

Microsurfacing – a cost effective treatment for low trafficked surfaced roads

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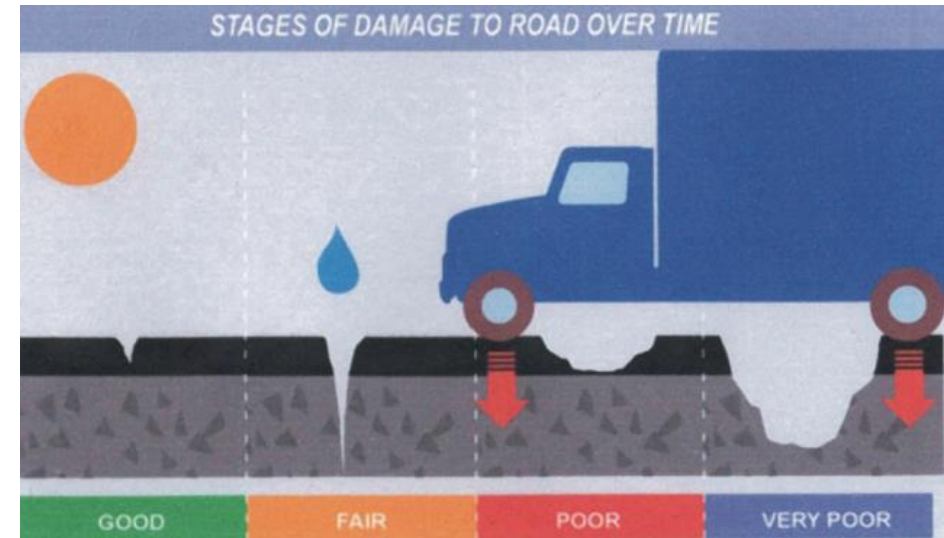
Overview

- What is microsurfacing
- Specifications & mix design
- Use of microsurfacing
- Equipment & application
- Quality control
- Summary



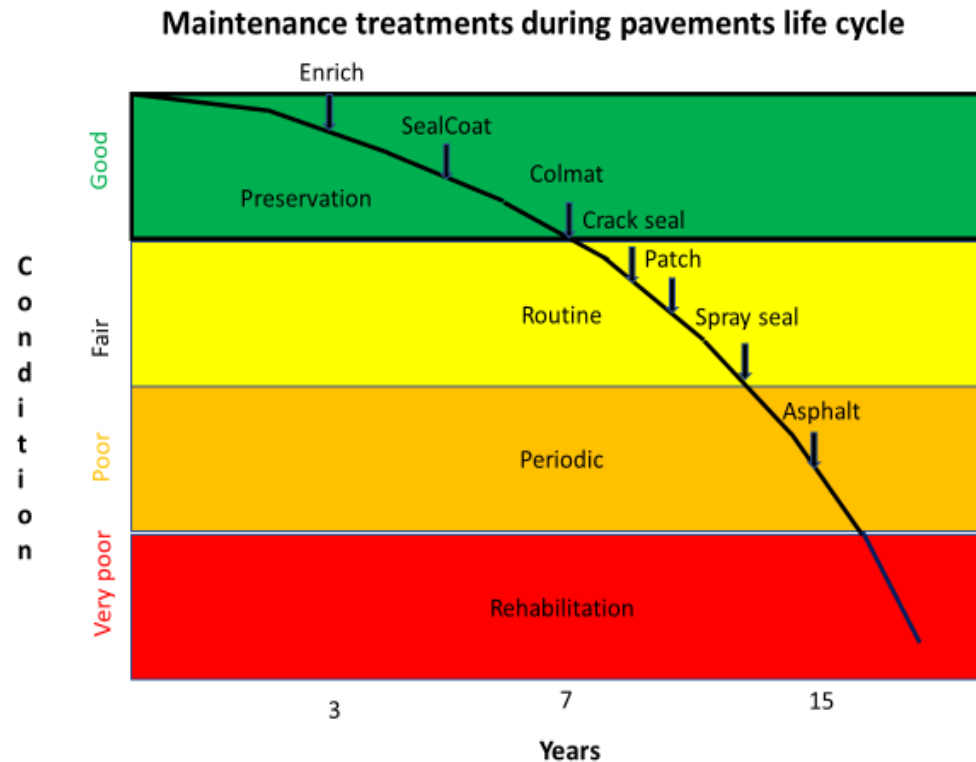
Introduction

- Low trafficked bituminous surfaces deteriorate over time from **oxidisation of the bitumen and not from traffic**
- This results in
 - the bitumen hardening which can lead to premature cracking and stone loss
 - ingress of water into the pavement and base failures requiring expensive repairs
- This presentation focuses on the use of microsurfacing as a cost effective treatment for restoring the functional properties of existing surfacings



