Aim

Aim is to reduce the production temperature of asphalt by a nominal 20°C to 30°C (and potentially lower) and recognise an energy savings and reduced carbon footprint.

Warm mix asphalt manufacture currently utilizes three main technologies -

- Hydro Technologies
- Organic or Wax additives
- Chemical additives

Hydro Technology

- Hydro or Foaming technology uses small amounts of water added to hot binder
  - Create microscopic bubbles of water vapour within the binder reduces its viscosity
  - Can be done by injecting water directly into the binder or variations of this simplistic approach.
Hydro Technology

Systems include –
Astec Double-Barrel Green system, Terex, Gencor Amman,

Hydro Technology

- The WAM system
- The Low Energy Asphalt (LEA) system
- Zeolites

Issues:
- Ensuring the aggregate is dried
- Potential for residual moisture in the asphalt
- Restricted to a few plants (currently)

Warm mix asphalt manufacture currently utilizes three main technologies -
- Hydro Technologies
- Organic or Wax additives
- Chemical additives

Organic Technology

- Several different types of wax additives
- Melting points in the order of 70°C - 115°C

Sasobit (Fischer-Tropsch Wax)
**Organic Technology**

- These additives are generally used at rates 1.0% to 1.5% on binder
- Addition can be into the batch or mixing process, or by modifying the binder prior to use

**Chemical Additives**

- Surfactants/Amine work via a variety of different chemical mechanisms,
- Generally do not change the grade/classification of a binder

“If the aggregates can be coated, then the asphalt can be compacted.”

**Chemical Technology**

**Typical Rates of Addition of Surfactants**

<table>
<thead>
<tr>
<th>Additive</th>
<th>Form</th>
<th>Addition Rate (% on Binder)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cecabase RT</td>
<td>Liquid</td>
<td>0.2 – 0.5</td>
</tr>
<tr>
<td>Evotherm</td>
<td>Liquid</td>
<td>@ 5</td>
</tr>
<tr>
<td>Iterlow</td>
<td>Liquid</td>
<td>0.3 – 1.0</td>
</tr>
<tr>
<td>Rediset WMX</td>
<td>Pastille/Pellet</td>
<td>@ 2</td>
</tr>
<tr>
<td>Revix</td>
<td>Liquid</td>
<td>0.4 – 0.7</td>
</tr>
</tbody>
</table>

**Warm mix asphalt manufacture currently utilizes three main technologies -**

- Hydro Technologies
- Organic or Wax additives
- Chemical additives

**Chemical Technology**

- A variety of different surfactants available, but commonly available additives include:
  - Akzo Nobel Rediset RMX
  - Cecabase RT
  - Iterlow
  - Mead Westvaco Evotherm
  - Revix
Benefits of Warm Mix Asphalt

- Less fumes and emissions
- Reduced plant emissions

Benefits of Warm Mix Asphalt

- Improved working conditions

Benefits of Warm Mix Asphalt

- Early site opening
- Cool weather paving
- Compaction aid for stiff mixes

Benefits of Warm Mix Asphalt

- Decreased binder aging
- Increased plant production
- Longer storage
- Longer haul distances
- Can be produced by remote plants

Use of RAP in WMA

- RAP can be included in all these warm mix asphalts
- Warm mix asphalts can be recycled just the same as hot mix asphalt.

Field Validation Project

- Comparison of field performance of HMA and WMA
- Includes 2 additives and 2 foamed WMA mixes
- 3 HMA, 4 WMA (0% RAP), 3 WMA (with RAP of 10% to 50%)
- HMA was VicRoads standard mix, Dense Graded Asphalt Type H
- Excellent performance of all WMA mixes
- TMR specifications permit the use of WMA
References
Austroads Technical Reports
AP-T62/06 Introduction to Asphalt Mix Design
AP-T91/07 Warm Mix Asphalt (WMA) Review
AP-T163/10 Review of the Environmental Aspects of Warm Mix Asphalt
AP-T215 Review of Overseas Trials of WMA
AP-T214 Field Validation of WMA Pavements
AP-T230-13 Laboratory Evaluation of WMA Mixes
AP-T231-13 Evaluation Protocol for WMA

Thank You