Specifications for modified binders - is change needed?

BMLC - Pretoria
10 November 1998
development of modified binder specifications

✓ Early 80s
  - introduction of modifiers

✓ 1991
  - Sabita roadshow “Flexible solutions for the road ahead”
development of modified binder specifications cont...

✓ 1994
   - publishing Sabita manual as a draft “Technical guidelines for seals using homogenous modified binders”

✓ 1998
   - Colto “Standard specifications for road & bridge works”
   - Sabita modified binders seminars
why modify bitumen?

- increase the softening point
- increase the cohesive strength
- improve elasticity
- improve low temperature flexibility
- increase viscosity @ higher road in-service temperatures
modified binder specifications for seals only
✓ hot applied and modified emulsions
✓ polymers - SBR, SBS & EVA*
  (no values specified for B8 nor modified emulsions)
✓ base bitumen - B8 & B4
✓ polymer content not specified
hot applied modified binders
 tests

✓ ring & ball
  (softening point)

✓ dynamic viscosity
  (Brookfield)

✓ ductility @ 10 C

✓ elastic recovery

✓ stability

✓ adhesion test
  (modified Vialit)
ring & ball softening point

- good correlation with polymer %
- comparison between consistency of modified and pen bitumen
  - SABS 307 for 80/100: 42 - 51 °C
  - COLTO for SBR: 47 °C min
  - COLTO for SBS: 49 °C min
- field results above specified minimum
SBR softening point test results

Source A
Source B
Source C
Limit (deg C, min)
dynamic Brookfield viscosity

- Min value of 1.0 Pa.s specified @ 135°C
- Modified binders display non-Newtonian behaviour @ 60°C
- SHRP specification has only max value
- Specify a range to ensure sprayability without binder degradation or tramlining - spray viscosity of 0.1 Pa.s
<table>
<thead>
<tr>
<th>Source</th>
<th>Viscosity at 135 deg C (Pa.s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source A</td>
<td>0.3, 0.5, 0.7, 0.9, 1.1</td>
</tr>
<tr>
<td>Source B</td>
<td>0.3, 0.7, 0.9, 0.9, 1.1</td>
</tr>
<tr>
<td>Source C</td>
<td>0.3, 0.7, 0.9, 0.9, 1.1</td>
</tr>
</tbody>
</table>

**SBR Viscosity test results**

- **Source A**
- **Source B**
- **Source C**
- **Limit (Pa.s, min)**
low temperature ductility

✓ indication of compositional balance and cohesive strength at low temperatures

✓ min value specified @ 10 C
  - SBR 1000 mm
  - SBS 500 mm

✓ more applicable to unmodified binders
  - force-ductility test more appropriate to compare modified binders
elastic recovery

✓ indicates compositional balance and sufficient polymer for elasticity
✓ choose appropriate product to accommodate crack activity
✓ min value specified @ 10°C
  - SBR 55%
  - SBS 60%
✓ SBR field results are below specified min, SBS above
SBR Elastic recovery test results

- Source A
- Source B
- Source C
- Limit (%, min)
stability

✓ measures difference between lower and upper sections of sample
✓ max difference in R&B of 2 C specified
✓ indicates whether the modified binder is storage stable @ a temperature of 160 C for 3 days, or whether agitation is required during transport and storage
adhesion

✓ determines adhesiveness and cohesive properties of binder to stone

✓ min values specified
  - @ 5°C 90%
  - @ 50°C 100%

✓ conduct test on project aggregate prior to contract commencement
cold applied modified binders tests

- modified binder content
- Saybolt Furol viscosity
- residue on sieving
- particle charge
- sedimentation
- recovered binder properties
nett modified binder content

- Only min percentage specified
- includes bitumen, polymer, flux and emulsifiers
- revise specification to include upper limits similar to SABS 548
Saybolt Furol viscosity

- min value specified @ 50 C
- necessary to prevent run-off on steep gradients
- revise specification to include upper limits similar to SABS 548 to protect against high viscous binders
residue on sieving

✓ max value specified
✓ indicates degree of dispersion and if problems might occur with blocked nozzles
✓ specification should be revised to 0.5g /100ml for latex modified emulsions which have coarse dispersions
Recovered binder properties

✓ Tests performed on recovered binder residues of emulsions same as hot applied binders
✓ Softening point requirement 55°C vs 47°C for hot applied SBR
✓ Elastic recovery requirement 52% vs 55% for hot applied SBR
The Sabita specifications are a consensus view and were based on limited samples submitted to CSIR. Published as a draft to be revised over time as interim spec until penetration bitumen specs finalised. Specifications are necessary, however they must be appropriate, specific, achievable, practical, cost effective.
recommendations

reconvene BMLC sub committee on modified binders to develop a specification which will adequately:

✓ ensure quality control measures during manufacture, handling and application

✓ predict product performance

ie a Total Quality System