Strategies to reduce bitumen hardening

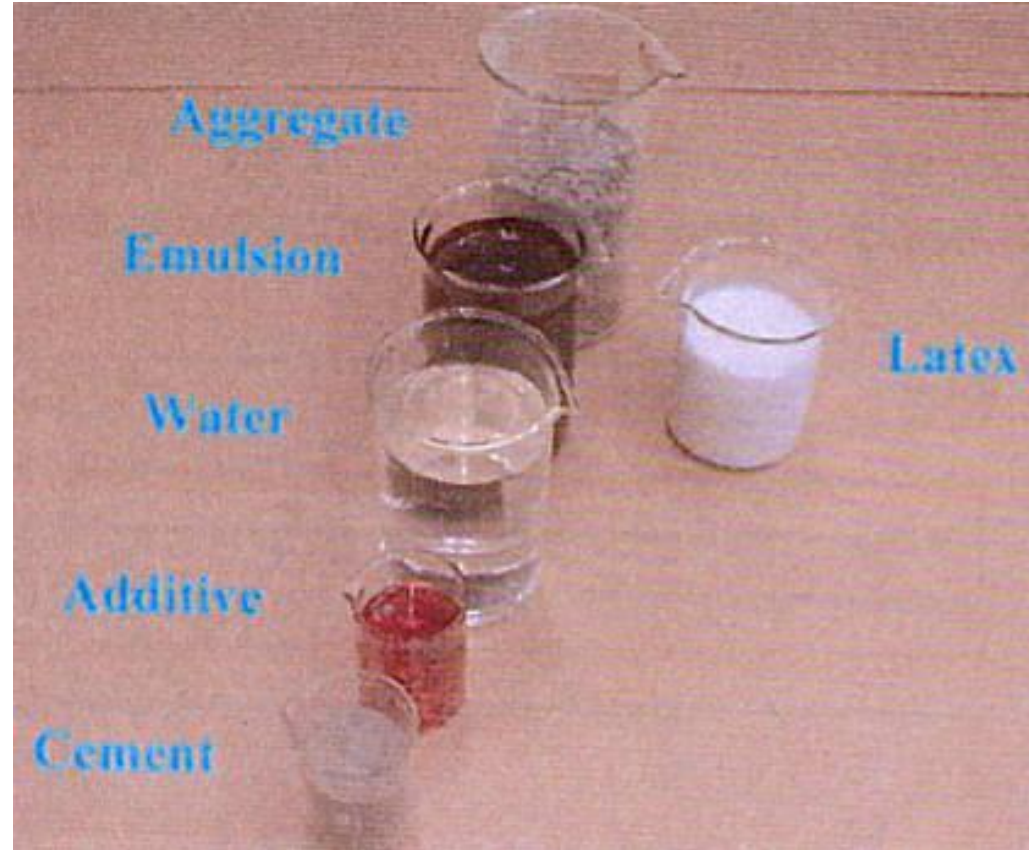
Make use of more cost effective surface preservation techniques to extend surface life and increase network coverage of financial spend



What is Microsurfacing?

