

PG Binder Specification

SATS 3208 to SANS 4001: BT10



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OUTLINE OF PRESENTATION

1. CAPSA feedback
2. Current BT1 (and TG1)
3. Revisit PG environment
4. Revisit PG Specification SATS
5. Status SATS 3208 to 4001:BT10
6. Intended workshop
7. View on Intermediate temperature
8. Temperature distributions
9. Temperature databases
10. Ageing of a 50/70

CAPSA 2023 FEEDBACK

- Conference Theme

Leading-edge technology to underpin sustainable roads

- PB Binder Specification is an essential contribution to leading-edge technology
- It addresses the performance requirements to ensure longevity of roads
- First step to fit for purpose

➤ **CAPSA 2023**

✓ **C1 Masterclass on PG**

✓ **C2 Speciality Session**

✓ **F2 SPG**

✓ **CAPSA Resolution**

CAPSA resolution 4

SABITA to task the Bitumen Performance Grade (PG) implementation group to address issues relating to maximum temperature definition, fatigue parameters and optimizing rheology testing

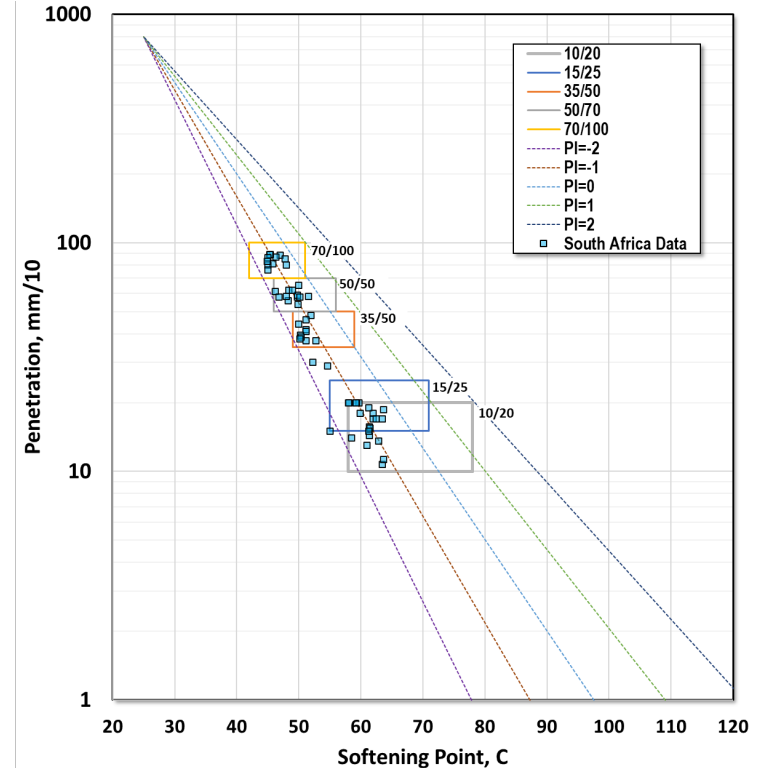
- **90% of SA PG based on USA**
- **We relied on their research**

CONVENTIONAL BT 1 EMPIRICAL SPECIFICATION

- Penetration
- Softening Point
- Viscosity

No environment
No traffic

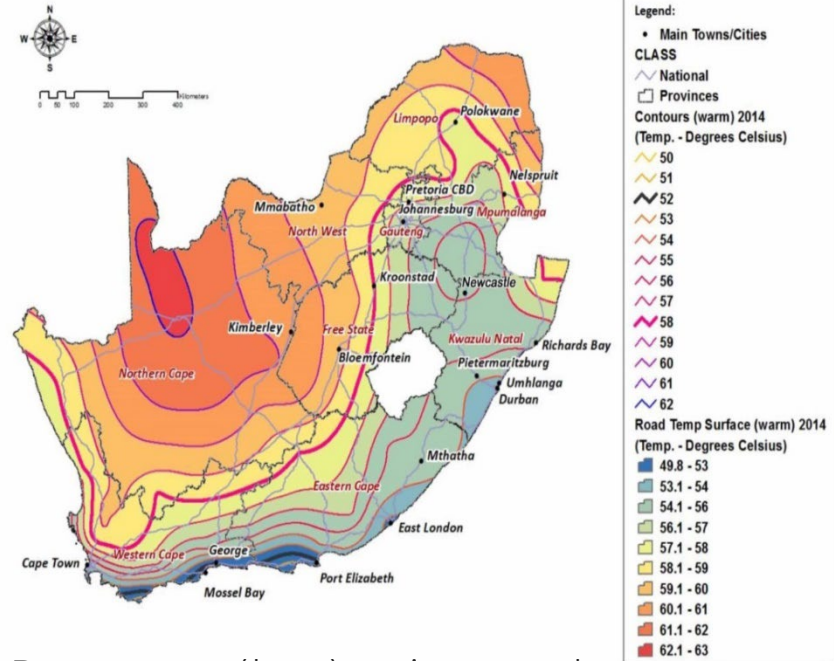
SANS 4001:BT1			
Pen		SP	
10	20	58	78
15	25	55	71
35	50	49	59
50	70	46	56
70	100	42	51



