2011 STUDY TOUR

Binders

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Learn more about

- Use of crumb rubber binder CRB in seals and asphalt
- Use of polymer modified bitumen emulsions in seals
- Development of performance based specifications for binders

Bitumen supply

- RSA has traditionally been a net exporter of bitumen
- Current demand exceeds 450,000 tonnes pa
- Experiencing shortfalls due to:
  - o unplanned refinery shut down
  - o increase peak demand
  - o limited storage facilities
  - o green fuels specifications
- Refineries supply penetration and cutback grades

Bitumen supply

Refinery bitumen grades

Grade	Use	Australian equivalent
80/100	Spray seal	C80
60/70	Asphalt wearing course	C170
40/50	Asphalt base course	C320
MC 30	Cut back prime	AMC 0
MC 3000	Cutback spray seal	AMC4

Comparison of specs

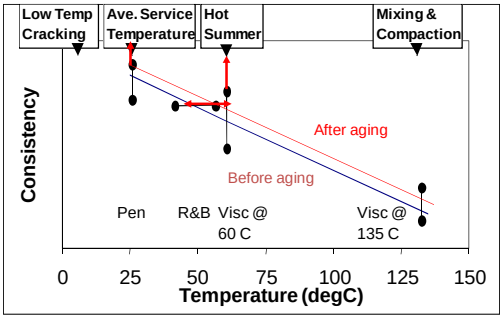
Penetration ranges @ 25 °C

	40/50	60/70	80/100	150/200
RSA	40/50	60/70	80/100	150/200
CEN	35/50	50/70	70/100	160/200
Australia	40 min	62 min		130 min
	C320	C170		C50

Viscosity ranges @ 60°C

	40/50	60/70	80/100	150/200
RSA	220 - 400	140 – 250	75 - 150	30 - 60
CEN	225 min	145 min	90 min	30 min
Australia	260 - 380	140 - 200		40 - 60

SANS 307 framework

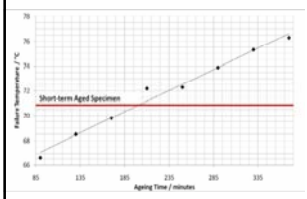


Development of PG specs

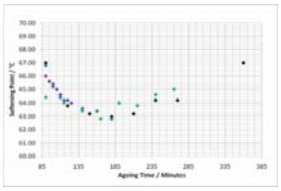
- Link binder properties to pavement performance
- Develop a 'simple' performance grade specification
- Seamless test regime across all types and grades of binders for seals & asphalt
- Using following performance criteria and tests:
  - Stiffness (G*) and elastic behaviour (phase angle) with the dynamic shear rheometer at maximum in-service temperature
  - Short term aging temperature susceptibility using dynamic viscosity after RTFOT
  - Long term aging performance using PAV and DSR

RTFOT ageing of SBS

G*/Sinδ

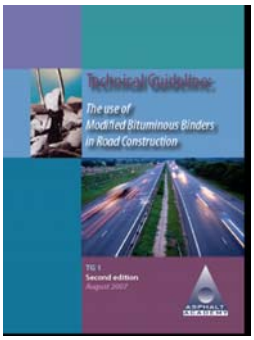


Softening point



Modified binders

- Polymer blind spec
- Based on achieving end binder properties
- Covers both hot and cold PMB's use in:
  - Spray seals
  - Asphalt
  - Microsurfacing
  - Crack sealants
  - Bond coats



Modified binders

Table 4: Modified Binder Classification System	
Modified Binder Class	**Application – Surface Seal**
S – E1	Surface seal – hot applied elastomer modified
S – E2	Surface seal – hot applied elastomer modified
S – R1	Surface seal – hot applied bitumen rubber
SC – E1[1]	Surface seal – emulsion elastomer modified
SC – E2[1]	Surface seal – emulsion elastomer modified
Modified Binder Class	**Application – Premixed Asphalt**
A – E1	Hot mix asphalt – elastomer modified
A – E2	Hot mix asphalt – elastomer modified
A – P1[1]	Hot mix asphalt – plastomer modified
A – H1	Hot mix asphalt – hydrocarbon modified
A – H2[1]	Hot mix asphalt – hydrocarbon modified
A – R1	Hot mix asphalt – bitumen rubber
AC – E1	Microsurfacing – emulsion elastomer modified
AC – E2	Microsurfacing – emulsion elastomer modified
Modified Binder Class	**Application – Crack Sealant**
C – E1	Crack sealant – hot applied elastomer modified
CC – E1	Crack sealant – emulsion elastomer modified
C – R1	Crack sealant – hot applied bitumen rubber

