

COFFS HARBOUR CITY COUNCIL



**DEVELOPMENT SPECIFICATION
DESIGN**

1143 Sprayed bituminous surfacing

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1143 SPRAYED BITUMINOUS SURFACING
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1 SCOPE AND GENERAL

1.1 SCOPE

This worksection covers the supply of materials, design and application of sprayed seals for roads and related applications and includes the following types of sprayed treatments:

- Prime.
- Primerseal.
- Seal:
 - . With conventional bitumen, cutback bitumen or bitumen emulsion binder.
 - . With modified binder, e.g. multigrade binder, polymer modified binder.
 - . Seal incorporating geotextile fabric, with or without modified binder.

The work to be performed under this worksection includes:

- Supply and delivery of materials.
- Storage and handling of raw materials.
- Precoating of aggregate.
- Preparation of pavement surfaces.
- Preparation of bituminous materials.
- Application of primer, primerbinder and binder.
- Spreading and rolling of aggregate.
- Removal of loose aggregate.
- Care of completed work.

The locations and required types of sprayed bituminous surfacings, including types of binders and aggregate sizes, shall be as detailed in the Appendix (Schedule of Job Details). For multiple treatments, the binder and aggregate may be required to be laid in one or more separate applications.

This section is to be read in conjunction with the Appendix (Schedule of Job Details). Where there is conflict between the requirements of this section and the Appendix, the requirements of the Appendix shall apply.

1.2 REFERENCED DOCUMENTS

The following documents referred to in this worksection shall be deemed as the latest edition of the Australian Standards, including amendments and supplements:

Worksections

0161 *Quality (Construction)*

1101 *Control of traffic*

Standards

AS 1141	Methods for sampling and testing aggregates
AS 1141.0	List of methods
AS1160	Bituminous Emulsions for Construction and Maintenance of Pavements
AS 1289 Various	Methods of Testing Soils for Engineering Purposes
AS 1742	Manual of uniform traffic control devices,
AS 1742.3	Traffic control devices for works on roads
AS 2008	Residual bitumen for pavements
AS 2157	Cutback Bitumen
AS 2341 Various	Methods of Testing Bitumen and Related Roadmaking Products
AS 2758	Aggregates and rock for engineering purposes
AS 2758.2	Aggregate for sprayed bituminous surfacing

AS 3568	Oils for reducing the viscosity of residual bitumen for pavements
AS/NZS ISO 9001	Quality Management Systems – Requirements
SAA HB 81	Field guide for traffic control.
SAA HB 81.6	Bituminous surfacing on roads.

Other publications

Austrroads

Manual of Test Procedures (www.austrroads.com.au/tm/testmethods.htm)

AP-T32	Audit and Surveillance of Sprayed Sealing Contract Works
AP-41/06	Specification Framework for Polymer Modified Binders and multigrade bitumens
AP-T42/06	Guide to the selection and use of Polymer Modified Binders and multigrade bitumens
AP-G76/04.	Sprayed sealing guide
AP-G41	Bitumen Sealing Safety Guide.

AAPA

Advisory note 7 – Guide to the heating and Storage of Binders for Sprayed Sealing and Hot mixed asphalt.

1.3 QUALITY

Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are given in 0161 *Quality (Construction)*.

1.4 DEFINITION OF TERMS

For the purpose of this worksection, the following definitions apply:

- Cutter Oil: A light petroleum distillate (e.g. kerosene) added to bitumen to temporarily reduce its viscosity.
- Double/double seal: A seal consisting of two successive applications of binder each followed by an application of aggregate.
- Flux Oil: A petroleum distillate (e.g diesel) added to bitumen to produce a long-term reduction in viscosity.
- Prime: An application of a primer to a prepared base, without cover aggregate.
- Primer: A bituminous material of low viscosity and low surface tension used in priming.
- Primerseal: An application of a primerbinder with a cover aggregate to a prepared base.
- Primerbinder: A material, more viscous than a primer, and required to act both as a primer and binder, and used in primersealing.
- Seal: A sprayed application of bituminous binder into which aggregate is incorporated. A sprayed seal may incorporate more than one application of binder and aggregate and may also be combined with a layer of geotextile fabric.
- Reseal: A seal applied to an existing sealed, or asphalt surface.
- Residual Binder: The volume of bituminous binder at 15°C including the volume of any polymer, crumb rubber and flux oil but not including the volume of any cutter oil, water, emulsifier or adhesion agent.
- Single/double seal: A seal consisting of a single application of binder followed by a double application of aggregate.
- Single/single seal: A seal consisting of a single application of binder followed by a single application of aggregate.
- High Stress Seal or Reseal (HSS): The application of a polymer modified binder into which aggregate is incorporated to provide a durable wearing surface.
- Strain Alleviating Membrane (SAM): The application of polymer modified binder into which aggregate is incorporated to provide a durable wearing surface with strain alleviating or other desirable properties.
- Strain Alleviating Membrane Interlayer (SAMI): The application of a polymer modified binder into which aggregate is incorporated. A SAMI is used as an interlayer between an asphalt wearing course and underlying layers to provide alleviation from tensile strains developed beneath it.

- Geotextile Reinforced Seal (GRS): The applications of C170 tack coat, geotextile or polymer modified binder into which aggregate is incorporated to provide a durable wearing surface with strain alleviating or other desirable properties.

1.5 TESTING

All laboratory testing of properties required by the worksection shall be undertaken in a laboratory registered by the National Association of Testing Authorities (NATA) or International Accreditation New Zealand (IANZ) for the appropriate tests and performed in accordance with procedures contained in the relevant Australian or New Zealand Standard or Austroads Manual of Test Procedures. Where there is no applicable Australian Standard or Austroads Test Method, or where the Standard/Manual provides a choice of procedures, the method to be adopted shall be that endorsed by the relevant State Road Authority in the State in which the work is being undertaken.

Requirements for NATA or IANZ registration shall not apply to field tests such as surface texture measurements or aggregate spreader calibration undertaken by competent and trained personnel.

1.6 PLANT

All plant shall be registered and insured as appropriate to its use on a public road and shall comply with statutory environmental regulations.

1.7 PROTECTION OF SERVICES AND ROAD FIXTURES

The Contractor shall take all necessary precautions to prevent primer, primerbinder, binder, aggregate or other material used on the work from entering or adhering to gratings, hydrants or valve boxes, manhole covers, bridge or culvert decks and other road fixtures.

Immediately after aggregate has been spread, the Contractor shall clean off or remove any sprayed material and leave the services and road fixtures in a condition equivalent to that existing when the Contractor commenced the sprayed surfacing work.

1.8 CONTROL OF TRAFFIC

The Contractor shall provide for traffic in accordance with 1101 *Control of traffic* while undertaking the work.

Any costs incurred as a result of the supply of labour and materials complying with 1101 *Control of traffic* shall be borne by the Contractor.

The Contractor shall take all necessary steps to avoid or minimise delays and inconvenience to road users during the course of the work but without compromise to the safety of the employees and the road users.

2 MATERIALS

2.1 BITUMINOUS MATERIALS

Bitumen

Standard Classes of bitumen shall comply with the requirements of AS 2008.

Multigrade bitumen shall comply with the Austroads AP-T42/06.

Polymer Modified Binders

Polymer modified binder shall comply with the Austroads AP-T41/06.

Bitumen Emulsion

Bitumen emulsion shall comply with the requirements of AS 1160.

Cutback Bitumen

Cutback bitumen shall comply with AS 2157 or may be prepared by the Contractor, in the field, by blending bitumen and cutter oil in proportions specified or selected as appropriate to the particular application. Proprietary grades of cutback bitumen shall comply with the manufacturer's specification.

Adhesion Agent

The type and proportion of adhesion agent to be added to bituminous binder or aggregate precoating material shall be:

- subject to evidence of previous satisfactory performance with the proposed combination of binder, aggregate source and precoating material, or

- selected from materials listed as approved by the relevant State Road Authority (where applicable).

Cutter Oil and Flux Oil

Cutter oil and flux oil shall comply with AS 3568.

Aggregate Precoating Materials

Aggregate precoating materials shall be flux oil, flux oil and bitumen mixture, cutback bitumen, proprietary bitumen emulsion or other proprietary product subject to evidence of previous satisfactory field performance as an aggregate precoating material. All precoating material shall contain a minimum of 1% of an approved adhesion agent.

2.2 AGGREGATE

Where requested, the source of all materials shall be subject to inspection and approval by the Superintendent and only material from a nominated quarry face or location shall be used.

Aggregate shall comply with AS 2758.2 with the following additional requirements. The class of aggregate, resistance to polishing, method of determination of aggregate shape, and combination of hardness and durability test measures shall be specified in the Schedule of Job Details. Only one method of determination of aggregate shape and one combination of hardness and durability shall apply. Where no aggregate details are specified in the Schedule of Details, the particular aggregate class, polishing resistance and combination of test methods shall be selected by the Contractor based on the service conditions and customary test procedures used in the State in which the works are located.

2.3 OTHER MATERIALS

Protective paper

A heavy-duty protective paper, weighing not less than 120 grams per square metre, shall be used for all start, finish and taper operations. The paper shall be of sufficient width to prevent overspray and of sufficient strength to prevent spillage during removal.

Geotextile

Geotextile fabric used in geotextile reinforced seals shall be a non-woven, needle punched fabric with a minimum melting point of 165°C and a minimum mass of 130 g/m².

3 DESIGN OF SPRAYED SEALS

The types of sprayed seal treatment shall be as listed in the schedule of job requirements, or as shown on drawings.

The Contractor shall determine rates of application of binder and aggregate for the nominated sprayed seal treatment types based on Austroads *Sprayed sealing guide*. Where specified, the Contractor's seal design shall be assessed by the Superintendent for compliance with the requirements of this worksection.

The selection of materials and application rates for surfacing treatments not covered by the Austroads *Seal Design Method*, such as priming, primersealing and special treatments, shall be in accordance with guidelines for accepted good practice.

4 APPLICATION OF SPRAYED BITUMINOUS SURFACING

The Contractor shall be responsible for:

- Supply and delivery of materials.
- Storage and handling of raw materials.
- Precoating of aggregate (where aggregates are not purchased suitably precoated).
- Preparation of bituminous materials, including selection and incorporation of appropriate proportions of cutter oil, adhesion agent and any other additives.
- Control of traffic through the works, including recording of traffic control measures.
- Removal and disposal, or protection, of existing raised pavement markers.
- Sweeping and cleaning pavement surfaces prior to spraying.
- Protection of road furniture from spray.
- Supply and placing of geotextile, where specified.

- Application of primer, primerbinder and/or binder, uniformly to the target application rate.
- Spreading of aggregate, uniformly to the target application rate.
- Rolling of aggregate.
- Removal of loose aggregate
- Removal and disposal of all surplus and waste materials.
- Installation of temporary pavement markers.
- Care of completed work.

Sealing work shall be performed in workman-like manner in accordance with recognised industry standards.

Completed and cured primes shall have a uniform appearance.

Completed primerseals and single/single seals with aggregates of 7 mm size, or less, shall have a uniform surface retaining a matrix of aggregate.

Completed single/single seals with aggregates of 10 mm size, or greater, shall have a uniform, single retained layer of aggregate.

Completed single/double seals shall have a uniform layer of retained aggregate with both sizes fitting together to produce a uniform surface texture.

Completed double/double seals shall have uniform double retained layers of aggregate with the second aggregate fitting inside the texture of the aggregate used in the first layer.

Work shall be finished with clean straight edges and no obvious defects related to poorly constructed longitudinal or transverse joints, blocked spray nozzles or any other construction fault.

5 REMOVAL OF LOOSE AGGREGATE

After final sweeping, and prior to removal of speed restriction and warning signs, the number of loose aggregate particles remaining on the surface of seals constructed with 10 mm, or larger, aggregates shall not exceed the values specified in Table 5.1.

At all times there shall be no windrow of aggregate on either the sealed surface or shoulder that could constitute a traffic hazard. Where specified, all surplus aggregate shall be uplifted and removed from the works.

Removal of loose aggregate from the trafficked pavement shall be completed within the time specified in Table 5.2.

Table 5.1 Loose stone particles remaining after sweeping

Road type	Loose stones (particles/m ²) max
Urban areas	20
Other medium to high traffic (>250 v/l/d)	30
Low traffic (<250 v/l/d)	40

Table 5.2 Time limit for removal of loose aggregate

Traffic volume (vehicles/lane/day)	Maximum time limits
> 2000 and all Freeways	Within 8 hours of sealing
1000 to 2000	Within 24 hours of sealing
250 to 1000	Within 48 hours of sealing
< 250	Within 5 days of sealing

6 REMOVAL OF SURPLUS AND WASTE MATERIAL

Prior to leaving the work site, the Contractor shall ensure that all services are uncovered and cleaned, if necessary. All waste paper and rubbish arising from the sprayed sealing operations shall be removed from site. The stockpile site shall be cleaned and any excess material left in a tidy heap or removed, depending on the requirements of the Principal.

7 PROTECTION AND CARE OF NEW WORK

The Contractor shall provide signs to warn public of loose stones and absence of line marking including provision of temporary raised pavement markers. Signs shall be maintained until loose aggregate has been removed and linemarking reinstated. Where linemarking is to be undertaken by others, warning signs indicating the absence of linemarking shall be erected and maintained by the organisation responsible for linemarking.

8 SAMPLING AND TESTING

The Contractor's Quality plan shall nominate the proposed testing frequency including, but not limited to:

- Specification compliance of bituminous materials
- Specification compliance of aggregates
- Measurement of loose aggregate on completed work.

9 MEASUREMENT AND PAYMENT

9.1 MEASUREMENT BY AREA

Priming, primersealing or sealing shall be measured by area in square metres. No deductions shall be made for openings each not exceeding one square metre.

Removal and disposal of existing raised pavement markers shall be measured by length in kilometres.

9.2 MEASUREMENT BY QUANTITY OF MATERIAL SUPPLIED

Supply and spray primer or primerbinder (including preparation of surface): The unit of measurement shall be litres at 15°C.

The quantities (in litres) shall be determined by either:

- multiplying the target application rate of the combined mixture of primer or primerbinder (including any cutter or flux oil) at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres); or
- measurement of actual volume (at 15°C) of materials used.

Supply and spray binder (including adhesion agent where required, and preparation of surface)

The unit of measurement shall be litres at 15°C.

The quantities (in litres) shall be determined by either:

- multiplying the target application rate of the residual (excluding any cutter oil or flux oil) at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres); or
- measurement of actual volume (at 15°C) of materials used.

Supply, incorporate and spray cutter oil, flux oil and adhesion agent in binder

The unit of measurement shall be litre measured at ambient temperature or 15°C.

The quantities shall be determined from either:

- the target proportion of cutter, oil flux oil, or adhesion agent added to the binder; or
- measurement of actual volume of materials used.

Supply, precoat, apply aggregate

The unit of measurement shall be cubic metre.

The quantity of aggregate (in cubic metres) shall be determined by dividing the area of road surface covered by each sprayer run (in square metres) by the target application rate (in square metres per cubic metre).

Roll and incorporate aggregate

The unit of measurement shall be square metres.

Supply and place geotextile

The unit of measurement shall be square metre of pavement area covered. Payment shall exclude laps and application of binder and aggregate.

9.3 NON COMPLYING MATERIALS

In the event that the work or materials supplied is not within the standards defined for supply and application of sprayed bituminous surfacing, the Superintendent may direct:

- that the reduced service life arising from the non compliance is offset by reducing payment for the non complying portion of work or material by the method defined in the Schedule of Job Details; or,
- with the consent of the Contractor, any other remedial treatment that is expected to provide the required level of service.

11 ANNEXURE B

11.1 GUIDELINES FOR PERFORMING SPRAYED SEALING WORKS**Scope**

This section provides a guide to good practice to achieve satisfactory outcomes and durable performance from sprayed sealing work. The following procedures may be incorporated in the Contractor's Quality Plan or provide a benchmark for assessing the effectiveness of the process standards adopted by the Contractor.

Storage and handling of raw materials

Aggregates: Aggregate stockpiles shall be arranged and managed in accordance with the following requirements:

- The maximum lot size shall be limited to 250 cubic metres (approximately 300 tonnes).
- Stockpiles shall each be located on a firm level ground and effectively separated to prevent cross-contamination and interfere with the loading and/or precoating operations.
- Siting of stockpiles shall ensure adequate clearance between machinery and overhead power lines.
- Stockpiles shall be managed to avoid environmental damage from dust or run-off of bituminous materials.
- The quantity and type of each stockpile shall be clearly signposted on the stockpile at all times.
- Stockpiles shall be covered, if necessary, to reduce contamination by dust or water.
- Recovery from stockpiles shall be such as to avoid contamination of aggregates.
- Contamination, weathering or reduction in effectiveness of precoating of aggregates in stockpiles shall be rectified or the stockpile replaced.

Binder: Binder shall be heated in accordance with the manufacturer's written recommendations but shall never exceed 200°C.

Binder shall be stored in accordance with the temperature and time combinations specified in the manufacturer's written recommendation.

Any bituminous material that has been overheated shall not be used unless tested for compliance with the relevant specification. Where no specific recommendations are provided, the temperature guidelines set out in AAPA Advisory Note 7 – Guide to the Heating and Storage of Binders for Sprayed Sealing and Hot mixed Asphalt, shall be adopted.

The Contractor shall implement procedures for storage and handling of binder that ensure prevention of segregation and contamination of the binder by flushing liquids or other materials. Straining devices shall be used at all times when transferring binders into sprayers to avoid particles of hardened bituminous material or other contaminants that could cause blockages in spraying jets.

Condition for commencement

Acceptance of Surface Condition: Prior to commencing sprayed sealing work the Contractor shall make an inspection to determine any pavement defects that could adversely affect the quality of the finished work. Sprayed sealing work shall not proceed until defects have been corrected or agreement reached with the Superintendent's Representative on responsibility for consequences of any recorded defects.

Defects requiring correction may include, but are not limited to:

- Excessive moisture in unbound granular base to be primed or primersealed.
- Loose, poorly bonded, or inadequately compacted materials in the surface of unbound granular base to be primed or primersealed.
- Poorly shaped unbound granular base to be primed or primersealed.
- Presence of soft, fatty or bleeding patches in pavements to be resealed.
- Presence of uncured patching materials, crack sealing, etc.
- Presence of porous patches in surface to be resealed.
- Significant variations in surface texture requiring corrective treatment before resealing.
- Inadequate repair of weak or cracked pavements.
- Inadequate curing of primed surfaces prior to sealing.

- Inadequate curing of primersealed pavements (generally a minimum of 12 months for cutback bitumen primerbinders) prior to resealing.

Preparation of Pavement Surface: Before the application of primer, primerbinder or binder, the pavement surface shall be swept by the use of a rotary road broom or suction broom to provide a uniformly clean surface. If necessary, additional sweeping shall be done by hand, using stiff brooms. Sweeping shall extend at least 300 mm beyond each edge of the area to be sprayed. Where sealing work is carried out on localised areas and/or half pavement widths, any remaining loose material immediately adjacent to the swept areas shall be removed from the pavement surface.

Adherent patches of foreign material shall be removed from the surface of the pavement. Raised pavement markers shall be removed.

Pavement Temperature and Weather Conditions: The Contractor shall measure and record pavement temperatures at regular intervals during the course of the work using appropriate equipment and measurement procedures.

If the pavement is partly in sun and partly in shade, the temperatures for both conditions shall be taken and recorded. The lower recorded temperature shall be used as a basis for decisions on suitability for spraying and selection of cutter oil proportions.

Spraying primers, primerbinders and binders should only be undertaken if the pavement temperature has been at or above for the temperature shown in Table B1 at least one hour before commencement of spraying and does not fall below the recommended minimum pavement temperature during the period of spraying. Spraying at temperatures below that recommended shall only be undertaken where the risk of poor bitumen adhesion can be adequately managed through suitable type and proportion of cutter oil, traffic control, speed of aggregate covering, rolling and aftercare of completed work.

Spraying shall not be carried out on a wet pavement, while rain appears imminent or during strong winds or dust storms.

Surfaces to be primed should be surface dry, and no more than damp to the depth of pavement penetration.

Surfaces to be primersealed should be damp, but not wet. If necessary, the pavement surface may be lightly watered shortly before applying the primerbinder.

Surfaces to be sealed should be dry and clean.

Environmental Risk: The risk of environmental damage due to primer or primerbinder being washed off into adjacent drains and open watercourses as a result of rain on uncured materials must be considered as an element of an overall risk management plan. A guide to the risk of primer or primerbinder wash-off as a result of rain within stipulated periods after spraying is shown in

Table B1 Minimum pavement temperature

Type of work	Minimum pavement temperature
Priming	10°C
Primersealing	10°C
Sealing: – Class 170, Class 320 bitumen, Multigrade binder or bitumen emulsion – PMB binder (hot)	15°C 20°C

Table B2 Priming Primersealing Risk Assessment

(From: Guidelines for Environmental Management when Spraying Bituminous Materials, AAPA HS&E Guide No 8)

(a) Cutback bitumen				
Weather conditions (Note 2)	Risk of wash-off in the event of rain within the stipulated periods after spraying (Note 1)			
	0–12 hours	12–24 hours	24–48 hours	Over 48 hours
Fine, sunny, warm/hot	Moderate	Moderate	Low	Low
Fine, overcast, cool/warm	High	Moderate	Low	Low
Damp, overcast, warm	High	High	Moderate	Moderate

(a) Cutback bitumen				
Weather conditions (Note 2)	Risk of wash-off in the event of rain within the stipulated periods after spraying (Note 1)			
	0–12 hours	12–24 hours	24–48 hours	Over 48 hours
Damp, overcast, cool	Unacceptable	High	High	Moderate
Wet, overcast, warm	Unacceptable	Unacceptable	High	High
Wet, overcast, cool	Unacceptable	Unacceptable	Unacceptable	Unacceptable
(b) Bitumen emulsions				
Weather conditions (Note 2)	Risk of wash-off in the event of rain within the stipulated periods after spraying (Note 1)			
	0–12 hours	12–24 hours	24–48 hours	Over 48 hours
Fine, sunny, warm/hot	Moderate	Low	Low	Low
Fine, overcast, cool/warm	Moderate	Low	Low	Low
Damp, overcast, warm	High	Moderate	Low	Low
Damp, overcast, cool	High	Moderate	Moderate	Moderate
Wet, overcast, warm	Unacceptable	High	High	Moderate
Wet, overcast, cool	Unacceptable	Unacceptable	Unacceptable	High
<ol style="list-style-type: none"> 1. The risk levels reflect the likelihood of a wash-off from granular pavements on moderate grades with typical crossfall. For roads on steep grades, or with abnormal crossfall, or with low porosity base course, the risk of wash-off is higher than that shown. 2. Typical temperatures associated with different weather conditions are: Hot = 25°C, Warm = 15–25°C, Cool = 15°C. 3. Where risk is classified as unacceptable, application should be delayed until conditions improve. 4. Where risk is classified as high, application should be delayed or the application and curing supervised continuously until dry. Precautionary measures include blocking of stormwater entry points, placing of spill response equipment, regular weather checks and frequent inspections. 5. Where risk is classified as moderate, inspections must be frequent enough to respond to rain events. Stormwater entry points should be blocked and spill response equipment available on site. 6. Where risk is classified as low, inspections may be less frequent but weather should be monitored to ensure prompt response to rain events. 				

Preparation of aggregates

Precoating of Aggregate: Aggregate shall be either:

- Precoated at the quarry, or on site, and stockpiled for later use, or
- Precoated on site, immediately prior to use.

Advance precoating is preferred and shall be done with a bitumen-based material that leaves a thin film of bitumen adhering to the aggregate. Bitumen based materials may be a mixture of bitumen, flux oil/cutter oil and adhesion agent or bitumen emulsion specifically formulated for use as aggregate precoating material. Bitumen/flux oil mixtures shall be cured for a minimum of one week before use. Precoated aggregates that have been stockpiled for more than one month shall be re-assessed for effectiveness of precoating and possible rejuvenation before use.

Precoating on site, for immediate use, shall be done with either flux oil, flux oil/cutter oil mixture, cutter oil or bitumen emulsion specifically formulated for use as aggregate precoating material. Adhesion agent shall be added to oil based precoating materials at the rate of 1% by volume when aggregates are damp or the weather conditions are unfavourable with rain threatening or humid conditions.

The aggregate precoating agent shall be applied to the aggregate in a manner and at a rate and time which will provide a complete, light, uniform, effective cover of all aggregate particles at the time of spreading.

A guide to rates of application on clean, dry aggregates is given in Table B3. Dusty or dirty aggregates require a heavier rate of precoating than clean dry aggregates of the same type and size. For porous aggregates, rates may need to be increased by up to 2 L/m³, and for smooth, hard aggregates,

reduced by up to 2 L/m³, from the values shown in Table B3. Generally, bitumen based materials and emulsions require heavier rates of application than oil based precoating materials.

Field precoating of aggregate for immediate use shall not be carried out when rain is imminent. If aggregate has been precoated and rain appears imminent, the aggregate shall be adequately covered to prevent the fresh precoating material being washed from the aggregate particles.

The Contractor shall take precautions, such as covering stockpiles, to prevent settlement of dust, penetration of moisture or drying out of the precoating material on the stockpiled aggregate.

Table B3 Typical precoating rates (L/m³)

Aggregate Condition	Precoating material	
	Bitumen based, including bitumen emulsions	Oil based
Clean	6 to 12	4 to 10
Dirty	8 to 14	6 to 12

PREPARATION OF BITUMEN BINDER

Proportion of Cutter Oil: The Contractor shall determine and record the proportion of cutter oil required for each sprayer load. Tables B4 and B5 provide a guide to the proportions of cutter oil for Class 170 or 320 bitumen, multigrade binder and polymer modified binders, respectively.

Adding Cutter Oil: Binder shall be within the temperature range shown in Table B6 when cutter oil is incorporated. The sprayer load of cutback bitumen shall be circulated at a rate of at least 700 litres/min (approximately 350 rpm) for a minimum of twenty minutes before spraying.

Care shall be taken to ensure that any material that is to be added to hot binder is free of moisture. Materials considered at risk from moisture contamination, for example drummed materials stored in the open, should be checked with a water-finding paste before use. When adding cutter oil to standard bitumen binders, risks associated with moisture can be reduced by placing the cutter oil, without being previously heated, into the sprayer, followed by the hot bitumen.

When adding cutter oil to polymer modified bitumen binders, including crumb rubber binder, the cutter oil shall be added to the hot binder.

If a part sprayer load of field prepared cutback bitumen is unused on the day of mixing, and needs to be returned to the heater tanks, it shall be placed in a tank reserved for that purpose. No bitumen or cutter oil shall be added to the returned cutback bitumen unless the tank is fitted with an effective circulation system. When the returned cutback bitumen is subsequently used as part of a sprayer load, allowance shall be made for the cutter oil contained in the returned cutback bitumen.

Cutback bitumen shall be within the temperature range shown in Table B7 at the time of spraying. Spraying temperatures for proportions of cutter oil between those shown in the table may be established by interpolation.

Adding Flux Oil: Where flux oil is to be included, it shall be added to the bitumen in the sprayer and the mixture circulated at a rate of at least 700 litres/min for 20 minutes before spraying. Care shall be taken to ensure that flux oil that is to be added to hot binder is free of moisture.

Adding Bitumen Adhesion Agent

Where bitumen adhesion agent is to be included, it shall be added to the bitumen in the sprayer and the entire mixture circulated at a rate of at least 700 litres/min for 20 minutes, after addition of the last component, before spraying.

Where bitumen containing adhesion agent is not used within 8 hours of mixing with hot bitumen, the active contribution of adhesion agent shall be ignored in subsequent use of the bitumen material. Allowance shall, however, be made for the oil component of the adhesion agent in the returned bitumen.

Table B4 Basic Cutting Practice for Class 170 Bitumen and Multigrade Binder

(Parts by volume of cutter oil to be added to bitumen measured at 15°C)

Aggregates of 10 mm nominal size or larger				Aggregates of 7 mm nominal size or smaller			
Pavement temperature (°C)	Traffic (vehicles/lane/day)			Pavement temperature (°C)	Traffic (vehicles/lane/day)		
	<100	100–1500	>1500		<100	100–1500	>1500
15-19	10	8	6	15-19	12	10	8
20–25	8	6	4	20–25	10	8	6
26–32	6	4	2	26–32	8	6	4
33–38	4	2	0	33–38	6	4	2
39–45	2	0	0	39–45	4	2	0
>45	0	0	0	>45	2	0	0

1. Rates are based on fine, stable weather conditions and active, freshly applied or partially dried oil or bitumen precoating.
2. For dry or inactive precoating, add 2 parts except for heavy traffic and high pavement temperatures.
3. For damp aggregates, add 2 parts, except for heavy traffic and high pavement temperatures.
4. For periods of falling temperatures, add 2 parts or up to 4 parts if very cold overnight temperatures are expected to follow.
5. Add a further 2 parts of cutter oil for pavement temperatures below 15°C, provided that sprayed sealing work should not be carried out at temperatures below 10°C.
6. Subtract 5°C from measured pavement temperature for wind chill and fresh breeze. Cease spraying in strong winds.
7. In double/double seals, where the second application is to be applied the same day, or without any significant period of trafficking, it is undesirable to include any cutter oil in the first binder application. If cutter oil is considered necessary, it should be a maximum of 2 parts.
8. Where cutter proportions are added as percentage of total binder, the proportions shown here as parts per 100 parts of bitumen may be taken as a reasonable approximation of percentage by volume.
9. Where pavements are not intended to carry normal design traffic for a period of time after sealing, the proportion of cutter oil may be varied to reflect the conditions likely to prevail at the time of opening to traffic.

Table B5 Guide to Cutting Practice for PMBs used in SAM and HSS Applications 1, 2

(Parts by volume of cutter oil to be added to 100 parts by volume of PMB-measured at 15°C) (Note 3)

Pavement Temperature ⁴ (°C)	Traffic (veh/lane/day)	Class of PMB				
		S15E	S20E S25E	S35E	S45R S50R5, 6	S55R5, 6
20 to 25	<1000	6-8	8	6	10	12
	≥1000	6	6-8	4	8	10
26 to 32	<1000	4-6	6	4	8-10	10-12
	≥1000	4	4-6	2	6-8	8-10
33 to 38	<1000	4	4-5	2	6-8	8
	≥1000	2	3-4	2	6	6-8
39 to 45	<1000	Min 2	Min 3	0-2	4-6	6
	≥1000				4-6	4-6
> 45	All	Min 2	Min 3	0-2	Min 4	Min 5

1. In SAMI applications, where the seal is to be covered by asphalt within a short period, it is undesirable to include any cutter oil at all. If cutter oil is considered necessary, it should be a maximum of 2 parts of cutter oil to 100 parts of PMB. Similar provisions apply to the first binder application of a double/double seal where the second application is to follow the same day, or within a short period.

2. In aggregate retention applications using lower levels of polymer modification ie. S10E, S40R, and some proprietary blends of PBD, the binder should be cut back as per normal Class 170 bitumen

3. Where cutter proportions are added as percentage of total binder, the proportions shown here as parts per 100 parts of PMB may be taken as a reasonable approximation of percentage by volume.

4. Pavement temperature should generally be based on the worst condition, i.e., shaded areas.

5. Pre-blended crumb rubber grades may contain process oil used in their manufacture. This oil will most likely reduce the viscosity compared to field blended grades, and may allow a small reduction, say 2 parts, in added cutter oil compared to field produced grades.

6. At high rates of application of binder (greater than say 2 L/m²) the proportion of cutter oil may be reduced by 2 parts.

Table B6 Binder Temperature

Binder	Temperature range (°C)
Bitumen Class 170, Multigrade 600/170	160–180
Bitumen Class 320	170–190
PMB	Within a range of 10°C below the maximum recommended application temperature

Table B7 Cutback Bitumen Spraying Temperature

AS Grade (if applicable)	Equivalent Cutter Oil (%)	Temperature Range (°C)
AMC 00	56	ambient
AMC 0	44	35–55
AMC 1	34	60–80
AMC 2	27	75–100
AMC 3	21	95–115
AMC 4	16	110–135
AMC 5	11	120–150
	9	130–155
AMC 6	7	135–160
	5	145–170
AMC 7	3	150–175
	2	155–180

Application of primer, primerbinder and binder

General: The area to be sprayed with primerbinder or binder shall be limited to the area that can be covered with aggregate within fifteen minutes of spraying.

Primer and Primerbinder: The class and grade of primer and primerbinder shall be as specified in the Schedule of Details.

Application rates and quantities of primer and primerbinder shall apply to the mixture, including cutter oil or the water content of bitumen emulsion, measured at 15°C.

After application of a primer, a period of at least forty-eight hours, or such longer period as determined to be necessary for the primer to become completely dry, shall elapse before the binder for a seal is applied. All traffic shall be kept off the primed surface.

Where it is necessary to give traffic limited access to the primed surface, the surface shall have a light layer of grit applied to avoid pickup. Gritting shall not be applied until a substantial proportion of the primer has been absorbed into the pavement.

Binder: The class or type of bitumen, modified bitumen, cutback bitumen, or bitumen emulsion shall be as specified in the Schedule of Details.

Nominated and target application rates and quantities of binder shall be based on the volumes of bitumen measured at a temperature of 15°C and shall not include any adhesion agent and/or cutter oil or the water content of emulsions. If flux oil has been added to the bitumen, the quantity of flux oil shall be included as part of the binder.

Where adhesion agent and/or cutter oil have been added to the binder, the application rate of the total binder at 15°C shall be adjusted to allow for the quantities of adhesion agent and/or cutter oil in the mixture.

The Contractor shall determine the forward speed of the bitumen sprayer based on either:

- the hot application rate of total binder, including adhesion agent and/or cutter oil, or
- allowances for temperature and proportion of adhesion agent and cutter oil, measured at 15°C.

Volume correction factors for converting volume of bituminous binders from 15°C to elevated temperature, or from elevated temperature back to 15°C are shown in Tables B8 and B9.

Table B8 Volume Conversion Table – Bitumen (Including cutback bitumen)

MULTIPLY BY "A" TO REDUCE VOLUME AT T _o TO VOLUME AT 15 _o MULTIPLY BY "B" TO INCREASE VOLUME AT 15 _o C TO VOLUME AT T _o					
Multiplier A	Temp. °C T	Multiplier B	Multiplier A	Temp. °C T	Multiplier B
.9856	38	1.0146	.9537	90	1.0486
.9844	40	1.0158	.9524	92	1.0500
.9831	42	1.0172	.9512	94	1.0513
.9819	44	1.0184	.9500	96	1.0526
.9806	46	1.0198	.9488	98	1.0540
.9794	48	1.0210	.9476	100	1.0553
.9782	50	1.0223	.9464	102	1.0566
.9769	52	1.0236	.9452	104	1.0580
.9757	54	1.0249	.9440	106	1.0593
.9745	56	1.0262	.9428	108	1.0607
.9732	58	1.0275	.9416	110	1.0620
.9720	60	1.0288	.9404	112	1.0634
.9708	62	1.0301	.9392	114	1.0647
.9695	64	1.0315	.9380	116	1.0661
.9683	66	1.0327	.9368	118	1.0675
.9671	68	1.0340	.9356	120	1.0688
.9659	70	1.0353	.9344	122	1.0702
.9646	72	1.0367	.9332	124	1.0716
.9634	74	1.0380	.9320	126	1.0730
.9622	76	1.0393	.9308	128	1.0743
.9610	78	1.0406	.9296	130	1.0757
.9597	80	1.0420	.9284	132	1.0771
.9585	82	1.0433	.9272	134	1.0785
.9573	84	1.0446	.9260	136	1.0799
.9561	86	1.0459	.9249	138	1.0812
.9549	88	1.0472	.9237	140	1.0826
.9225	142	1.0840	.9049	172	1.1051
.9213	144	1.0854	.9037	174	1.1066
.9201	146	1.0868	.9025	176	1.1080
.9189	148	1.0883	.9014	178	1.1094
.9178	150	1.0896	.9002	180	1.1109
.9166	152	1.0910	.8990	182	1.1123
.9154	154	1.0924	.8979	184	1.1137
.9142	156	1.0939	.8967	186	1.1152
.9130	158	1.0953	.8956	188	1.1166
.9119	160	1.0966	.8944	190	1.1181
.9107	162	1.0981	.8933	192	1.1195
.9095	164	1.0995	.8921	194	1.1209
.9084	166	1.1009	.8909	196	1.1224
.9072	168	1.1023	.8898	198	1.1239
.9060	170	1.1038	.8886	200	1.1253

Table B9 Volume Conversion Table – Bitumen Emulsion

HOT LITRES x A = COLD LITRES (at 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	1.0000	15	1.0000	1.0000	15	1.0000
.9998	16	1.0002	.9977	20	1.0023	.9974	20	1.0026
.9989	18	1.0011	.9951	25	1.0049	.9948	25	1.0052
.9980	20	1.0020	.9924	30	1.0076	.9921	30	1.0079
.9971	22	1.0029	.9899	35	1.0102	.9895	35	1.0106

HOT LITRES x A = COLD LITRES (at 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
.9962	24	1.0038	.9872	40	1.0129	.9868	40	1.0134
.9953	26	1.0047	.9840	46	1.0162	.9837	46	1.0166
.9944	28	1.0056	.9830	48	1.0172	.9826	48	1.0177
.9935	30	1.0065	.9819	50	1.0184	.9816	50	1.0187
.9926	32	1.0074	.9809	52	1.0194	.9805	52	1.0199
.9917	34	1.0083	.9798	54	1.0206	.9794	54	1.0210
.9908	36	1.0092	.9788	56	1.0216	.9783	56	1.0222
.9899	38	1.0102	.9777	58	1.0228	.9773	58	1.0232
.9890	40	1.0111	.9767	60	1.0238	.9762	60	1.0244
.9881	42	1.0120	.9752	62	1.0254	.9751	62	1.0255
.9872	44	1.0129	.9746	64	1.0260	.9740	64	1.0267
.9863	46	1.0138	.9736	66	1.0271	.9730	66	1.0277
.9854	48	1.0148	.9725	68	1.0282	.9719	68	1.0289
.9845	50	1.0157	.9715	70	1.0293	.9709	70	1.0300
.9836	52	1.0166	.9704	72	1.0305	.9698	72	1.0311
.9827	54	1.0176	.9693	74	1.0316	.9687	74	1.0323
.9818	56	1.0185	.9683	76	1.0327	.9677	76	1.0334
.9809	58	1.0194	.9672	78	1.0339	.9667	78	1.0344
.9800	60	1.0204	.9662	80	1.0349	.9656	80	1.0356
.9791	62	1.0213	.9651	82	1.0361	.9643	82	1.0370
.9782	64	1.0222	.9640	84	1.0373	.9630	84	1.0384
.9773	66	1.0232	.9630	86	1.0384	.9616	86	1.0399
.9764	68	1.0241	.9619	88	1.0396	.9603	88	1.0413
.9755	70	1.0251	.9608	90	1.0407	.9590	90	1.0427

Application of sprayed bituminous surfacing

Plant: A mechanical sprayer shall be used to apply primer, primerbinder and binder. The sprayer shall have a current Sprayer Certificate issued by a NATA accredited testing authority. A copy of the test certificate shall be kept with the sprayer.

A register of accredited sprayers is maintained by AAPA and available on the AAPA Web Site (www.aapa.asn.au).

The spray nozzles shall be of the make and type endorsed on the Sprayer Certificate. Any nozzles that may be damaged or become unduly worn or defective shall be replaced.

Mechanical spreading equipment shall be used to spread aggregate and shall be capable of achieving a uniform spread rate.

Rollers shall be pneumatic tyred multi-wheel rollers with a minimum mass of 7 tonnes, smooth tyres and a minimum tyre pressure of 550 kPa, or combination rollers having a rubber coated, vibratory drum on one axle and pneumatic tyres on the other.

Rollers must be capable of achieving effective incorporation of aggregate into the binder without breakdown or crushing of the cover aggregate.

The Contractor shall remove from the work any plant or equipment not fully operational or not in a satisfactory condition for carrying out work in accordance with this Worksection.

Operation of the Sprayer: The type of spray nozzles to be used on the spray bar of the sprayer shall be compatible with the nature of the binder to be sprayed and its application rate.

Where the longitudinal edges of spray runs are not required to overlap, either special type end nozzles or intermediate nozzles set with a jig as end nozzles may be used. Where an overlap is required, the overlap of spray between adjacent longitudinal runs shall be 50 mm for special type end nozzles or jig set intermediate nozzles. Where intermediate nozzles, set in the normal manner, are to be used to overlap adjacent longitudinal sprays, the overlap shall be 300 mm.

The spraying of primer, primerbinder or binder for each run of the sprayer shall commence on a protective strip of heavy paper laid across, and held securely to, the pavement surface beforehand.

The sprayer shall commence moving at a sufficient distance in advance of the protective strip to ensure that the road speed for correct application is attained at the commencement of spraying.

The sprayer shall maintain a constant road speed throughout the length of each sprayer run.

The spraying for each run shall terminate on protective paper laid across, and held securely, to the pavement surface beforehand.

Spraying shall cease immediately any defect develops in the spraying equipment and the fault rectified before further spraying.

Where any blockage or partial blockage of nozzles occurs, spraying shall cease immediately. Spraying shall not recommence until the cause of the blockage is identified and rectified.

Areas not within 5 percent of the target application rate of primer, primerbinder or binder shall constitute a 'Non-conformance' under the Contract.

Where a mechanical sprayer is not able to satisfactorily spray small areas or areas of irregular shape, such areas shall be sprayed by means of the hand spray equipment attached to the sprayer.

After each sprayer run, the quantity of binder sprayed shall be checked against the area covered. If the actual application rate is not within specified limits, adjustments shall be made to ensure that the target application rate is achieved in subsequent runs.

Temperature: The Contractor shall measure and record the temperature of the binder.

If the temperature of the bituminous material is below the applicable lower limit from Tables B6 or B7, the bituminous material may be heated provided that safe heating practices are adopted. All heating activities shall comply with the Austroads *Bitumen Sealing Safety Guide*.

Burners shall not be used unless the level of the material in the heating tank is at least 150 mm above the tops of the heating tubes, or as indicated by the manufacturer of the equipment. Two or more suitable fully charged pressurised chemical fire extinguishers shall be placed conveniently to the heaters at all times while heating is in progress.

During heating, the temperature of the bituminous material shall not exceed the applicable upper limit from Tables B6 or B7. The rate of heating shall not exceed the rate shown in Table B10. Materials shall be circulated at all times while heating and for a further minimum of 15 minutes after burners are turned off.

Table B10: Maximum Heating Rate for Bituminous Materials

Material	Maximum Heating Rate (°C/hr)
Bitumen & Multigrade binder	40
Cutback Bitumen:	
– Priming grades	30
– Primersealing grades	30
– Sealing grades	30
Crumb rubber bitumen	40
Polymer modified binder	Refer manufacturer's recommendations
Bitumen emulsion	15

Geotextile: Geotextile shall be applied where nominated in the Schedule of Details. The geotextile shall be fixed to the pavement smoothly and without wrinkles, using a tack coat of up to 0.8 L/m² (residual) of Class 170 bitumen. The rate of application of tack coat is included in, and not additional to, the overall design binder application rate for the geotextile reinforced seal (including allowances for surface texture and absorption by the fabric).

Joins shall be butt joined or overlapped by a minimum of 200 mm as specified in the schedule of details. Longitudinal joins shall not be placed in wheel paths.

Work Records: The Contractor shall record details of the work performed. Details of primer, primerbinder, binder and aggregate applied shall be recorded immediately after every sprayer run. Each form shall be signed by the Contractor's representative as a true record of the work performed. The Contractor shall supply to the Superintendent a copy of each completed form.

Control of Traffic: The Contractor shall provide for traffic in accordance with the requirements of AS 1742.3 and SAA B 81.6 while undertaking the work and shall take all necessary precautions to protect the work from damage until such time as the new seal coat has developed sufficient strength

to carry normal traffic without disturbance of the aggregate. Where early use of the new seal is needed to facilitate the movement of traffic, vehicles may be allowed to run on the work after initial rolling has taken place provided that vehicles are controlled to such slow speeds that no displacement of aggregate occurs. Where necessary, the Contractor shall use patrol vehicles to ensure that traffic travels at an acceptable speed.

The Contractor shall take all necessary steps to avoid or minimise delays and inconvenience to road users during the course of the work. Where adequate detours or sidetracks are included in the Contract or are otherwise available, traffic shall be temporarily diverted while the work is in progress.

If facilities for the diversion of traffic are not available, the Contractor shall spray part width of the pavement in the one operation and make available to traffic the adjacent strip of roadway or schedule spraying operations in such a manner so as to restrict traffic delays to a maximum of 15 minutes. All traffic movement through the work shall cease during the actual spraying operation.

Detailed records of traffic control including control device type, precise location of device and the time at which such device was installed and removed; should be maintained throughout the works and then kept on file.

Spreading and rolling of aggregate: Spreading of aggregate shall proceed as close as practical after spraying of the binder has commenced and shall be completed within fifteen minutes of spraying.

The Contractor shall apply the aggregate of the specified nominal size and at the target aggregate application rate. The method to determine the actual aggregate spread rate shall be detailed in the Quality Plan. Sufficient loaded and measured trucks of aggregate shall be at the site to provide full cover for the area sprayed.

The aggregate shall be spread uniformly over the sprayed surface by means of suitable mechanical spreading equipment.

Spreaders should be calibrated with aggregate from the stockpile to be used for the work. Calibration is best done off-road. A calibration site needs to be of sufficient length to allow the aggregate spreading unit to reach normal operational speed before applying the aggregate. Calibration can be done with standard calibration mats or by painting 1 m² areas on the test site. The total width of the aggregate spreader must be calibrated.

Any bare or insufficiently covered areas shall be re-run by the mechanical spreader or covered by hand as necessary to give a uniform and complete coverage. Any local excess of aggregate shall be removed before rolling is commenced.

Sufficient rollers shall be supplied to ensure that total area sprayed receives the minimum coverage (roller hours) derived from Table B11. Adequate time must be allowed at the end of the day's work to ensure that the last materials spread receive the same amount of rolling as that placed earlier in the day.

After the aggregate has been applied to each section of the work, initial rolling shall be carried out with one or more rollers complying with Application of primer, primerbinder and binder.

Initial rolling shall continue until the aggregate is firmly adhered to the primerbinder or binder.

The amount of rolling shall be reduced while the aggregate is wet, but normal rolling resumed as soon as aggregate dries. Trafficking during this period must be avoided, or kept to a minimum speed, until aggregate has dried sufficiently for adhesion to be established.

Table B11 Area that can be effectively rolled, per hour, with each pneumatic tyred multi-wheel roller.

Aggregate size (mm)	Traffic Volume (vehicles per lane per day)		
	< 300	300–1200	> 1200
	Area – m ² per roller hour		
7 or smaller	4500–5000	5000–5500	5500–6000
10	3000–3500	3500–4000	4500–5000
14	2500–3000	3000–3500	3500–4000

If the aggregate is not evenly distributed over the surface of the pavement, the surface shall be traversed with a light drag broom after the initial rolling. If the broom has any tendency to dislodge aggregate particles bedded in the primerbinder or binder, the Contractor shall defer or eliminate the drag brooming. Where drag brooming is eliminated, the Contractor may substitute light hand brooming.

Backrolling shall then be carried out until the effective amount of rolling in terms of roller hours for the total area sprayed achieves that shown in Table B11.

When the aggregate has been evenly distributed and adhered to the binder, any remaining loose particles of aggregate shall be removed from the pavement.

Variation to spreading and rolling procedures shall be applied to different types of seals as follows:

- Single/single seals A single application of aggregate shall be applied on a single application of binder and then the seal is rolled and, where necessary, brooming shall be carried out as described above.
- Single/double seals In a single/double seal, the second application of aggregate is applied after initial rolling of the first application, and before final rolling and trafficking.
- Double/double seals Where both applications of binder and aggregate are to be applied on the same day, the first application of binder and aggregate shall be completed as described above, except that the aggregate application is reduced by approximately 10% compared to that required for a single/single seal. The second application of aggregate, following the second application of binder, shall be applied at a rate that is just sufficient to fill the voids in the first application, and rolling and removal of any remaining loose aggregate completed as described above. Where the binder in the first application is a bitumen emulsion, the second application must not be applied until the binder in the first coat is completely broken to form a stable seal.

Where the first application of a double/double seal is to be trafficked for a short period of time, generally not exceeding several weeks, the first application shall be completed as a single/single seal and the aggregate in the second application reduced by about 30% to occupy the voids in the first application.

Where the second application is applied after a significant period of trafficking, both applications shall be completed as single/single seals.

12 ANNEXURE C

12.1 NOTES FOR IMPLEMENTATION AND USE OF SPECIFICATION CLAUSES

HEADINGS BELOW INCLUDE CLAUSE NUMBER AND CLAUSE TITLE OF CLAUSE IN THE MAIN BODY OF THE WORKSECTION BEING DISCUSSED.

Scope

General: The worksection covers the supply of materials and application of sprayed sealing. It is generally applicable to contract works where the Principal defines the type of treatment required and the Contractor undertakes those activities associated with supply of materials, determination of application rates of binder and aggregate, preparation and spraying of binder, preparation and application of aggregates, rolling of aggregates and clean-up of completed work. Where some of the activities described in this worksection are undertaken by others, responsibility for the relevant items must be clearly defined in the scope of works.

This worksection will normally be used as contract documentation in conjunction with a standard General Conditions of Contract such as AS 2124. Contract documentation may also include other works. The terms used in the worksection guidelines are generally consistent with AS 2124, and include Principal, Superintendent, and Superintendent's Representative. Where these terms are in conflict with those otherwise used, a general interpretation clause should be inserted in the contract documents.

Schedule of Details: The type of seal, class and nominal size of aggregate and any special binder requirements should be specified in the Schedule of Job Details – See Annex A.

Careful consideration of the Schedule of Job Details is required to ensure that the sprayed seal is of the appropriate type and quality, and provided in a cost effective manner.

Surface Preparation: Preparation of surfaces under this worksection is limited to preliminary sweeping and cleaning of surfaces immediately prior to spraying of bituminous material. The scope of work does not include preparation of granular pavements for priming or primersealing, rectification or maintenance of surfacings prior to resealing or the reinstatement of linemarking, raised pavement markers, etc.

Surface preparation is extremely important to the success of sprayed sealing work. Granular pavements should be prepared to a smooth dense surface and dried back to a suitable moisture

content (typically 70% of saturation level) to avoid weakening of the granular pavement with trapped moisture. Preliminary work for retreatment of existing surfacings should be carried out well in advance of sealing work (typically six weeks or more). Embedment of aggregate and variable texture of patches is a major cause of blemishes in finished work. Effective application of sprayed seals requires an underlying surface of uniform texture. Corrective treatments may be required for variable surfaces prior to, or in conjunction with sprayed sealing treatments.

Notes on the preparation of pavements are provided in Annexures A and B. Further detailed guidance for the selection of sprayed seal treatments and preparation of surfaces is provided in the *Austrroads Guide to the Selection of Road Surfacing*s, *Austrroads Sprayed Sealing Guide*, *Austrroads Specification Framework for Polymer Modified Binders*, *Austrroads Provisional Specification for Multigrade Binders*, *Austrroads Guidelines for the Selection and Use of Modified Binders* and various *Austrroads/AAPA Pavement Work Tips*.

Quality Systems

The quality requirements of Quality are design to apply the AUS-SPEC quality system requirements.

The following paragraphs may be substituted if desired:

'The Contractor shall establish, implement and maintain a Quality System in accordance with this worksection and the requirements of AS/NZS ISO 9001:2000, or a recognised equivalent.'

'Where required in the Contract general clauses, the Contractor shall submit a Quality Plan prior to commencement of any works. The Quality Plan shall take into account the specific requirements for inspection and testing, acceptance/rejection criteria, details of proposed methods and other quality requirements that are contained in the Contract Documents. Appendix B provides Guidelines for process items which may be included in the Quality Plan. No part of the Quality System shall be used to pre-empt or otherwise negate the technical requirements of the Contract Documents.'

Depending on project type and performance risk, the Principal may undertake an audit of a Contractor's Quality System and/or Quality Plan as part of prequalification or contract acceptance procedures. The Principal may also establish additional procedures for surveillance of contract activity and audit/verification of quality of materials and testing.

12.2 MATERIALS

Bituminous materials: The type and/or grade of primer, primerbinder or binder should be specified in Annex A Schedule of Details.

Cutback bitumen for priming and primersealing (and occasionally for sealing) may be specified in terms of the following alternatives:

- standard grades of cutback bitumen manufactured to comply with AS 2157 – Cutback Bitumen;
- cutback bitumen produced in the field by blending Class 170 bitumen with an appropriate type and proportion of cutter oil in a bitumen sprayer, tanker, etc.;
- proprietary grades of cutback bitumen;
- standard grades of bitumen emulsion complying with AS 1160 – Bitumen Emulsions for Construction and Maintenance of Pavements;
- proprietary grades of bitumen emulsion.

Suppliers of proprietary products should be required to submit their own product specifications for use as a basis for quality control.

Depending on their viscosity, standard grades of cutback bitumen are classified as follows:

- Priming classes (AMC00, AMC0, AMC1);
- Primersealing classes (AMC2, AMC3, AMC4);
- Sealing classes (AMC5, AMC6, AMC7).

When used for primersealing, an adhesion agent (usually 1%) should be added to cutback bitumen primerbinders. Adhesion agents may also be added to priming classes, although this is not mentioned in AS 2157.

A guide to the properties of cutback bitumen is provided in Tables C1 and C2. Table C1 provides a guide to the proportions of cutter oil required for field preparation of cutback bitumen. Table C2 provides a guide to practical grades of cutback bitumen primer and primerbinder for various applications based on the viscosity of the binder.

The selection of particular priming and/or primersealing products should be based on field trials or experience. Guidance on the selection of grade and application rate of primer and primerbinder is given in Design of spray seals.

Generally, Class 170 (also Class 320) bitumen is used as the binder for sprayed sealing work with the addition of cutter oil as required, depending on ambient conditions. Modified binders, as well as bitumen emulsion, may also be used. Guidance on the selection of modified binders and other binders for special application is provided in the references outlined in Scope, above.

The use of standard grades of cutback bitumen for sealing is uncommon, as sealing binders are generally prepared at the time of application with the proportion of cutter oil adjusted to the ambient conditions at that time.

Table C1 Field preparation of medium curing cutback bitumen

Class (AS 2157 designation)		Approx. parts kerosene per 100 parts bitumen (vol. at 15°C)	Equivalent percent of kerosene (vol. at 15°C)	Viscosity at 60°C (Pa.s)
Precoating and priming classes	AMC00	127	56	0.008–0.016
	AMC0	78	44	0.025–0.05
	AMC1	51	34	0.06–0.12
Primersealing classes	AMC2	37	27	0.22–0.44
	AMC3	27	21	0.55–1.10
	AMC4	19	16	2.0–4.0
Sealing classes	AMC5	12	11	5.5–11.0
	AMC6	7	7	13.0–16.0
	AMC7	3	3	43.0–86.0

Table C2 Grades of primers and primerbinders

Grade	Viscosity Range Pa.s @ 60°C
Primer:	
– Very light	0.010–0.020
– Light	0.025–0.050
– Medium	0.050–0.080
– Heavy	0.080–0.200
– Very Heavy	0.200–0.400
Primerbinder:	
– Light / Medium	1.0–3.0
– Heavy	4.0–7.0

Aggregate: The worksection refers to AS 2758.2, which requires the user to select from a number of options for determination of aggregate hardness and soundness. These options tend to have been developed around the tests considered to provide the most suitable characterisation of the various stone types found in different localities. As a general rule, the standards are applied on a State by State basis as follows:

- Soundness based on Los Angeles Abrasion and Unsound Stone Content – Victoria and Western Australia.
- Soundness based on Ten Percent Fines Value and Wet/Dry Strength Variation – All other States.

AS 2758.2 provides for three classes of aggregate based on the following pavement classifications:

- Class A – premium quality aggregates suitable for freeways, highly trafficked highways or pavements carrying a high volume of heavy vehicles.
- Class B – aggregates suitable for highways or main roads carrying medium traffic volumes, medium to lightly trafficked pavements, general parking areas and similar.
- Class C – aggregates suitable for lightly trafficked roads.

The class of aggregate should be nominated in the schedule of details as well as the minimum value of polishing resistance (PSV or PAFV), if required. For general application, a minimum value of 48 should be specified for applications where Class A aggregates are required. No minimum value of PSV or PAFV is usually required for Class B or Class C applications. Surface friction requirements will vary according to the risks associated with operating environment or particular sites, which will also influence design factors associated with surface texture. This may lead to the adoption of higher or lower minimum polishing resistance values for some applications.

12.3 DESIGN OF SPRAY SEALS

General: A distinction is made between selection of treatment type and determination of application rates of binder and aggregate for a selected sprayed seal treatment type. The worksection requires the Contractor to determine rates of application using Austroads *Sprayed Seal Design Method Revision 2000*.

In the context of this worksection the Principal is required to nominate the treatment type as well as provide sufficient information for an accurate assessment of traffic volume for determination of binder application rates.

The traffic volume should be based on actual traffic counts, including the proportion and distribution of heavy vehicles. Where actual traffic counts are not available, or difficult or impractical to measure, a reasonable estimate should be made based on expected usage. Estimates of traffic should only be used for low volume roads. Actual measurement of traffic volumes is particularly important at high traffic volumes or where there is a large proportion of heavy vehicles. Traffic counts should also take into account seasonal variation such as local events, crop harvesting or seasonal tourist traffic. Generally, summer traffic volumes are more critical to design of application rates than winter traffic volumes.

Further critical inputs to determination of application rates using the Revision 2000 Method include condition and texture of the existing surface and measurement of aggregate properties.

Estimates of existing surface conditions and aggregate average least dimension (ALD) may be made by the Principal as a basis for determining nominal rates of application for tendering purposes. Before commencing spraying operations, nominal rates of application must be checked by the Contractor, and adjusted as necessary, based on actual measurement of surface texture and aggregate grading, shape and ALD determined from testing of materials sampled from stockpiles of the aggregates to be used on the work. Variations to texture within the job and use of corrective treatments must be noted. Aggregate properties must be determined on current materials and not be based on assigned values or estimates from previous work.

Geotextile Reinforced Seals: Binder application rates for geotextile reinforced seals should be determined in accordance with standard procedures (Revision 2000 Method) with an additional allowance for binder retained by the fabric. The amount of additional binder required will depend on the grade or thickness (mass) of the fabric and may vary between different manufacturers. Preferably, the amount of binder retained in the fabric should be determined by test. The Roads and Traffic Authority of New South Wales have developed a draft test method (T654) that details this process. An Austroads Test Method is also in the course of preparation. Typical allowances are shown in Table C3.

A minimum fabric mass of 130 g/m² is used for general sealing applications. On soft substrates, such as initial treatment on low quality granular base materials, heavier grades of fabric (175 g/m² to 200 g/m²) should be used to minimise the potential for aggregate to puncture the fabric, particularly when using aggregates of 14 mm nominal size, or greater.

Austroads *Guide to Geotextile Reinforced Seals*, covering both design and field procedures, is in course of preparation.

Priming: A guide to selection of grade of cutback bitumen primer and primer application rates is shown in the Table C4.

Standard grades of bitumen emulsion are generally not suitable for priming but proprietary grades have been developed that should be used in accordance with manufacturer's guidelines.

Primersealing: A guide to the selection of type and grade of primerbinder is shown in Table C5.

The aggregate size will depend on traffic and climatic conditions. For less than 1200 vehicles/lane/day, 5 mm or 7 mm size aggregate is appropriate, and for higher traffic situations use 7 mm or 10 mm size aggregate. However, if the conditions are either very hot or wet and the traffic is in excess of 600 v/l/d, a 10 mm size aggregate may be used. The use of 10 mm aggregate

may, however, result in a coarse texture that requires extra consideration in the placing of the subsequent seal.

There are no formal design procedures for primerbinder application rates for primerseals. Table C6 offers some practical guidelines. The basic primerbinder application rates shown may need to be adjusted in line with allowances for absorption, existing surface condition and embedment. Austroads Test Method SDT 05 – Penetration of road bases by bituminous primers or primerbinders, may also provide assistance in estimating pavement absorption.

The primerbinder application rates shown refer to the total volumes of the mixtures (i.e., including cutter oils and/or water content) expressed at 15°C.

Aggregate spread rates should be about 130 m²/m³ to 150 m²/m³ for 5 mm and 7 mm aggregates and 110 m²/m³ to 130 m²/m³ for 10 mm aggregates.

Table C3 Typical Geotextile Retention Allowances

Geotextile Grade	Retention Allowance (L/m ²)
130 - 140g/m ²	0.9 to 1.0
175 - 200g/m ²	1.1 to 1.3

Table C4 Guide to grade and rates of application of primer

Pavement	Primer	
	Grade	Rate of Application L/m ²
Tightly bonded	Light	0.6–1.1
Medium porosity	Medium	0.8–1.1
Porous	Heavy to Very heavy	0.9–1.3
Limestone	Heavy to Very heavy	2 applications: – 1st @ 0.7–0.9 – 2nd @ 0.5–0.7
Sandstone	Heavy to Very heavy	2 applications: – 1st @ 0.7–0.9 – 2nd @ 0.5–0.7
Hill gravels, granitic sands	Light	0.8–1.1
Stabilised	Very light to Light	0.5–0.8
Concrete	Very light	0.2–0.4

Table C5 Selection of type and grade of primerbinder

Primerbinder	Recommended Use
Light-medium grade of cutback bitumen	– Cool and/or damp conditions. – Tightly bonded or medium porosity type pavements.
Heavy grade of cutback bitumen	– Warmer and/or dry conditions – Porous type pavements.
Bitumen Emulsion (60% and 67% bitumen content)	– All year, but more suited to cool and/or damp conditions – Porous type pavements – When final surfacing is to be applied immediately or within 3 months.

Table C6 Basic primerbinder application rates

Traffic (v/l/d)	Aggregate Size	Total Primerbinder Application Rate (L/m ² @ 15°C)		
		Cutback Bitumen	Bitumen Emulsion	
			60%	67%
≤ 150	7 or 5	1.3	1.6	1.4
	10	1.4	1.8	1.6
151–1200	7 or 5	1.2	1.5	1.3
	10	1.3	1.6	1.4

Traffic (v/l/d)	Aggregate Size	Total Primerbinder Application Rate (L/m ² @ 15°C)		
		Cutback Bitumen	Bitumen Emulsion	
			60%	67%
> 1200	7 or 5	1.1	1.4	1.2
	10	1.2	1.5	1.3

12.4 APPLICATION OF SPRAYED SEALING

The worksection does not include detailed procedures for carrying out sprayed sealing work. A general guide to good practice is provided in the Appendix to the worksection. The detailed provisions of are not mandatory but it is expected that the Contractor will adhere to the principles described and incorporate relevant procedures in his own Quality Plan. A guide to evaluating and auditing of quality plans and surveillance of contract activity is provided in a separate document prepared jointly by Austroads and AAPA (AP-T32 – *Audit and Surveillance of Sprayed Sealing Contract Works*).

12.5 REMOVAL OF LOOSE AGGREGATE

Removal of loose aggregate can generally commence when initial aggregate adhesion and interlock has been completed by rolling and traffic, the binder has hardened to a state where no more aggregate can be pressed into it, and the seal is less prone to damage by sweeping.

Factors that influence the timing of aggregate removal include:

- Traffic volume/road class
- Type of binder
- Aggregate size
- Ambient temperature/pavement temperature

High traffic volumes will rapidly fix aggregates into the binder so that removal of surplus stones may commence within a few hours of spreading. High traffic volumes are also often associated with roads in urban areas and other situations where it is important to minimise risks associated with loose aggregate, so that removal is often undertaken within about 12 hours of spreading.

On lighter trafficked roads, a period of up to 48 hours may be allowed to elapse before completing the removal of excess aggregate, provided the safety of the travelling public is appropriately considered.

Polymer modified binders develop cohesion more rapidly, particularly at higher ambient temperatures, so that aggregate removal can often be undertaken on the same day.

Emulsion binders develop cohesion more slowly. Up to 48 hours curing may be necessary, in some circumstances, before sweeping can be undertaken without a high risk of damage to the seal.

Extra care is required at higher temperatures, particularly in sunny conditions and air temperatures of 30°C or more. In such circumstances it is preferable to undertake aggregate removal at night or early morning, when air and pavement temperatures are lower.

In urban areas, the use of a vacuum broom or suction sweeper to uplift and remove aggregate from site as well as removal from kerb and channel, adjoining paved areas, etc. should be specified. In rural areas, where loose aggregate can be safely swept onto unpaved verges, uplifting and removal of aggregate from site is generally not necessary.

12.6 REMOVAL OF SURPLUS AND WASTE MATERIAL

Special requirements for disposal of surplus aggregate at stockpile sites should be specified in additional clauses or included in the schedule of job details.

12.7 PROTECTION AND CARE OF NEW WORK

Generally the Contractor is responsible for protecting the new work and correction of any defects occurring within the defects liability period with the exception of damage caused by accident and other events outside the control of the Contractor.

12.8 SAMPLING AND TESTING

The worksection requires the Contractor to prepare a schedule for the nominated items. The Principal may, however, choose to specify test methods and minimum frequency of sampling and testing.

12.9 MEASUREMENT AND PAYMENT

The worksection provides for two alternatives, measurement by area only, or measurement of actual quantities used.

Measurement and payment by area may be used for straightforward works where conditions are readily identifiable at the time of tender.

Measurement by quantity of material supplied allows for variation in the design rates of application of binder and aggregate and compensation for actual amounts of cutter oil based on the conditions at the time of spraying. In such cases, the schedule may nominate provisional rates of application or quantities for tendering purposes, but incorporate schedule items for actual quantities or variations to rates of application. This type of payment schedule is particularly applicable to contracts incorporating a range of types or location of works.

Schedule items may also be included for other special items such as geotextiles, and for additional works such as reinstatement of raised pavement markers and linemarking, if required.

A typical schedule of rates is shown in Table C7.

Table C7 Typical Schedule of Rates

Activity	Unit	Rate
Control traffic to worksite	m ²	
Sweep surface prior to seal: – Gravel pavements – Sealed pavements	m ² m ²	
Supply and spray binder @ 15o C	Litre	
Supply, incorporate and spray cutter oil @ 15o C	Litre	
Supply, incorporate & spray Adhesion agent @ 15o C	Litre	
Remove existing raised pavement markers	each	
Protect existing raised pavement markers	each	
Supply and install temporary raised pavement markers	each	
Supply, load, haul and spread precoated aggregate	m ³	
Roll and incorporate aggregate	m ²	
Post-sweep of seal including stone counts: – With rotary broom – With suction broom as stipulated	m ² m ²	
Supply and place geotextile	m ²	
Load, haul and spread additional where closest available stockpile greater than 5 Km from jobsite	m ³ /Km > 5Km	

Annex C Schedule of job details

The following actions should be taken in the preparation of the schedule of job details and price schedule:

- Define scope of work. In addition to a description of location, the limits of work should also be clearly marked on the road pavement.
- Define type of sprayed seal treatment(s).
- Define aggregate Class and minimum PSV or PAFV, if required.
- Define binder type or grade.
- Include details of traffic for design purposes.
- Include any special design requirements, if applicable.
- Prepare and insert special clauses for submission of sprayed seal design details in advance of sprayed sealing work, if applicable.
- Prepare price schedule based on the scope of work and method of measurement and payment.
- Prepare a schedule for sites available for the stockpiling of aggregates, if applicable.
- Prepare and insert special clauses for test methods and frequency of testing, if applicable.
- Prepare and insert special clauses for payment for non complying materials, if applicable.

- Prepare and insert special clauses for removal of loose aggregate by suction broom, if applicable.
- Prepare and insert special clauses for reinstatement of line marking, if applicable.
- Prepare and insert clauses for any other special job requirements, if applicable.