

Roads

Master Specification

RD-BP-D2 Design of Sprayed Bituminous Surfacing

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RD-BP-D2 Design and Application of Sprayed Bituminous Surfacing

1 General

- 1.1 This Part specifies the requirements for the design and application of sprayed bituminous surfacing or resurfacing (sprayed seal coat treatment).
- 1.2 Documents referenced in this Part are listed below:
 - a) AS 1141 Methods for Sampling and Testing Aggregates.
 - b) AS 1289 Methods of Testing Soils for Engineering Purposes.
 - c) AS 2008 Residual Bitumen for Pavements.
 - d) AS 3706 Geotextiles – Methods of Test.
 - e) Australian Asphalt Pavement Association: Code of Practice: Manufacture, Storage and Handling of Polymer Modified Binders
- 1.3 The Principal is responsible for the selection of treatment type, including aggregate size, binder type and geotextile grade.
- 1.4 The Contractor is responsible for:
 - a) the design of the seal, including binder application rates, aggregate application rates, use of additives, rolling times and minimum and maximum pavement temperatures;
 - b) any adjustment necessary to the design necessary to account for site conditions at the time of application; and
 - c) application of the seal treatment so that it complies with the requirements of Clause 3.1 “Performance Requirements” and Clause 18 “Acceptance Criteria” until at least the expiry of the Defects Liability Period.
- 1.5 Where the Contractor considers that an alternate treatment from that stipulated in the work summary may be appropriate for the site and will meet the requirements of Clause 3.1 and Clause 18 an alternate treatment design may be submitted 14 days prior to the work commencing, stating the reasoning for the selection of the proposed treatment.
- 1.6 Traffic counts supplied by the Principal do not take into account seasonal or temporary increases in traffic. Where necessary the Contractor must allow for such variations in the seal design.

2 Quality Requirements

- 2.1 The Contractor must prepare and implement a Quality Plan that includes detailed procedures and documentation for:

Primer, Primer Binder, Binder and Overspray

- a) Design of appropriate rates of application to achieve the desired surface characteristics.
- b) Achievement of cutter proportions.
- c) Ensuring compatibility of emulsion primers with the pavement material including any additives or modifiers and the achievement of stated curing times.
- d) Achievement of a homogeneous mixture (including the elimination of tank contamination).
- e) Control of temperature.
- f) Ensuring even and accurate application.
- g) Details of spray bars proposed and methods to avoid blockage of nozzles and valves (refer Clause 8 “Operation of Sprayer”).

- h) Ensuring adequate cure of the primer / overspray.
- i) Field sampling of binder. In addition to the above, for Emulsions, Polymer Modified Binders and Crumb Rubber
- j) Management of curing process for emulsion, including traffic management for emulsions (refer Clause 5.1 "Constraints to Work").
- k) The manufacturer's recommendations regarding:
 - i) handling instructions including temperature range;
 - ii) maximum storage time for particular temperatures;
 - iii) maximum heating temperature, and
 - iv) any other relevant information.
- l) Transportation of Polymer Modified Binder in accordance with Australian Asphalt Pavement Association "Code of Practice: Manufacture, Storage and Handling of Polymer Modified Binders, First Edition", June 2004, Clause 4.2.1 and Clause 4.2.6.
- m) For crumb rubber binder and high bitumen content emulsions the achievement of a homogeneous product that can be sprayed as a uniform application of binder across the pavement, free of streaking. Details that must be included as a minimum are recommended spray nozzle sizes, maximum width of spray runs, and management of storage times and temperatures.
- n) Materials Technical Data sheets for each product.

Aggregate

- o) Controlling loading to avoid contamination and wastage.
 - p) Removal of dust and dirt.
 - q) Application of precoat.
 - r) Application of aggregate including the monitoring of aggregate spread rates.
 - s) Rolling of aggregate including minimum rolling times.
 - t) Sweeping and removal of loose aggregate
- 2.2 If not provided previously the procedures must be submitted at least 28 days prior to the commencement of site work.
- 2.3 Provision of the procedures listed in this Clause shall constitute a **Hold Point**.

3 Seal Design

Performance Requirements

- 3.1 The Contractor is responsible for the design and application of spray seal treatments outlined in the Work Summary (including primes, primer seals, initial seals, reseals and any surface texture regulation treatments) so that the finished seal achieves the following requirements:
- a) the parameters specified in Clause 18 "Acceptance Criteria";
 - b) minimal loose aggregate after application to reduce the potential for accidents and broken windscreens;
 - c) retention of aggregate after application to provide a skid resistant surfacing and prevent water from entering and weakening the pavement;
 - d) surface texture to optimise contact between the road surface and tyres, and provide a skid resistant surface; and
 - e) uniform colour and texture appearance.

- 3.2 These functional requirements also apply to the first application of a double application seal until the final treatment is applied.

Surface Texture Regulation

- 3.3 The Contractor must design and implement any activities to regulate the surface texture prior to resealing specified in the Work Summary in order to meet the surface texture and aggregate loss limits on the finished seal. Separate payment will not be made for such texture regulation works.

