ISAET '21
7th International Symposium on Asphalt Emulsion Technology

High performance bond coat emulsion for high stressed pavement layers

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Overview

- Tack/bond coat definition
- Why do we need tack/bond coat?
- Desired properties of tack/bond coat emulsions
- Laboratory evaluation of tack/bond coat emulsions
    - emulsion testing,
    - tracking testing, and
    - bond shear strength testing
- Case studies and trials
- Conclusions

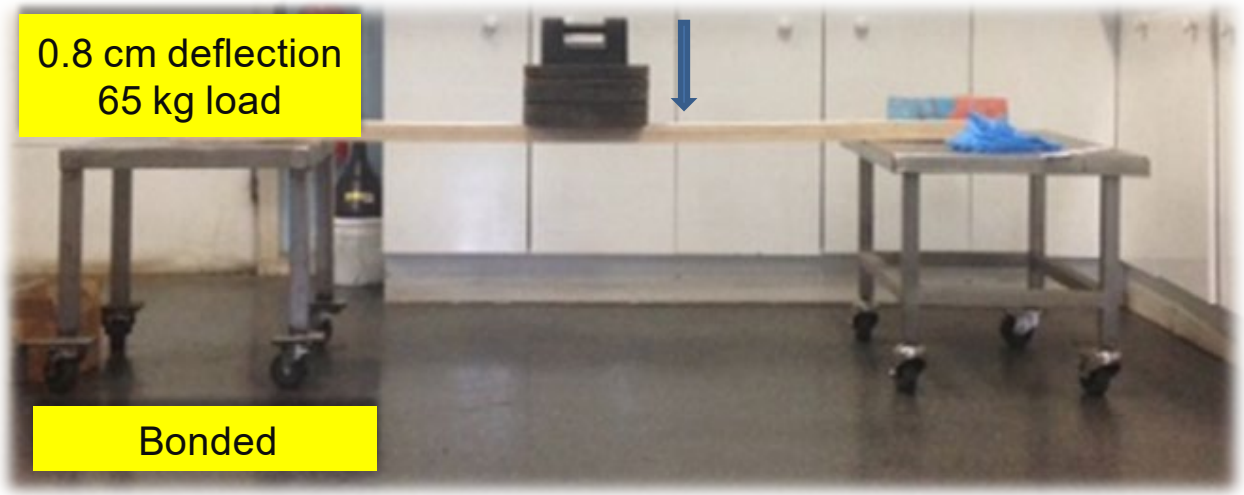
What is tack/bond Coat ?

- Tack/bond coat- work as the glue between the layers of asphalt;
- Tack/Bond coat - a very light application of bitumen emulsion;
- Used to promote a bond between the existing surface and the new asphalt application;
- For example , CRS60 is a conventional tack coat emulsion in Australia

Why Do We Need A Good Bond?

Lack of bonding:

- delamination and slippage failure
- longitudinal wheel path cracking
- fatigue cracking
- Shoving / rutting



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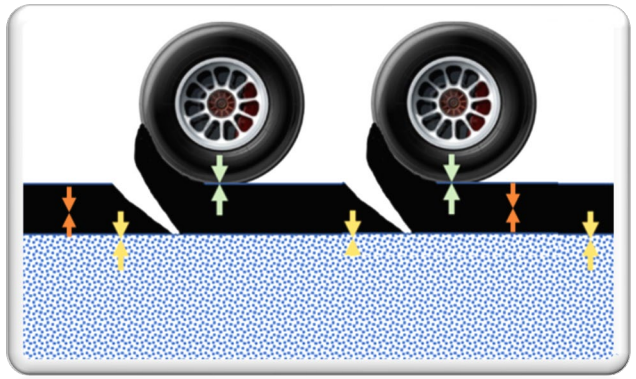
Desired properties of Tack/Bond Coat Emulsions

- Low enough viscosity for spraying and ensuring adequate coverage;
- Particle size important in order to prevent spray nozzles from blocking;
- Must be rapid setting emulsion
- Good storage stability;

Desired Properties Of Tack/Bond Coat Emulsions (cont'd)

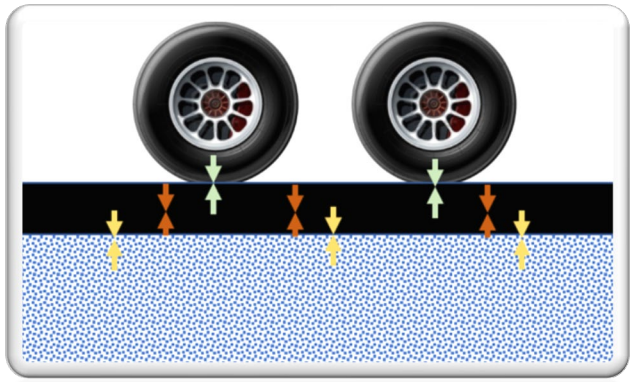
- Non-tracking emulsion to keep enough bond coat residue on the substrate

traffic →



Conventional tack/bond coat emulsion

traffic →



Trackless tack/bond coat emulsion

- Polymer modified emulsion designed to withstand high shear stresses

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What Is Tracking?

- The pick-up of bituminous materials by paving equipment tyres;
- Can occur when tack coat residue is sticky and/or was not appropriately applied;
- Can result in little, or no tack coat left in the wheel paths
- Can be aesthetically unpleasing if fresh bitumen is tracked onto neighboring surfaces

If you have a lot of tracking, that means the glue is being removed!!