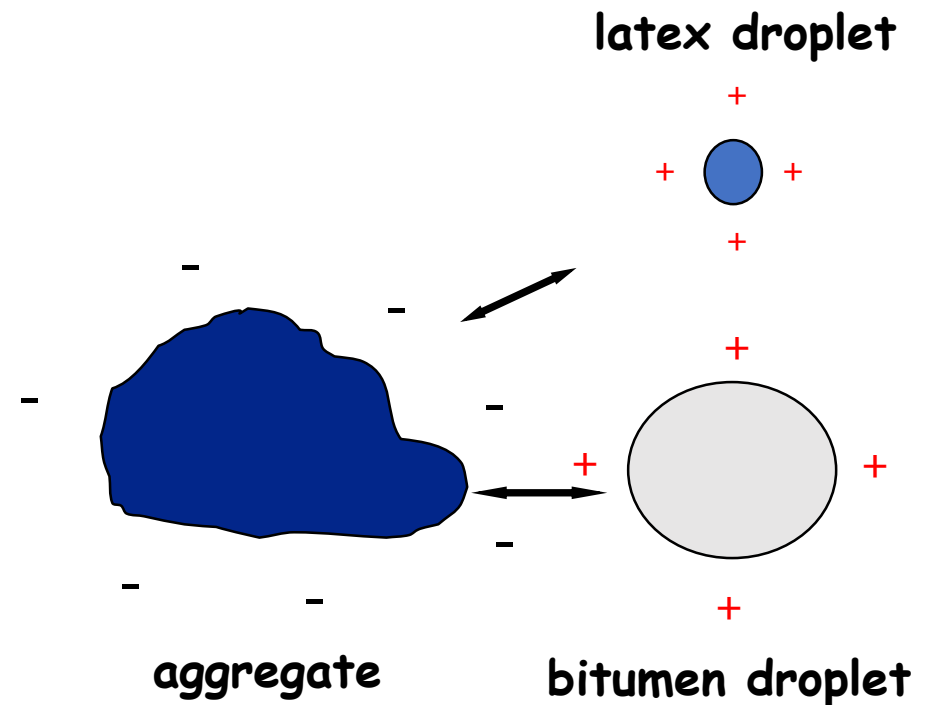
MS is a mixture of:

- Cationic quickset bitumen emulsion
- Modified with SBR latex
- Cement
- Water
- Crusher dust & aggregate



Raw materials properties

- SBR latex
 - improves adhesion
 - reduced risk of loose aggregate
 - improves temperature susceptibility of binder
- Water
 - acts as a wetting agent
 - helps adjust workability
- Chemical additive
 - post addition during mixing helps control product breaking rate
- Cement
 - used as a setting agent
 - adjust grading curve



Microsurfacing characteristics

- MS is specially formulated so that it:
 - Has sufficient workability to be mixed and laid at ambient temperature in 3 – 5 minutes to allow machine and hand placing
 - Breaks and cures to allow it to be trafficked after 1 hour with normal weather
- To achieve the above performance
 - Crusher dust must have specific grading
 - Fines in the crusher dust must have sufficient reactivity
 - Emulsion must be specially formulated with project bitumen and crusher dust