PG TEMPERATURE DEFINITION

- T_{MAX} is the 7-day average at 20 mm depth in the layer at 97.5 % confidence level
- $T_{MIN} = T_{MAX} - 80^{\circ}\text{C}$ ($UTI = 80^{\circ}\text{C}$) must be maintained to force T_{IT} in low 20's to protect against fatigue
- $T_{IT} = (T_{MIN} + T_{MAX})/2 + 4^{\circ}\text{C}$

Note: fatigue is not specified but isotherms at T_{IT} is reported to be used in research, more on this later



Dangerous (lazy) to just read from graph, there are mini- and micro-temperature zones, rather be site specific

PG Specification in a Nutshell

Test Property	Traffic class				Test Method
	S	H	V	E	
Max pavement design temperature (°C)	T_{max}				
Minimum grading temperature (°C)	T_{min}				
Tests on Original Binder					
G^* and δ at $[(T_{max} + T_{min})/2 + 4]^{\circ}\text{C}$	Compulsory report only				ASTM D7175
Viscosity at 165°C (Pa.s) $\geq 30 \text{ sec}^{-1}$	≤ 0.9				ASTM D4402
Flash Point (°C)	≥ 230				ASTM D92b
Tests on Binder After RTFO Ageing (ASTM D2872)					
Mass Change (% m/m)	≤ 1.0				ASTM D2872 / TG1 MB3
J_{nr} at T_{max} (kPa ⁻¹)	≤ 4.5	≤ 2.0	≤ 1.0	≤ 0.5	ASTM D7405
Ageing ratio [$G^*_{RTFO} / G^*_{Original}$]	≤ 3.0				ASTM D7175
After RTFO & PAV Ageing (ASTM D6521)					
Maximum creep stiffness tested at temperature [S (60s) $\leq 300 \text{ MPa}$]	$T_{min} + 10^{\circ}\text{C}$				ASTM D6648
Minimum m-value tested at temperature [m (60s) ≥ 0.300]	$T_{min} + 10^{\circ}\text{C}$				
ΔT_c (°C) = $T_{c,S} - T_{c,m}$	≥ -5				ASTM D7643
Ageing ratio [$G^*_{PAV} / G^*_{Original}$]	≤ 6.0				ASTM D7175

PG Binder-grades
PG58-22, PG64-16, PG70-10

Traffic classes
S = standard, H = High
V = Very high, E = Extreme

Design traffic (million E80)	Traffic Speed (km/h)			Asphalt mix design level
	< 20	20 - 80	> 80	
< 0.3	S	S	S	IA
0.3 - 3	H	S	S	IB
3 - 10	V	H	S	II
10 - 30	E	V	H	
30 - 100	E	E	V	III
> 100	E	E	E	

STATUS SATS 3208 TO SANS 4001:BT10

- RPF Implementation Committee establish 2020, chaired by SJB
 - Meet when required to address implementation issues
- Request for transition made to SABS in 2022
- **BT10 WG** managed by SABITA – now the lead group
- **SABS Committee** chaired by Georges Mturi
- Report by BT10 WG submitted to SABS WG
- Draft of BT10 submitted to SABS WG
- Detailed feedback received from SABS WG, most incorporated in draft BT10

**Way forward workshop with industry
with international review**

WHY SATS 3208 TO SANS 4001:BT10

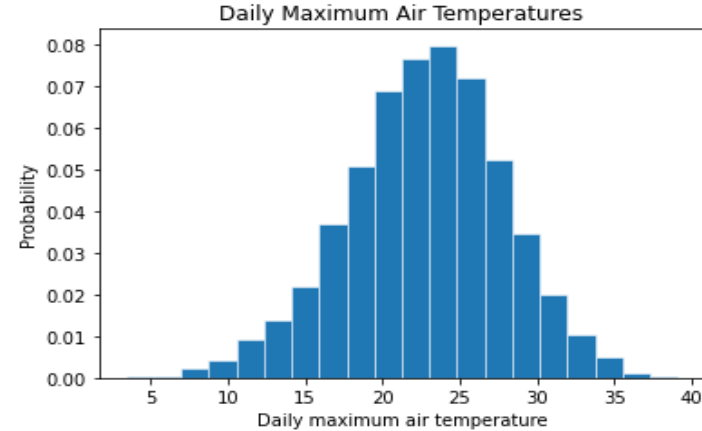
- **SATS 3208** a technical specification, meant to guide test phase
 - Implementation voluntary
- **SANS 4001:BT10** the national specification