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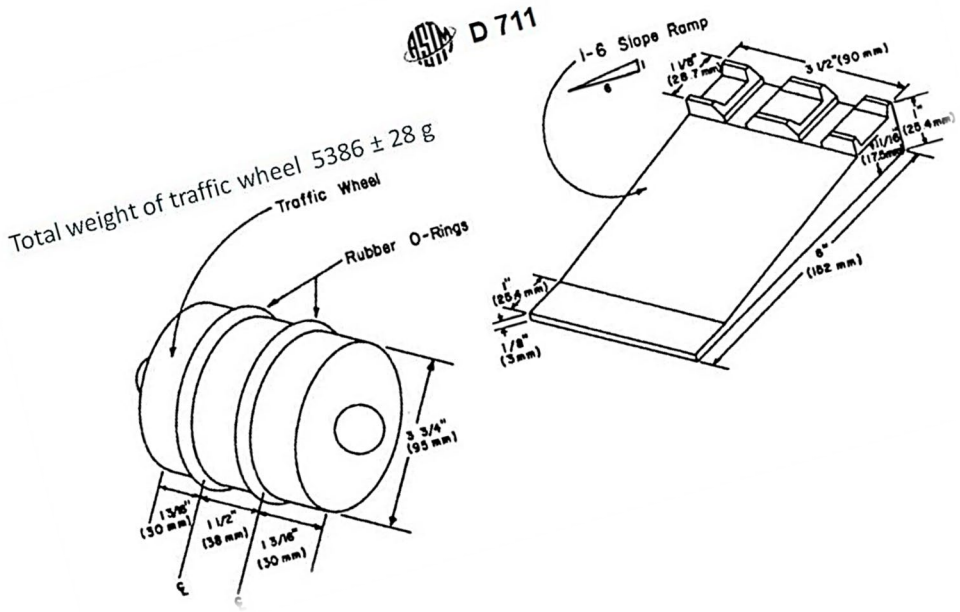
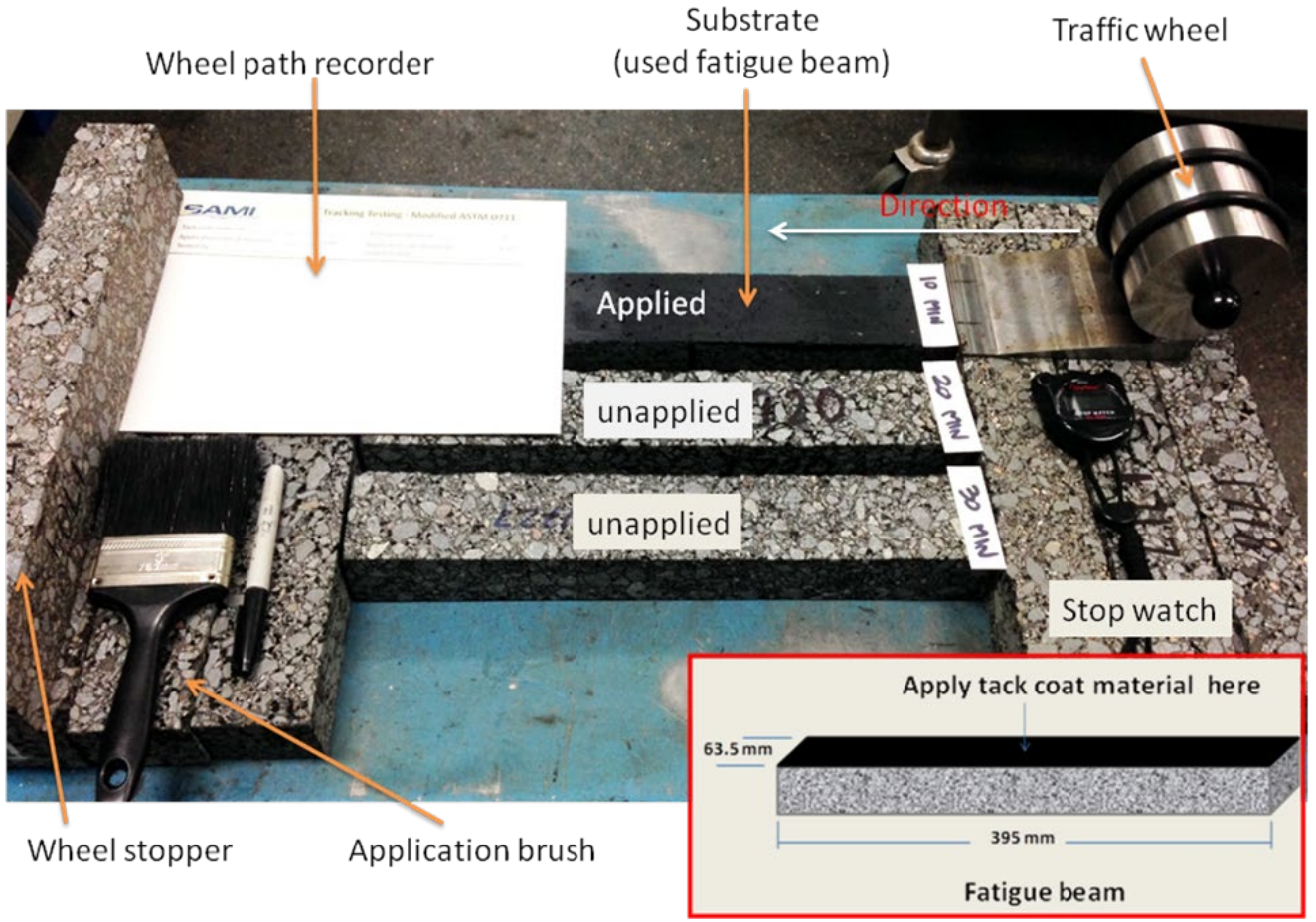
Laboratory performance comparison of trackless bond coat emulsion vs conventional tack coat emulsion

Properties	Trackless bond coat Emulsion (SAMIBond 007)	Conventional tack coat emulsion in AUS (CRS60)
Emulsion type	Cationic rapid setting	Cationic rapid setting
Polymer modification	Yes	No
Residual content, %	60-61	60-61
Viscosity at 25 °C, mPas	30-70	30-60
Viscosity at 60 °C, mPas	25-40	25-30
Sieve residue (710 micron), %wt	<0.02	<0.02

Tracking Test- Modified ASTM D711 (Internal method)





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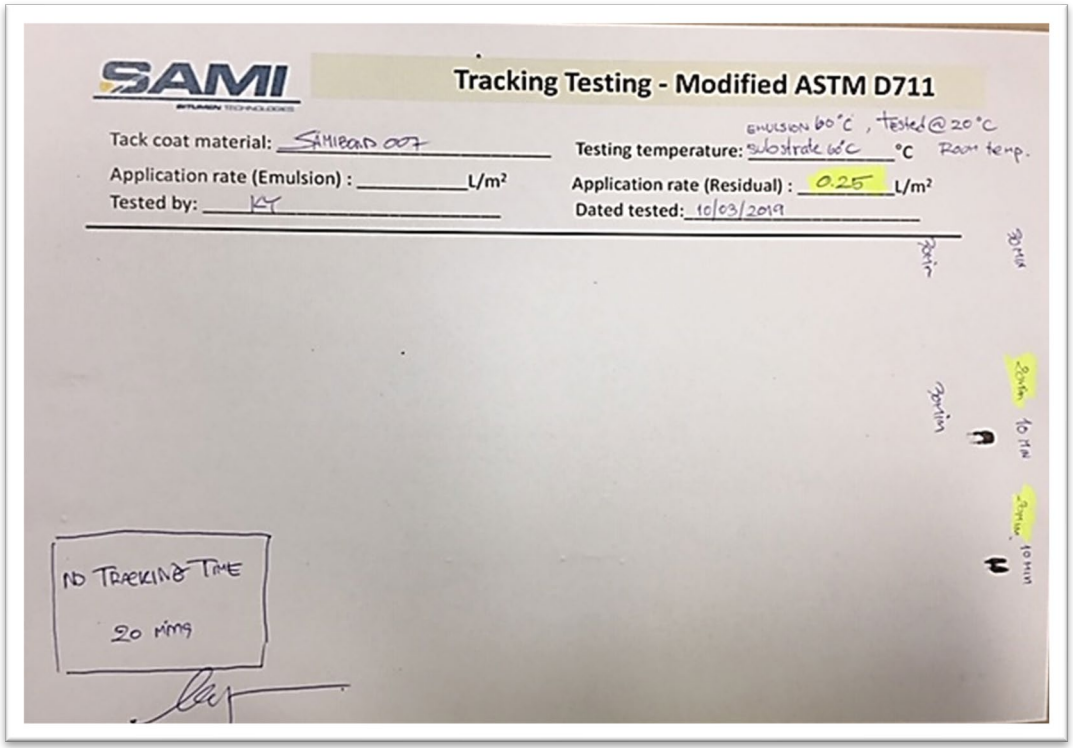
Tracking Test- Modified ASTM D711 (Internal method) (cont'd)