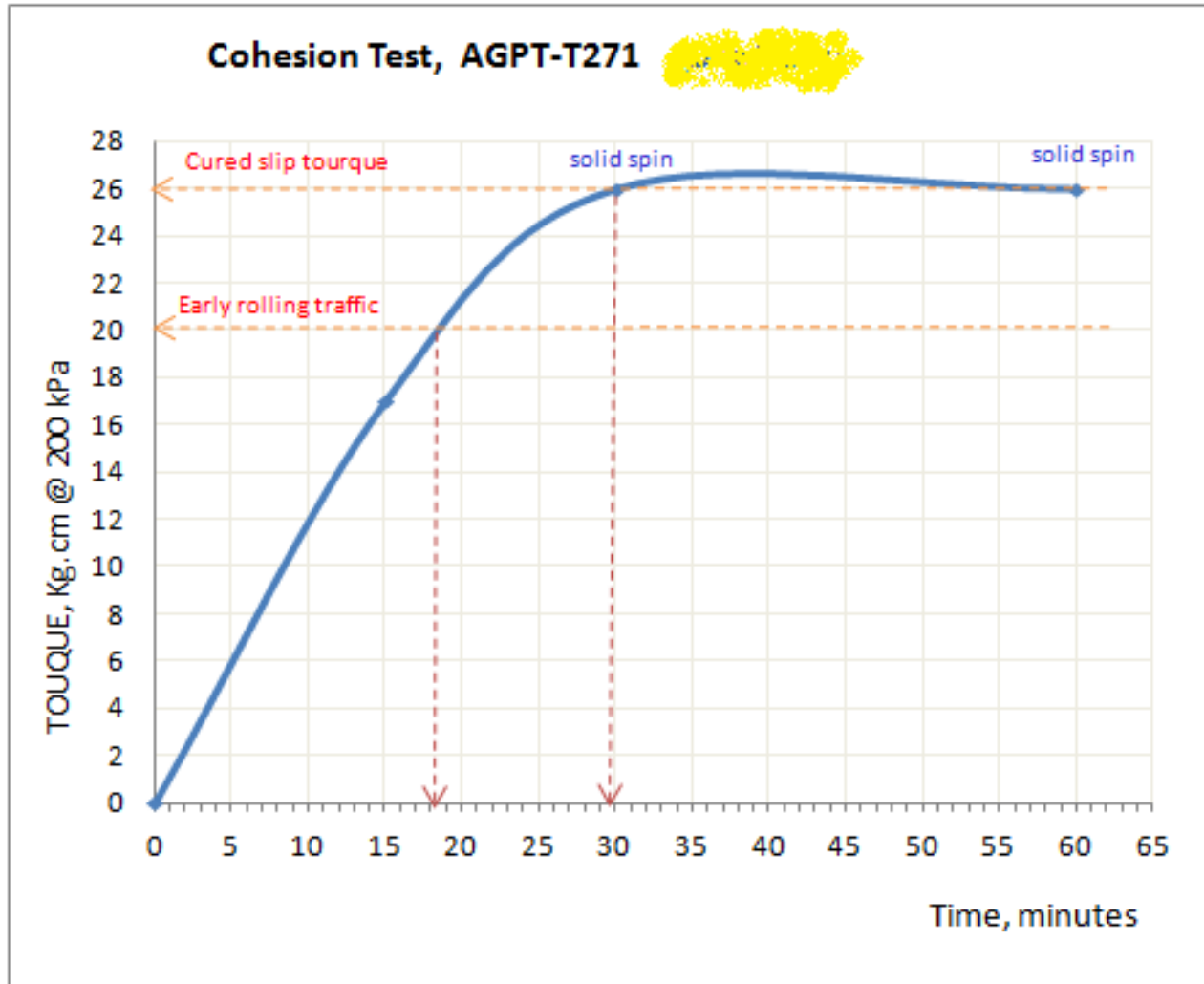
Mix design

Comprehensive mix design must be undertaken to determine the optimum binder content and emulsion formulation to achieve the following performance criteria:

Property	Test	Criteria
Workability	Mix test	90 – 120 seconds
Traffic accommodation	Cohesion development	> 20 kg.cm @ 30 minutes
Ravelling	Wet track abrasion	< 540g/m ² @ 1 hour
Adhesion	Wet stripping test	> 90%

It is essential that the raw materials tested in the mix design process are identical to those used to produce the MS for the project

Cohesion & wet track abrasion test



Specifications: Aggregates (QTMR)

Table 7.2.1 – Grading limits for combined aggregate and filter

Sieve size	Percentage passing by mass bituminous slurry nominal size (mm)			
	QS3	QS5	QS7	QS10
13.2				100
9.5			100	85 - 100
6.7		100	85 - 100	70 - 90
4.75	100	85 - 100	72 - 87	60 - 80
2.36	80 - 100	60 - 85	50 - 70	42 - 60
1.18	60 - 85	42 - 65	33 - 51	28 - 46
0.60	39 - 63	28 - 47	22 - 38	19 - 34
0.30	24 - 42	18 - 32	13 - 27	12 - 25
0.15	15 - 29	11 - 22	8 - 19	7 - 18
0.075	8 - 20	6 - 15	5 - 13	4 - 12

Table 7.1.2 – Aggregate properties

Property	Limit
Wet Ten Percent Fines Value (kN)	Minimum 150
Wet / Dry Strength Variation (%)	Maximum 30
Polished Aggregate Friction Value	Minimum 45
Sand Equivalent	Minimum 60

Uses of MS...

Aggregate grading is appropriate to traffic conditions and application thickness



Nominal size (mm)	Wearing course Traffic v/l/d	Rut filling	Application rates (m ² /m ³)
3 & 4	< 100	No	300 -280
5	100 – 3000	10 – 20 mm	200 -110
7	> 3000	20 – 30mm >30mm multiply layers	140 - 80
10	> 3000	20 – 30mm >30mm multiply layers	110 -70



Microsurfacing is effective for...

- **improving durability** by preventing further oxidation of aged binder in existing surface
- **preventing the ingress of water** into the underlying layers by filling in micro cracks and voids of existing surface
- **improving the skid resistance** by increasing the micro texture of the surfacing
- **improves the rideability** by filling the undulations in the existing surface
- **reduces aquaplaning** by filling the ruts in the wheel paths



Microsurfacing will not ...

