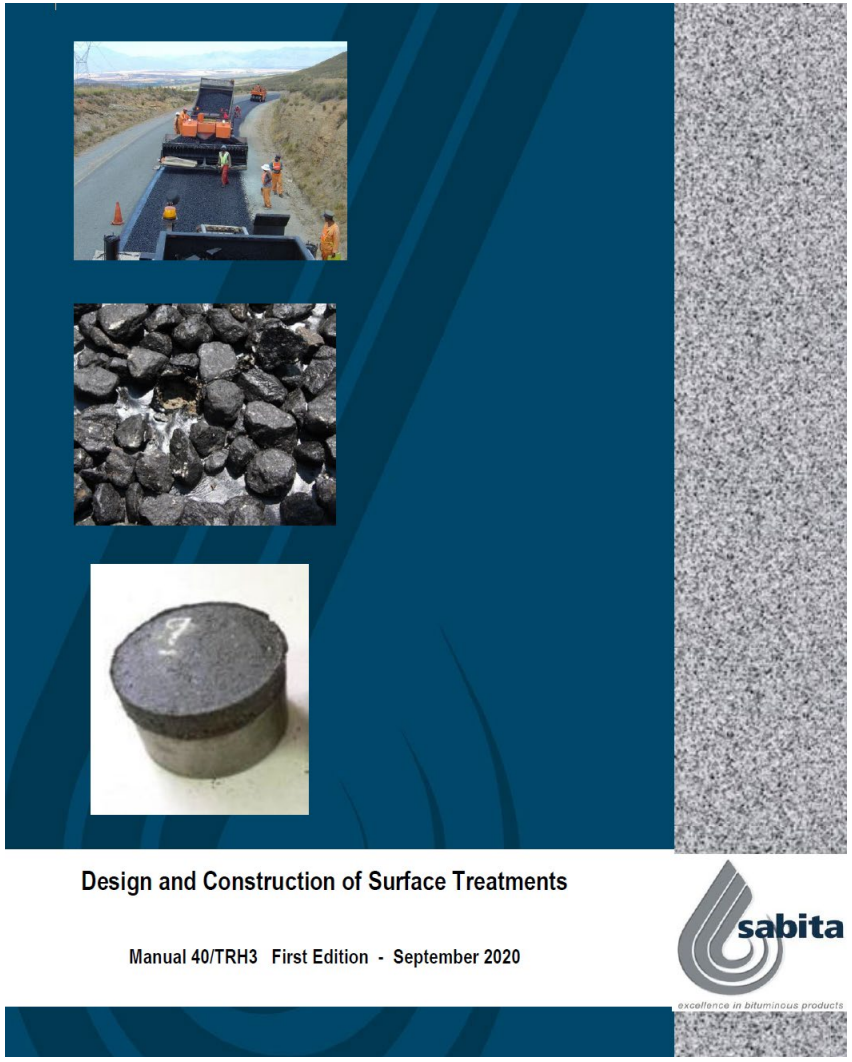
PAR C: Performance

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 C: Performance

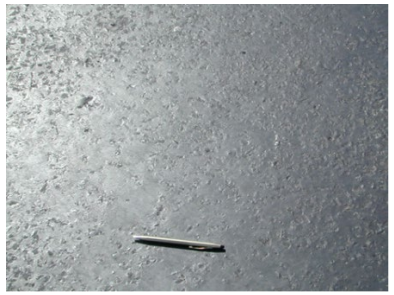
- **How different factors influence seal performance**
  - ❑ Pavement structure and condition
  - ❑ Traffic
  - ❑ Road geometry
  - ❑ Design
  - ❑ Aggregate
  - ❑ Binder
  - ❑ Seal structure
  - ❑ Pre-treatment and repairs
  - ❑ Construction and supervision
  - ❑ Maintenance
  - ❑ Physical and social environment

NB for

- Seal type and binder selection
- Design
- Construction

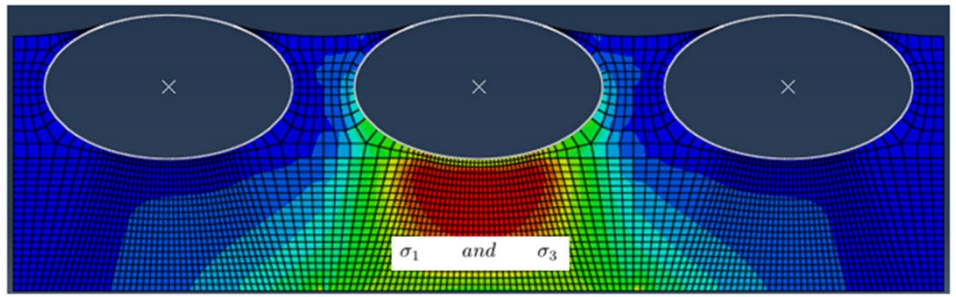
Terminal condition

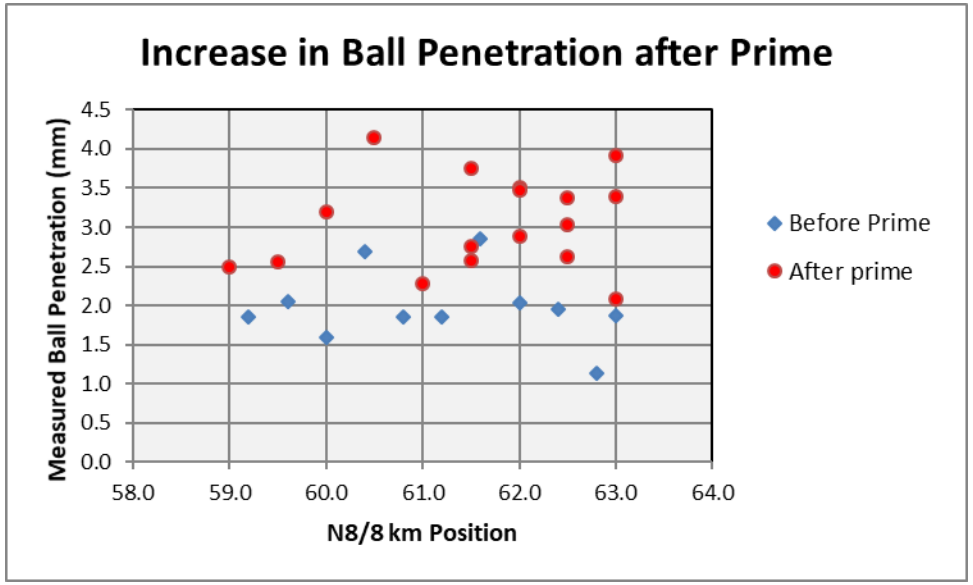
- **Purpose of a seal**
  - Provide a waterproof cover to the underlying pavement
  - Provide a safe all-weather, dust-free riding surface with adequate skid resistance
  - Protect the underlying layer from abrasive forces of traffic and environment
- **Terminal condition**
  - Aggregate loss (stripping).
  - Reduced skid resistance (texture loss and polishing of the aggregate)
  - Inability to retard crack initiation and crack reflection and permeability


