GETTING STARTED WITH WARM MIX ASPHALT IN SOUTH AFRICA

Krishna Naidoo | Tony Lewis | Wynand Nortjè | Herman Marais | Kevan Rocher

2ND INTERNATIONAL WARM MIX CONFERENCE, OCTOBER 2011, ST LOUIS, USA
Fast-tracking the introduction of WMA in RSA

Formation of Warm Mix Asphalt Interest Group

Trial 1 → Trial 2 → Trial 3

2008 → 2010

Routine full-scale implementation 2011
Fast-tracking made possible due to:

- Focus and dedication of Warm Mix Asphalt Interest Group
- eThekwini Municipality’s enthusiasm & passion for environmentally sustainable road building solutions
- Asphalt suppliers willingness to take part in the trials
- Co-operation of WMA-T suppliers
Warm Mix Asphalt Trials
South Africa
Template Version 3  May 2011
Agree mix design protocol

Agree testing protocol at plant and paver (include curing effect)

Agree manufacturing plant requirements / modifications

Agree manufacturing plant staff requirements

Agree materials requirements

Agree blending / additive addition protocol

Agree construction staff and plant requirements

Agree conditions within which the product can successful – loading, support, temp, etc

Agree safety protocols

Agree monitoring, sampling and testing team

Agree emission monitoring protocols

Agree energy consumption monitoring protocols

Agree LTTP

Working group meeting to go to next stage

Agreements and Protocols
Driving Definition

**WMA** is asphalt that is manufactured and paved at between 20°C and 30°C lower than conventional hot mix asphalt (**HMA**), with all its properties and performance being equal to or better than **HMA**
One WMA-T
Reduce temp by 20°C
10% RA in some mixes
30% RA in one mix

Two WMA-T
Reduce temp by 20°C
10% RA in all mixes
Heavily trafficked road

Four WMA-T
Reduce temp by 20°C to 30°C
10%, 20%, 40% RA mixes
Polymer mod binders
10 Surfacing mixes
8 Base mixes
Rejuvenator in 40% RA mix
Major urban arterial

Trial 1
November 2008
One WMA-T
Reduce temp by 20°C
10% RA in some mixes
30% RA in one mix

Trial 2
May/June 2009
Two WMA-T
Reduce temp by 20°C
10% RA in all mixes
Heavily trafficked road

Trial 3
Nov/Dec 2010
Four WMA-T
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Knowledge & Practical Experience
One WMA-T
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Major urban arterial

Nov/Dec 2010
Trial 3

Knowledge & Practical Experience
Polymer modified (A-P1) base using foamed bitumen
Outcome of trials: 
Mix Properties

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture susceptibility</td>
<td>Modified Lottmann</td>
</tr>
<tr>
<td>Rutting</td>
<td>MMLS / Hamburg Wheel track / Dynamic creep</td>
</tr>
<tr>
<td>Stiffness</td>
<td>Repeated load ITS / Four-point beam test.</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Four-point beam test.</td>
</tr>
<tr>
<td>Field compaction</td>
<td>Nuclear gauge / Core specimens</td>
</tr>
</tbody>
</table>
# Outcome of trials

Successful in:

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>![Icon]</td>
<td>Reducing mixing and paving temperatures <strong>by 25°C to 30°C below those of conventional mixes</strong></td>
</tr>
<tr>
<td>![Icon]</td>
<td>Including polymer modified binders in the “warm” mixes</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Adding up to 40% RA</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Using base as well as surfacing mixes</td>
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</table>

The quality of the WMA was shown to be at least as good as that of the HMA control mixes
SABITA MANUAL 32

Contents of this CD

This document presents best practice guidelines for the production and construction of Warm Mix Asphalt (WMA) for roads and airports. WMA, which has significant environmental, occupational health and safety, economic and engineering benefits, is already being used extensively in the USA, some European countries and China, and its use seems set to expand significantly over the next five years.

The main purpose of these guidelines, which utilise knowledge and experience gained from extensive local trials as well as that gleaned from international experience, is to ensure that best practice is implemented in the application of WMA in South Africa.

Accompanying these best practice guidelines is a stand-alone interim specification, its purpose being to assist practitioners to implement the production and paving of WMA in South Africa.

The full range of SABITA manuals, guidelines and other publications is more fully described and may be ordered from the SABITA website:

www.sabita.co.za Tel: +27 21 931 2718 Fax: +27 21 931 2806 email: info@sabita.co.za

Manual 32
Best practice guideline and specification for warm mix asphalt
ISBN 978-1-8974968-55-1
September 2011
SABITA MANUAL 32
WMA BEST PRACTICE GUIDELINE

UTILISE:

- Information and experience gained from the 3 trials
- Worldwide literature search of WMA
- Information from study tour of some EU countries
- South African manuals (especially TRH 21:2009 “Hot Mix Asphalt Recycling”)
We used the opportunity to:

Revisit general “best practice” in asphalt design, manufacture, and paving.