Crumb rubber bitumen

TG1 has specifications for CRB for use in seals & asphalt

Criteria	Requirement
Base bitumen	80/100
Rubber content	20 – 24 %
Extender oil content	3 % max
Blending/digestion temperature	170 - 210° C
Digestion time	45 minutes min
Shelf life at application temperature	6 hours max

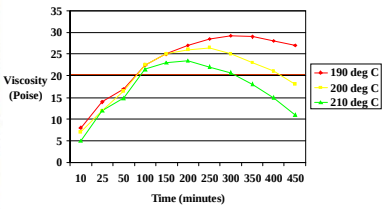
30 mesh crumb rubber used

Properties of bitumen rubber

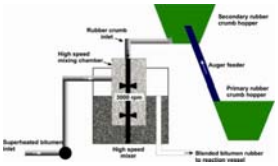
Property	S-R1	A-R1
Softening point, ° C	55 – 62	55 – 65
Resilience @ 25° C, %	13 – 35	13 - 40
Flow @ 60° C, mm	15 –70	10 – 50
Compression recovery, % 5 minutes 1 hour 4 days	 70 min 70 min 25 min	 80 min 70 min n/a
Viscosity @ 190° C	20 –40	20 – 50

Viscosity with time vs temp

Hand held Rion



Manufacture of CRB



Digestion of CRB

Compartment tank

Spray with belly auger

Use of emulsions

New construction

- Priming
  - Invert cutback
  - Oil in water
- Tack/bond coats
  - Ultra thin asphalt
- Spray sealing in winter
  - Tack spray
  - Penetration spray
  - Cover spray

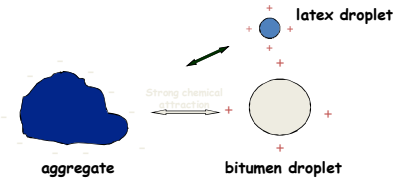
Rehab & maintenance

- In-situ stabilisation
- Enrichment sprays
  - Dilute emulsion
  - Proprietary cutback emulsions
- Slurry & microsurfacing
  - Rutfilling
  - Texture treatments
  - overlays
- Cold mix asphalt
- Cold pour crack sealants

Use of PMBE's

Properties of emulsion	Spray	Bond coat	Micro surfacing	Crack sealant
Binder content (%)	65 & 70	65	62 – 65	55
Viscosity @ 50° C (SF.s)	51 -200 51 – 400	21 – 100		< 0.8 @ 25° C
Properties of residue binder				
Softening point residue (min ° C)	48 & 55	48	48[1] & 55[2]	80
Elastic recovery @ 15° C on residue (min %)	50 & 55	50	50[1] & 55[2]	60

Curing of Cationic Emulsion



3 phase emulsion

Spray sealing

Construction of Cape seals

Cover sprays

Use emulsions allows construction of seals when road surface temperatures >10° C

Microsurfacing

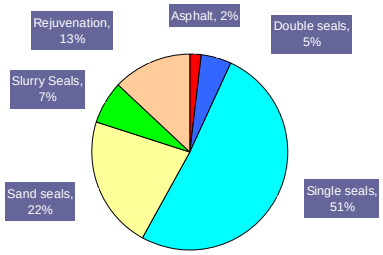
Overlays

Rutfilling

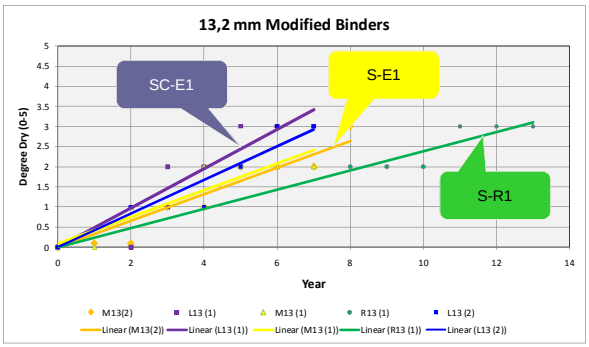
Cost effectiveness of enrichment sprays

- Prolong life of existing seal by ± 3 years
- Apply up to 3 times before resealing

Seal Type Distribution
(Western Cape 6 – year average)



Hardening/ Oxidation (WCPA)



Summary

- Increased use of CRB for improved performance
  - Only high speed field blended CRB use in spray seals
  - On-site measurement of viscosity before use
  - Augers in digestion tanks & sprayers
  - >20 % rubber crumb used
  - Use of preblended CRB for asphalt wearing courses

Summary

- Increased use of emulsions
  - To allow construction of new seals in winter
  - Dilute sprays used to enriched aged seals to extend service life
- Development of PG specs for binders
  - Use of DSR to measure binder properties across temperature spectrum
  - More suitable for measuring PMB degradation after RTFOT