Pavement

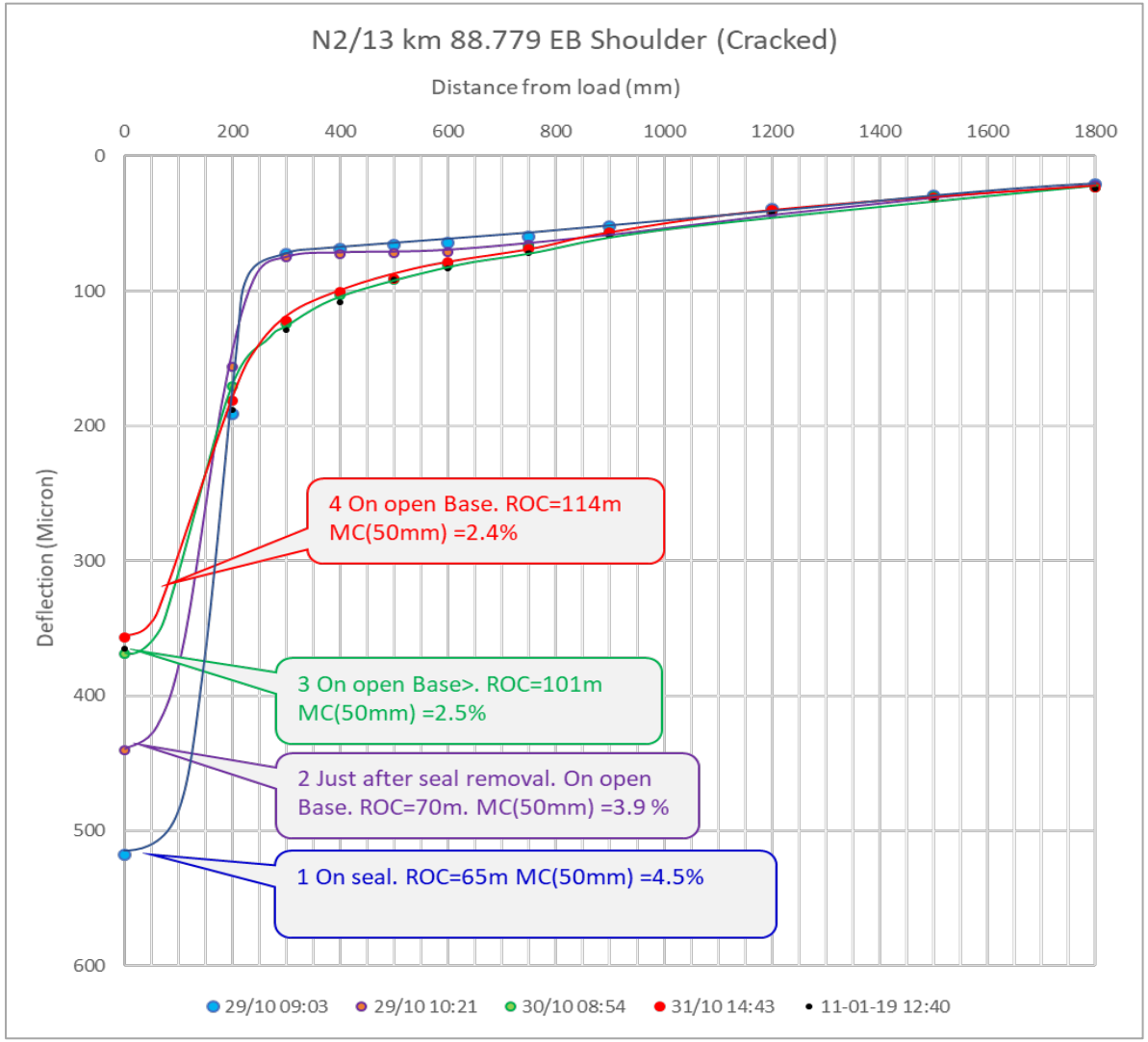
- **Embedment**
  - ❑ The type of material in the base, compaction and moisture content.
  - ❑ A layer of fine material on a crushed stone base (not properly broomed).
  - ❑ High application of a prime coat with solvents.
  - ❑ Seal type (structure) and stiffness.





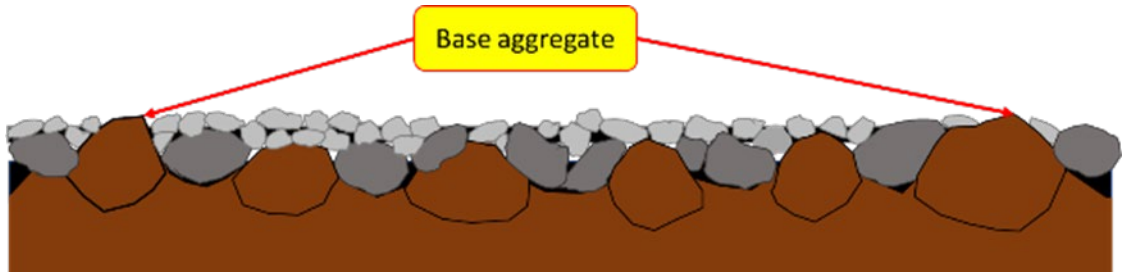
Effect of upper layer softness

- **Effect of**
  - Moisture in the upper base
  - Soft layer underneath the seal



Base coarseness/variation

- **Effect of coarse base surface**



- **New guidelines for maximum existing texture allowed before texture treatment**

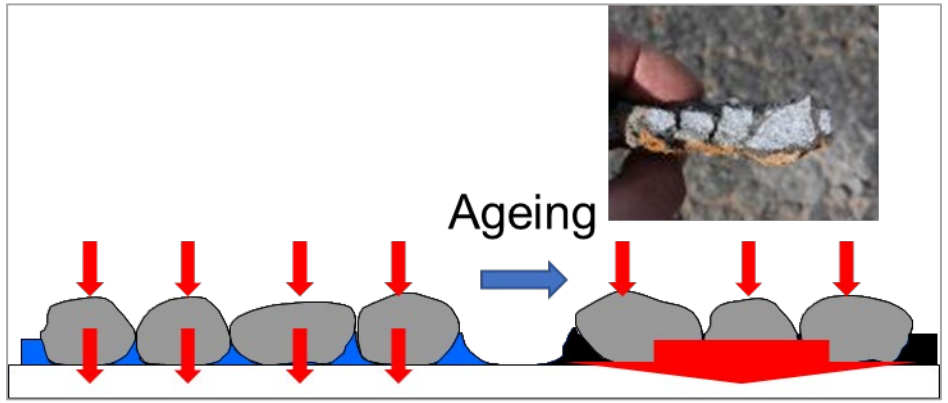
Maximum texture before sealing

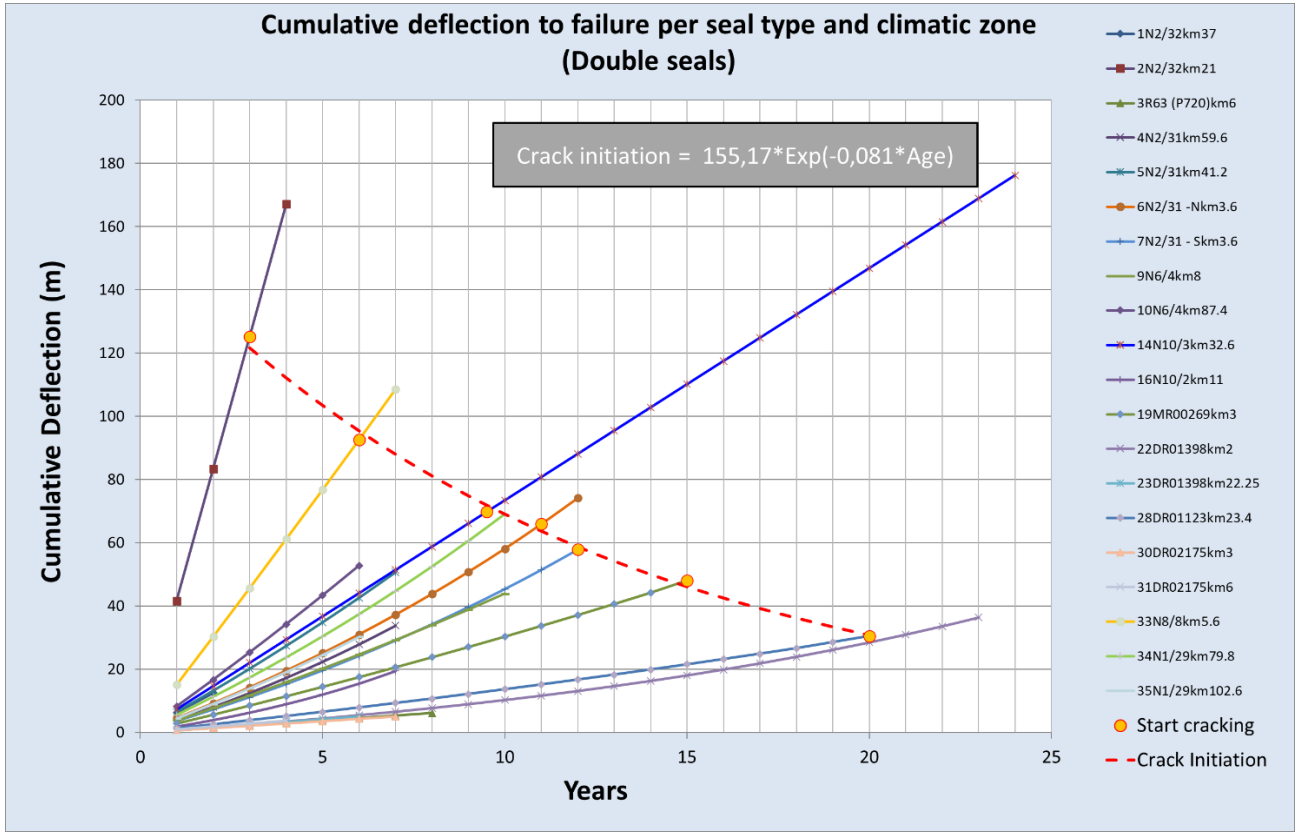
MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

