

TRANSPORT FOR NSW (TfNSW)

QA SPECIFICATION R106

SPRAYED BITUMINOUS SURFACING (WITH CUTBACK BITUMEN)

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REVISION REGISTER

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 1/Rev 1		First Issued	GM, CMS	Feb 91
Ed 1/Rev 2		Annexure R106/3 corrected to include Hold Point from Clause 5.4	GM, CMS	13.11.91
Ed 1/Rev 3	7	Reference to 20 mm aggregate deleted (See also RTA 3151)	GM, CMS R Gaughan	26.02.92
Ed 2/Rev 0		This document has been converted to MS Word 6.0c. Specification Number changed from R45 to R106. Incorporated current RTA Forms. Hold points have been written in the new format.	GM, RNIC (W Ho)	07.04.97
	1.3	Information to be supplied by the Contractor listed		
	2.3	Oils for reducing the viscosity of bitumen conforms to AS 3568		
	2.5	New clause		
	3	Australian Design procedure replaced by RTA Form 395.		
	5.1	Witness Point added		
	1.2, 5.5	Added reference Austroads Bitumen Sealing Safety Guide.		
	5.7.1, 5.8.3, 5.9	RTA Forms changed.		
	5.8.2	Adjust application rates. Binder delayed 12 months after primerbinder applied.		
	5.8.3	Table R106.3 amended.		

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 2/Rev 0 (cont'd)	5.8.5 5.11 6.2 7 Annexure R106/2 Appendix A	New clause - Geotextile Types of seals defined. General changes to acceptance. Pay item descriptions revised. Pay item for geotextile added. Minimum frequency of testing extended to more materials. Deleted Austroads Procedure.		
Ed 3/Rev 0	1.2 Annexure R106/4	This document has been reformatted to include the following: Process Control End Product Criteria Schedule of Key Quality Planning Action Points Minimum Process Standards References are made to Standard Australia test method if deemed appropriate. Schedule of Identified Records added	GM, RNIC	31.08.01
Ed 3/Rev 1	Global Global 1.1 1.2, A3.2.1 1.3 4.3 4.4 4.5 4.5	Removed references to "mechanical" in spreaders and sprayers Replaced references to AS1141.12 with RTA T203 Replaced references to Class 600/170 with Multigrade 600/170 General sealing requirements Inserted additional test method RTA T274 and T277 in to Table 106.1 Additional information for definitions of Bituminous Sprayed Sealing terminologies Included timber surface in reseal definition Stipulate minimum size of sprayer run for Process control charts. Specified number of successive runs. Table 106.3: Added Multigrade 600/170 Maximum allowable limits for loose aggregates after final sweeping and before opening to traffic Clarified speed limit requirements for opening to traffic after sweeping. Modify signage requirement.	GM, RNIC	03.04.03

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 3/Rev 1 (cont'd)	<p>4.5</p> <p>5.2.1</p> <p>5.2.2</p> <p>Table R106.7</p> <p>6</p> <p>Annexure R106/1</p> <p>Annexure R106/1</p> <p>A3.4.2</p> <p>A3.4.3</p> <p>A3.4.4</p> <p>Annexure R106/1-A3.7</p> <p>Annexure R106/4</p> <p>Annexure R106/6</p>	<p>WITNESS POINT</p> <p>Final sweeping and loose aggregate measurement prior to opening to the traffic.</p> <p>Expanded definition</p> <p>(a) Added Multigrade 600/170</p> <p>(c) - Table R106.7 Added deductions for deviation from target binder rate.</p> <p>(c) - Specified minimum sprayer run quantity</p> <p>Specified minimum sprayer run quantity</p> <p>Pay Item added for Multigrade 600/170 Aggregate application rate to be paid at design target rate</p> <p>Supplementary information for maximum loose aggregate particles added.</p> <p>Thermoplastic lines must be masked</p> <p>Alternative temperature measurement may be proposed</p> <p>Added provision for Fast Curing cutter oils</p> <p>Expanded rolling requirements</p> <p>Payment at design rate. Additional aggregate at Contractor's cost.</p> <p>Replaced minimum tyre mass for multi-wheel with minimum unballasted total mass.</p> <p>Loose aggregate spread rate frequency test of RTA T277</p> <p>Fractured Faces requirement changed for 'drill and blasted' rocks.</p> <p>Added Process Control Chart</p>		
Ed 4/Rev 0	<p>Various</p> <p>Various</p> <p>Foreword</p>	<p>Formatting changed.</p> <p>"Contractor" replaced by "you",</p> <p>"Superintendent" replaced by "Principal".</p> <p>Grammatical and minor changes.</p> <p>Clauses renumbered (old/new):</p> <p>1.2/1.2.5, 1.4/1.2.4, 4.4/6.6, 4.5/9, 5.1/B2.1, 5.2/B2.2, A3.1.1/2.4.2, A3.1.2/2.1.2, A3.2.1(deleted), A3.2.2/4.5.2, A3.3.1/6.1, A3.3.2/6.2, A3.3.3/6.3, A3.3.4/6.4, A3.3.5/4.4, A3.3.6/6.5, A3.4/5, A3.5/7.6, A3.6/7, A3.7/8.</p> <p>Foreword added.</p> <p>Notes on "Revisions" and "Project Specific Changes" moved to the Foreword.</p>	GM, RNIC	20.09.06

