Development of performance requirements for binder distributors in South Africa

Cost effective high performance surfacings

Trevor Distin
Overview

• Introduction
  – types of binders
  – Types of sprayers

• Issues

• Developments
  – Transverse distribution
  – Certification scheme
  – Spray tolerances
  – Safe work practices

• Summary
Binder usage in spray seals

- +- 125 million litres sprayed annually
- +- 44% of all seals are modified
- Focus on development of binder specs
- Shift to spraying more viscous hot binders

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Spraying of binders

- +- 100 calibrated pressurised distributors
- Most common types of spray bar systems used
  - Bearcat
  - Etnyre
  - Rosco
  - Acmar
- Standard bar length = 4.2 m
- Nozzle spacing = 100mm
- Angle of nozzle to bar = 30° C
- Triple overlap required
Sprayer characteristics

- Tank capacities vary from 9 – 20kl
- Application rates vary from
  - Dilute emulsion: > 0.5 l/m² @ 60° C
  - Bitumen rubber: < 3.0 l/m² @ 210° C
- Older sprayers have auxiliary engines which deliver 150l/min/m
  - fixed discharge (vary speed to achieve spray rate)
- New generation are powered by PTO & pressure governed by varying pump speed
  - Pump speed adjusts to change in speed to maintain constant spray rate
Issues facing binder distributors

Industry task team was formed in May 2002 to address issues related to the performance of BD

- Current BD calibration system does not guarantee field performance
- Testing oil does not emulate high viscosity modified binder properties
- Spray rate tolerances not realistic for modified binders
- No standard protocols for flushing BD on-site
Issues facing binder distributors

• Lack of confidence
  – Outdated specifications/standards
  – No standard methods for conducting BD tests = no consistency in results

• Uncertainty over future
  – Only 2 fix pit testing centres still operational
Outputs of task team

Agreement was reach by task team on:

• Transverse distribution test method
• New certifying scheme for BD
• Spray rate tolerances
• Guidelines for safe handling
Transverse distribution test

- Investigated developing a field test
  - Using carpet tiles
  - Buckets
- Preferred non destructive test prior to spraying
- Bucket test chosen because:
  - Can be conducted on-site using project binder
  - Accurate measurement
  - Does not require sophisticated equipment
  - Binder sucked back (no waste)
Transverse distribution tolerances

<table>
<thead>
<tr>
<th>Type of binder</th>
<th>Spray viscosities (CPs)</th>
<th>Max variation from mean (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetration, cutback or emulsion</td>
<td>40 – 100</td>
<td>+- 5.0</td>
</tr>
<tr>
<td>Polymer modified binders</td>
<td>120 -200</td>
<td>+- 7.0</td>
</tr>
<tr>
<td>Bitumen rubber binder</td>
<td>2000 – 3000</td>
<td>+- 10.0</td>
</tr>
</tbody>
</table>

- The net mass of each individual bucket must not vary by more than the mean value for binder type
- Mean value of LHS & RHS must be < 5% of centre section of spray bar
- Spray angle and bar height must still be checked
New certification scheme sought to replace annual calibration

- Need to develop standard test methods
- Develop a step function to improve correlation between slotted tray & bucket test
- Values distorted due to measurements too small
Output distribution of a single nozzle discharge
## Bucket vs slotted tray test

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Equipment</th>
<th>Medium</th>
<th>Unit</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14 buckets @ 265mm</td>
<td>Project binder</td>
<td>mass</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>84 trays @ 50 mm</td>
<td>Oil @ 40° C</td>
<td>volume</td>
<td>18%</td>
</tr>
</tbody>
</table>

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New certification scheme

• New scheme proposed to certify a BD ‘fit for purpose’ to replace annual calibration scheme at fixed pit
• Standard test methods developed to conduct tests on-site or at depot
  – Conduct all tests at operator premises prior to start of project
  – Bucket test to be done on site as a control during project
• Record of all tests to be kept in BD orange box

<table>
<thead>
<tr>
<th>Property</th>
<th>SANS method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verification of dipstick</td>
<td>3001-BT20</td>
</tr>
<tr>
<td>Power &amp; road speed indicator</td>
<td>3001-BT21</td>
</tr>
<tr>
<td>Pump system performance</td>
<td>3001-BT22</td>
</tr>
<tr>
<td>Transverse distribution</td>
<td>3001-BT24</td>
</tr>
</tbody>
</table>
New certification scheme

- The initial calibration of BD to become the responsibility of equipment manufacturer
- General requirements for road worthy will remain responsibility of BD owner

Two situations envisaged:-

1. Large projects – tests* carried out on-site
2. Small/occasional work – tests* carried out in BD owner’s yard shortly before use or on an annual basis

* To be supervised by independent accredited tester
Spray rate tolerances

- Deviation from target spray rate can result in ‘bleeding’ or ‘stripping’
- Spray rates based on volume sprayed/area
- Various factors can affect accuracy of measurements
- Agreement reach on:
  1. Minimum lot size of 1500 litres
  2. +/-5.0% of target spray rates for all binders or
  3. +/-0.06 l/m² of target spray rates except +/-0.10 l/m² for bitumen rubber
- Use greater value obtained for 2 & 3
Safe handling

- Sabita published:
  - Guidelines for safe & responsible handling of bituminous binders (2003)
  - Quality management in the handling & transport of bituminous binders (2005)
  - Guidelines for primes & precoating fluids (2006)
  - Working safely with bitumen DVD (2007)
- HSE Certification scheme introduced with measurable criteria (2007)
- Use of drip trays required on large projects

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Summary

- New certification scheme required to guarantee performance of BD ‘fit for purpose’
  - Increase use of modified binders
  - New generation sprayers
  - Outdate specifications
  - Unreliable test methods (slotted tray)
  - Concern over future of state managed facilities

- Development of depot or on-site tests to validate performance prior to spraying

- Acknowledge contributions of RPF task team