It is not meant to develop a new specification; it is a transition from a

technical specification to national specification

INTENDED WORKSHOP

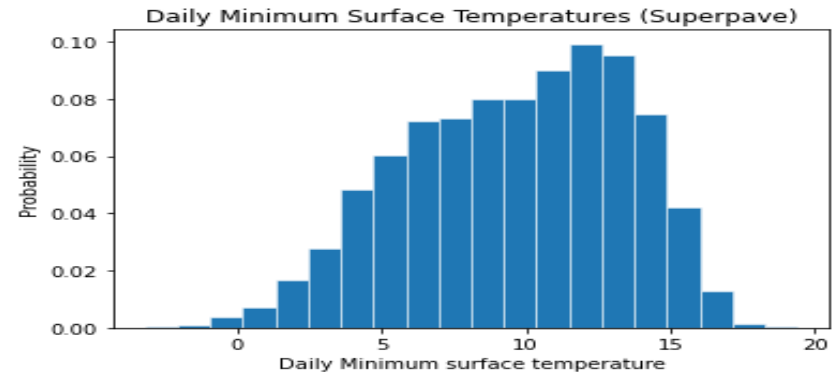
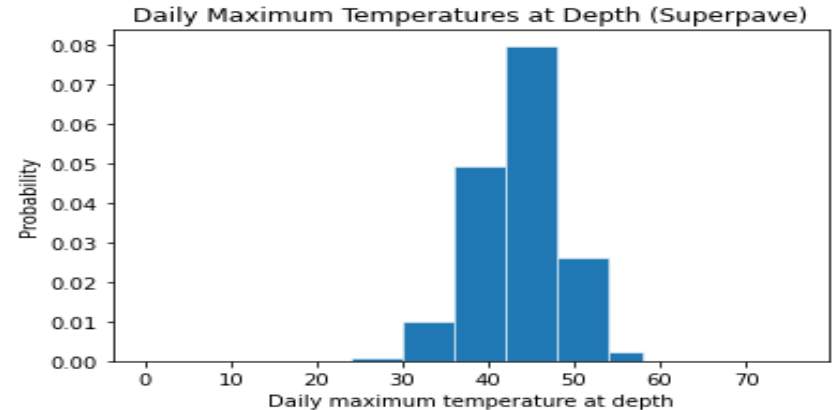
- Address CAPSA Resolution 4
 - T_{MAX} , Fatigue and “*optimizing rheology testing*”
- Address issues from SABS WG feedback
 - Viscosity 0,9 Pa.s @ 165°C and $\geq 30 \text{ s}^{-1}$
 - T_{MIN} , ΔT_c
 - Testing time in refinery/ship (especially after PAV)
 - Site QA/QC
 - 80% of bitumen import goes to surfacing seals, PG drives asphalt hard binders against rutting
 - Research done binders that are not available anymore



INTERMEDIATE TEMPERATURE

- Intermediate temperature, T_{IT} definition for fatigue
- USA: $G^* \cdot \sin\delta \leq 5000$ kPa @ T_{IT}
- Revised to:
 - $G^* \cdot \sin\delta \leq 6000$ kPa @ T_{IT}
 - If $\delta > 42^\circ\text{C}$
- Glover-Rowe now being considered
 - $G-R = G^*(\cos^2\delta)/\sin\delta$
 - $G-R \leq 5000$ kPa @ T_{IT}
- For SA perhaps we need to consider
 - $T_{IT} = ??^\circ\text{C}$

