Crumb Rubber Sprayed Seal Binder
What can we do with all of these... ???

Crumb rubber sourced from recycled scrap tyres
“Scrap Tyre” facts

20 million car/truck tyres scraped annually throughout Australia

QLD scraps about 3.5 million tyres per year and many end up as landfill

Tyres used as landfill are shredded into pieces approx 100-150 mm in size
2 registered tyre disposal companies in Brisbane (only 2 in QLD)

Process about 4 million tyres /year

Currently recycling capacity in Qld to produce rubber crumb for use in spray sealing is 5000 tyres per day
Recycled tyres are granulated into various sizes

20 mm
Horse arenas, rifle range “back-stop”

4 mm
Sports field underlay, playground surfacing

0.7 mm - 4 mm
In-fill for synthetic sport surfaces

Finer sieve sizes
Filler for tile adhesive glue, blending with bitumen
tyres collected, sorted and classified for recycling
shredded, ready for granulating
shreddings fed into hopper
process area
steel separated out and removed - (gets recycled)
nylon is separated
nylon stockpile - (gets recycled)
granulators (0.7mm – 20mm crumb)
granulators - finer grade crumb
finished product bagged
crumb used to modify bitumen
truck tyre sidewalls – hold down silage covers
Disposal of scrap tyres is a **major problem** for local governments and state government agencies

A significant Environmental Advantage using recycled tyres to modify bitumen

Consistent with Federal Government's policies of Resource Management through Recycling

Greater use of recycled waste, creates sustainable markets for recycled product (economy of scale)
Using crumb rubber spray seal binder ..... will help reduce stockpiles like these.
Spray Sealing

1975 ........

VicRoads / ARRB jointly began experiments using scrap rubber in bitumen

Developed methods of incorporating the rubber into bitumen, and spraying it using conventional spraying equipment

First recorded trial of crumb rubber seal - Princes Highway, Hallam, VIC in December 1975
Only about 2% of all PMB sprayed will be crumb rubber
Crumb rubber binders generally consist of between 5% and 20% (by mass) of scrap rubber.

- **5% crumb** - provides better adhesion than C170
  - reduces spray drift

- **10% crumb** - similar properties to S0.3B
S1.8R QMRD specification
(AustRoads S45R)

a very good “all-rounder”
- aggregate retention
- water proofing various surface conditions and textures

1000 tyres are recycled to produce a tanker load of S1.8R crumb rubber PMB

5km of reseal, 9m wide @ 2.0 l/sqm = 3500 tyres
Manufacture

Use uniform and constant supply stream of crumb (eliminates any variation in binder quality)

De-vulcanise crumb (improves the elasticity of the binder = better resistance to fatigue and temperature susceptibility)
Produced through a “high shear” mill

Blends are “stabilised”
(minimises settlement to improve long distance transportation, storage and spraying)

All blends are manufactured at a central plant and fully tested prior to dispatch
Where should Crumb Rubber Spray Seal PMB be used?
AUSTROADS TECHNICAL REPORT

Guide to the Selection and Use of Polymer Modified Binders and Multigrade Bitumens
AustRoads Technical Report AP-T42/06

recommends Crumb Rubber Modified Spray Seal Binders for:

- **High Stress Seal (HSS)**
- **Strain Alleviating Membrane (SAM)**
- **Strain Alleviating Membrane Interlayer (SAMI)**
# Comparisons
(new “draft” specification MRS11.18)

<table>
<thead>
<tr>
<th></th>
<th>S1.8R</th>
<th>S0.25S</th>
<th>S0.3B</th>
<th>10% CR (typical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elastic Recovery @ 60° (min)</td>
<td>25%</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<tr>
<td>Elastic Recovery @ 45° (typical results)</td>
<td>43%</td>
<td>31%</td>
<td>18%</td>
<td>13%</td>
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<tr>
<td>Torsional Recovery @ 25°</td>
<td>25-55%</td>
<td>22-50%</td>
<td>16-32%</td>
<td>28%</td>
</tr>
<tr>
<td>Softening Point</td>
<td>55-65°</td>
<td>48-64°</td>
<td>48-56°</td>
<td>55°</td>
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</tbody>
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Note: * Binders are too soft and have insufficient resistance to record a value
Bitumen modified with Crumb Rubber will:

- Improve aggregate retention
- Minimise or delay reflective cracking
- Minimise risk of bleeding
- Reduce water penetration
- Improve shear resistance in high traffic situations
- Reduce temperature dependence of properties
- Allow early brooming of seals
- Extend the life of seals
S1.8R crumb rubber binder applied at 190°C
Spraybar Nozzle (Jet) sizes

Generally Copley B6, or B8 used

B6  24 – 27 litres per min
B8  27 – 35 litres per min

(Standard Size - A18N  18 litres per min)
cracking, patches and flushing
repair a stripped surface
about 3 months later
reseal over cracking and shoulder widening
Use and Handling of Crumb Rubber PMB

Seal Design
Design the seal using appropriate PMB Factor (PF) from Table 4.1 AP-T68/06.

