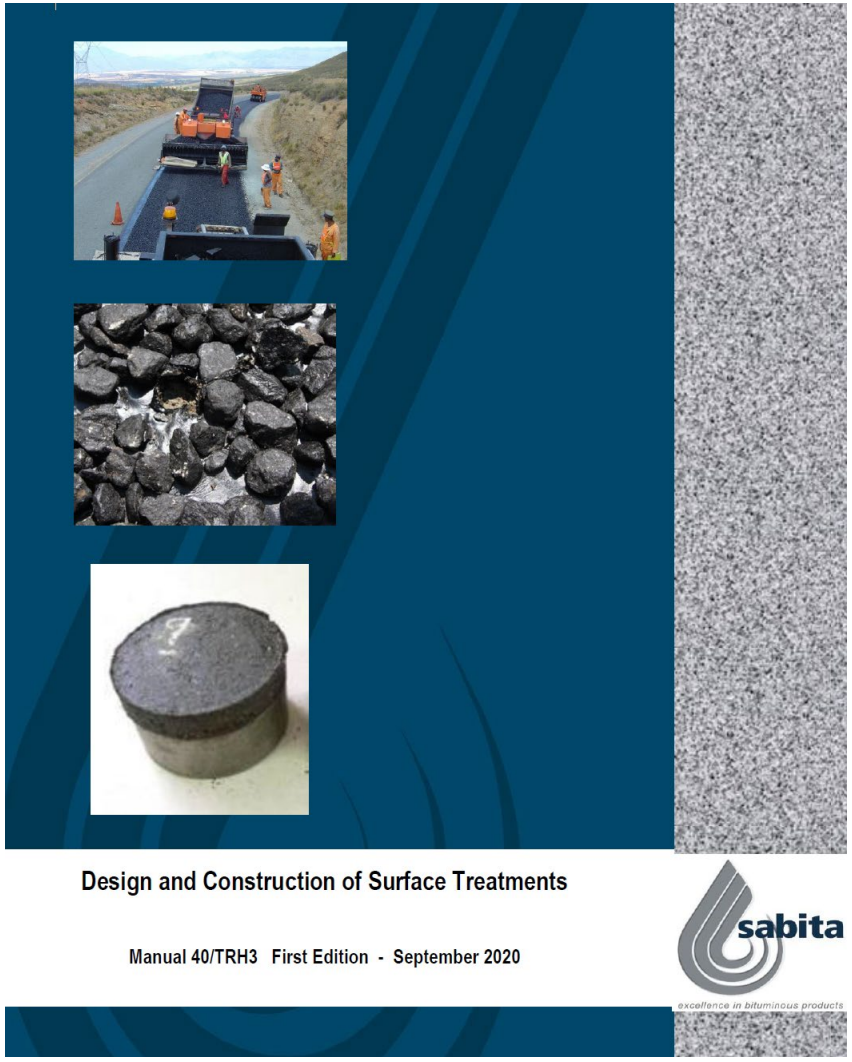
PART B: Materials

Part A	• General
Part B	• Materials
Part C	• Performance
Part D	• Seal type and binder selection
Part E	• Design
Part F	• Construction
Part G	• Quality assurance
Part H	• Repair of premature failures



Part B: Materials

- Introduction
- Aggregate
- Bituminous binders
- Test methods

Aggregate properties affecting performance

- Shape, nominal size and grading;
- Spread rate;
- Adhesion characteristics, micro texture, cleanness and dust content;
- Strength, durability and wearing characteristics, and
- Porosity/absorption.

Aggregate property guidelines

Traffic (AADT)	Less than 300	300 - 3000	More than 3000
Relevant Aggregate Grade	C	B	A

Hardness	C	B	A
Dry 10 % FACT [kN] (min)	130	180	210
Wet 10 % FACT [kN] (min)	100	135	160

Polishing stone value	C	B	A
Aggregate position in seal			
Exposed aggregate	48	49	50
Underlying aggregate	45	47	48

Flakiness	C	B	A
20 mm nominal size	30	30	25
14 mm nominal size	30	30	25
10 mm nominal size	35	35	30
7,1 mm nominal size	35	35	30