Structured around:

**F**requently **A**sked **Q**uestions
<table>
<thead>
<tr>
<th>FAQ</th>
<th>CHAPTER</th>
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<tbody>
<tr>
<td>What are the benefits of WMA in terms of the environment, working conditions and costs?</td>
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</tr>
<tr>
<td>What technologies are used to reduce the asphalt temperature while still enabling a high level of compaction to be achieved?</td>
<td>4</td>
</tr>
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<td>How are WMA Technologies classified?</td>
<td>5</td>
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<td>Are any additional or less stringent measures required regarding HSE when manufacturing and paving WMA?</td>
<td>6</td>
</tr>
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<td>7</td>
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<td>8</td>
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<tr>
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</tr>
<tr>
<td>What quality assurance measures should be implemented at the paving site?</td>
<td>13</td>
</tr>
<tr>
<td>When new WMA Technologies become available what procedure is used to implement and approve them?</td>
<td>14</td>
</tr>
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What technologies are used to reduce the asphalt temperature while still enabling a high level of compaction to be achieved?

How are WMA Technologies classified?

- Water Technologies
- Chemical additives
- Rheological modifiers
- Rheological polymer modified hybrids
CHAPTER 7

How should the various components that are used to make up WMA be handled?

Reclaimed asphalt (RA)

Stockpiling & processing RA prior to recycling – crushing, screening into fractions

Milled asphalt from site

Crushing and screening

Stockpiling, testing & approval
CHAPTER 7

How should the various components that are used to make up WMA be handled?

WMA Technologies

- Mechanical binder foam systems
- Water carrying chemical additives
- Moist fine aggregate addition systems
- Blending of powdered, pelletized, or liquid WMA additives
What process is used to approve the mix? What changes are there to the mix design procedures used for WMA?

CHAPTER 9

Step 1: Laboratory mix design
Step 2: Full-scale plant mix
Step 3: Plant mix & pave trial
Step 4: Final mix approval

NOTE: This guideline only caters for continuously graded mix types
CHAPTER 9
WMA MIX DESIGN

AGGREGATE PACKING

OPTIMUM BITUMEN CONTENT

OPTIMUM WMA TEMP

WMA-T bitumen temps

4 Bitumen contents

+ - 5°C
How is WMA manufactured?

- Can both batch and continuous type drum mixers be used,

- What modifications are required,

- How is the plant adjusted to produce mix at a lower temperature?
How is WMA manufactured?

Recommended maximum RA contents:

<table>
<thead>
<tr>
<th>TYPE OF MIXING PLANT</th>
<th>MAXIMUM % RA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch mix</td>
<td></td>
</tr>
<tr>
<td>- Pug mill only</td>
<td>10</td>
</tr>
<tr>
<td>- Pug mill &amp; hot elevator</td>
<td>25</td>
</tr>
<tr>
<td>Drum mix</td>
<td></td>
</tr>
<tr>
<td>- Parallel flow feed with aggregate</td>
<td>10</td>
</tr>
<tr>
<td>- Parallel flow with centre ring</td>
<td>30</td>
</tr>
<tr>
<td>- Counter flow with RA ring</td>
<td>40</td>
</tr>
<tr>
<td>- Counter flow with after-mixer</td>
<td>40</td>
</tr>
<tr>
<td>Twin dryer drum</td>
<td>50</td>
</tr>
<tr>
<td>Double barrel drum</td>
<td>70</td>
</tr>
</tbody>
</table>
When new WMA Technologies are proposed, what procedure is used to introduce and approve them?

Some WMA-T are already proven:

- Sasobit®,
- Rediset WMX™,
- Sasolwax Flex™,
- NA Foamtec ™,
- Rediset WMX™ in combination with standard EVA
# Phased approach for new technologies

<table>
<thead>
<tr>
<th>Phase</th>
<th>Process / Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>Provide information – usage, dosage, MSDS, etc</td>
</tr>
<tr>
<td>Phase 2</td>
<td>Mix design approval process as in Ch 9, including moisture susceptibility and rutting potential testing, plant mix and full-scale trials</td>
</tr>
<tr>
<td>Phase 3</td>
<td>Approval of the new WMA –T based upon the assessment of documentation, and results of lab, plant and full-scale paving trial</td>
</tr>
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</table>
ANNEXURE A

INTERIM SPECIFICATION FOR WARM MIX ASPHALT BASE & SURFACING

Styled as a “stand-alone” specification based on COLTO 4200
Interim Specification

- Allows use of polymer modified
- Limited to continuously graded mixes
- Aggregate & RA moisture content limits
Interim Specification

<table>
<thead>
<tr>
<th>RA preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>WMA-T</td>
</tr>
<tr>
<td>Plant modifications to enable lower temperatures</td>
</tr>
<tr>
<td>Weather conditions</td>
</tr>
<tr>
<td>Mix approval – lab, plant mix, and trial pave</td>
</tr>
</tbody>
</table>
Where to now?

- Investigate the greater consistency of quality and workability achieved with WMA?
- Investigate the improvement of permeability of the entire mat?
- Optimise mix designs to match the strengths peculiar to each WMA-T?
- Residual life / recyclability of each WMA-T?
I’m going through changes....

WMA is now being used on a routine basis in South Africa but….we still have a lot to learn!

Guideline will be helpful with implementation and refining practice.

Next step – half warm mix?
Siyabonga!
Dankie!
Thank you!

See you in Durban for COP 17

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