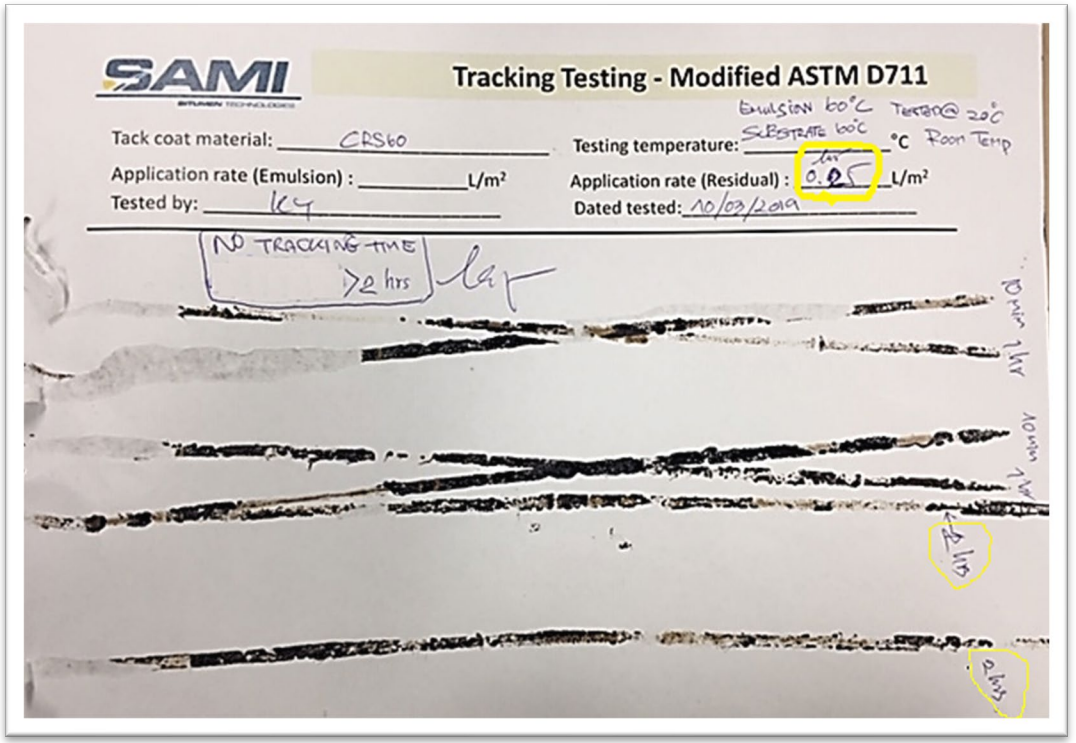
60 °C emulsion / 60 °C substrate / Ambient testing condition (25 °C)

SAMIbond 007 – Residual application rate 0.25 L/m²



No tracking time – 20 mins

CRS60 – Residual application rate 0.25 L/m²



No tracking time – more than 2 hrs

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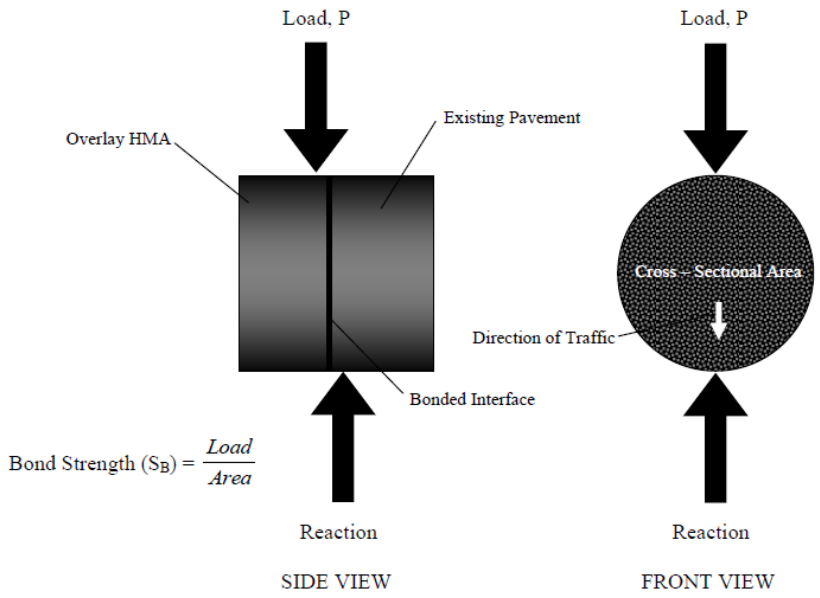
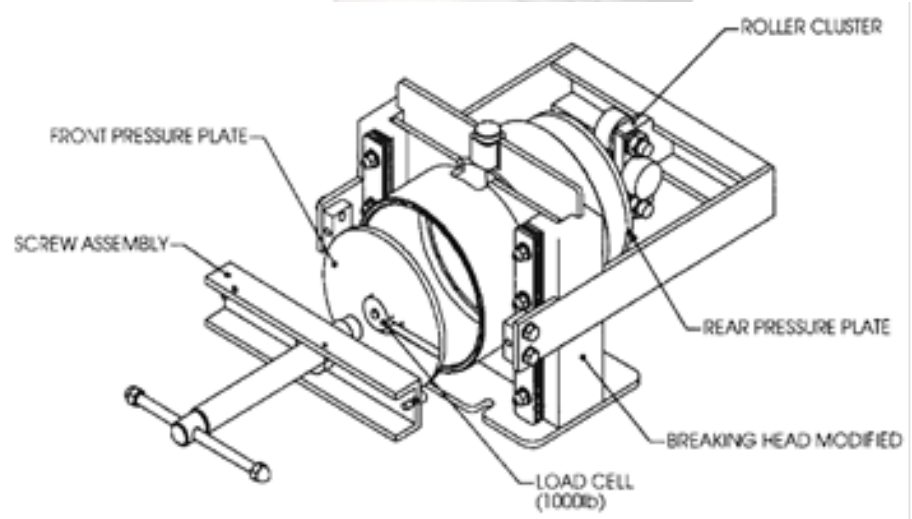
Bond Shear Strength Testing