Application Rate for Binder and Aggregate

- 3.4 Binder and aggregate application rates must be calculated by the Contractor in accordance with a proven design method based on sound scientific principles. Existing site and pavement conditions including road geometry, pavement hardness and surface texture must be incorporated into the final designs.
- 3.5 The Contractor may need to take into account short term traffic affects generated by local events.
- 3.6 At least 14 days prior to the commencement of works on site, seal designs must be submitted to the Superintendent. The information provided for each of the treatments must include:
- a) design input data (including ALD, flakiness, pavement hardness, AADTs and percentage of Commercial Vehicles);
 - b) proposed additives to be used;
 - c) aggregate source, type and design rates of application;
 - d) proposed details of any surface regulation activities;
 - e) binder source and design rates of application;
 - f) details of other necessary materials or products for each job; and
 - g) details of proposed NATA endorsed laboratory.
- 3.7 Provision of the above information shall constitute a **Hold Point**.
- 3.8 By 2 p.m. on the day prior to sealing, the Contractor must confirm whether there will be any variation to the design application rates.

4 Materials

Quality of Materials

- 4.1 Binder (including Prime, Primer Binder, C170, C320, PMB, Crumb Rubber, Multigrade and Emulsion), Flux and Cutter must comply with RD-BP-S1 "Supply of Bituminous Materials".
- 4.2 Where aggregate is supplied by the Contractor:
- a) Aggregate must comply with RD-PV-S1 "Supply of Pavement Materials".
 - b) Aggregates must be sampled in accordance with RD-PV-S1.
 - c) At least 7 days prior to the commencement of sprayed bituminous surfacing, the Contractor must supply a NATA endorsed test certificate to show conformance with RD-PV-S1.
- 4.3 Prior to the use of sealing aggregates, a **Hold Point** must apply.
- 4.4 Where aggregate is supplied by the Principal:
- a) At least 7 days prior to the commencement of sprayed bituminous surfacing, the Contractor will be supplied with test results for the Average Least Dimension, Flakiness Index and Grading of all sealing aggregates.
 - b) The Contractor warrants that it has:
 - i) examined and carefully checked the material and test results;

- ii) taken into account the potential variability of material in stockpiles and made allowance for this variability in its design of the spray seal treatment; and
 - iii) made all allowances necessary to ensure that adhesion between aggregate and binder is achieved.
- 4.5 Prior to the use of sealing aggregates, a **Hold Point** must apply for the purpose of ensuring that the quantity of stockpiled material is agreed.

Measurement of Materials

- 4.6 Unless otherwise stated all rates and quantities under this Specification relating to Prime, Primer Binder, C170, C320, PMB, Crumb Rubber, Multigrade, Emulsion and cutter must refer to measurement by volume at 15°C.
- 4.7 Where the volume of such materials is measured at a higher temperature, the Volume Conversion Formulae must be used for converting the volume to equivalent volume at 15°C. The Volume Conversion Tables are included as Appendix 1: Volume Conversion Table - Bitumen Emulsion and Appendix 2: Volume Conversion Table - Hot Bitumen Based Binders. For the purpose of sprayed bituminous surfacing, rates and quantities relating to volume of aggregate must refer to loose volume.

5 Constraints to Work

Binder and Traffic

- 5.1 The Contractor must comply with the constraints regarding binder listed in Table RD-BP-D2 5-1. Refer to PC-SM1 "Provision for Traffic" for other constraints relating to traffic control.

Table RD-BP-D2 5-1 Binder Constraints

Treatment	Constraint
	Traffic must not be permitted on the surface within 24 hours of spraying or until the prime has dried sufficiently so as not to be damaged by vehicles.
Prime	A binder must not be applied over a cutback prime within 72 hours or over an emulsion prime within 12 hours of spraying of the prime. These times may need to be increased in cold weather to allow the prime to cure and also in the case of cutback primes to permit the solvent cutters to have substantially evaporated.
Primer seal	A treatment must not be applied over a cutback primer seal within 6 months or over an emulsion primer seal within 2 weeks of spraying of the primer seal. Where an emulsion primer seal is to be overlayed with asphalt this period may be reduced to 1 day.
	Crumb Rubber must not be stored longer than 12 hours unless sufficient evidence is provided that demonstrates the ability of the storage / blending vessel to maintain the properties of the binder. In that case, an additional 12 hours of storage will be allowed provided that the temperature of the binder does not exceed 150°C.
Field Blended Crumb Rubber	Blended crumb rubber may only be transported for six hours from the point of manufacture, and both plant blended and field blended crumb rubber must be sprayed within four hours from the transfer into the sprayer.
	Base binder must consist of C170 bitumen complying with AS 2008.
	Once rubber has been added to the base binder the contents must be circulated for the minimum period indicated in the quality plan to provide a homogenous product of consistent quality.
Emulsion	In addition to the protective measures specified in the Quality Plan, the Contractor may be required to provide pilot vehicles to control traffic speeds to 25 km/h for at least 2 hours or until the binder has cured sufficiently to retain the screenings.

Treatment	Constraint
All two-coat seals	Both courses of a double seal shall be laid on the same day.
	The top seal shall overlap each finished edge of the bottom seal by 50 mm.
Spraying of intersections and junctions	Details of the proposed spray plan for intersections and junctions shall be submitted on a diagram to the Principal prior to works commencing
5.2	Submission of the diagram showing the proposed spray plan for intersections and junctions shall constitute a Hold Point .