Prevent reflective cracking

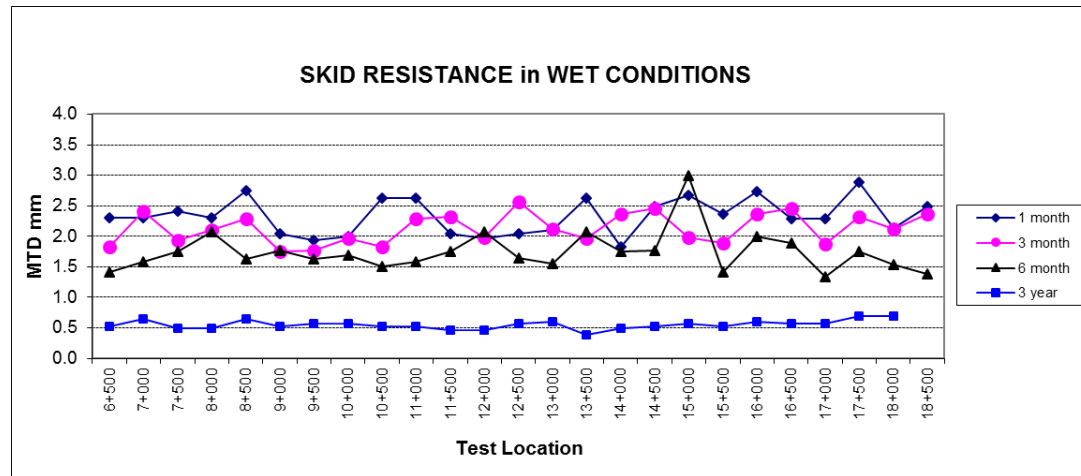
- Avoid using on pavements with high deflections
- Localised fatigue cracking must be repaired prior to placing of MS
- The use of a Stress Alleviating Membrane like a seal or geofabric will help mitigate crack reflection
- Cracks in the aged existing surface caused from binder ageing will not reflect through MS

Add structural strength

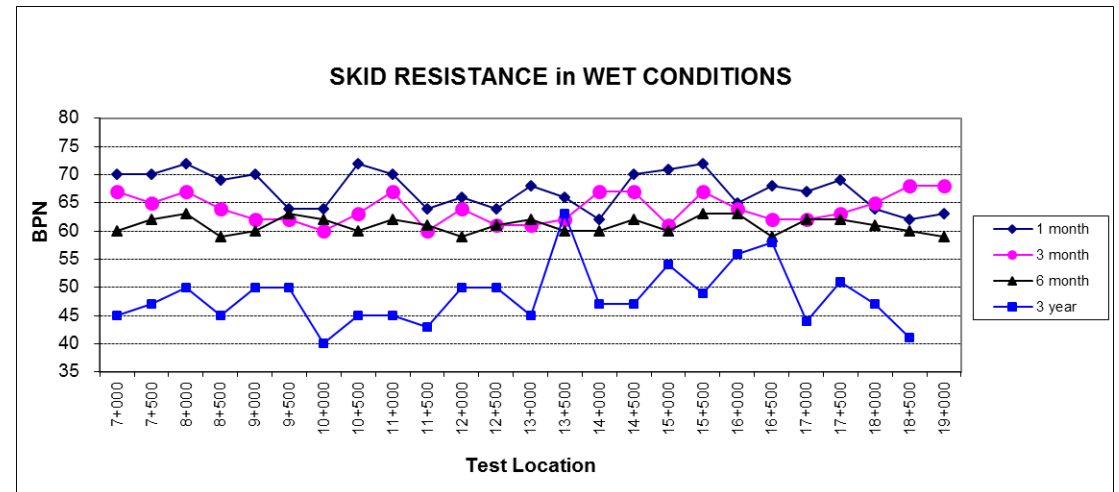
- When rut filling make sure that the deformation is not in the surfacing layer but is from the consolidation of the under lying layers