NCAT Bond Strength Test Device





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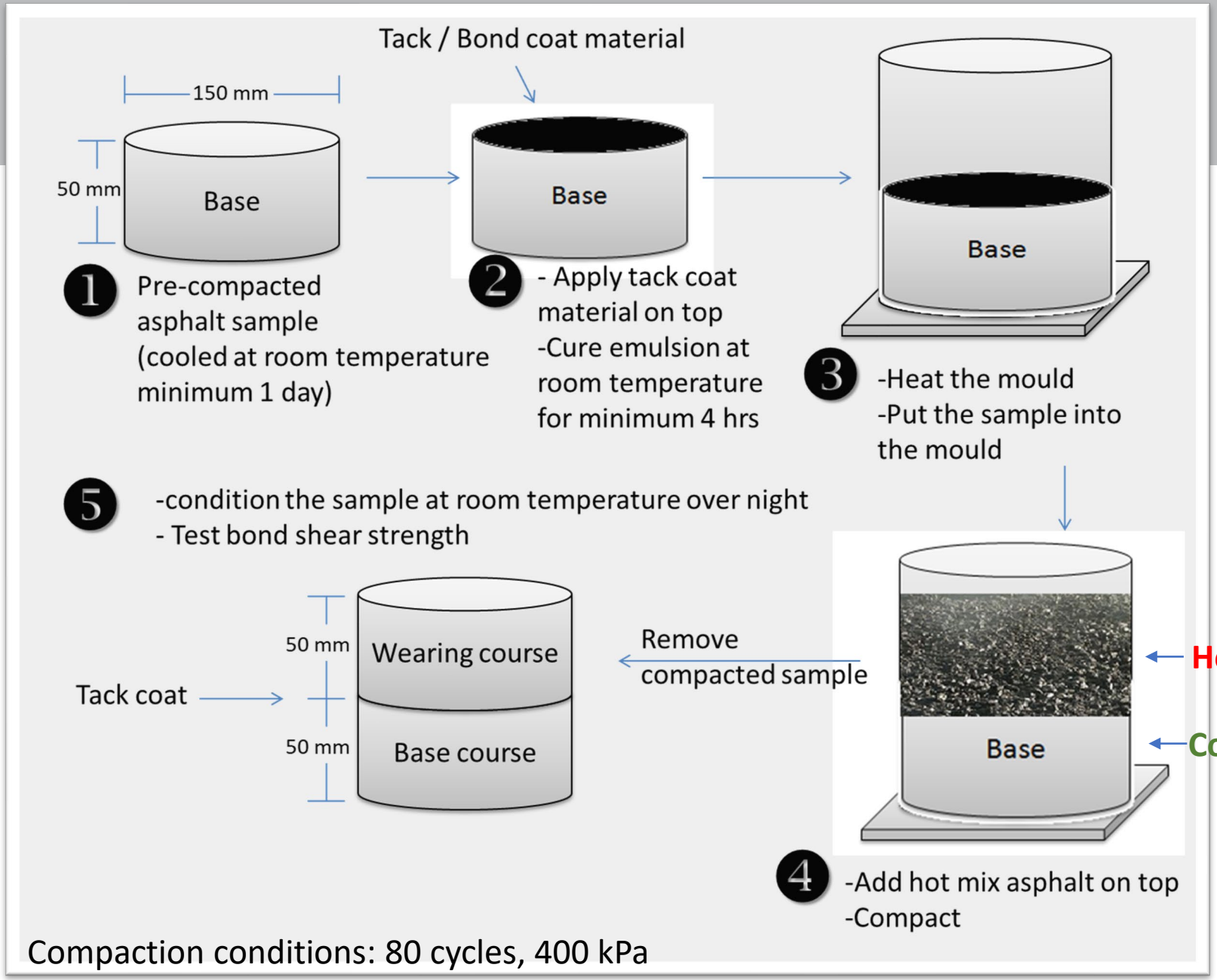
Bond Shear Strength Testing

(cont'd)

Specimen Preparation



Compaction conditions: 80 cycles, 400 kPa

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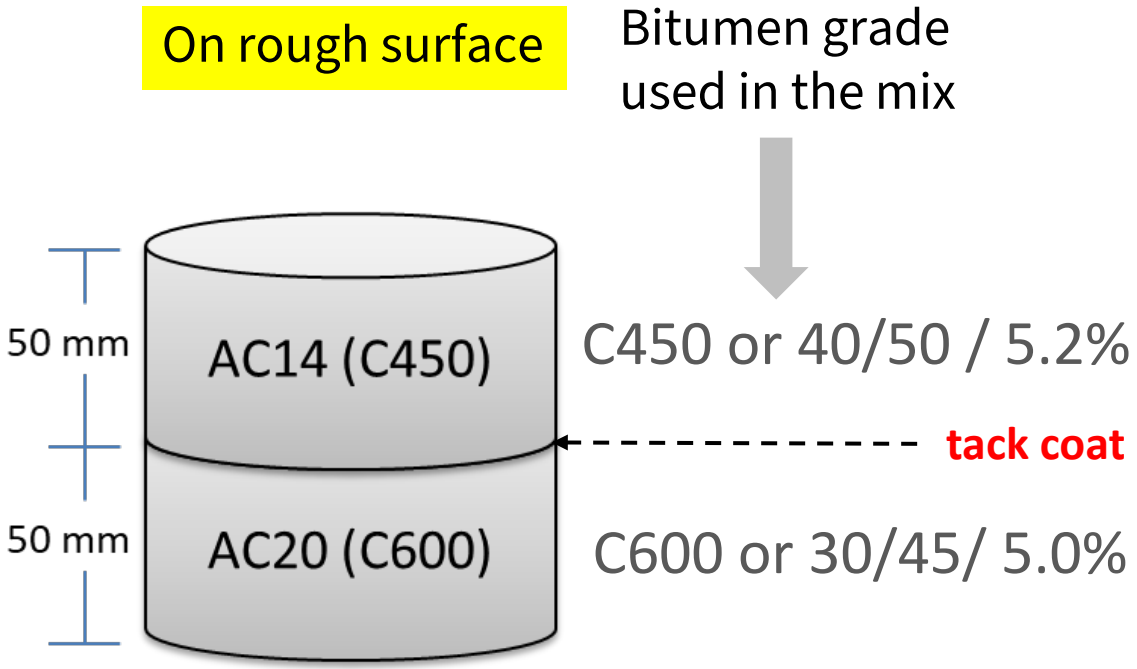
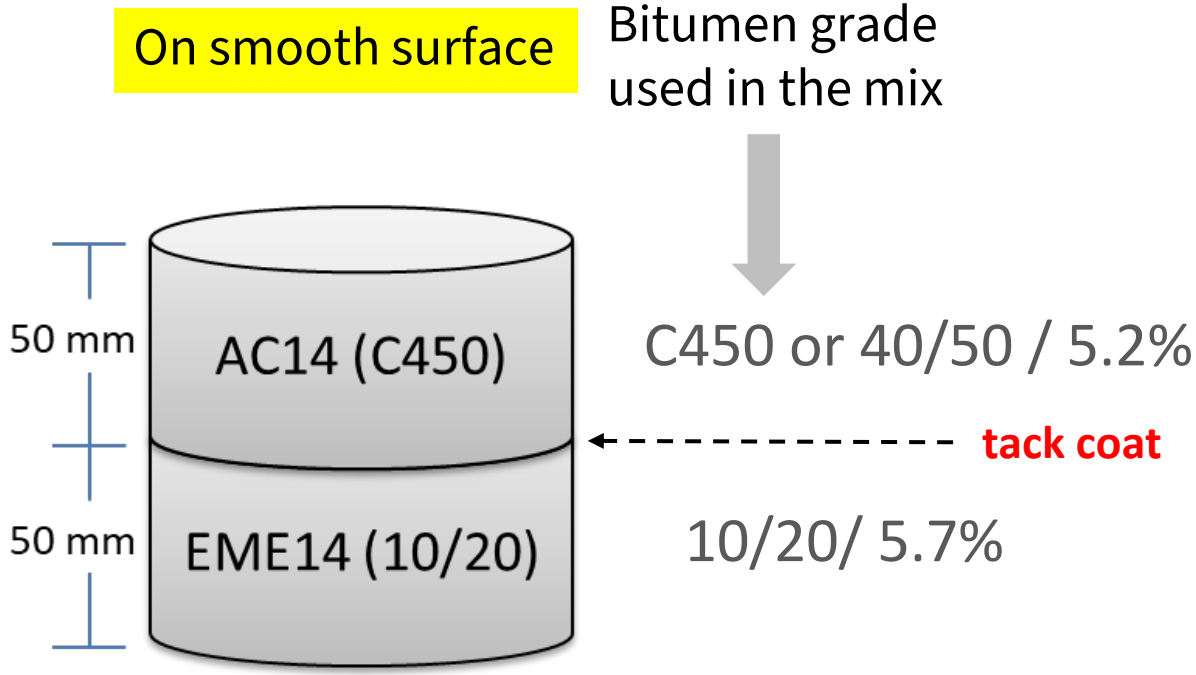
Bond Shear Strength Testing (cont'd)