Seal Code	Final surfacing type	Max Texture allowed
S1(10)	Single seal with 10 mm aggregate	0.8
S1(10)	Single seal with 10 mm aggregate (with cover spray)	1.0
S1(14)	Single seal with 14 mm aggregate	0.8
S1(14)	Single seal with 14 mm aggregate (with cover spray)	1.5
S1(14)	Single seal with 14 mm aggregate (with Bitumen rubber)	1.2
S2(10/S)	Double seal with 10 mm aggregate and sand	1.0
S2(14/S)	Double seal with 14 mm aggregate and sand	1.5
S4(10)	Cape Seal with 10 mm aggregate and one layer of slurry	1.5
S4(14)	Cape Seal with 14 mm aggregate and one layer of slurry	2.0
S4(20)	Cape Seal with 20 mm aggregate and two layers of slurry	2.5
S2(14/7)	Double seal with 14 mm aggregate and a layer of 7 mm aggregate	1.5
S2(14/5)	Double seal with 14 mm aggregate and a layer of 5 mm aggregate	1.5
S2(20/10)	Double seal with 19 mm aggregate and a layer of 9,5 mm aggregate	2.0
S2(20/7)	Double seal with 19 mm aggregate and a layer of 6,7 mm aggregate	2.0
S2(20/7/7)	Double seal with 19 mm aggregate and two layers of 6,7 mm aggregate	1.5