Improvement in skid resistance

Texture Depth



British Pendulum

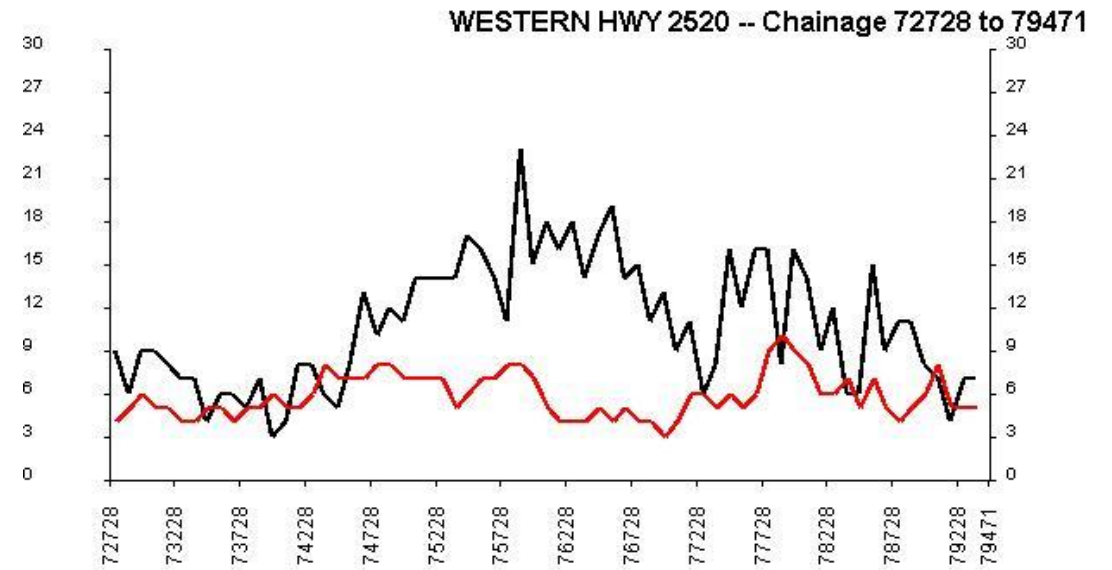


Source: Uttrapimuk Tollway in Bangkok, Thailand

Improvement in rutting & roughness

VicRoads Western region project

- 87 microsurfacing projects from 2006 – 12
- Total area 963,000 m²
- Average roughness reduction per project 23 NRM
- Average reduction in rutting per project 27%
- Average reduction in cracking per project 71%



Western Freeway - VicRoads



Uses of MS...

Overlay of

- urban streets and rural roads carrying medium level of traffic up to 3000 vpd
- existing blacktop surfaces or concrete pavements in single pass from 5 to 20 mm



Uses of MS...

Rut filling in single pass

- to restore profile in a single pass if rut depth is <15 mm



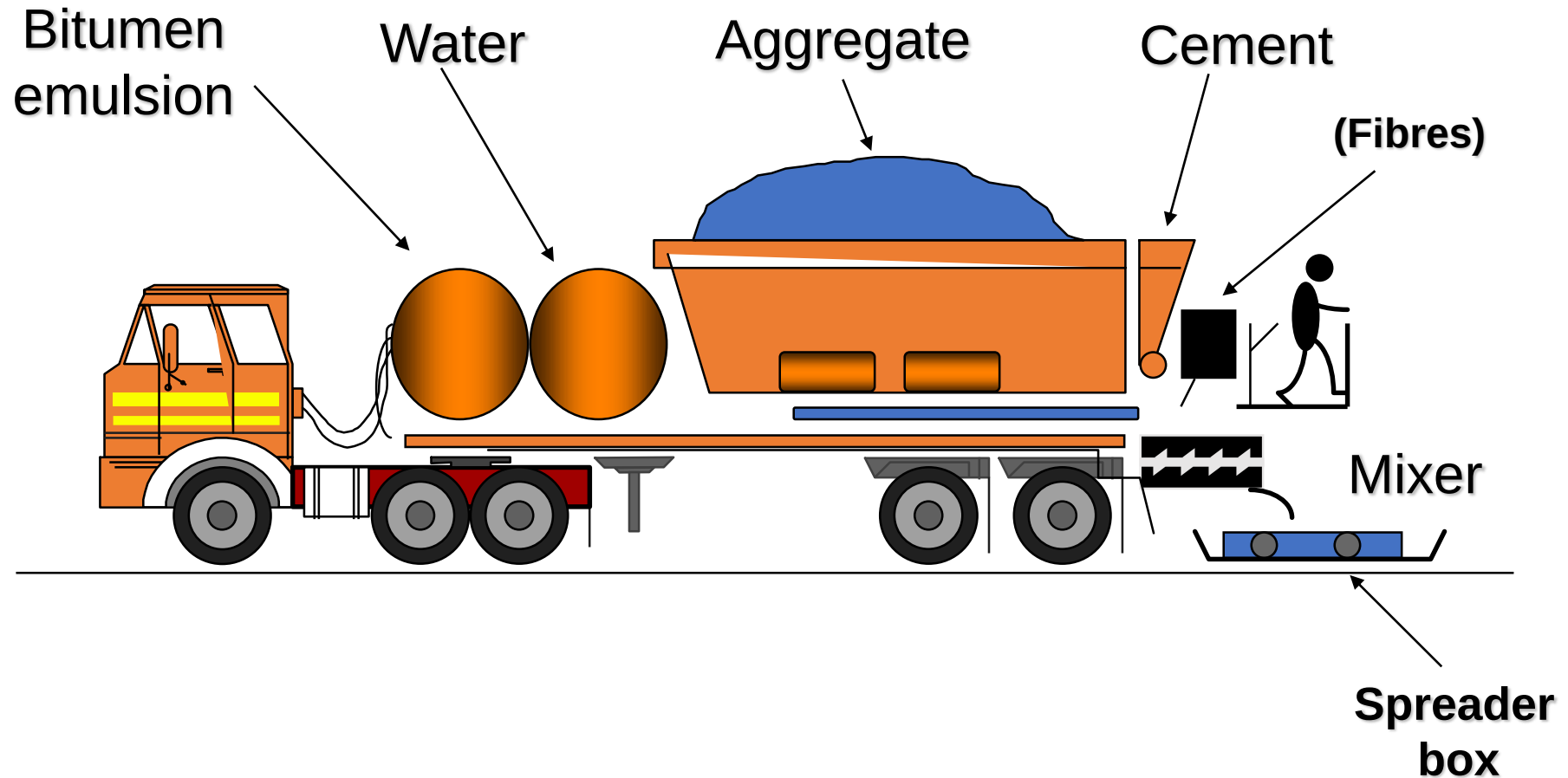
Uses of MS...