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 4/Rev 0 (cont'd)	1.1	“Defects liability period” replaced by “12 months”. Surface texture measurement defined.		
	1.2	New clause explaining format. References transferred to Annexure R106/M.		
	2.1.1, 2.4.1	Evidence of conformity and samples of materials required.		
	3.3.3	Hold Point: submit 7 days prior and include planning documents.		
	4.1	Sample to AS 2008		
	4.3	Show tolerances on control chart		
	5.2	Mask thermoplastic when specified		
	8	Report spread rates on Form 500C		
	9	Transferred to Annexure R106/B Show reporting system in PQP		
	Annexures	Renumbered with letters		
	Annex A	Masking of thermoplastic to be nominated		
	Annex C	Schedules of Hold and Witness Points added		
	Annex D	New items in accordance with changes to requirements in R106		
	Annex L, M	AS 1141.6.1 and Test Method T240 added		
Ed 4/Rev 1	Annex B	Payment for sprayed bituminous waterproofing membrane, including primer, over concrete bridge decks to be made under pay item in Spec B344 clarified.	GM, IC	24.10.12
	Annex M	Referenced documents updated.		
Ed 4/Rev 2	Global	References to “Roads and Maritime Services” or “RMS” changed to “Transport for NSW” or “TfNSW” respectively.	DCS	22.06.20

GUIDE NOTES

(Not Part of Contract Document)

Using Specification TfNSW R106

Specification TfNSW R106 is a QA Specification and the use of QA Specifications requires the Contractor to implement a quality management system that meets the quality management system requirements specified in TfNSW Q. To comply with the intention of government policy as well as TfNSW R106, sprayed bituminous surfacing works carried out using TfNSW R106 require adequate surveillance and audit by the Principal.

TfNSW R106 requires the TfNSW Project Manager to select appropriate parameters identified in TfNSW R106 and nominate them in Annexure R106/A.

Seals should not be applied over a primed surface unless it has been cured for a period of at least forty-eight hours or such longer period as is necessary for the primer to become completely dry.

Masking should be considered for large thermoplastic pavement markings such as pedestrian crossings and chevrons prior to application of a sprayed seal or reseal.

For a primersealed surface, a period of at least twelve months must elapse, or the hardness of the primersealed surface measured using TfNSW Test Method TfNSW T271 must be less than 2.5 mm, before the subsequent seal is applied. Should circumstances require the surface to be trafficked and a primerseal is not an option, a prime (as described in Specification Clause 7.2) followed by a seal may be used.

Limits on loose aggregate particles, after final sweeping and prior to the work being opened to the traffic, have been included.

Where Electric Arc Furnace Slag (also known as EAF Slag) aggregate is to be used in a double/double seal, the second application may be delayed for about 14 days.

It should be noted that the cutter chart (TfNSW Form 382 - for cutting back the bitumen to the acceptable viscosity for spraying) is only applicable for Class 170 and Multigrade 600/170 bitumen.

The aggregate spread rate must be determined using a 1 m² mat or a 500 mm x 500 mm tray in accordance with TfNSW Test Method TfNSW T274 along the length being sealed or by other appropriate means approved by the Principal and in accordance with the PROJECT QUALITY PLAN.

The following document has been developed for use in sprayed sealing works but is not mandated under this Specification:

- TfNSW Form 501C – Cutback Seal and Reseal – Sprayer Loading Slip.

Information on test certificates and test results should be forwarded to Pavements Surfacing Section when requested or where important design and performance issues have arisen.