Pavement

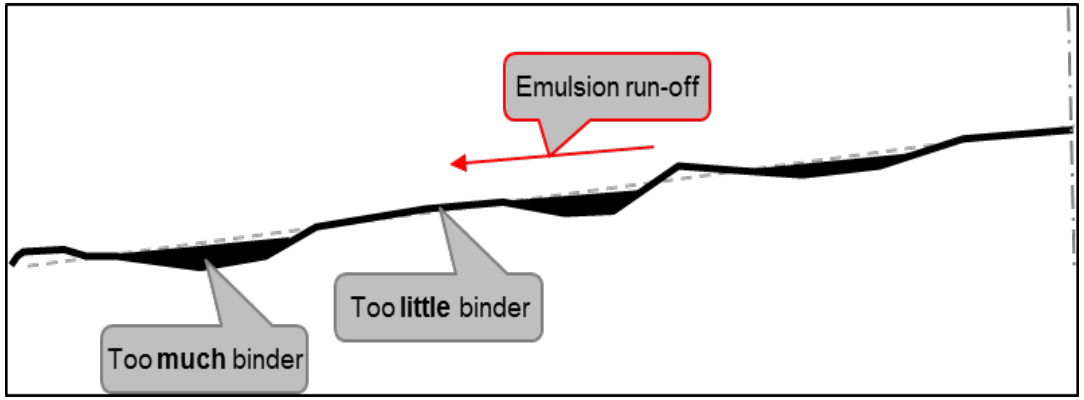
- **Flexural properties**





Pavement and binder

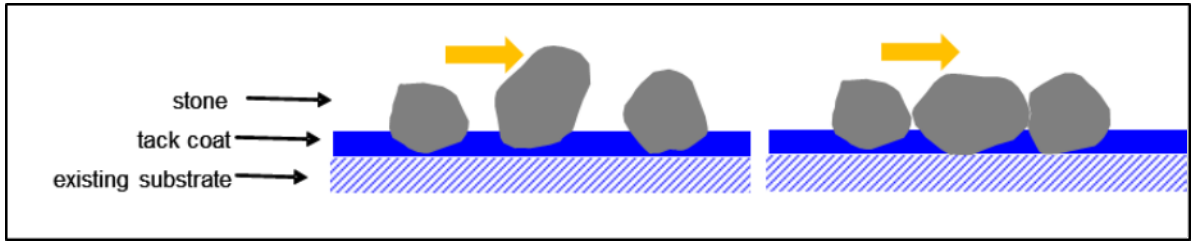
- **Surface irregularities**
  - Binder

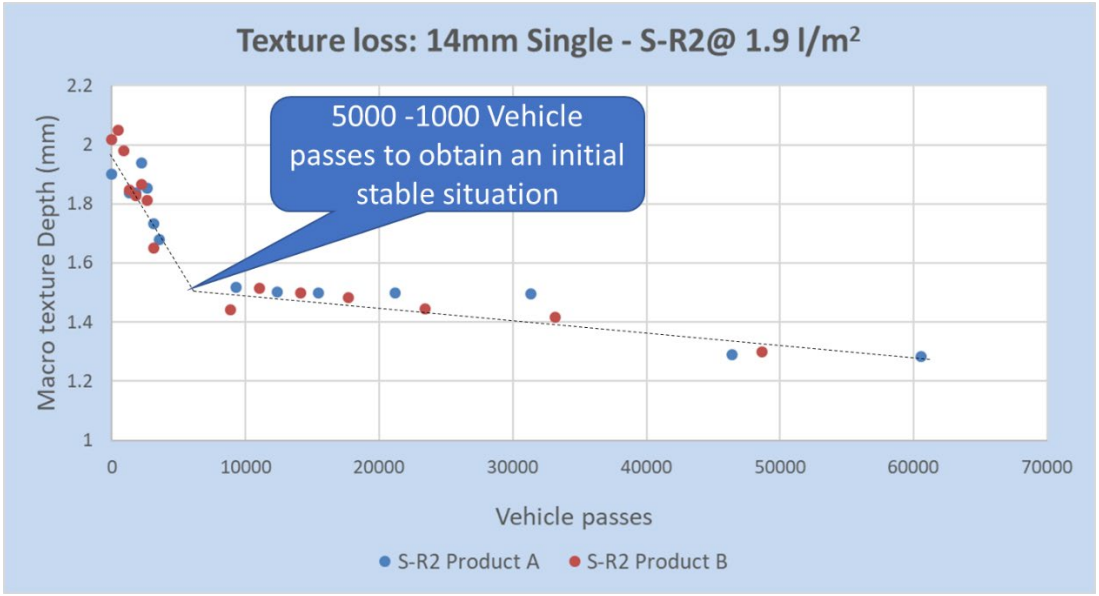


  - Effect on seal compaction

Traffic compaction

- **Importance of controlled traffic compaction**





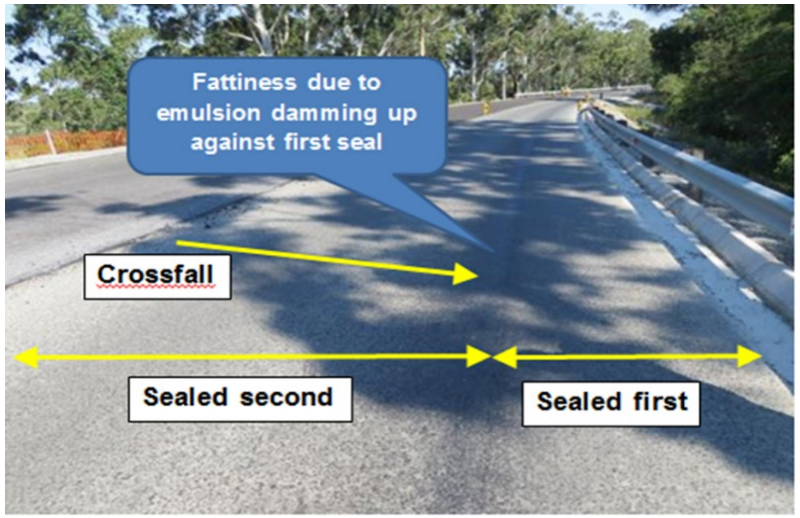
Road geometry

- Gradient and smooth surface

- Erosion of a double seal

Road geometry

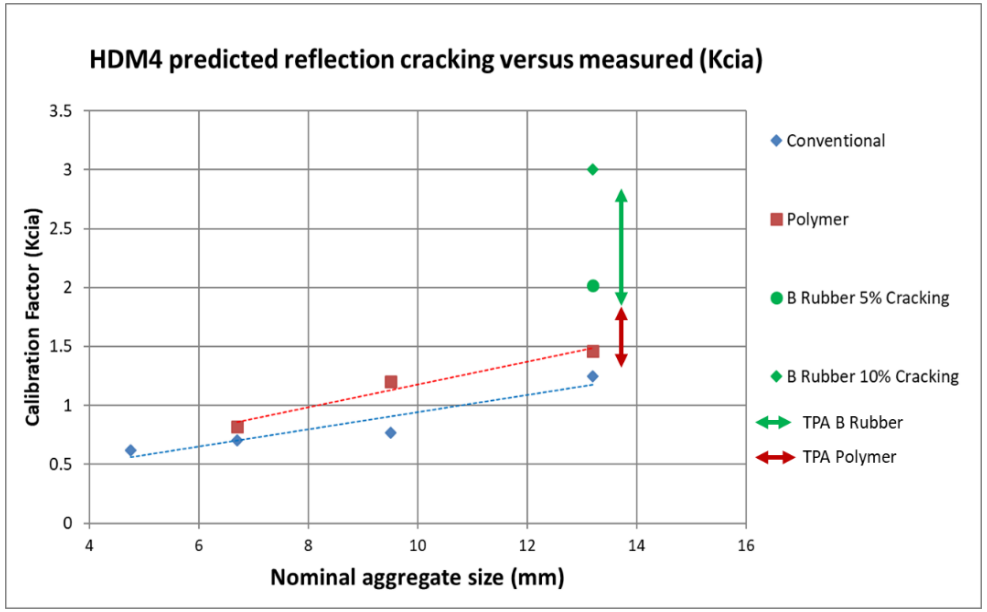
- **Emulsion run-off (crossfall)**



- **Turning actions at intersections**

Binder type and film thickness

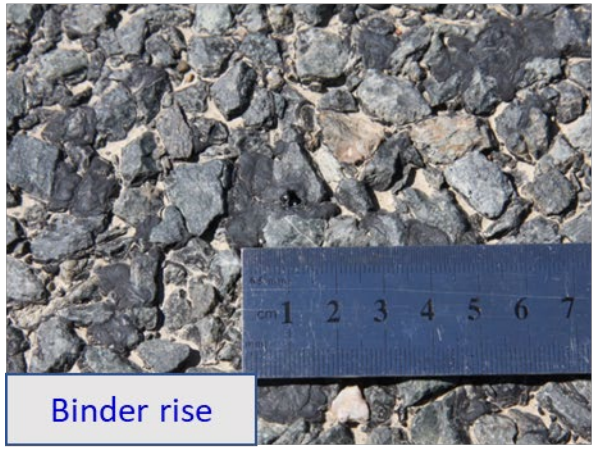
- **Effect of binder type and film thickness on crack reflection**