Rut filling with overlay

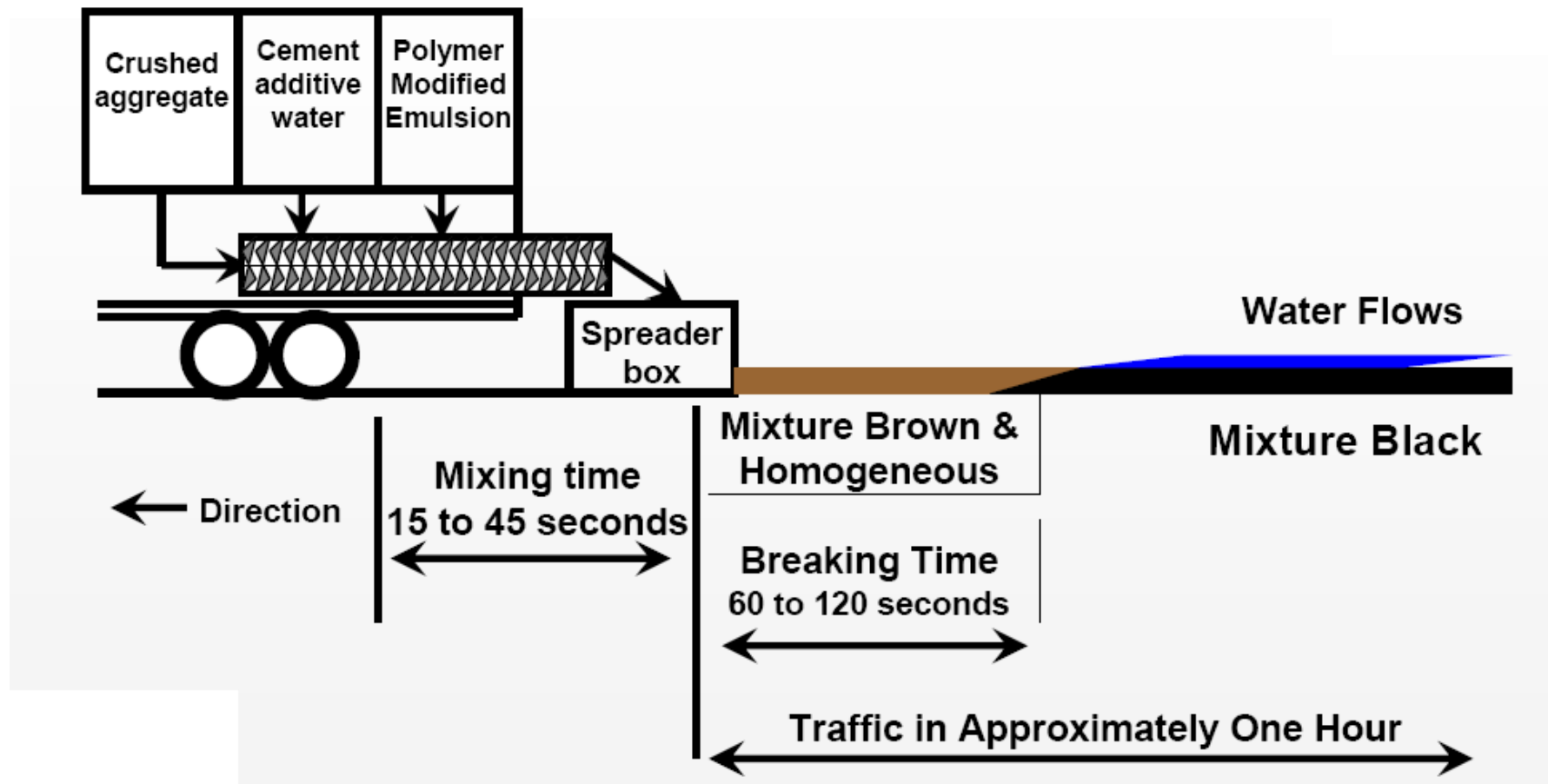
- rut filling in 2 passes if rut is $> 15\text{mm}$
- option to increase latex content and use larger size aggregate
- second layer provides more uniform appearance