Asphalt mixes details





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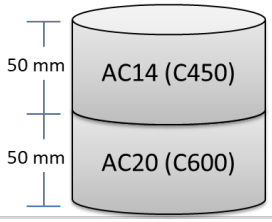
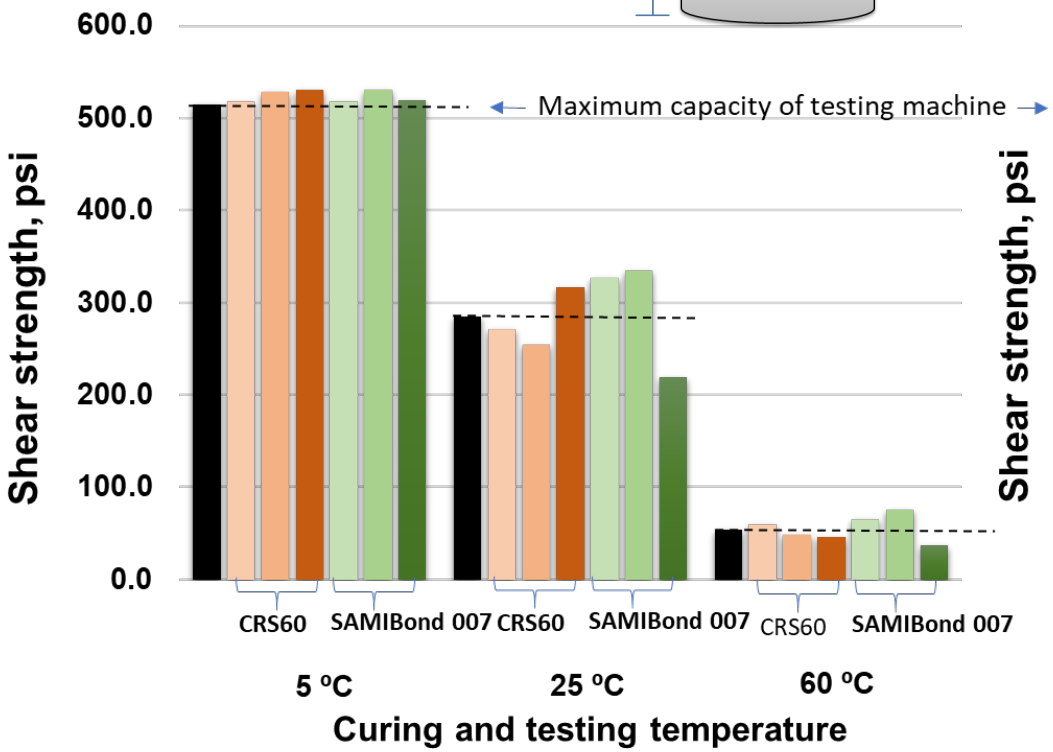
Bond Shear Strength Testing (overall results)

Rough base course

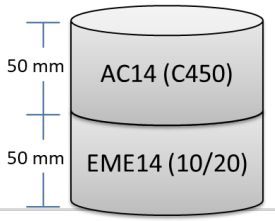
AC20 base (C600)

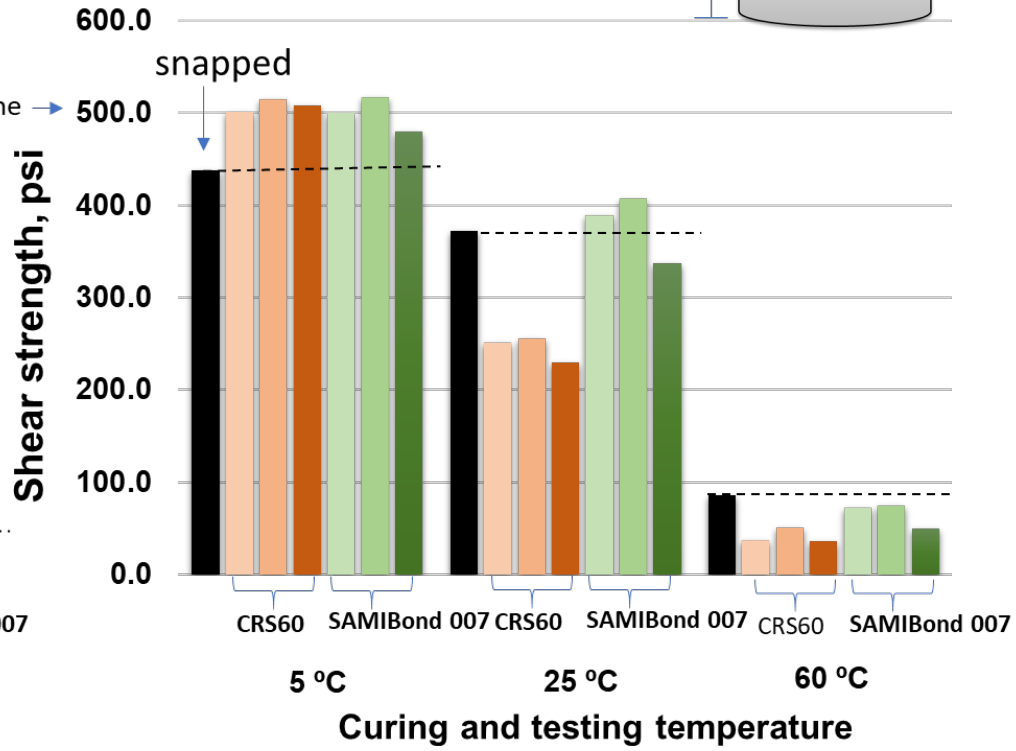




Smoother base course

EME14 base (EME 10/20)