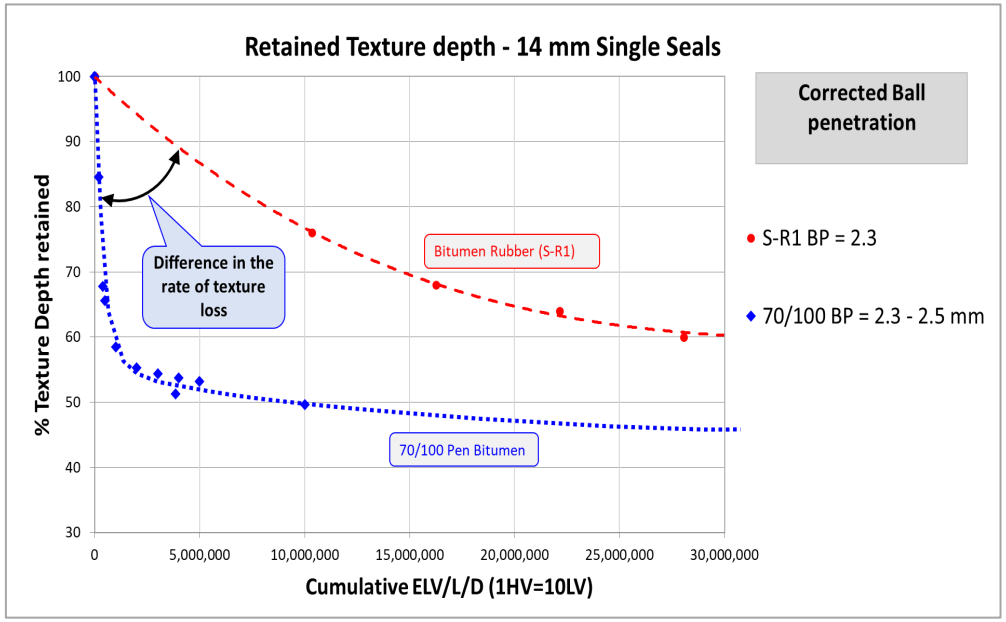


- **Effect of polymer modified binder geotextile seal**

Macro texture retention

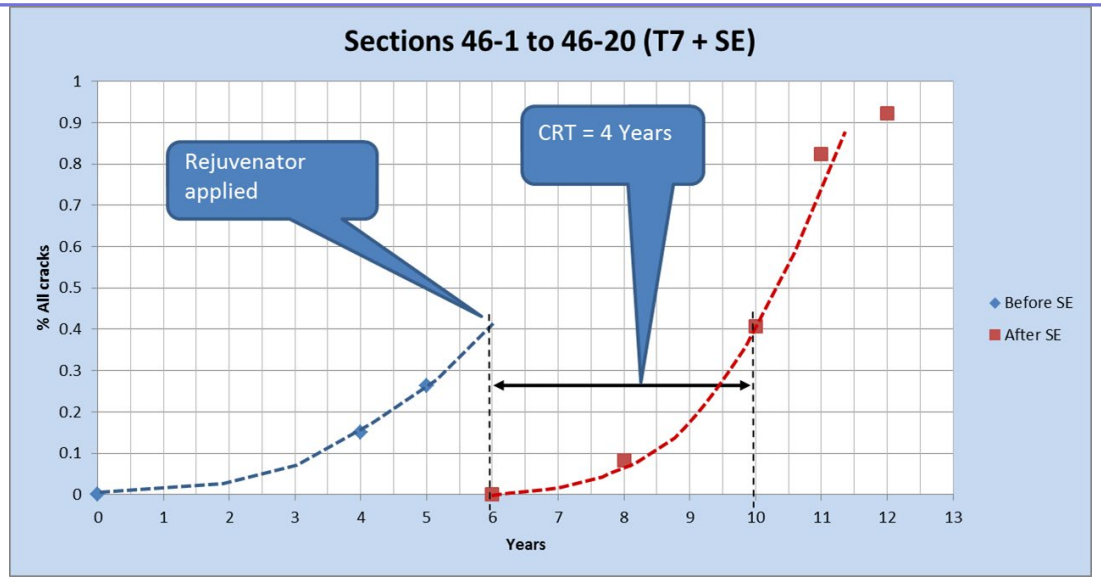
- Mechanisms
- Effect of binder type





Binder rejuvenation

- **Effect of rejuvenators on crack retardation**

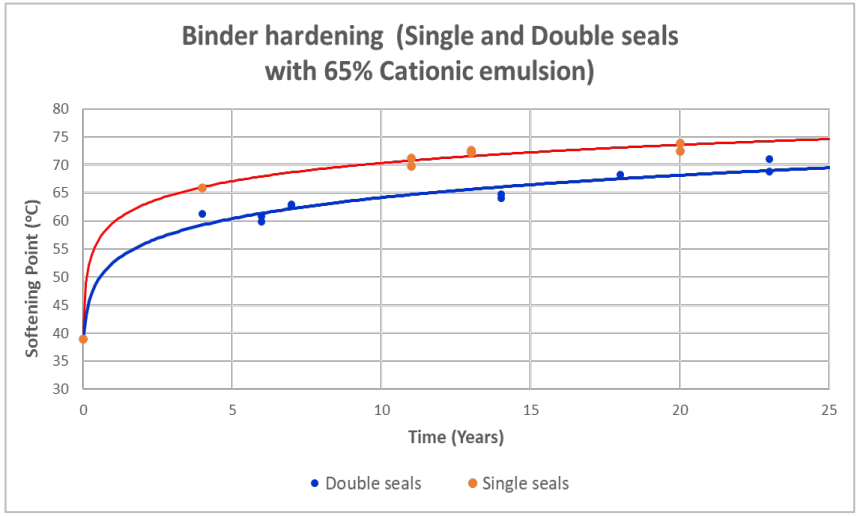


Binder ageing

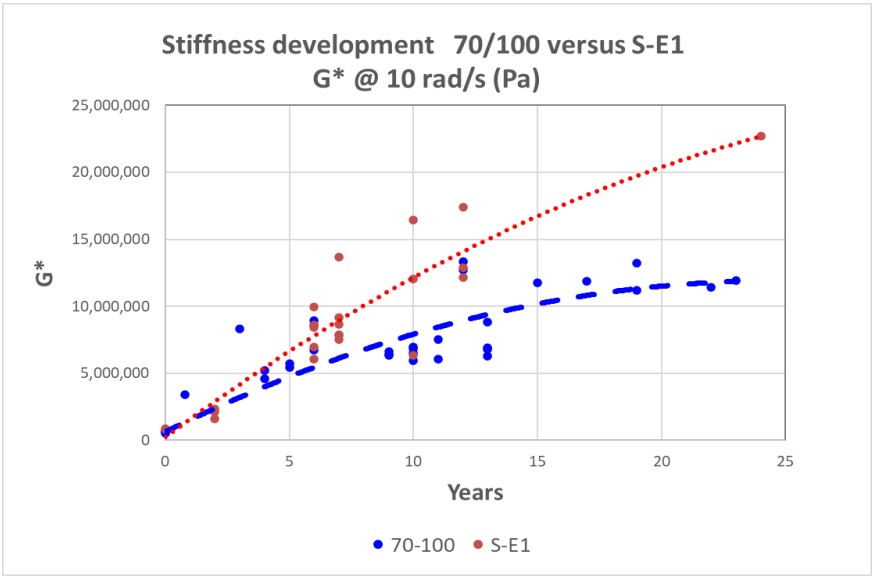
- **Oxidation:** Reaction of oxygen with the binder, the rate depending on the character of the bitumen (source) and the temperature
- **Volatilisation:** The evaporation of the light fractions from binders (Primarily a function of temperature)
- **Polymerisation:** A combination of like molecules to form larger molecules, resulting in progressive hardening.
- **Thixotropy:** (Steric Hardening) A progressive hardening due to the formation of a structure within the binder over a period of time.
