Engineering Road Note 15
Sprayed Seal Design
January 2017
Document Control

<table>
<thead>
<tr>
<th>Owner</th>
<th>Manager Materials Engineering</th>
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<tr>
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Amendments

<table>
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<tr>
<th>Revision Number</th>
<th>Revision Date</th>
<th>Description of Key Changes</th>
<th>Section / Page No.</th>
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<tr>
<td>0</td>
<td>January 2017</td>
<td>New document</td>
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INTRODUCTION

The design of sprayed seal treatments is to be undertaken in accordance with Austroads documents AP-T68 Update of the Austroads Sprayed Seal Design Method and AP-T236 Update of Double/Double Design for Austroads Sprayed Seal Design Method with exceptions as directed in this Engineering Road Note. In addition, this Engineering Road Note provides guidance on the design of sprayed seal treatments.

Section numbering in this document follows the numbering within AP-T68, therefore the numbering is not sequential where there is no further guidance or direction on a specific section.

CHANGES TO AUSTROADS AP-T68 CLAUSES

1.5 CALCULATION OF DESIGN TRAFFIC

Where multiple traffic counts are available, or if a traffic survey is being sought, the traffic count location selected should be representative of the traffic on the design section.

Example: There are large changes in the heavy vehicle mix on Coolgardie Esperance Hwy (H010) between Norseman and Esperance. At 289 SLK, the percentage of Class 9 – 12 vehicles is 9% of the AADT of 540 v/d. At 334 SLK (further south), the percentage falls to 7% of the AADT of 700 v/d, and then again at 358 SLK where it reaches 3% of the AADT of 1350 v/d. Therefore, the traffic count data which is representative of the traffic on the design section shall be used to avoid under or over estimating the traffic.

Traffic on multi-lane roads should be calculated at per Section 1.5.3.

Where heavy vehicle counts are available, the lane allocation of heavy vehicles should be made to the effect that all heavy vehicles are assumed to travel in the left lane.

2 SINGLE/SINGLE SEALS – SIZE 10 MM AND LARGER AGGREGATES

2.1.3 BASIC VOIDS FACTOR

The basic voids factor shall be capped at a maximum of 0.20 L/m²/mm for traffic volumes less than 150 v/l/d including sealed shoulders.

2.1.4 ADJUSTMENT TO BASIC VOIDS FACTOR

If the equivalent heavy vehicle percentage is greater than 65%, the seal design shall be based on traffic calculated as per Section 1.5.6.

In environments where there are a significant number of restricted access vehicles (RAV) operating on the network, selection of binder type and stone size is critical. Refer to Section 11 of this document for further advice.

2.1.7 ALLOWANCES APPLIED TO BASIC Binder APPLICATION RATE

2.1.7 (a) SURFACE TEXTURE ALLOWANCE

There are circumstances where it is necessary to apply a different binder application rates across a lane. Situations where different binder application rates may be beneficial include the following:

- Locations with significantly different surface texture across the lane, and
- Demanding locations where high %EHV are present (i.e. situations where Table 2.2 requires and adjustment for traffic effect (Vt) between -0.04 and -0.05).
It is recommended the texture depth be measured in both wheel paths, between/outside wheel paths and the centreline. This will assist in deciding if separate design rates of binder need to be considered across the lane. If the difference in texture allowance is 0.3 L/m² or greater, one of the following alternatives may assist in achieving optimal performance across the full width of the seal.

- Pre-spray the coarse textured areas using the techniques described in Austroads Pavement Work Tip No 36 Pre-spraying to correct surface texture.
- Use a bitumen sprayer with a variable rate spray bar.

### 2.1.7 (b) BALL EMBEDMENT ALLOWANCE

In situations where the ball penetration of a base course exceeds 3 mm as per AP-T68 (in environments where there are a significant number of restricted access vehicles, consider a lower ball embedment value), one or more of the following treatments may be required to reduce the ball penetration of the prepared pavement surface to acceptable levels immediately prior to sealing:

- **a)** If due to surface moisture, defer sealing to allow the surface to harden as it dries back. The surface should be retested once it has dried sufficiently.
- **b)** Re-prepare the pavement, for any of the issues
  - Insufficient density has been achieved in the base course
  - Laminations within the base course
  - Loose or bony surface preparation
  - Excessive slurry on the surface of the base course
- **c)** Strengthen the base course if a relatively low quality base course material has been used. This may include
  - Improving the quality of the base course material
  - Stabilising the base course material
  - Armour-coating the surface of the base course with a thin layer of good quality material
- **d)** On a primed base course, allow a sufficient curing time between priming and sealing to ensure the surface of the primed base course returns to a ball penetration value of less than 3 mm.