Residual application rate

- No tack/bond coat
- 0.25 L/m² CRS60
- 0.5 L/m² CRS60
- 1.0 L/m² CRS60
- 0.25 L/m² SAMIBond 007
- 0.5 L/m² SAMIBond 007
- 1.0 L/m² SAMIBond 007

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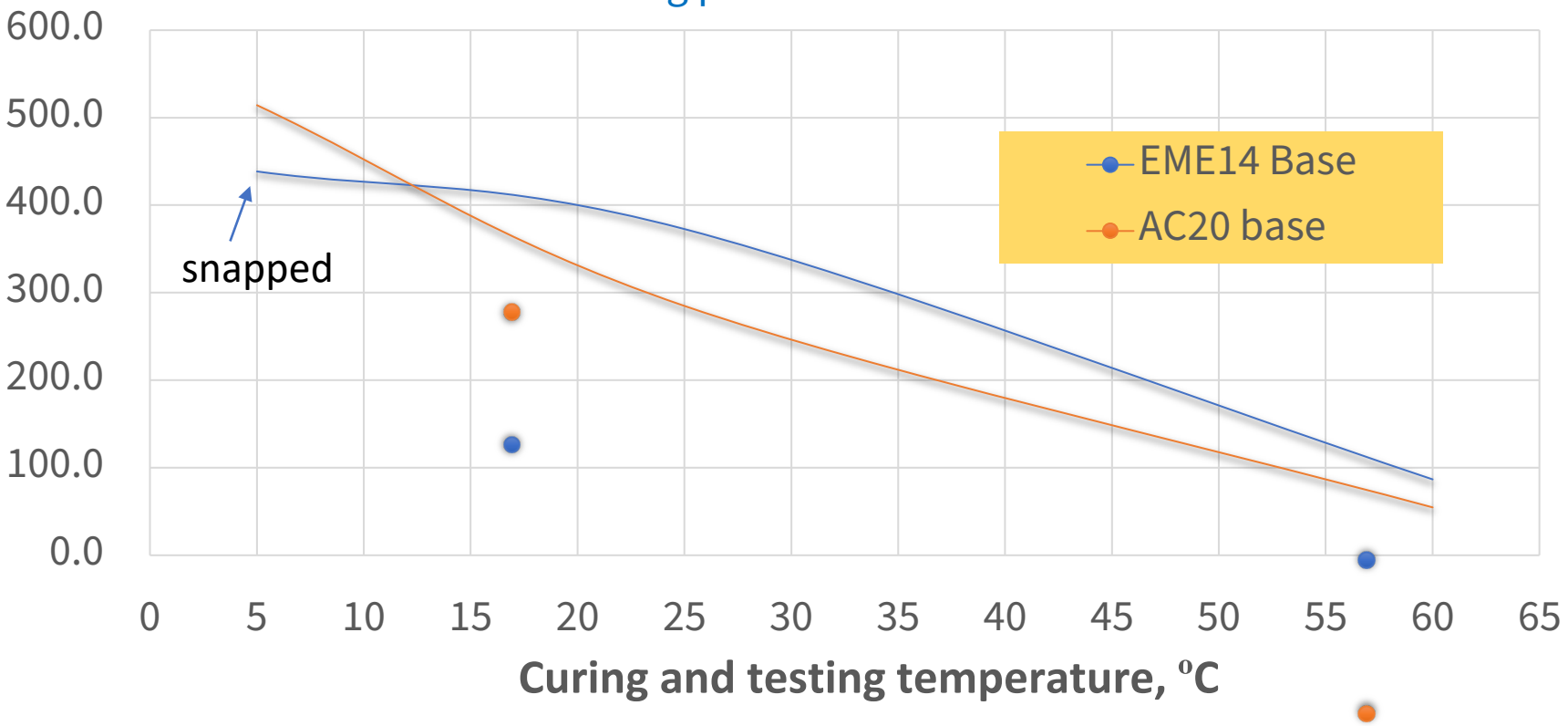
***EME** - Enrobe Module Élevé (high modulus asphalt)

Bond Shear Strength Testing (cont'd)

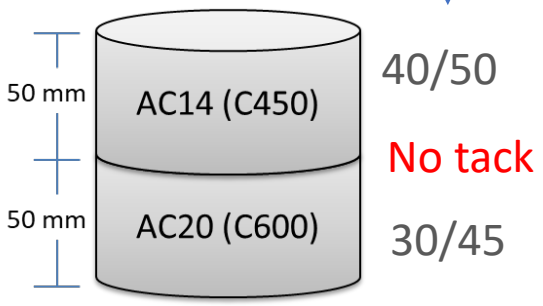
No Tack/Bond coat on different base course (different binders)

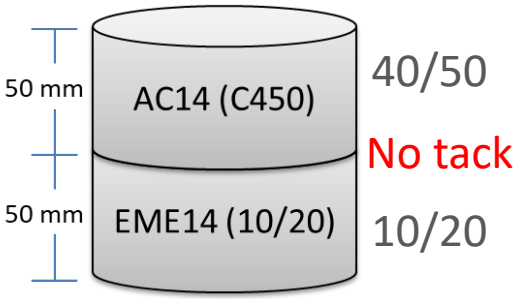
Shear Strength, psi

Binder film on the top of AC20 and EME14 play a major role in bonding performance when there is "no tack"