- **Syneresis:** A reaction in which the expulsion of thin oily liquids to the surface of the binder film takes place
- **Separation: (exudation)** The removal of the oily constituents, resins, or asphaltenes from the bitumen caused by absorption into porous aggregates.

Hardening

- **Effect of seal type**



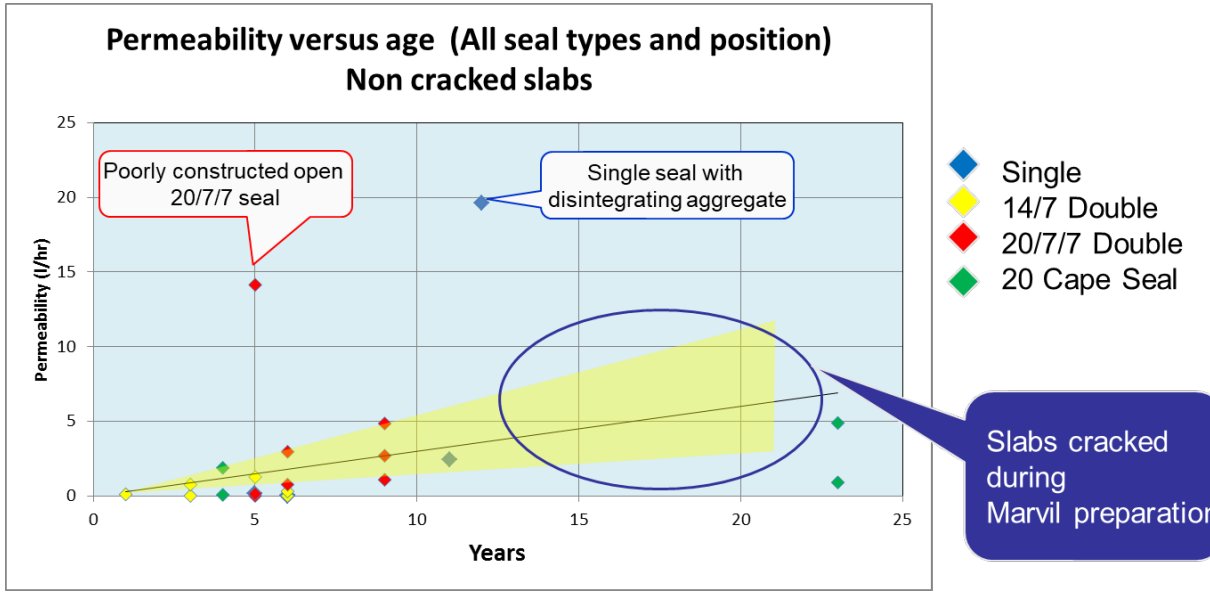
- **Effect of binder type**



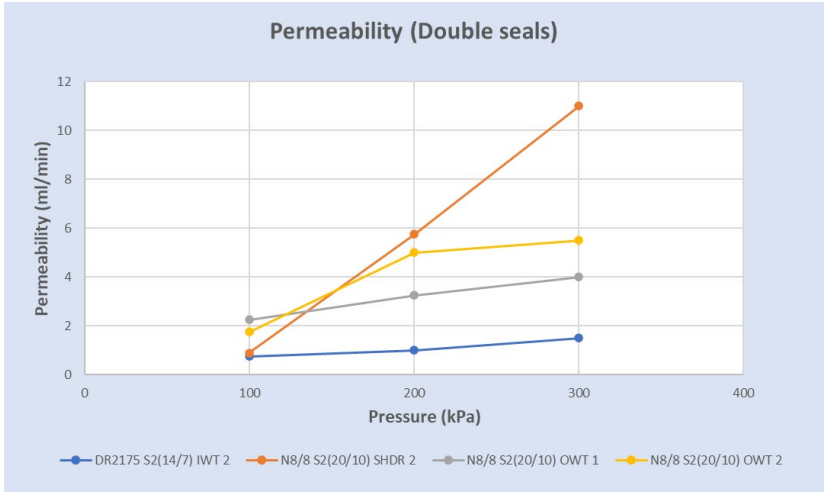
Note: Crack sensitivity not equal to stiffness

Increase in permeability

- Ageing



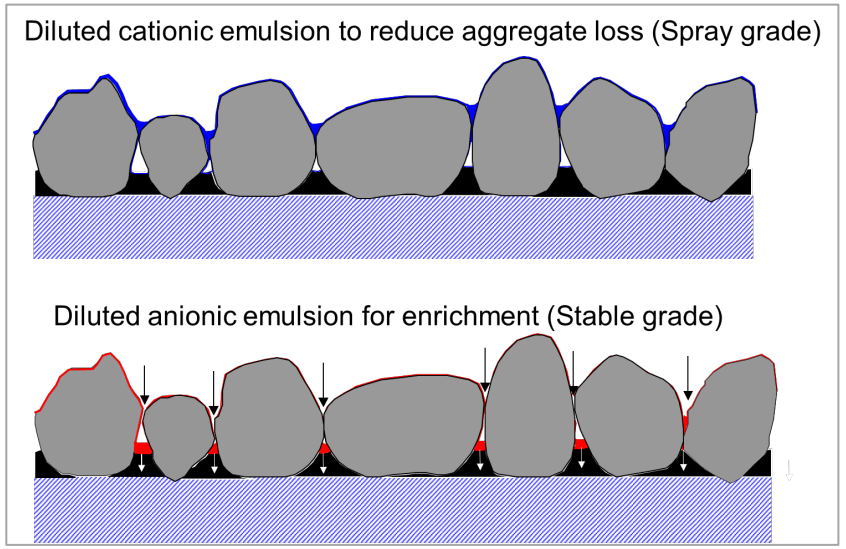
- Contact pressure/ ponding



Purpose and effect of emulsions

- **Cover spray versus enrichment and rejuvenation**
  - ❑ Cationic spray grade
  - ❑ Anionic stable grade
  - ❑ Invert cut-back emulsions for rejuvenation