- Relaxation from TRH3 2007
- COTO 2020
- See durability

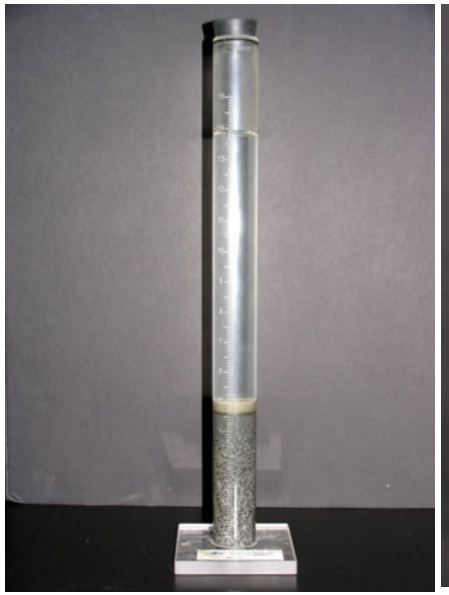
Average Least Dimension

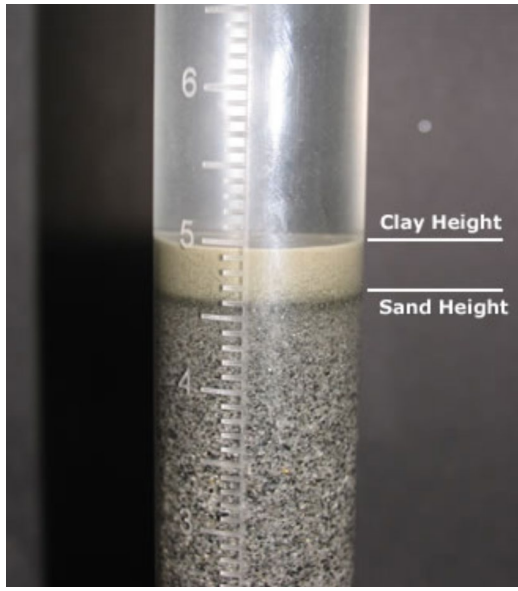
Relevant Aggregate Grade	C	B	A
Nominal Aggregate Size (mm)			
20	**10.8**	**12**	**12**
14	**7.4**	**8**	**8**
10 single layer	**5**	**5.5**	**5.5**
10 second layer	**NA**	**5**	**5**

Sand and Grit seals

Sieve size (mm)	Percentage passing by mass
7	100
0.300	0 - 15
0.150	0 - 2
Sand Equivalent [%] (min)	35
Plasticity Index: Non-Plastic	

Sieve size (mm)	Percentage passing by mass
5	100
2	0 - 100
1	0 - 50
0,600	0 - 20
0,300	0 - 10
0,150	0 - 5
0,075	0 - 2
Sand Equivalent [%] (min)	35





Sand equivalent – affecting bond strenght
(pastic fines and dust content)
-4.75 mm, flocculation agent,
shake, 20min settle

Slurry aggregate

- **Slurry**

Sieve size (mm)	PERCENTAGE PASSING SIEVE, BY MASS				
	Fine slurry			Coarse slurry	
	Fine Grade	Medium grade	Coarse grade	Type 1	Type 2
14					100
10				100	85 – 100
7		100	100	85 – 100	70 – 90
5	100	82 - 100	70 – 90	70 – 90	60 – 80
2	90 - 100	56 – 95	45 – 70	45 – 70	40 – 60
1	65 - 95	37 – 75	28 – 50	25 – 45	25 – 45
0.600	42 - 72	22 – 50	19 – 34	15 – 30	15 – 30
0.300	23 - 48	15 – 37	12 – 25	10 – 20	10 – 20
0.150	10 - 27	7 – 20	7 – 18	6 – 15	6 – 15
0.075	1 – 15	4 – 15	2 – 8	4 – 10	4 – 10

- **Microsurfacing**

Sieve Size (mm)	Type II Percent Passing	Type III Percent Passing	Stockpile Tolerance
	Overlay or Rut fill (up to 12 mm)	Rut fill (more than 12 mm)	
10	100	100	
7	100	85 - 100	5%
5	90 - 100	70 - 90	5%
2	65 - 90	45 - 70	5%
1	45 - 70	28 - 50	5%
0.6	30 - 50	19 - 34	5%
0.3	18 - 30	12 - 25	4%
0.15	10 - 21	7 - 18	3%
0.075	5 - 15	5 - 15	2%