$$T_{IT} = (T_{MIN} + T_{MAX})/2 + 4^\circ\text{C}$$

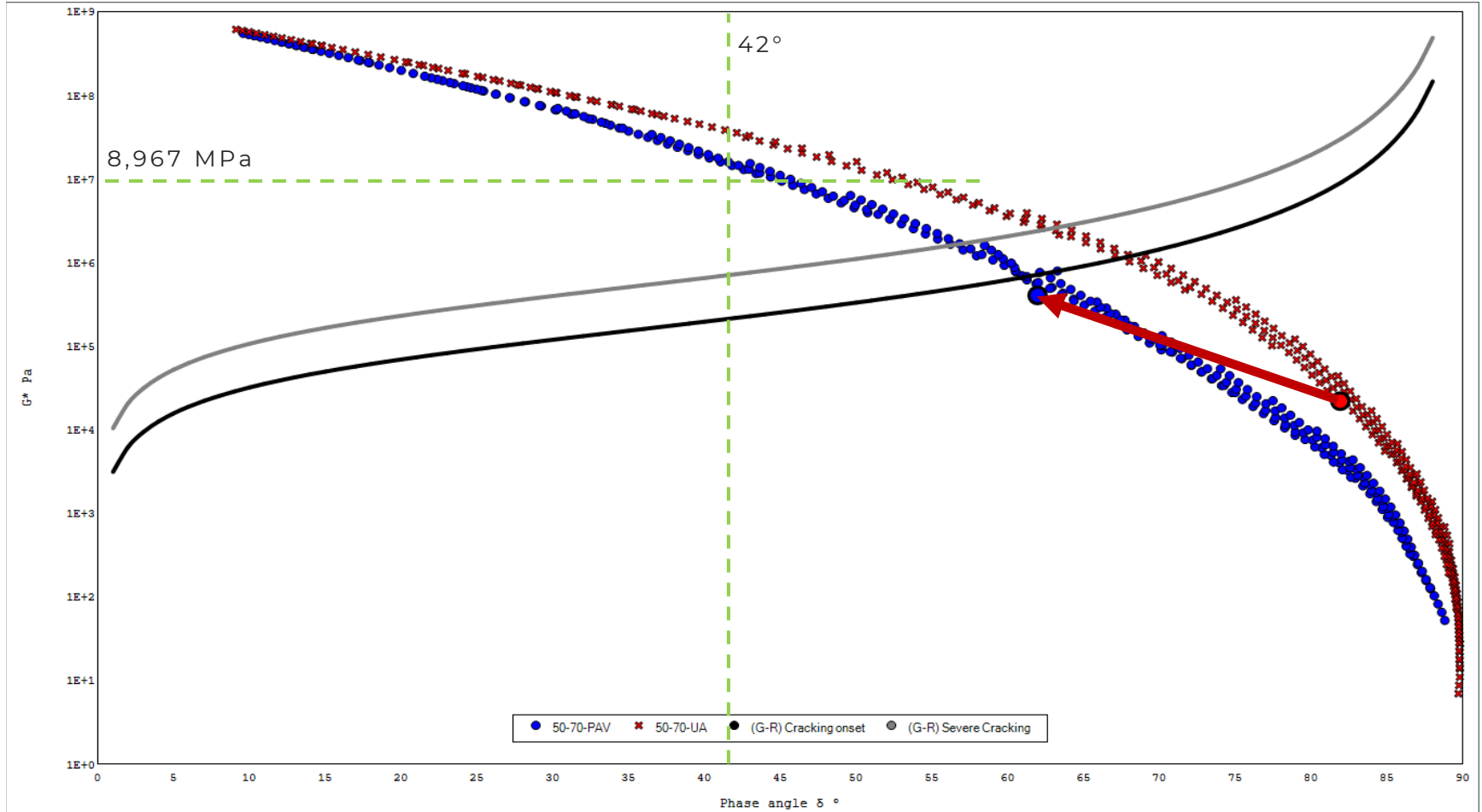


TEMPERATURE COMPARISON

- CAPSA paper on temperature
 - SA data very expensive
 - CSIR research limited and old
 - Investigated NOAA and MERRA
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- Max temperature at depth compared reasonably well
 - Min surface temperature
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- Degree Day concept not much different from max temperature at 20 mm depth

	DESCRIPTION	STAT-TEMP MERRA	STAT-TEMP NOOA	Thermal-Pads S.A. (Viljoen)	STAT-TEMP MERRA Degree day
Pretoria	Maximum temperature at 20 mm °C	59.80	57.86	56.88	59.59
	Minimum surface temperature °C	2.53	0.93	1.22	-0.31
Cape Town	Maximum temperature at 20 mm °C	54.32	54.28	53.19	52.68
	Minimum surface temperature °C	8.23	5.02	3.67	1.75
Pietermaritzburg (Cedara)	Maximum temperature at 20 mm °C	56.97	56.14	52.95	54.75
	Minimum surface temperature °C	0.13	0.93	0.60	-3.11

AGEING OF 50/70



Questions?