Bitumen grade used in the mix





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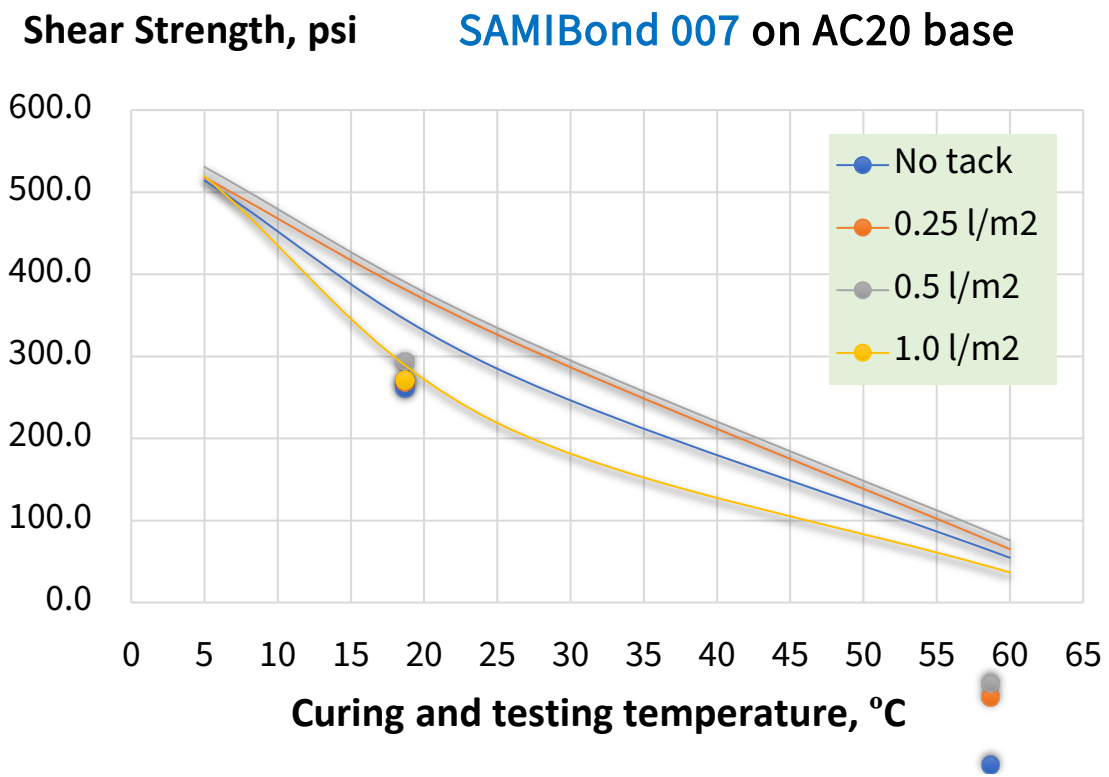
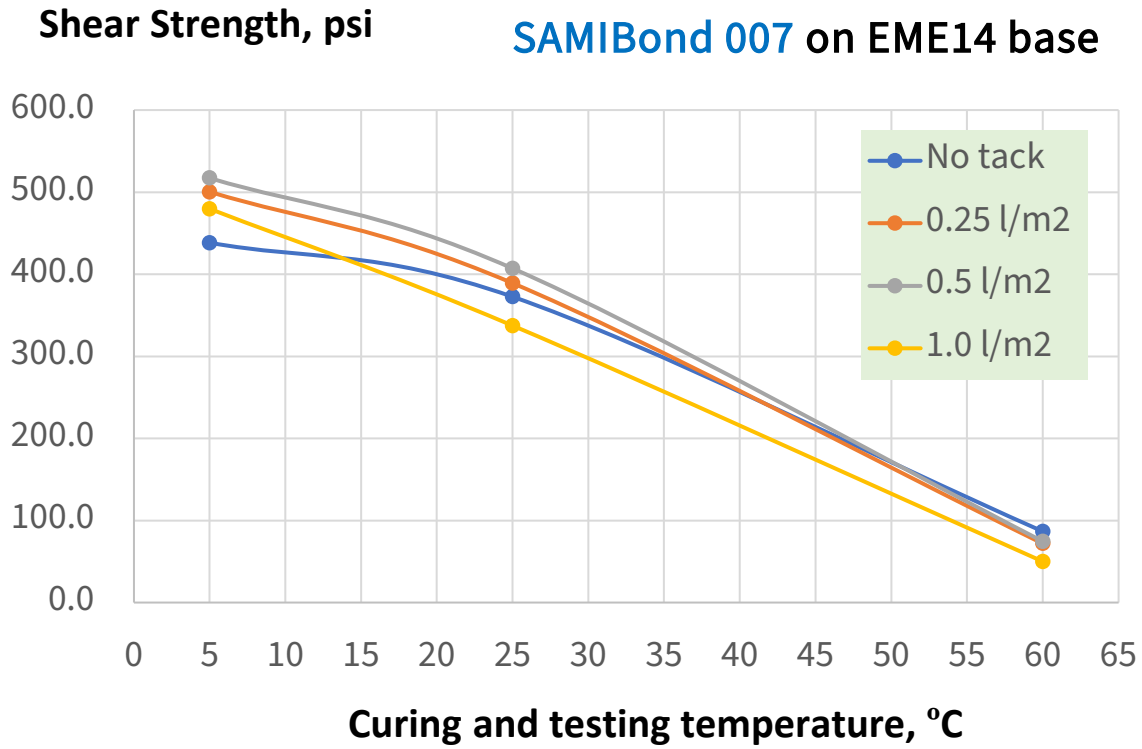
Bond Shear Strength Testing (cont'd)

