should be using a frequency that delivers about 12 impacts per foot.

Step 7
Leave enough lift of loose mix to compact into a cold longitudinal joint using the “6-inch” method.

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