6 Protection of Road Fixtures

- 6.1 The Contractor must prevent primer, binder, aggregate or other material used on the work from entering or adhering to gratings, hydrants or valve boxes, inspection pit covers kerbs and other road fixtures. Damage to roadside furniture must be recorded on the daily record sheets to enable costs to be recovered.

7 Cleaning Of Pavement

- 7.1 The pavement must be cleaned free of loose material so that primer will be absorbed into the base, or binder adhere to the existing seal, without prilling or being absorbed onto loose material.
- 7.2 The method of cleaning must ensure that damage to the existing surface is prevented. Steel brooms must not be used on unsealed base.
- 7.3 The Contractor must remove all raised pavement markers and pavement bars prior to sealing and undertake any necessary repair to the existing seal. Additional payment will not be made for this activity.

8 Operation of Sprayer

- 8.1 Binder volumes shall be determined in accordance with the sprayer trucks manufactures guidelines.
- 8.2 The application of primer, primer binder, overspray and binder must be by means of sprayer(s) currently certified as complying with Austroads Sprayer Calibration Procedures series AGPT/T530 to AGPT/T535. Hand spraying will only be permitted when the use of a mechanical sprayer is not practicable. The Contractor must include details of how a uniform application of binder across the joint between runs will be achieved in the Quality Plan.
- 8.3 Works must be performed so that at the start and end of each run a straight line is produced with no gaps or overlap between adjacent runs.
- 8.4 Where binder application rates below 0.7 litres per square metre are specified, A3 nozzles or S2 (Austroads AN9) nozzles must be used.

9 Application of Prime and Primer Seal

- 9.1 Prior to the application of the prime or primer seal, a **Hold Point** must apply. Release of the Hold Point will occur when it has been verified that:
- the surface to be primed or primer sealed is suitable;
 - marked guide lines have been set out correctly; and
 - the Contractor is properly prepared to proceed.
- 9.2 For unstabilised granular pavements, priming and / or primer sealing must not be commenced until the moisture content of the top 20 mm of the base is less than 60% of OMC.
- 9.3 Where slow absorption of the prime causes interference with traffic or the application of binder, or at an intersection where traffic must cross the new prime, the Contractor must apply approved cover material evenly over the primed surface.

9.4 The Contractor must maintain the surface in a satisfactory condition until the seal coat is applied.

10 Application of Binder

- 10.1 Prior to the application of binder, a **Hold Point** must apply. Release of the Hold Point will occur once it has been verified that the pavement surface is suitable for the application of binder and that the Contractor is properly prepared to proceed.
- 10.2 Class 170 bitumen in a sprayer must be deemed to be 100:0:0 and a tolerance of + 0.5 parts of cutter must be allowed for the effect of minor quantities in previous loads, cleaning and the like. Flux must not be used unless approved otherwise.
- 10.3 Unless specified otherwise application temperatures for primes, primer binder and binders must comply with Table RD-BP-D2 10-1 and Table RD-BP-D2 10-2

Table RD-BP-D2 10-1 Application Temperatures

Product	Minimum Spraying Temp (°C) Un-cut	Maximum Re-heating Temp (°C) Un-cut	Minimum Spraying Temp (°C) Cut	Max Re-heating Temp (°C) Cut
AMC 00	10	30	N/A	N/A
AMC 0	35	55	N/A	N/A
AMC 4	120	135	N/A	N/A
AMC 5	120	135	N/A	N/A
C170	175	200	Resultant	185
C320	175	200	Resultant	185
PMB	190	200	185	190
Crumb Rubber	190	200	185	200
Multigrade	175	185	Resultant	185
Emulsion	Manufacturers Recommendation	90	N/A	N/A

*For cut C170, C320 and Multigrade the binder must be heated to 185°C, additive and / or cutter added and then sprayed at the resultant temperature.

Table RD-BP-D2 10-2 Acceptable limits for temperature, wind and pavement condition prior to sealing

Product	Minimum Air / Pavement Temperatures (°C)	Maximum Air / Pavement Temperatures (°C)	Maximum Wind Speed (KPH)	Pavement
Prime	10/10	None	20	Dry
Primer Binder ⁽²⁾	10/10	None	30	No free water present
C170 ⁽²⁾	15/15	None	30	Dry
C320 ⁽²⁾	15/15	None	30	Dry
PMB (SBS based) ⁽²⁾	20/20 ⁽¹⁾	None	30	Dry
PMB (PBD based) ⁽²⁾	15/15	None	30	Dry
Crumb Rubber ⁽²⁾	15/20 ⁽¹⁾	None	30	Dry
Multigrade ⁽²⁾	15/15	None	30	Dry
Emulsion ⁽²⁾	10/10	40/70	30	No free water present

(1) 15/15 can be applied for SAMI in non-trafficked areas.

(2) Max wind speed reduced by 5 km/hr where application rate less than 0.9 l/m².

- 10.4 Air temperatures shall be measured using a thermocouple based temperature device taken 1 metre from the pavement surface. The temperature device shall be positioned:
- away from any heat source;
 - shaded from the sun; and
 - not protected from the wind.

- 10.5 The use of alternative products to those nominated in the Quality Plan for binder and precoat must be subject to approval and the Contractor demonstrating the suitability and compatibility of the products.

11 Application of Strain Alleviating Membrane Interlayer

- 11.1 A SAMI seal must be left exposed for at least 1 day but no more than 7 days, prior to the application of the asphalt overlay. If the SAMI seal is subject to traffic, other than construction vehicles, then an alternative time for the application of the asphalt overlay may be directed.
- 11.2 Where the temperature of the pavement surface on which the SAMI is to be placed is below 20°C, the following additional requirements must apply:
- a) the use of an emulsion binder; or
 - b) the use of hot application of binder with hot sealing aggregate.
- 11.3 These measures do not apply where the SAMI is not subject to public traffic and measures are put in place to prevent aggregate loss.
- 11.4 The amount of cutter in a SAMI binder must be limited to a maximum of 2 parts.

12 Application of Aggregate

Precoating

- 12.1 Precoat may be applied at the quarry or at the stack site. Precoated aggregate may be stockpiled, provided that the Contractor implements approved measures to ensure that contamination does not occur.
- 12.2 Methods to eliminate contamination from deleterious material and deterioration of the pre-coated aggregate must be included in the Quality Plan.
- 12.3 The Contractor's methods to monitor, manage, mitigate or eliminate pollution or environmental impacts of pre-coated aggregate sites will be included in the Contractor's Environment Management Plan outlined in PC-ENV1 "Environmental Management Requirements".

Aggregate Spreading and Rolling

- 12.4 Aggregate must be spread in a single uniform layer that will prevent pick up of the binder and minimise the level of aggregate breakdown under traffic.
- 12.5 Rolling must commence immediately after aggregate spreading has commenced and continue without interruption until the aggregate is firmly embedded in the binder across the full width of the seal.

13 Removal of Loose Aggregate after Rolling

- 13.1 Removal of loose aggregate must commence within 12 hours of the completion of rolling and applies to all seals, including the first coat of a double seal. All loose aggregate must be removed clear of the edge of the seal. Loose aggregate only must be removed, and without disturbance of the embedded aggregate. Damage to the seal resulting from the removal of loose aggregate must be rectified by the Contractor immediately.
- 13.2 Where the pavement has kerb and gutter, the loose aggregate must be picked up and removed from the site.
- 13.3 The Contractor must ensure that loose aggregate does not present a traffic hazard. The number of loose aggregate particles in any square metre during the defects liability period must not exceed the limits in Table RD-BP-D2 13-1.

Table RD-BP-D2 13-1 Maximum Loose Aggregate Count

Aggregate Size	Maximum Loose Aggregate Count per Square Metre
7 mm	60
10 mm & larger	40

- 13.4 Where the number of loose stones exceeds the maximum values warning signs must be erected within 12 hours and the surface swept within 48 hours

14 Paving Fabric

- 14.1 Where the use of paving fabric is specified, it must comply with RD-EW-S1 "Supply of Geotextiles" and must be placed in accordance with the manufacturer's instructions and the following:
- a) traffic must not be permitted to travel on the paving fabric where this will cause damage to or pick up of the paving fabric;
 - b) folds in the fabric must be removed;
 - c) overlap of the paving fabric on longitudinal joints must be between 100 and 150 mm;
 - d) at transverse joints, adjacent rolls may be butt joined;
 - e) longitudinal overlap of the fabric must be placed within 200 mm of the centreline or lane line;
 - f) the fabric must be bonded to the pavement with a tack coat sprayed 100 mm wider than the fabric. Appropriate end jets must be used to ensure the specified tack coat rate is applied across the entire width of fabric; and
 - g) equipment used to place fabric must not cause undue migration of the underlying tack coat into the fabric.
- 14.2 A certificate of compliance for the paving fabric must be included with the respective AE Lot data.
- 14.3 Seal dimensions specified do not allow for additional binder or fabric required for overlap.

15 Surplus and Waste Materials

- 15.1 Waste, including unused contractor supplied aggregate, bitumen, empty containers or other materials remaining after completion of the work must be removed from the site by the Contractor and the work site must be left in a neat and tidy condition. Disposal must be in accordance with the Environment Protection Act.
- 15.2 All work must be conducted in accordance with the Department's Environmental Code of Practice.

16 Records of Work

- 16.1 The Contractor must complete the form "Daily Record Sheet - Seal Coat Treatment" included as Appendix 3: Daily Record Sheet - Seal Coat Treatment, or an approved equivalent, which must then be certified correct by the Contractor and forwarded by the start of the next working day. Details of all materials applied must be recorded immediately after each spraying "run".
- 16.2 The Contractor may submit an alternative recording form for acceptance provided that all details required in Appendix 3: Daily Record Sheet - Seal Coat Treatment are included.
- 16.3 Note that the Contractor must submit documentation in accordance with RD-BP-S1 "Supply of Bituminous Materials" and RD-PV-S1 "Supply of Pavement Materials" to demonstrate compliance with the Specification.

17 Application Tolerances

- 17.1 Materials must be applied, or added to, within the following tolerances of the final design rate:
- a) Cutter proportions - ± 1.0 parts per 100 parts of bitumen, except that for overspray when cutback is specified the tolerance must be - ± 1.5 parts per 100 parts of bitumen.

- b) Application of primer, primer binder, binder and overspray must be within $\pm 20\%$ for short bar runs and hand spray work.
 - c) Spreading of aggregate must be within $\pm 5\%$.
- 17.2 The longitudinal line followed must be within 50 mm of that specified for straight runs and 100 mm on curved alignments.

18 Acceptance Criteria

Binder Application

Where actual binder application rates vary from the design binder application rates, the deductions outlined in Table RD-BP-D2 18-1 Binder Rate Variations

- 18.1 must apply. Deductions will not apply to the areas where deductions or rectification works are required to conform to the aggregate retention and surface texture requirements in "Testing Requirements" Clauses 18.3 and 18.4.

Table RD-BP-D2 18-1 Binder Rate Variations

Variations from Design Binder Application Rate	Action
> + 5%	No payment for additional binder
0% to +5%	Payment for additional binder
< 0%	Proportionate deduction

- 18.2 For double seals and geotextile seals the above tolerances shall be applied to the individual sprayer rates for the tack coat, bottom and top binder applications.

Testing Requirements

- 18.3 For the purposes of texture and aggregate retention testing the following requirements must apply:

- a) Testing must be undertaken using the procedures outlined in Clause 19.
- b) Texture measurements must be performed in the wheel paths where surface texture is considered to be at its lowest.
- c) Aggregate retention measurements may be performed across the lane but where aggregate loss is considered to be most severe.
- d) Lots must be limited to individual lanes.
- e) Lots must be selected to encompass visually uniform sections of seal.
- f) Lots must be no less than 100 m and no more than 1 km in length.
- g) Testing must be performed at the rate specified in Table RD-BP-D2 18-2.
- h) Areas outside of the traffic lanes lot sizes must be no less than 500 m² and no more than 1000 m² with 3 tests being required per lot.
- i) The following information must be supplied in support of surface related test results:
 - i) date and time of testing;
 - ii) test site offset and chainage;
 - iii) surface condition noting the presence of moisture; and
 - iv) individual test results and mean values per lot.

- 18.4 The Principal must be given 2 days' notice of when testing will be undertaken.

Table RD-BP-D2 18-2 Texture and Aggregate Testing Frequency

Lot Size (m2)	Testing Frequency per Lot AGPT-T250-08
100 – 500	3

Lot Size (m2)	Testing Frequency per Lot AGPT-T250-08
501 – 1000	5

Texture

- 18.5 The mean surface texture for each lot must conform to the requirements in Table RD-BP-D2 18-3. Surface texture measurements shall be undertaken no sooner than 10 weeks after placement, and no later than 15 weeks after placement. Where the texture is considered to be unsatisfactory the Contractor may be requested to undertake testing of specific areas. This shall be performed within 14 days of being notified by the Superintendent of a potential non-conformance. Results shall be supplied within 5 days of testing. Work to be re-tested within one month prior to the end of the Defects Liability Period.

Table RD-BP-D2 18-3 Surface Texture

Treatment	Texture Depth (mm)				Action Required
	5 mm	7 mm, 10/5	10 mm, 14/5, 14/7, 16/7	14 mm & 16 mm	
Seals (All Types)	1.0 – 1.6	1.2 – 1.8	1.4 – 2.5	1.8 – 3.5	Accept
	0.8 – 1.0 Or 1.6 – 1.8	1.0 – 1.2 Or 1.8 – 2.0	1.2 – 1.4 Or 2.5 – 3.0	1.6 – 1.8 Or 3.5 – 4.5	Rectify or reduce payment for the lot by 10%
	< 0.8 Or > 1.8	< 1.1 Or > 2.0	< 1.3 Or > 3.0	< 1.7 Or > 4.5	Work to be rectified
		1.0 – 2.0	1.2 – 3.0	N/A	Accept
Primer seals		< 1.0 Or > 2.0	< 1.2 Or > 3.0	N/A	Work to be rectified

- 18.6 Sections less than 1 m² must be excluded unless the accumulated area of the seal outside of the acceptable range is more than 5 m² per lot.

Aggregate Retention

- 18.7 The mean degree of aggregate retention for each lot must comply with the requirements in Table RD-BP-D2 18-4. Aggregate retention measurements shall be undertaken no sooner than 10 weeks after placement, and no later than 15 weeks after placement. Where the degree of aggregate retention is considered to be unsatisfactory the Contractor may be requested to undertake testing on specific areas. This shall be performed within 14 days of being notified by the Principal. Results shall be supplied within 5 days of testing. Work to be re-tested within one month prior to the end of the Defects Liability Period.

Table RD-BP-D2 18-4 Aggregate Retention

Degree of Aggregate Retention	Action Required
0 – 2	Accept
3 – 5	Work to be re-tested within one month prior to the end of the Defects Liability Period. If the Degree of Aggregate Stripping has increased since it was last tested, the work must be rectified before the end of the Defects Liability Period.
Greater than 5	Work must be rectified within 5 days.

- 18.8 Sections less than 0.5 m² must be excluded unless the accumulated area of the seal outside of the acceptable range is more than 3 m² per lot.

Rectification and Exclusions

- 18.9 Assessment and testing of seals can be undertaken at any time. Within 24 hours of becoming aware of any defects the Contractor must put in place temporary traffic control measures to make the road safe and minimise damage to the seal. The Contractor must within 5 days submit for review the proposed method of remediation together with the schedule for the works. All defects must be rectified when conditions are conducive to the repair being carried out successfully but must be completed no later than 6 months from the end of the defects liability period.
- 18.10 The Contractor must submit a completion report 28 days before the end of the defects liability period outlining the seal condition (including but not limited to; aggregate retention and texture), the presence of any defects and measures to rectify those defects.
- 18.11 The defects liability period must apply to rectification works carried out to repair any defect under this Contract.
- 18.12 The Contractor will not be held responsible for pavement failures or damage to the seal from events outside of their control including oil spills, accidents, fires, heavy vehicles braking and turning and mechanical damage from farm equipment.

19 Test Procedures

- 19.1 The Contractor must use the following test procedures (refer https://www.dpti.sa.gov.au/contractor_documents) to verify conformance with the Specification:

Table RD-BP-D2 19-1 Test Procedures

Test	Test Procedure
Moisture Content:	Oven Drying Method
	Microwave Method
Sampling of Soil, Aggregates and Rocks	RD-PV-S1
Determination of Average Texture Depth of a Pavement Surface using the Sand Patch Method	AGPT-T250-08
Determination of aggregate retention	RC 317.03 (VicRoads)
Determination of Aggregate Stripping Value - One Day Plate Stripping Test	TP 705

20 Hold Points

- 20.1 The following is a summary of Hold Points referenced in this Part:

Table RD-BP-D2 20-1 Hold Points

Document Ref.	Hold Point	Response Time
2.3	Submission of Procedures and documentation (if not in Post Tender Submission)	7 Working Days
3.7	Submission of seal designs	2 Working Days
4.3	Prior to use of sealing aggregates	2 Working Days
5.2	Submission of a diagram detailing spray plan for intersections and junctions	2 Working Days
9.1	Prior to application of prime or primer seal	3 hours
10.1	Prior to application of binder	3 hours

21 Verification Requirements and Records

Test Records

- 21.1 The Contractor must undertake the testing specified in this Clause and supply written evidence of compliance with the lot package.

Table RD-BP-D2 21-1 Verification Requirements

Document Ref.	Subject	Property	Test Procedure	Test Frequency	Acceptance Limits
4.2 & RD-PV-S1	Precoat and Aggregate*	Stripping	TP 705	Annually / Source of Aggregate	Wet: Max 15% Dry: Max 5%
4.2 & RD-PV-S1	Precoat and Aggregate*	ALD	AS1141.20.1 or AS 1141.20.2	3 tests per lot	Report Value
4.2 & RD-PV-S1	Precoat and Aggregate*	Grading	AS 1141.11	One test per lot	Refer RD-PV-S1
4.2 & RD-PV-S1	Precoat and Aggregate*	Flakiness	AS 1141.15	One test per lot	Refer RD-PV-S1
4.2 & RD-PV-S1	Precoat and Aggregate*	Misshapen Particles	AS 1141.14	One test per lot	Refer RD-PV-S1
4.2	Precoat and Aggregate*	Moisture Content	AS 1289.2.1.1 AS 1289.2.1.4	On Request	Non-PMB: 0.8%PMB: 0.01%
14 & RD-EW-S1	Paving Fabric	Mass per unit area	AS 3706.1	One per lot	Refer RD-EW-S1
14 & RD-EW-S1	Paving Fabric	Wide Strip Tensile Strength	AS 3706.2	One per lot	Refer RD-EW-S1
14 & RD-EW-S1	Paving Fabric	Maximum Elongation	AS 3706.2	One per lot	Refer RD-EW-S1
14 & RD-EW-S1	Paving Fabric	Binder Retention Rate	ASTM D6140-00	One per lot	Refer RD-EW-S1
16	Binder and Aggregate	Application Rate	As recorded on Daily Record Sheet	Per Run	Refer Clause 17 "Application Tolerances"
4.1 & RD-BP-S1	Supply of Bitumen	Refer RD-BP-S1			
18	Acceptance criteria	Texture	AGPT-T250-08	Refer Table RD-BP-D2 18-2	Refer Table RD-BP-D2 18-3
18	Acceptance criteria	Aggregate retention	RC 317.03	Refer Table RD-BP-D2 18-2	Refer Table RD-BP-D2 18-4

* Not applicable for aggregate supplied by the Principal.

Other Records

21.2 The Contractor must supply the following records:

Table RD-BP-D2 21-2 Other Records

Document Ref.	Subject	Record to be Provided
16	Records of Work	Appendix 3: Daily Record Sheet - Seal Coat Treatment
18	Acceptance of Surface Condition	Completion report outlining surface condition, defects present and remediation methods

22 Measurement

22.1 Measurement of Quantities will be based on Appendix 3: Daily Record Sheet - Seal Coat Treatment or an approved equivalent.

22.2 For two coat seals, measurement will be determined from the area of the first coat. Measurement of Paving Fabric will be based on the final surface area covered, with no allowance for the specified overlaps.

23 Payment by Schedule of Rates

23.1 This clause applies if payment for sprayed bituminous surfacing will be made by Schedule of Rates.

- 23.2 On an individual sprayer run basis, payment will be made at the rates in the Schedule of Rates minus any deductions as outlined in Clause 18 for the actual quantities of primer, primer binder, overspray and binder prepared and sprayed on the road under this Specification at rates of application specified or ordered and within the tolerances specified.

24 Payment by Lump Sum

- 24.1 This clause applies if payment for sprayed bituminous surfacing will be made by Lump Sum or part thereof.
- 24.2 Where a direction has been issued to adjust the proportions or application rates, the amount paid will be adjusted by an amount determined from the applicable rate in the Schedule of Rates for Variations.
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25 Appendix 1: Volume Conversion Table - Bitumen Emulsion

Table RD-BP-D2 25-1 Volume Conversion Table - Bitumen Emulsion

Hot Litres x A = Cold Litres (15°C)			Cold Litres x B = Hot Litres (T°C)					
60% Bitumen Emulsion			70% Bitumen Emulsion			80% Bitumen Emulsion		
A	Temp (T°C)	B	A	Temp (T°C)	B	A	Temp (T°C)	B
1.0000	15	1.0000	1.000	15	1.0000	1.0000	15	1.0000
0.9998	16	1.0002	0.9977	20	1.0023	0.9974	20	1.0026
0.9989	18	1.0011	0.9951	25	1.0049	0.9948	25	1.0052
0.9980	20	1.0020	0.9924	30	1.0076	0.9921	30	1.0079
0.9971	22	1.0029	0.9899	35	1.0102	0.9895	35	1.0106
0.9962	24	1.0038	0.9872	40	1.0129	0.9868	40	1.0134
0.9953	26	1.0047	0.9840	46	1.0162	0.9837	46	1.0166
0.9944	28	1.0056	0.9830	48	1.0172	0.9826	48	1.0177
0.9935	30	1.0065	0.9819	50	1.0184	0.9816	50	1.0187
0.9926	32	1.0074	0.9809	52	1.0194	0.9805	52	1.0199
0.9917	34	1.0083	0.9798	54	1.0206	0.9794	54	1.0210
0.9908	36	1.0092	0.9788	56	1.0216	0.9783	56	1.0222
0.9899	38	1.0102	0.9777	58	1.0228	0.9773	58	1.0232
0.9890	40	1.0111	0.9767	60	1.0238	0.9762	60	1.0244
0.9881	42	1.0120	0.9752	62	1.0254	0.9751	62	1.0255
0.9872	44	1.0129	0.9746	64	1.0260	0.9740	64	1.0267
0.9863	46	1.0138	0.9736	66	1.0271	0.9730	66	1.0277
0.9854	48	1.0148	0.9725	68	1.0282	0.9719	68	1.0289
0.9845	50	1.0157	0.9715	70	1.0293	0.9709	70	1.0300
0.9836	52	1.0166	0.9704	72	1.0305	0.9698	72	1.0311
0.9827	54	1.0176	0.9693	74	1.0316	0.9687	74	1.0323
0.9818	56	1.0185	0.9683	76	1.0327	0.9677	76	1.0334
0.9809	58	1.0194	0.9672	78	1.0339	0.9667	78	1.0344
0.9800	60	1.0204	0.9662	81	1.0349	0.9656	80	1.0356
0.9791	62	1.0213	0.9651	82	1.0361	0.9643	82	1.0370
0.9782	64	1.0222	0.9640	84	1.0373	0.9630	84	1.0384
0.9773	66	1.0232	0.9630	86	1.0384	0.9616	86	1.0399
0.9764	68	1.0241	0.9619	88	1.0396	0.9603	88	1.0413
0.9755	70	1.0251	0.9608	90	1.0407	0.9590	90	1.0427

26 Appendix 2: Volume Conversion Table - Hot Bitumen Based Binders

Table RD-BP-D2 26-1 Volume Conversion Table - Hot Bitumen Based Binders

Multiply by "A" to Reduce Volume at T° to Volume at 15°C Multiply by "B" to Increase Volume at 15°C to Volume at T°					
Multiplier "A"	Temp. °C "T"	Multiplier "B"	Multiplier "A"	Temp. °C "T"	Multiplier "B"
0.9856	38	1.0146	0.9356	120	1.0668
0.9844	40	1.0158	0.9344	122	1.0702
0.9831	42	1.0172	0.9332	124	1.0716
0.9819	44	1.0184	0.9320	126	1.0730
0.9806	46	1.0198	0.9308	128	1.0743
0.9794	48	1.0210	0.9296	130	1.0757
0.9782	50	1.0223	0.9284	132	1.0771
0.9769	52	1.0236	0.9272	134	1.0785
0.9757	54	1.0249	0.9260	136	1.0799
0.9745	56	1.0262	0.9249	138	1.0812
0.9732	58	1.0275	0.9237	140	1.0826
0.9720	60	1.0288	0.9225	142	1.0840
0.9708	62	1.0301	0.9213	144	1.0854
0.9695	64	1.0315	0.9201	146	1.0868
0.9683	66	1.0327	0.9189	148	1.0883
0.9671	68	1.0340	0.9178	150	1.0896
0.9659	70	1.0353	0.9166	152	1.0910
0.9646	72	1.0367	0.9154	154	1.0924
0.9634	74	1.0380	0.9142	156	1.0939
0.9622	76	1.0393	0.9130	158	1.0953
0.9610	78	1.0406	0.9119	160	1.0966
0.9597	80	1.0420	0.9107	162	1.0981
0.9585	82	1.0433	0.9095	164	1.0995
0.9573	84	1.0446	0.9084	166	1.1009
0.9561	86	1.0459	0.9072	168	1.1023
0.9549	88	1.0472	0.9060	170	1.1038
0.9537	90	1.0486	0.9049	172	1.1051
0.9524	92	1.0500	0.9037	174	1.1066
0.9512	94	1.0513	0.9025	176	1.1080
0.9500	96	1.0526	0.9014	178	1.1094
0.9488	98	1.0540	0.9002	180	1.1109
0.9476	100	1.0553	0.8990	182	1.1123
0.9464	102	1.0566	0.8979	184	1.1137
0.9452	104	1.0580	0.8967	186	1.1152
0.9440	106	1.0593	0.8956	188	1.1166
0.9428	108	1.0607	0.8944	190	1.1181
0.9416	110	1.0620	0.8933	192	1.1195
0.9404	112	1.0634	0.8921	194	1.1209
0.9392	114	1.0647	0.8909	196	1.1224
0.9380	116	1.0661	0.8898	198	1.1239

Multiply by "A" to Reduce Volume at T° to Volume at 15°C					
Multiply by "B" to Increase Volume at 15°C to Volume at T°					
0.9368	118	1.0675	0.8886	200	1.1523

27 Appendix 3: Daily Record Sheet - Seal Coat Treatment

A.E. No. /											
Road Name											
Date / /											
Contractor											
Type of Work (e.g. prime, seal, reseal, etc.)											
Sprayed No.											
Location of Work (on this sheet) From -Wards (insert directions)											
To											
Reference to km Post, Junctions, chainages, etc.											
Run No.	1	2	3	4	5	6	7	8	9	0	Totals
Time											
Air Temp °C											
Surface Temp °C											
Binder Mix 100/											
Added Load (Litres)	Bitumen hot										
	Flux cold										
	Cutter cold										
	Additive										
	Total										
Dipstick Reading	Start										
	Finish										
Litres Sprayed	Hot*										
	Temp °C										
	Cold*										
	Cutter*										
	Resid Binder*										
Distance From Starting Point	Start of run										
	End of run										
Length of spray.....m											
Width of spray.....m											
Side of road											
Area sprayed m2											
Specified appl. Rate*											
Specified litres*											
Tolerance.....*											
Difference.....*											
Actual appl. Rate											
Aggregate	Source and Size										
	Spec. Coverage										m2/m3
	Quantity Used										
	Act. Coverage										
	Precoat (l)										
Sample Number											

Remarks (alterations to specifications – weather, etc.)
rolling? Yes/No

No. of Rollers used.....Swept after

Department Representative.....
Contractor's Representative.....

28 Appendix 4: Guidelines for Addition of Cutter

- 28.1 Cutter is used to reduce the viscosity of the binder, and enhance the initial wetting of the aggregate. Following the addition of cutter to the binder, the load should be circulated for at least 15 minutes to ensure a uniform mixture.
- 28.2 The amount of cutter required will vary with the pavement temperature and the temperature and traffic conditions in the next few days after application. Table RD-BP-C5 28-1 shows typical cutter addition rates in parts per hundred parts of bitumen.

Table RD-BP-C5 28-1 Cutter Addition Rates

Product 100:0:y Parts Cutter	Pavement Temperatures (°C)							
	15 – 20	20 – 25	25 – 30	30 – 35	35 – 40	40 – 50	50 – 60	Over 60
C170	6	5	4	3	2	0	0	0
C320	7	6	5	4	3	0	0	0
Multigrade	6	5	4	3	2	1	0	0
S10E	Na	6	5	4	3	2	0	0
S15E	Na	7	6	5	4	3	2	0
S20E	Na	8	7	6	5	4	3	0
S35E (SBS based)	Na	6	5	4	3	2	0	0
S35E (PBD based)	4	3	2	1	0	0	0	0
S15RF	Na	9	8	7	6	4	4	4
S18RF	Na	10	8	9	7	5	5	4
S45R	Na	9	8	7	6	4	4	4

- 28.3 Further changes to the cutter rates may be made on-site to account for:
- Weather changes prior to completion of rolling: Treat as for likely conditions.
 - Time lapse between temperature measurement and actual spray run: Try to anticipate the actual temperature, and cut accordingly.
 - Age of prime or primer binder (if applicable): If these still contain significant amounts of cutter, the cutting rate may be reduced by 1 part.
 - Two-coat crumb rubber seals require a minimum of 4 parts of cutter in the bottom coat. For all other binders no more than two parts of cutter in the bottom coat is generally required.
 - Traffic conditions: High traffic volumes and masses require less cutter to achieve wetting. Cutter can be reduced by up to 2 parts for roads carrying high volumes and percentages of commercial vehicles (e.g. National Highways), particularly in spray runs completed in the morning, and which will be under traffic control for most of the day. Larger aggregates may require 1 part more cutter to assist wetting where traffic volume is low.
 - Pre-blended crumb rubber grades may contain process oil. This oil will most likely reduce the viscosity of the binder compared to field blended grades; this may allow a reduction of 1-2 parts in the cutting rate.
- 28.4 Wind speed at the time of spraying can affect the rate at which the binder cools. This should be considered when determining the amount of cutter required.