



12TH Conference on Asphalt Pavements for southern Africa

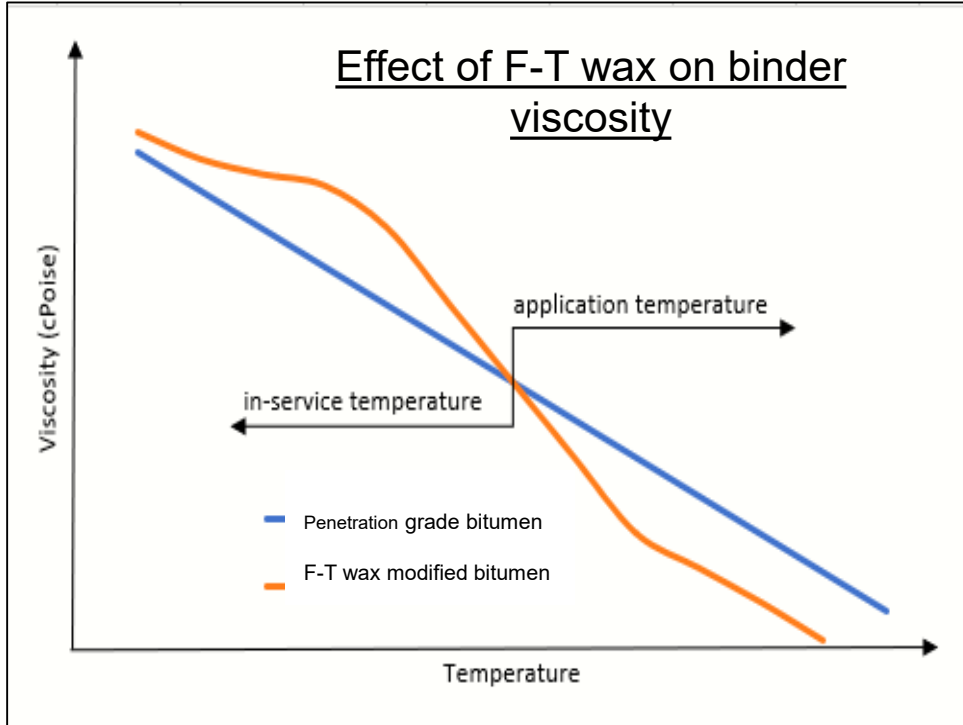
13 -16 October 2019 | Sun City | South Africa

New Crumb Rubber Technology - a life cycle extender for Porous Asphalt

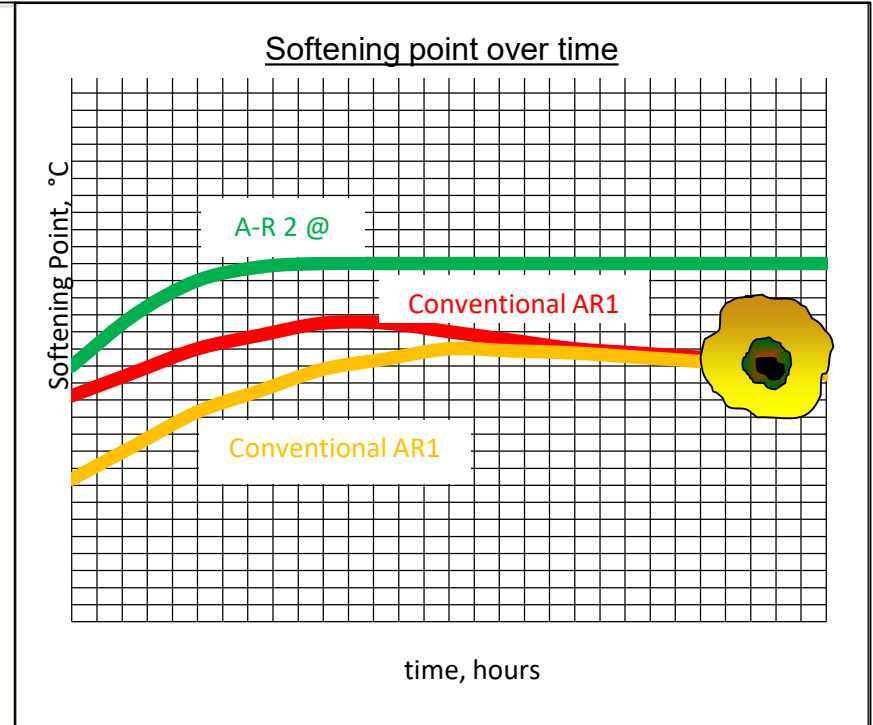
Tafadzwa Mafuma
Much Asphalt

- Conventional bitumen rubber A-R1 used in South Africa since 1980s
- Bitumen rubber is an excellent solution for pavement surfacings
 - extends service life
 - self-healing
 - prevents reflective cracking
 - carbon-black in rubber crumbs shields against UV action
 - reduces life cycle cost
- Conventional bitumen rubber has big environmental footprint
 - high handling temperatures
 - special blending units
 - limited shelf-life
- New technology developed to reduce environmental footprint: A-R2
 - same rubber crumbs as used for A-R1
 - warm-mix alternative with F-T wax