A further option where it is not practical to achieve a low ball embedment value is to apply a double/double high stress seal using large aggregate sizes with a polymer modified binder. A proportion of the larger ALD will be lost through embedment but the larger stone size should afford enough residual surface texture after embedment occurs. Refer to Section 11 of this document for advice on the selection of seal combinations.

### 3 SINGLE/SINGLE SEALS – SIZE 7 MM AND SMALLER AGGREGATES

Single/single sprayed seals with aggregate sized 7 mm and smaller are to be designed in accordance with Section 3 of AP-T68.

#### 3.1 GENERAL (SCATTER COAT)

A scatter coat is the application of a 5 or 7 mm aggregate on to a single coat seal to provide mechanical interlock between the larger particles, preventing rolling or dislodgement of the larger particles whilst the seal binder is relatively soft. An example of its use could be at farm gates to provide extra strength to the seal.

A scatter coat is applied after initial rolling of the application of the larger aggregate. As there is very little binder contact with the second aggregate, it is expected that a significant proportion of
the smaller aggregate will be lost during the early service life of the seal as part of the process of further re-orientation of the larger aggregate under the action of traffic.

The spread rate of a scatter coat is determined in accordance with AP-T68 Section 3.3.

### 4 SINGLE/SINGLE SEAL WITH POLYMER MODIFIED BINDER

#### 4.1 GENERAL (SCATTER COAT FOR HIGH STRESS SEALS)

A high stress seal (HSS) is the application of a modified binder covered with typically 14 mm aggregate (or larger) and application of a scatter coat. The scatter coat is the application of a 7 mm aggregate on to a HSS to provide mechanical interlock between the larger particles, preventing rolling or dislodgement of the larger particles whilst the seal binder is relatively young.

A scatter coat is applied after initial rolling of the application of the larger aggregate. As there is very little binder contact with the second aggregate, it is expected that a significant proportion of the smaller aggregate will be lost during the early service life of the seal as part of the process of further re-orientation of the larger aggregate under the action of traffic.

The spread rate of a scatter coat is determined in accordance with AP-T68 Section 4.3.

#### 4.2 SINGLE/SINGLE WITH PMB DESIGN FOR 10 MM AND LARGER AGGREGATE

Single/single sprayed seals with polymer modified binder are to be designed in accordance with AP-T68 using the application, binder types and PMB factor shown in the table below. Recommended size of aggregate is shown in the table.

<table>
<thead>
<tr>
<th>Application</th>
<th>Class of PMB</th>
<th>PMB Factor</th>
<th>Aggregate Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Retention</td>
<td>S45R</td>
<td>1.0 to 1.1</td>
<td>10 mm or larger</td>
</tr>
<tr>
<td></td>
<td>S35E</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>High Stress Seals with scatter coat</td>
<td>S35E</td>
<td>1.0</td>
<td>14 mm</td>
</tr>
<tr>
<td></td>
<td>S45R</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Strain Alleviating Membrane (SAM)</td>
<td>S10E</td>
<td>1.1</td>
<td>14 mm</td>
</tr>
<tr>
<td></td>
<td>S45R</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>Strain Alleviating Membrane Interlayer (SAMI)</td>
<td>S20E</td>
<td>1.5</td>
<td>10 mm</td>
</tr>
<tr>
<td></td>
<td>S45R</td>
<td>1.5</td>
<td></td>
</tr>
</tbody>
</table>

Replace Table 4.2 Aggregate spread rates with the following.

<table>
<thead>
<tr>
<th>Application</th>
<th>Aggregate Spread Rate (m² / m³)</th>
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</thead>
<tbody>
<tr>
<td>Aggregate Retention</td>
<td>800 / ALD</td>
</tr>
<tr>
<td>High Stress Seals</td>
<td>900 / ALD</td>
</tr>
<tr>
<td>Strain Alleviating Membrane (SAM)</td>
<td>900 / ALD</td>
</tr>
<tr>
<td>Strain Alleviating Membrane Interlayer (SAMI)</td>
<td>900 / ALD</td>
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</table>
5 SINGLE/SINGLE SEALS WITH BITUMEN EMULSION BINDER

Single/single sprayed seals with bitumen emulsion binder are to be designed in accordance with Section 5 of AP-T68.