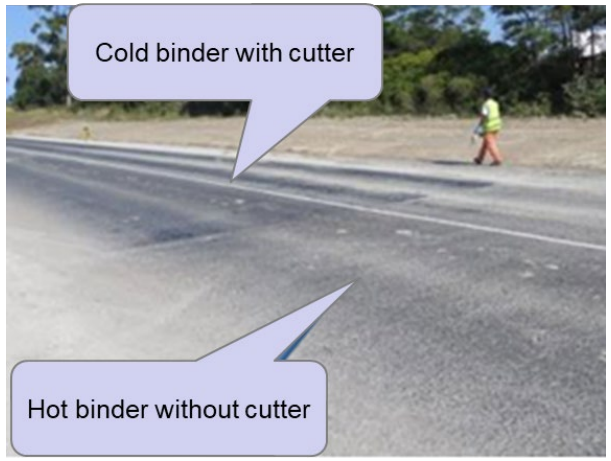
Polymer modified emulsion



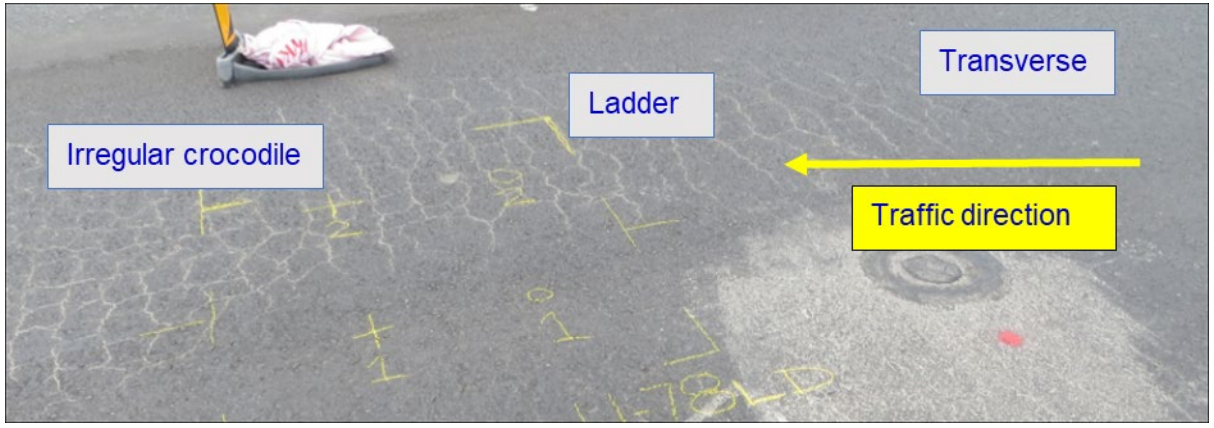
- **Several proprietary products**

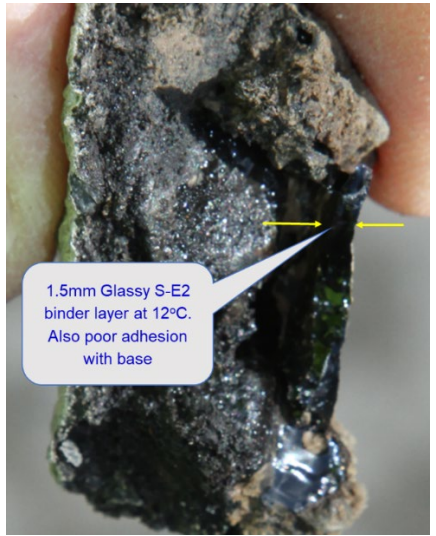
Cape Seals

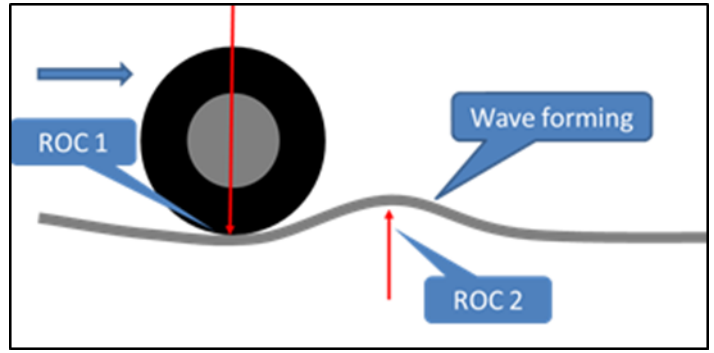
- **Effect of solvents**



- **Effect of cold temperature on highly polymer modified binders**

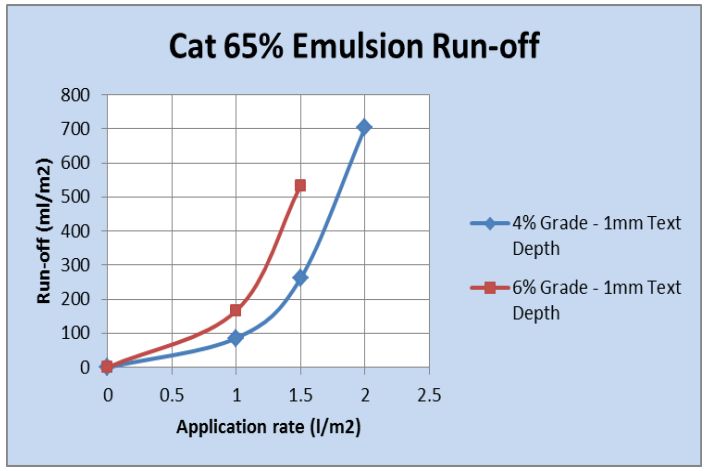


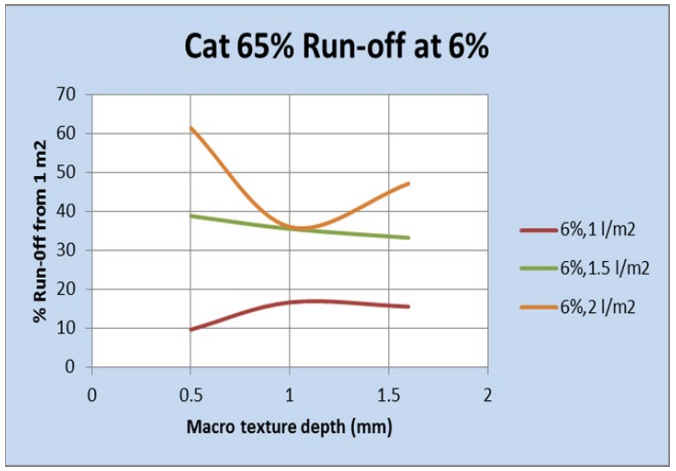


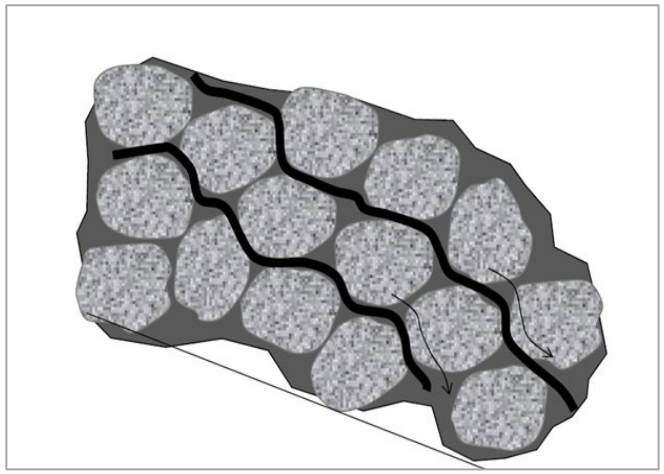


Viscosity at time of application

- **Emulsion runoff**



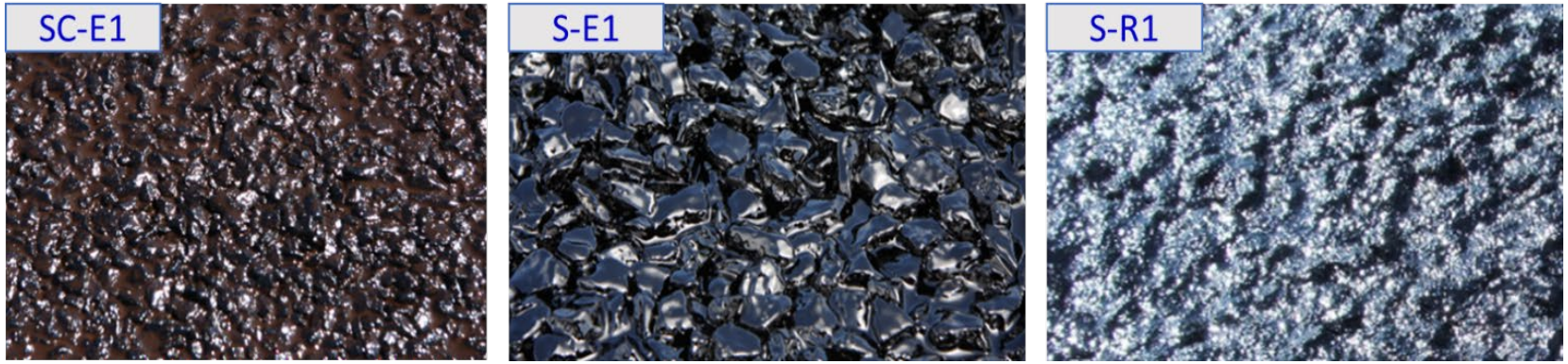


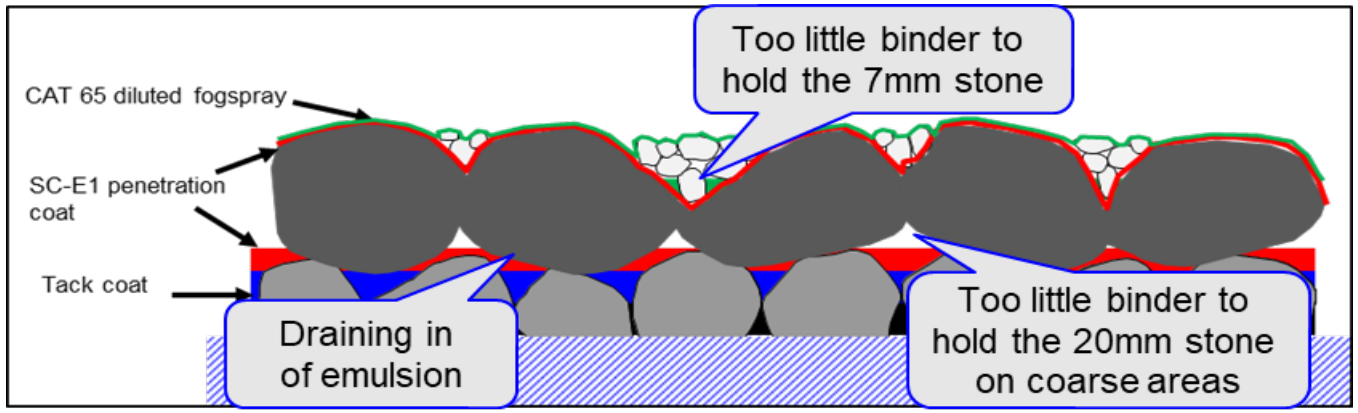


A Kashaya

Viscosity at time of application

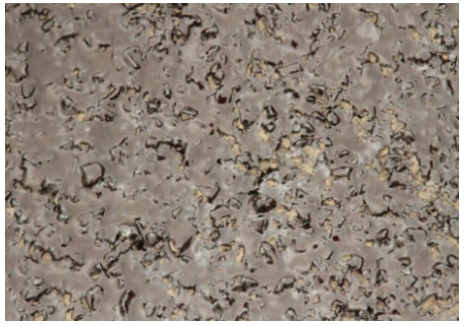
- **Binder run-in**



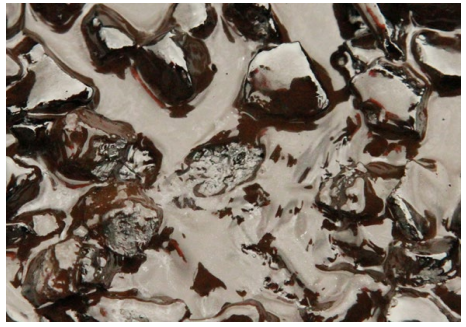


Viscosity at time of application

- **Emulsion alternatives**
  - Multi-grade (high shear/low flow) emulsion
  - Double spray bar (catalyst on 2nd bar cause rapid breaking)
  - High viscosity emulsions
- **Caution (Some limitations as well)**