SAMIbond 007 on different base course mixes at different application rate





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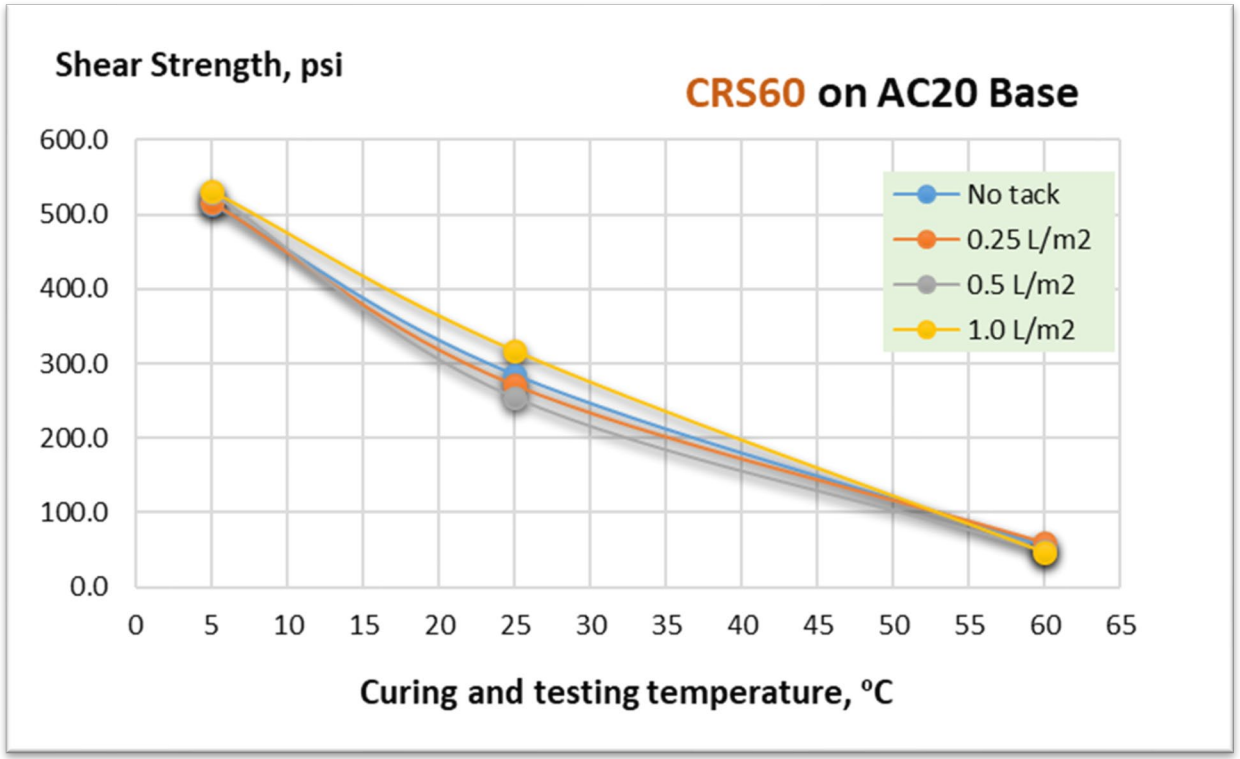
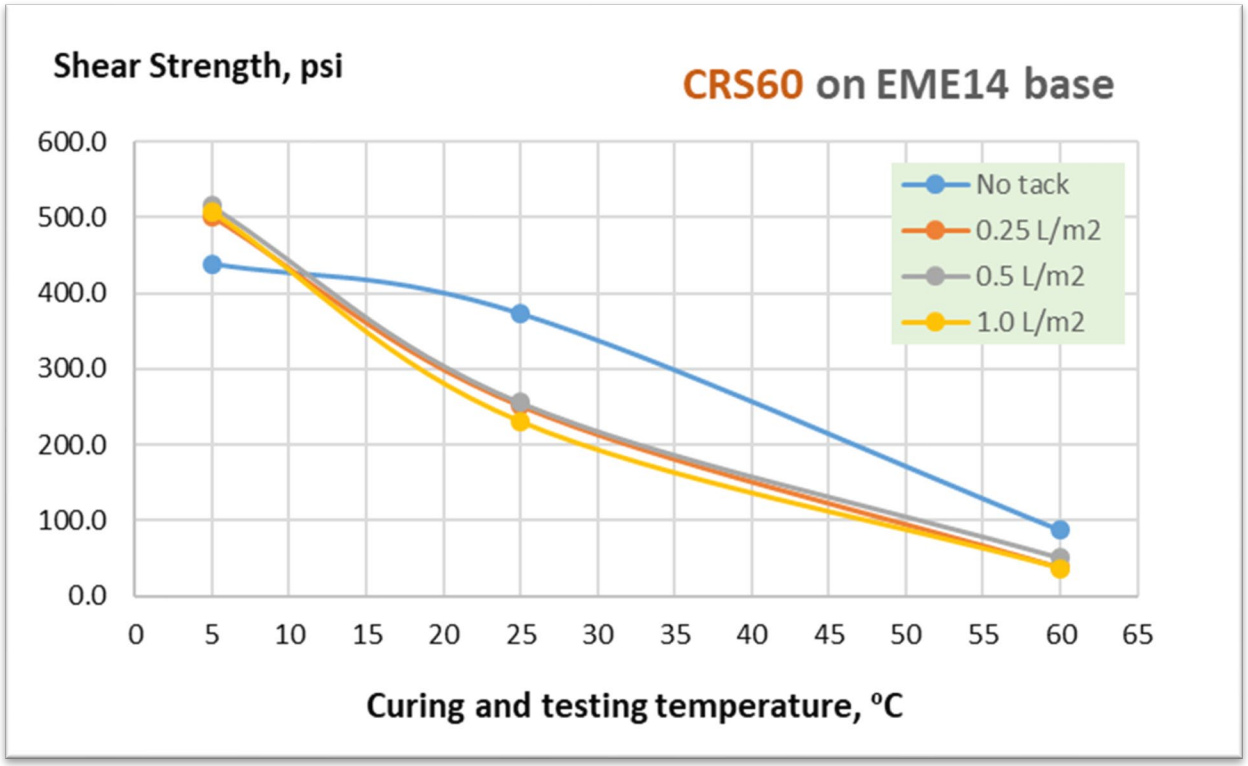
Bond Shear Strength Testing (cont'd)

CRS60 on different base course mixes at different application rate





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SAMIBOND 007 Trackless Tack Coat Trial Mamre Rd., Mt. Vernon, NSW August 2020

SAMIbond 007 and CRS60 were used in this job

- Night work
- Milled surface
- Ambient Temperature 2-5°C
- Spraying temperature 60°C
- Area 300 m^2 for SAMIbond 007
- Target residual spray rate: 0.20 L/m^2
- Achieved residual spray rate: 0.21 L/m^2
- Cores extracted from the pavement for shear bond strength testing

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SAMIBOND 007 Trackless Tack Coat
Trial Mamre Rd., Mt. Vernon, NSW August 2020 (cont'd)

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SAMIBOND 007 Trackless Tack Coat Trial Mamre Rd., Mt. Vernon, NSW August 2020

(cont'd)

Shoes test- 40 minutes after spraying

Sprayer tyres after trafficking the tack coated area –

45 minutes after spraying

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SAMIBOND 007 Trackless Tack Coat
Trial Mamre Rd., Mt. Vernon, NSW August 2020 (cont'd)

Bond shear strength SAMIbond 007 vs CRS60

NCAT report 05-08 (1) states that a minimum bond shear strength of **100 Psi** averaged from at least three tests is recommended.

Bond Strength @ 25 ºC	SAMIbond 007					CRS60		
	TL1	TL2	TL3	TL4	TL5	NT1	NT2	NT3
Load, kN	15.7	13.0	14.4	13.1	13.0	12.5	11.5	13.6
surface area of core sample, m^2	0.0177	0.0177	0.0177	0.0177	0.0177	0.0177	0.0177	0.0177
Bond shear strength, kN/m^2	887	734	814	740	734	706	650	768
Bond shear strength, Psi	**129**	**106**	**118**	**107**	**106**	**102**	**94**	**111**
The 2 layers are still intact?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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The cores were taken 7 days after construction.

SAMIbond 007 at Solomon Airport, WA (Pilbara) July/August 2020

- Night work
- Milled surface
- Ambient Temperature 10°C
- Spraying temperature 60°C
- Total volume 50,000 L
- Application rate residual 0.15 L/m²

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Sydney Airport Main Runway 16R-34L, November 2020

Night work

Milled surface

Ambient Temperature 14°C

Spraying temperature 60°C

Total area 4,275 m^2

Application rate residual 0.15 L/ m^2

35 minutes after spraying

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Conclusions

- Interlayer bonding is essential to pavement's long-term performance;
- The track-free behavior of SAMIbond 007 emulsion makes the residual binder available for a better bonding in the wheel paths;
- NCAT bond shear test shows that SAMIbond 007 provides improved results over CRS60 at intermidiate temperatures on field samples;
- Selection of an appropriate tack/bond coat material, applied at the recommended application rates, provides a better bonding between pavement layers;
- Surface roughness, mixture types and binder used in the mix as well as tack/bond coat emulsion type affect bonding performance.

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Thank you for your attention

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