6 DOUBLE/DOUBLE SEALS

Double/double sprayed seals are to be designed in accordance with AP-T236.

7 DOUBLE/DOUBLE WITH PMB

Double/double sprayed seals with polymer modified binder are to be designed in accordance with AP-T236 using the application, binder types and PMB factor shown in the table below. Recommended size of aggregate is shown in the table. Refer to Section 11 of this document for advice on the use of 16 mm and 20 mm aggregate sizes.

<table>
<thead>
<tr>
<th>Application</th>
<th>Class of PMB</th>
<th>PMB Factor</th>
<th>Aggregate Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Stress Seals</td>
<td>S35E</td>
<td>1.0</td>
<td>14/7 mm, 16/7 mm, 16/10 mm, 20/10 mm</td>
</tr>
<tr>
<td></td>
<td>S45R</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Strain Alleviating Membrane (SAM)</td>
<td>S45R</td>
<td>1.3</td>
<td>14/7 mm, 14/10 mm</td>
</tr>
<tr>
<td>Strain Alleviating Membrane Interlayer (SAMI)</td>
<td>S45R</td>
<td>1.5</td>
<td>14/7 mm</td>
</tr>
</tbody>
</table>

- For 16 mm stone calculate aggregate spread rate using 1275 / ALD
- For 20 mm stone calculate aggregate spread rate using 1550 / ALD aiming to achieve a nominal aggregate spread rate of 110 m²/m³

8 DOUBLE/DOUBLE SEALS WITH BITUMEN EMULSION BINDER

Double/double sprayed seals with bitumen emulsion binder are to be designed in accordance with Section 4 of AP-T236.

9 GEOTEXTILE REINFORCED SEALS (GRS)

Refer to Main Roads Guideline document 71/06/137 Use and Design of Geotextile Reinforced Seals for advice on the design of a GRS.

10 FIBRE REINFORCED SEALS

Fibre reinforced seals are outside the scope of this document.
11 SELECTION OF TREATMENT TYPES

AP-T68 Section 11 – Selection of treatment types and AP-T236 Appendix A – Preliminary Seal Selection Guide shall be used as a general guide only. Further advice is available in Austroads Guide to Pavement Technology Part 4K – Seals. Further guidance is available in Main Roads Western Australia documents:

- 6706-04-153 Guidelines for the Timing of Bituminous Surfacing Treatments
- 6706-04-154 Guidelines for Surfacing Type Selection
- 71-05-1396 Guidelines for the Application of Waterproof Membranes to Bridge Decks

There are environments where a Class 170 bitumen will not provide an optimal outcome. Examples of these environments can include:

- Roads with very high maximum road temperatures carrying heavy vehicles
- Roads with a high volume/proportion of heavy vehicles or restricted access vehicles
- Roads with very low surface texture in the wheel paths

In such environments a modified binder is recommended and possibly the use of a larger sized aggregate. Where 16 mm and 20 mm aggregate sizes are used the seal must be a double/double seal using a modified binder. Recommended binder types include S45R or S35E. An example of use of such treatments is shown below.

Example: Great Northern Hwy between approximately 80 SLK – 110 SLK had very low surface texture across the lane width. A double/double 16/10 mm seal using S45R rubber binder was applied. The rubber binder is less sensitive to change in temperature than bitumen and provides enhanced adhesion between binder and aggregate. Use of a 16 mm aggregate requires careful control of the aggregate spreading in the field. The 16 mm aggregate should not be crowded and instead leave large gaps between the stones.

In environments where there is a large ball embedment in a new base course, the use of a double/double seal using large aggregate sizes with a polymer modified binder is an option.

The double/double high stress seal combinations could include 16/7 mm, 16/10 mm or 20/10 mm. These most likely need to be planned ahead of the works because 16mm stone is not readily available across the state and a special order may have to be done by a quarry. Alternatively 20 mm is more likely to be available however this should be confirmed beforehand.

When using large aggregate sizes to counter a loss of texture due to embedment a single/single seal shall not be used as the consequences of stone loss with large sized stones poses too much of a risk to road users, therefore a double/double seal must be used. Larger sized seals require more binder which also contributes to loss in surface texture. Where the BAR is low, the use of S45R rubber binder will provide improved adhesion to S35E. The use of a large stone size with polymer modified binder as a single/single seal shall not be undertaken without seeking advice from Materials Engineering Branch.

12 PRIMING AND PRIMERSEALING

Priming and primersealing are outside the scope of this document.