Refinery Operations

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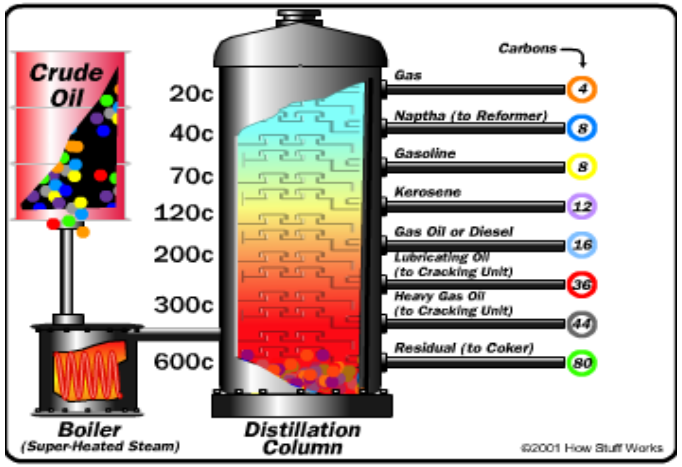
- The crude oil is injected into the distillation column at high temperatures
- This causes the crude to boil and evaporate
- In the column, condensation and re-evaporation take place on a continuous basis (scrubbing) as the vapor ascends
- Fractions with the required boiling range are continuously withdrawn from appropriate points in the column, the highest (most volatile) from the top and progressively heavier fractions at lower levels



Bituminous binders

- Penetration grade bitumen
- Cutback bitumen
- Bitumen Emulsions
- Modified bitumen and bitumen emulsions

Modified binders

- **TG1 classification and specifications apply**
  - Technical Guideline for the use of Modified Binders in Road Construction (TG1)
  - Type of application:
    - Spray seal (S);
    - Asphalt (A);
    - Crack sealant (C).
  - Modifier used
    - Elastomer (E) e.g. A-E1;
    - Plastomer (P) e.g. A-P1;
    - Rubber (R) e.g. S-R1;
    - Hydrocarbon (H) e.g. A-H1.

Modified binders

- **TG1 classification**
  - Example SC-E2 (t)
    - S - The binder is intended to be used in a surfacing seal;
    - C - The binder is an emulsion;
    - E - The main modifier is an elastomer type;
    - 2 - The binder has a higher softening point than an SC-E1;
    - (t) - The use of a fluxing agent or cutter is prohibited.
  - Main binders used for seals
    - S-E1, S-E2, S-R1, S-R2, SC-E1, SC-E2
    - Conventional: Cationic Spray grade 65%, Anionic Stable grade 60%,70/100 Pen bitumen, MC 3000

Binder classification

- **Penetration grade**
  - The penetration is expressed in units of dmm (0.1) mm of a standard needle. The standard conditions are a load of 100 g, time of 5 sec and a temperature of 25°C. The higher the penetration the softer the bitumen.
- **Viscosity grade (Not used in RSA)**
- **Performance grade**
  - The specified criteria remain constant, but the temperature at which the criteria must be achieved changes for the various grades
  - The classification for asphalt denotes a maximum temperature (Tmax) and a minimum temperature (Tmin) together with a traffic category i.e. Standard (S), High (H), Very High (V) and extreme (E)
  - Example: PG 64 -16 H

Binder classification … continued

- **Performance grade**
  - Tmax = The maximum pavement design temperature at a depth of 25 mm in asphalt and allowable rut depth of 12.7 mm
  - Tmin = The actual minimum grading temperature for fatigue related cracking
  - Surface temperature typically 3-4°C warmer that 25mm below
  - Therefore for seals adjustment **PG58-22 would thus become a PG61-19 for a surfacing seal**
  - 70/100 pen grade bitumen has a PG58-22 PG-grade, S-E1 a PG70-22 or PG76-22 depending on the base bitumen and an S-E2 PG76-22
  - For the moment if PG specified (PMB) or (CRM) added to Class
  - Typical project specifications will be included in PARTB as an appendix

The Performance Grade classification has not yet been implemented for surface treatment binders. Therefore, this manual still refers to the various unmodified (conventional) binders as per SANS specifications and modified binders as per SABITA manual TG1

Prime coats

- **COTO 2020**
  - ❑ Penetration depth
  - ❑ Drying time
  - ❑ Softening of the base
  - ❑ Permeability
  - ❑ Carbonation (in case of stabilised layers)
  - ❑ Note:
    - More detail on prime coats can be obtained from the companion document SABITA Manual 26: Guidelines for primes, bond coats and stone precoating fluids

Precoating Materials

- Manual 26 and COTO 2020
- Current working group on adhesion promotors

Bituminous binders: Test methods

- **Refer document**

End

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