Heating / Storage
Never heat crumb rubber modified binders above 200°C.
SAMI's crumb rubber binders may be stored at a temperature of 185°C to 195°C for up to 3 days. Binder can be stored up to 10 days provided the temperature is lowered to 120°C to 140°C.
During storage, ensure regular circulation/stirring.
When re-heating crumb rubber binders, heat at a maximum of 10°C per hour with slow circulation.

Preparation
Use of Pre-coated aggregate is highly recommended. Wet aggregate should not be used.
The use of bitumen adhesion agent is recommended.
Spraying

Ensure pavement temperature is at least 20°C and rising, prior to commencement of spraying.

Transfer temperature from tankers should be 190-195°C, using normal tanker-sprayer transfer procedure. A larger in-line strainer mesh (suited to product requiring B6 or 8 nozzles) is recommended.

Due to the higher viscosity of crumb rubber modified binders, cutter should be added to prevent streaking and to ensure a good even distribution of binder through the spray nozzles. Generally 2-3% cutter is required to achieve this. Where the pavement temperature is below 25°C at the time of spraying, or where the site experiences frosty winter conditions, up to 6% cutter is recommended.

It is recommended that the sprayer be fitted with Copely B6 or B8 nozzles due to the higher viscosity of crumb rubber modified binders. Copely A18N nozzles may be used, however some streaking may occur depending on application rates, spray temperature of the binder, and the amount of cutter added.

Minimum spraying temperature for crumb rubber modified binder is 190°C. Recommended temperature of the binder when spraying is 195°C.
Tankering of crumb rubber modified bitumen should be carried out by operators experienced in the cartage/pumping/transfer of this product. For tanker operators inexperienced in the cartage of crumb rubber binders, the following is a guideline to the cartage and handling of the binder from the point of manufacture to delivery to site/depot.

To ensure that the homogeneity of the modified bitumen is maintained, it is important that the binder temperature is maintained between 185-195°C throughout the journey, with regular recirculation.

Before the tanker commences the journey from the plant to site/depot, the modified bitumen should be at a minimum temperature of 195°C. (Apply heat to the product if the temperature is below 195°C prior to departure).

After departure, re-circulate the product every 2-3 hours for about 15-20 minutes (this should co-inside with the drivers regulatory breaks), and apply heat if necessary to maintain a temperature of 190-195°C.

Continue this method throughout the journey.
Tankering cont…….

On arrival at the site/depot, the product should be re-circulated for at least 15 minutes and heated to the customers requested delivery temperature just prior to discharging (not above 200°C).

In the period between discharging product into sprayers, re-circulate for at least 15 minutes immediately prior to each discharge.

The nature of crumb rubber bitumen is such that generally there will be a quantity of product left in the tanker which is unable to be pumped out. This is normal behavior for crumb rubber modified bitumen. The quantity of this residue is significantly reduced by ensuring that the re-circulation/heating regime (above) is carried out.

The re-circulation process forms is an important part of maintaining the product homogeneity and will help to ensure that the least possible product residue remains in the tanker after discharging. An amount of 200-400kgs of crumb rubber binder is considered “normal” for the first load. For repeat deliveries of another 2-3 loads of crumb rubber, there should be little increase (if any) in the amount of residue left in the tank from the first load, provided sufficient recirculation has been carried out.

It is recommended that after 3 continuous loads of crumb rubber modified bitumen in a tanker, the tank should carry a load or two of bitumen or cutback bitumen to flush out the residue in the tank.
- In Summary -

Crumb Rubber Sealing Binder

• High quality binder
• Excellent field performance
• Good value
• No requirement to import polymers
• Reduction of scrap tyre stockpiles
• Contributing to environmental responsibility
• Used extensively throughout NSW & VIC
an effective and sound surfacing treatment
Partnering with paving businesses
Adding value through focus, expertise and innovation