Comparison of A-R2 to A-R1



(adapted from SABITA TG1, 2015)



Bitumen Rubber Specifications *(adapted from F.J Pretorius et al, 2018)*

				A-R1		A-R2	
Blending Temperature				200°C		180°C	
Mixing Temperature				175 - 180°C		140 - 150°C	
Paving Temperature				Minimum 135°C		Minimum 100°C	
Shelf life				4 – 8 hours at 190 - 200°C		7 days at 150°C	
Test method				S-R1	A-R1	S-R2	A-R2
				TG1	TG1	TG1	TG1
Softening Point (R&B)	°C		MB-17	55-65	55 – 65	65 – 80	65 – 80
Dynamic viscosity	190°C	(dPa.s)	MB-13	20-40	20-50	-	-
	170°C	(dPa.s)	MB-13	-	-	10-40	10-40
Compression recovery	5min	%	MB-11	>70	>80	>70	>70
	1 hour			>70	>70	>70	>70
	24 hours			-	-	>40	>40
	4 days			>40	-	-	-
Resilience	25°C	%	MB-10	13-35	13-40	10-40	10-40
Flow	60°C	mm	MB-12	15-70	10-50	-	-
	70°C	mm	MB-12	-	-	10-40	10-40

- Ultra-Thin Porous Surfacing (UTPS)
 - paved thinner than typical porous asphalt
 - grading coarser than typical UTFC to accommodate rubber crumbs
- High interconnected voids in porous asphalt – need for
 - thick film-thickness for
 - cohesion
 - reduction in rate of oxidation of binder
 - viscous binder for thick film coating with no drain-down
- Different binders assessed for durability of porous asphalt
 - A-E2, homogenous elastomeric polymer modified binder
 - A-R1, conventional non-homogenous polymer modified binder
 - A-R2, warm-mix alternative to A-R1
- Durability indicators assessed
 - Schellenberg drain-down
 - Cantabro Abrasion Test
 - unaged, aged and moisture damage induced

A-R2 Application - Porous Asphalt

Coarse Aggregate Fraction (%)

Fine Aggregate Fraction (%)

Filler (%)

Additives (%)

Binder Content (%)

Binder content (%)

Compaction temperature (°C)

Average void content (%)

Schellenberg drain test (%)

Film thickness (µm)

Cantabro Abrasion mass loss (%)	Unaged
	Aged
	Moisture induced damage

- Bitumen Rubber porous asphalt best performance comparatively
- A-R1 and A-R2 have similar performance
- A-R2 binder of choice for durability and extras:
 - no bitumen rubber blending unit establishment (terminal blend)
 - reduced handling temperatures



A-R1 paving - fumes

A-R2 Application - Porous Asphalt

- N5 Harrismith – first application of A-R2 in porous asphalt
 - functional surfacing for rideability improvement
 - approximately 2200 tons of porous asphalt produced
- A-R2 terminal blend supplied Tosas, Wadeville
- Asphalt production plant in Bloemfontein
 - A-R2 blend stable over 405km haul
 - extended shelf life at remote site
- Asphalt production temperatures of 170°C due to long haulage in winter
 - energy saving compared to A-R1
 - no fumes
 - worker-friendly
- Porous asphalt hauled 330km from Bloemfontein to Harrismith
- A-R2 low viscosity enabled paving at 120°C and
- Compaction at 100°C
- After a year of service, the mat still looks as fresh as newly paved
 - in-service performance to be monitored over the life-span of project for more insight



- A-R2 bitumen rubber performs as well as A-R1 binder, with added benefits
 - extended shelf-life
 - economic for remote sites/small volume projects
 - relatively lower handling temperatures
 - less ageing of binder during productions/placement
 - energy savings
 - environmental benefit
 - healthier conditions for users
- In-service performance to be monitored over the life-span of A-R2 surfacings for more insight
- Monitor performance of other applications of A-R2 such as BRACS and chip-and-spray

A-R2 Application - experience



Thank you for your attention