Breining machine



How is Microsurfacing mixed and laid



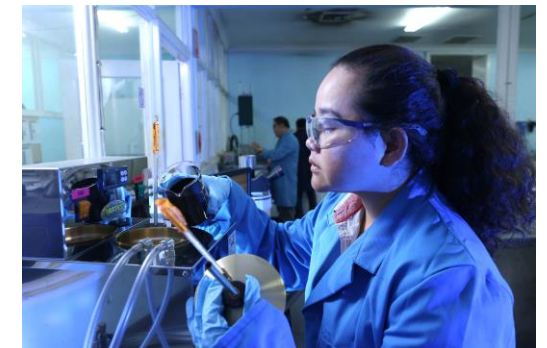
Application ...

- Apply when:
 - Ambient temperatures are between 4 and 40 °C
 - Pavement temperatures are between 10 and 55 °C
- Prestart
 - Applied on clean surface
 - Seal cracks > 3mm at least 4 weeks prior
 - Where the surface has shovelled mill out the bumps before laying the MS
 - Cover drains and manholes
- Prespray water in very hot weather to cool down surface
- No tack coat required unless existing surface highly oxidised
- Single pass if pavement deformation does not exceed 15 mm
- Open to traffic once emulsion has broken within 30 to 60 minutes depending on weather
- Post construction
 - Consider rolling to improve stone retention and reduce texture



Quality Assurance

- Follow internal Colas QA for managing raw materials
 - The clay content of the aggregates must be controlled by ensuring that the sand equivalent value $> 65\%$ and methylene blue value is between 5 – 11
 - Carry out a mix test with aggregates from the stockpile and check the breaking time
- Take samples from discharge chute and check against mix design:
 - Grading of crusher dust
 - Binder content of Colmat ($\pm 0.5\%$) by ignition oven
 - Quantitatively



Microsurfacing vs slurry

Slurry

- Slow curing – relies on evaporation to break
 - 2 to 5 hours for setting
- Traffic disruption
- Cannot be placed in thick layers
 - < 1.5 times max aggregate size
- Contains no polymers

Microsurfacing

- Chemical break so can be applied under a wide range of weather conditions
 - traffic within 30 min to 1 hour
- Minimal traffic disruption
- Can be applied in layers up to 20mm in single pass
- Contains 5% SBR polymer

Sustainability aspects of MS treatments

- Extending the life of the pavement and thereby reducing the demand for non-renewable materials like aggregates which would normally be used in the construction of reseals and asphalt overlays
- The use of **cold applied bitumen emulsion MS** make the maintenance of road pavements more sustainable by:
 - Reducing energy consumption in the manufacturing and application process
 - Reducing GHG emissions
 - Improving worker health and safety by reducing exposure to harmful fumes and risk of hot bitumen burns
 - Minimises the number of construction vehicles used per unit area



Summary

- MS provides a **safe sustainable economical solution** to pavement preservation
- The successful use of MS depends on:
 - Appropriate treatment selection
 - Correct mix design and emulsion formulation
 - Quality and control of raw materials
 - Workmanship during application
 - Weather conditions



**Safer
Sustainable
Solutions**