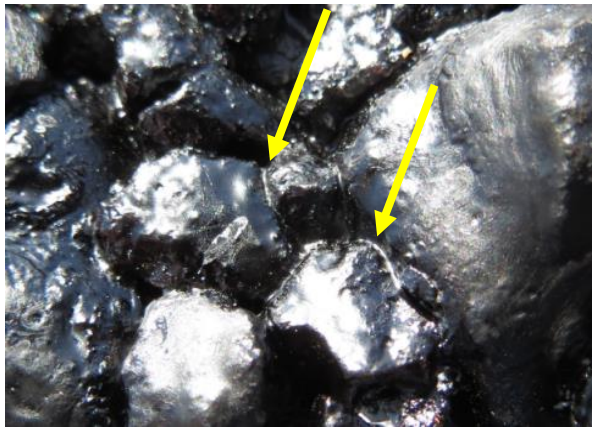



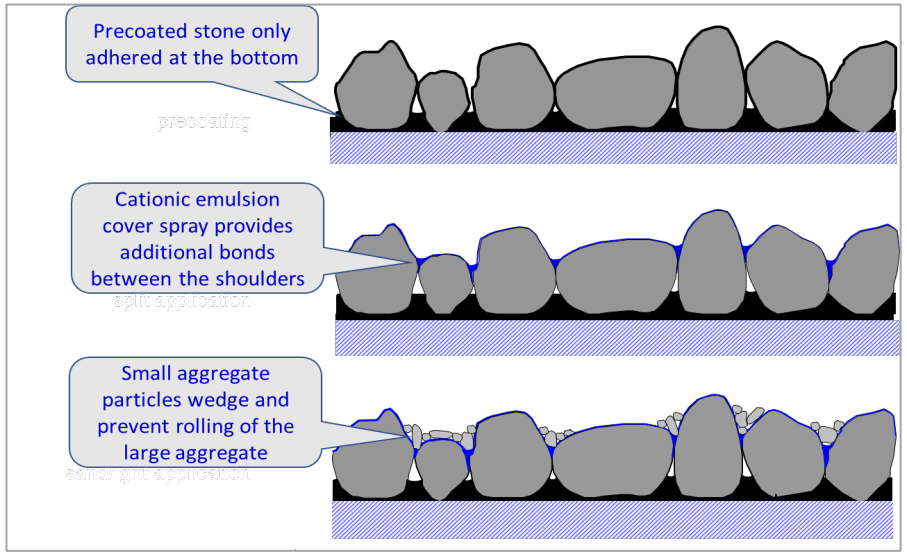
- **Curing**



Seal structure

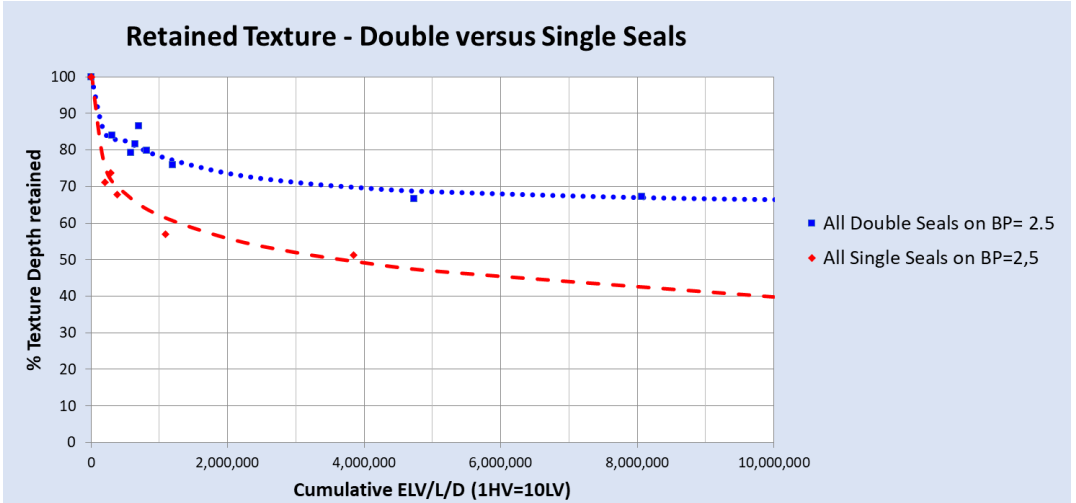
- **Binder position**





- **Wedging of smaller aggregate**

- **Texture loss (orientation)**



Existing surface

- Variation in surface texture

- Voids

Existing surface

- **Sealing too soon after rejuvenation (volatiles)**

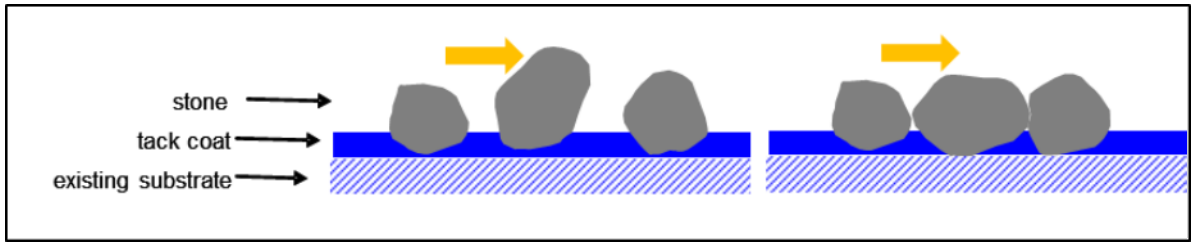
- **Importance of pretreatment**

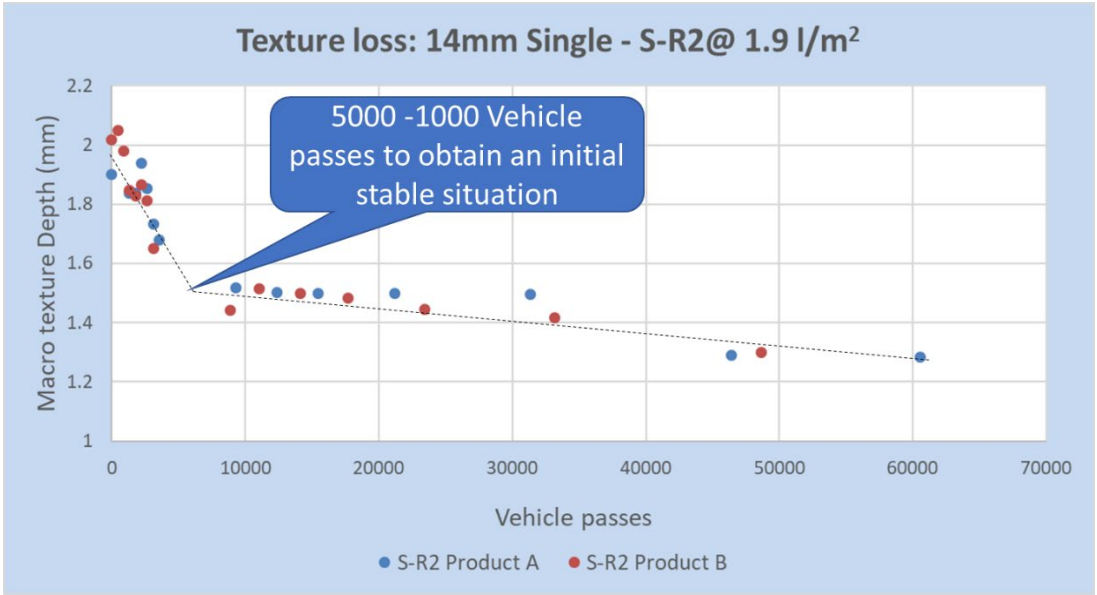
Environmental effects

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

Selection, Design and Construction

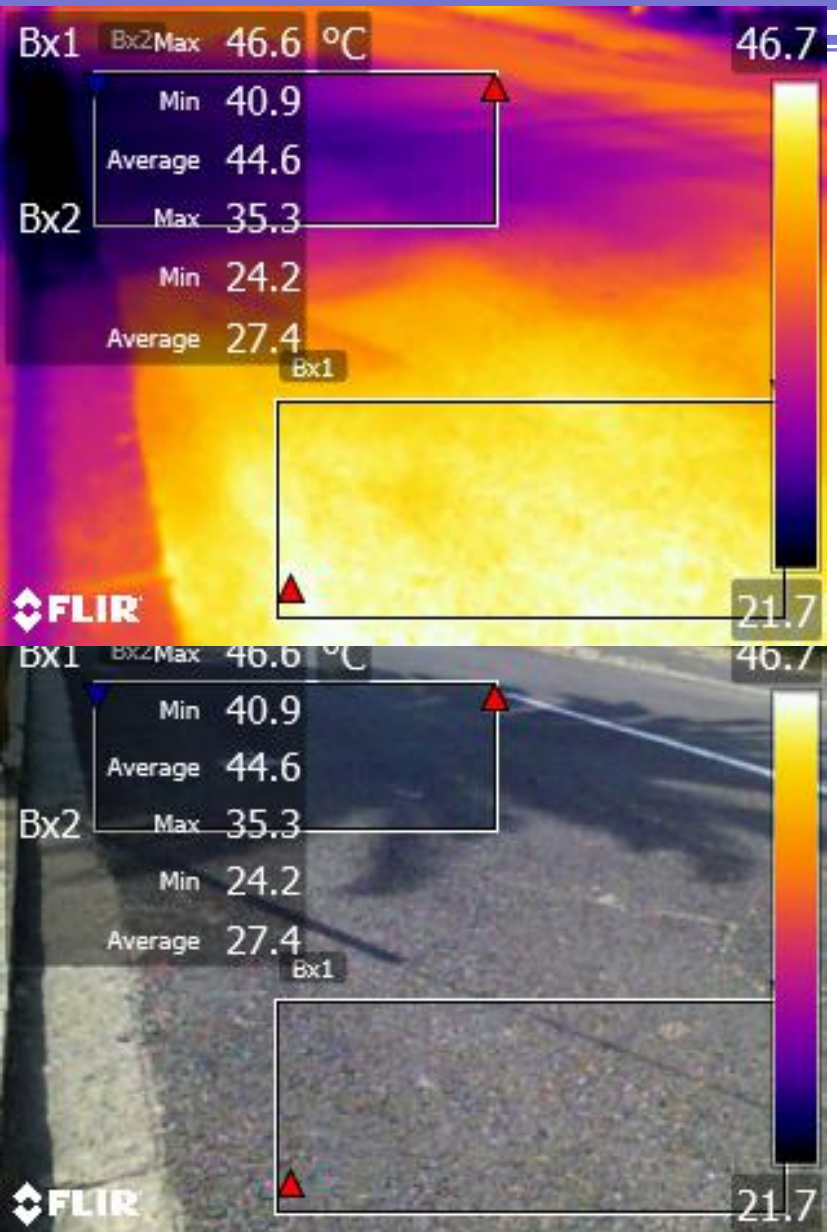
- **Correct seal type**
  - ❑PART D
- **Appropriate design**
  - ❑PART E
- **Quality of construction**
  - ❑PART F
- **Opening to traffic**





Road surface temperature

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD



Maintenance

- Enrichment
- Rejuvenation
- Joint repairs

End

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD