Emulsion Treated Road Base – Bracalba Quarry Case Study

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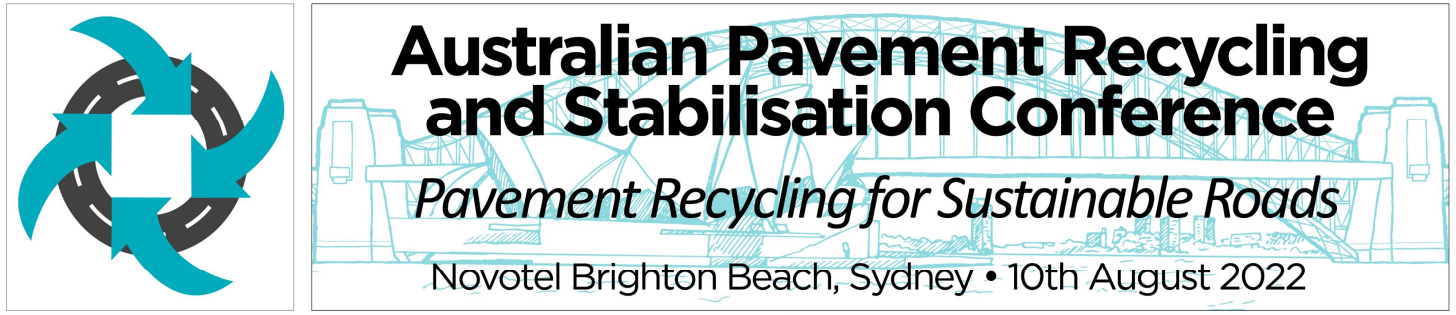
SAMI Bitumen Technologies



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Types of cold recycling

- **Cold Central Plant Recycling (CCPR)**

- Cold In Place Recycling (CIR)

  Also called partial depth cold in place recycling

Cold Central Plant Recycling (CCPR) process

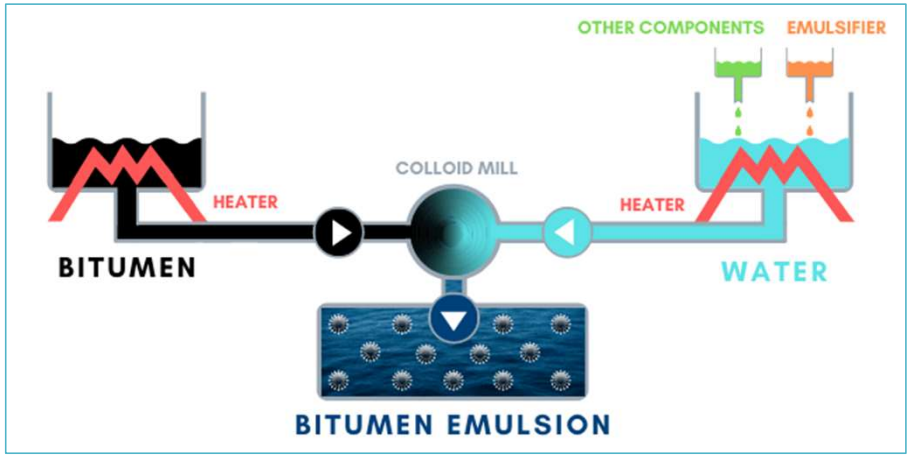
- **Mill and stockpile** – RAP and keep it clean
- **Crush RAP** to gradation
- **Mix** with water, recycling agent and additive as required
- **Stockpile** recycled mix if needed
- **Transport** to paving area
- **Pave** as a recycled mix
- **Compact** to specified density
- **Cure and reroll** if necessary
- **Apply final surfacing** as required

Recycling agents and additives

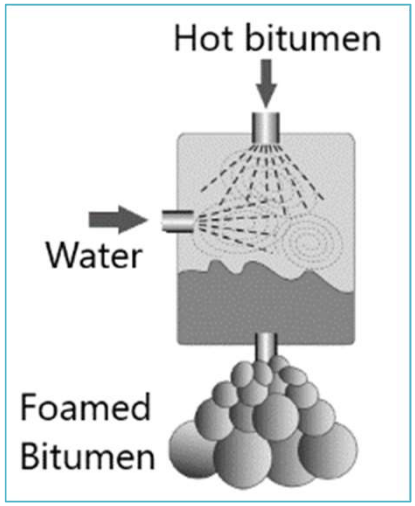
- **Recycling agents**
  - *Engineered emulsions (also called **Emulsion Treated Base (ETB)**)*
  - *Foamed bitumen*

- **Recycling additives (added in small quantity)**
  - *Dry Cement*
  - *Hydrated lime*

Bitumen emulsion manufacturing process



Foamed Bitumen manufacturing process



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Foam (FTB) vs. Emulsion (ETB)

- Foam is a Binding Technology
- Emulsions are a Coating Technology

Emulsion treated

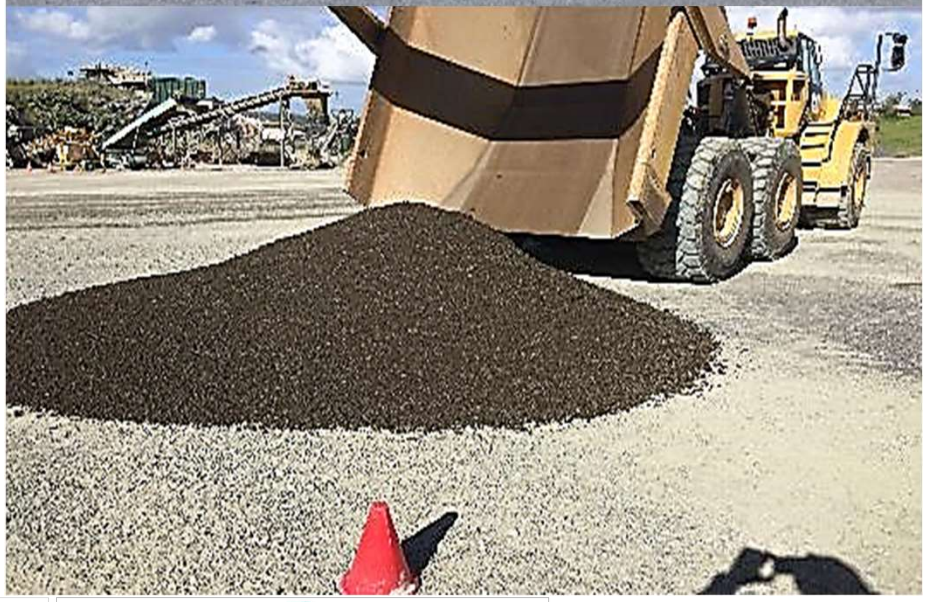
Foam treated

Technical advantage of bitumen emulsion

- **Higher Flexibility** - Reduce and delay cracks formation
- **Easy Making** - With machine equipped with flowmeter for metering the emulsion
- **Better compaction** - Liquid at compaction. It lubricates aggregates and aid compaction
  - Higher mechanical performances
- **Tiny bitumen particles** - Better coverage (1L of emulsion can develop an interfacial area of more than 5000m2), Waterproofing
- **Good coating** - Higher mechanical performances
- **Homogeneous binder** - Less variation of performances
- **High Stiffness Modulus** - Strengthen the structure, Increase service life
- **Cold Technique** - No pollution – Dust Free, Improve workers safety and working conditions, Environmental friendly, Save Heating Energy

Case study at Bracalba Quarry, Brisbane City Council (plant trial)

- 30 tonnes plant trail undertaken on 12/04/2018 at the Brisbane City Council's Bracalba Quarry using class 2.3 roadbase material and **3% Anionic Slow Set 60% emulsion**
- The ETB mix was stockpiled for 3 days
- Samples of mix were taken by the Bracalba Quarry laboratory staff for subsequent moisture, binder and gradings determination
- 20kg of the mix was sent 5 days post-manufacturing to SAMI laboratory in Sydney. This sample was immediately sealed after manufacturing in a container with the total time of the mix kept in the sealed bucket was 7 days



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Testing Results (Laboratory Design and Production Trial)

Sieve mm	Design	Trial
37.5	100	100
26.5	100	100
19.0	99.4	100
13.2	88	90
9.5	76	76
6.7	63	67
4.75	53	58
2.36	38	45
1.18	26	33
0.600	19	24
0.300	15	17
0.150	13.3	12.8
0.075	11.9	9.7
Residual Binder content	1.8	1.8

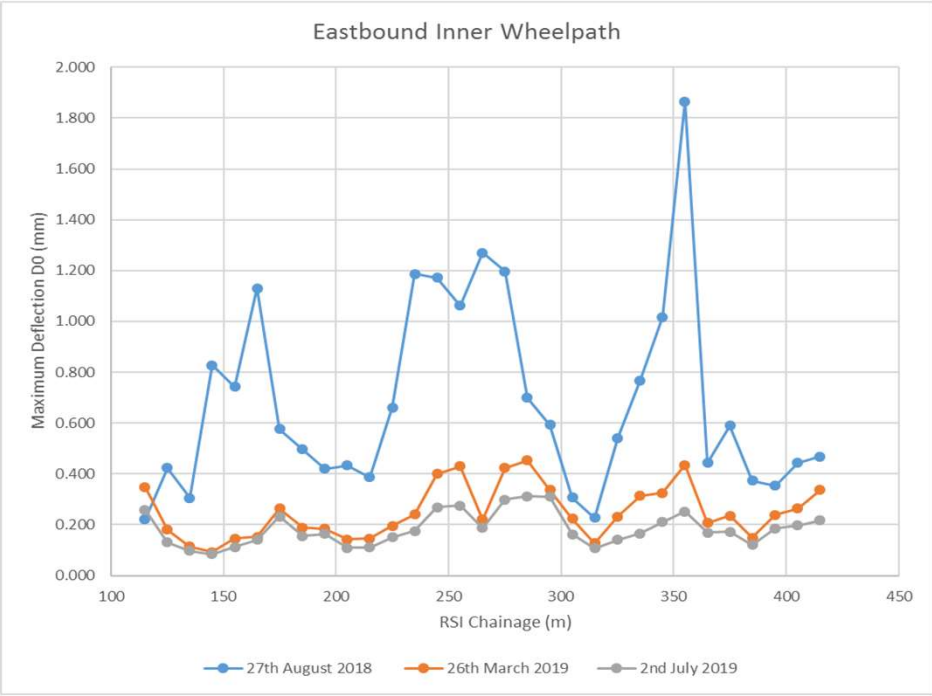
Curing Conditions	Resilient Modulus (MPa)					
Laboratory design mix stockpiled for 3 days while the trial mix stockpiled for 7 days	Cured for 3 Hrs @ 25°C		Cured for 3 days @ 40°C		Cured for 3 days @ 40°C, Soaked for 24 hrs in water @ 25°C	
	Design (3 days)	Trial (7 days)	Design (3 days)	Trial (7 days)	Design (3 days)	Trial (7 days)
1	710	-	3760	8178	1700	1913
2	670	578	3530	5774	1630	2022
3	560	591	3130	6723	1870	2232
Average	652	580	3480	6900	1730	2,000

Road project ETB plant mix (Abbott St., Camp Hill, Qld)

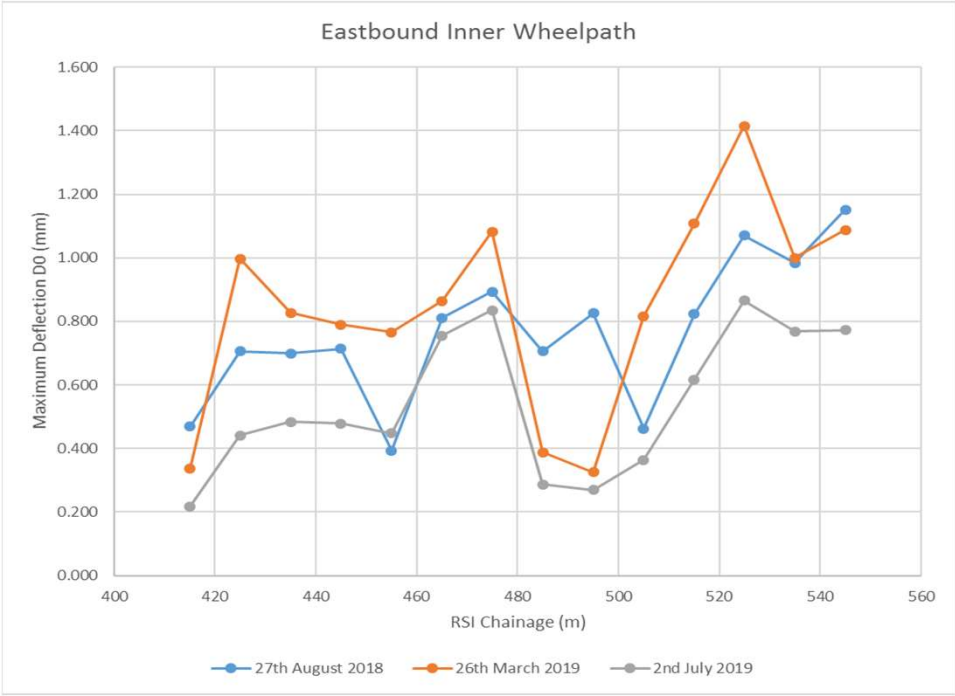
- In July 2018, 300 tonnes of ETB were plant produced at Bracalba Quarry for a road project in Brisbane using 2.3 roadbase material, 1% Hydrated Lime and 3% Anionic Slow Set emulsion
- 300mm of the existing road base material was profiled out, then 250mm of ETB was placed straight on top of untreated subgrade material (the subgrade was very soft and moved under the wheels of the trucks as they discharged the ETB into the paver)
- The ETB was found to be very easy to spread and compact (a steel vibratory roller and a rubber multi tyred roller were used)
- For monitoring purposes, core samples being extracted over 12 months in order to ascertain in-situ strength gain (at every three months)

Falling Weight Deflectometer Data - Inner Wheelpath

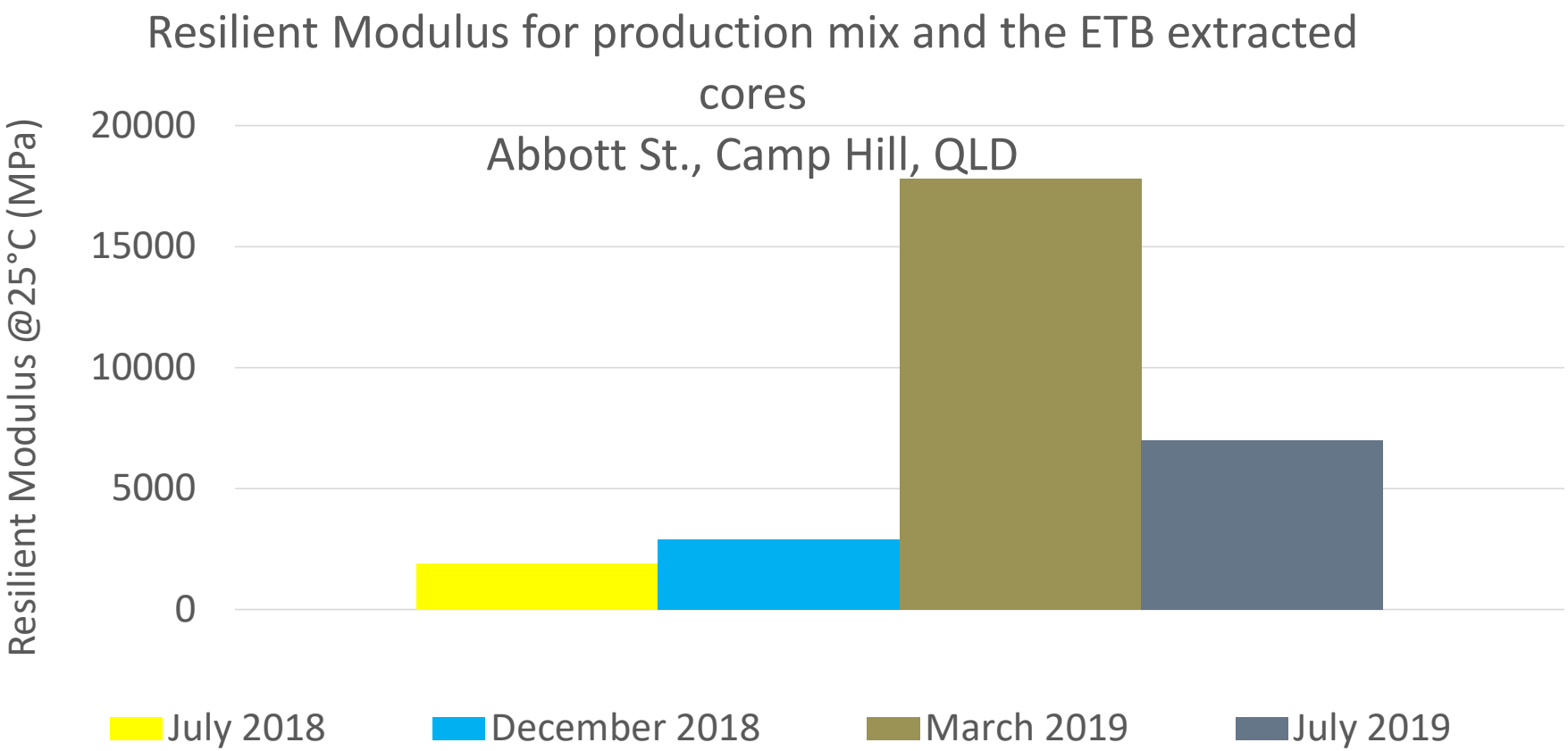
Treated



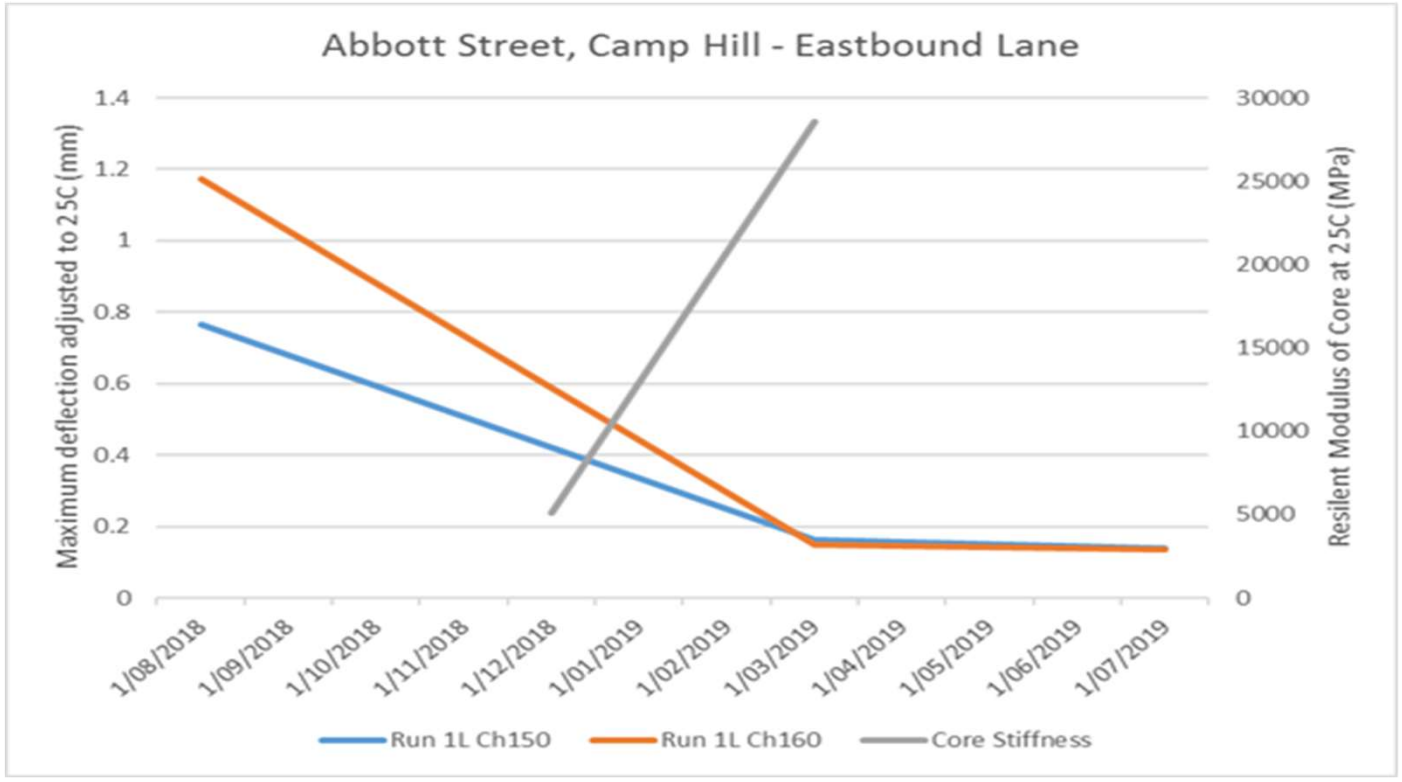
Untreated



Resilient Modulus results on production mix and field cores



Maximum Deflection (FWD) vs. Resilient Modulus for extracted cores



Project findings

- The resilient modulus testing results indicate a significant increase in the material' stiffness with time. However, the July 2019 results show an unexpected decrease in stiffness (possibly due to some cores being damaged during extraction/handling)
- In terms of FWD testing, the overall trend shows that the total maximum deflection has decreased over time indicating that the pavement is becoming stiffer (a reflection of an increase of strength due to curing)
- FWD testing in August 2018 indicates that the overall pavement was performing like a weak granular pavement while by July 2019 the pavement is performing more like a bound pavement
- Both the resilient modulus and FWD data suggest that the pavement stiffness between March and July 2019 is not substantially different indicating that the ETB material has reached its final cured state
- No further testing program was undertaken after July 2019 apart from visual inspection; the pavement doesn't show any sign of distress

Summary

- CCPR/ETB is an efficient technique for reducing Cracks formation
- CCPR/ETB has high mechanical performances provided

- CCPR/ETB is safe for workers
- CCPR/ETB is an economical alternative to new construction
- CCPR/ETB is an efficient alternative to the existing cold recycling techniques
- CCPR/ETB is **sustainable** - uses existing materials
  - paved without heat

Acknowledgements

Dr. Greg Stephenson – Brisbane City Council

Trevor Distin – Colas Australia

For Better Roads and to Preserve our Environment,
Emulsion is your alternative solution !!

Thank you for your attention