SPRAYED BITUMINOUS SURFACING (WITH CUTBACK BITUMEN)

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VERSION FOR: DATE:

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FOREWORD

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REVISIONS TO PREVIOUS VERSION

This document has been revised from Specification TfNSW R106 Edition 4 Revision 1.

All revisions to the previous version (other than minor editorial and project specific changes) are indicated by a vertical line in the margin as shown here, except when it is a new edition and the text has been extensively rewritten.

PROJECT SPECIFIC CHANGES

Any project specific changes are indicated in the following manner:

- (a) Text which is additional to the base document and which is included in the Specification is shown in bold italics e.g. *Additional Text*.
- (b) Text which has been deleted from the base document and which is not included in the Specification is shown struck out e.g. ~~Deleted Text~~.

TfNSW QA SPECIFICATION R106

SPRAYED BITUMINOUS SURFACING (WITH CUTBACK BITUMEN)

1 GENERAL

1.1 SCOPE

Take responsibility for the design, supply of all materials and the application of the following types of sprayed bituminous surfacing as required under the Contract:

- (a) Prime
- (b) Primerseal
- (c) Seal or Reseal.

The scope of this Specification excludes surfacing using modified or emulsion binders.

The work to be executed under this Specification includes all of the following:

- (i) Supply and delivery of all materials.
- (ii) Storage and handling of raw materials.
- (iii) Precoating of aggregate.
- (iv) Preparation of pavement surfaces.
- (v) Preparation of bitumen binder.
- (vi) Application of prime, primerbinder and binder.
- (vii) Application and incorporation of aggregate.
- (viii) Removal of loose aggregate.

The locations and required types of sprayed bituminous surfacing, including types of binders and aggregate sizes, must be as shown on the Drawings and as detailed in Annexure R106/A.

For multiple application treatments, the binder and aggregate may be required to be laid in one or more separate applications.

The prime/primerseal must be uniform in appearance and/or texture.

The primerseal/seal/reseal must not peel, pluck, strip, flush or bleed and aggregate must not crush during the period of 12 months after Completion. The prime/primerseal/seal/reseal must be uniform in colour and texture.

Measure Surface Texture, for the purposes of design (refer to Clause 3.1), in accordance with Test Method TfNSW T240. Minimum frequency of testing is shown in Annexure R106/L.

1.2 STRUCTURE OF THE SPECIFICATION

This Specification includes a series of annexures that detail additional requirements.

1.2.1 Details of Work

Details of work are shown in Annexure R106/A.

1.2.2 Measurement and Payment and Resolution of Nonconformities

The method of measurement and payment is detailed in Annexure R106/B.

Acceptance of materials and work must be in accordance with Annexure R106/B/

1.2.3 Schedules of HOLD POINTS, WITNESS POINTS and Identified Records

The schedules in Annexure R106/C list the **HOLD POINTS** and **WITNESS POINTS** that must be observed. Refer to Specification TfNSW Q for the definitions of **HOLD POINTS** and **WITNESS POINTS**.

The records listed in Annexure R106/C are **Identified Records** for the purposes of TfNSW Q Annexure Q/E.

1.2.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure R106/D and must be implemented. Where appropriate, use the TfNSW Sprayed Sealing Guide when planning and carrying out work under this Specification. The TfNSW Sprayed Sealing Guide must be regarded as a guide and not a specification.

In all cases where this Specification refers to the manufacturer's recommendations, these must be included in the PROJECT QUALITY PLAN.

1.2.5 Referenced Documents

Unless specified otherwise or is specifically supplied by the Principal, the applicable issue of a referenced document, is the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 1234). For convenience, the full titles are listed in Annexure R106/M.

1.3 DEFINITIONS

The terms "you" and "your" mean "the Contractor" and "the Contractor's" respectively.

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

"Prime": An application of a primer to a prepared base, without cover aggregate, to provide penetration of the surface (preferably from 5 mm to 10 mm), temporary waterproofing and to obtain a bond between the pavement and the subsequent seal or asphalt.

"Primer": A bituminous material of low viscosity and low surface tension used in priming.

"Primerbinder": A material more viscous than a primer and required to act both as a primer and binder, and used in primersealing.

“**Primerseal**”: An application of a primerbinder with a cover aggregate to a prepared base to provide penetration of the surface (preferably from 2 mm to 5 mm) and retain a light cover of aggregate.

“**Seal**”: A thin layer of bituminous material into which aggregate is incorporated.

“**Reseal**”: A seal applied to an existing sealed, asphalt, timber or concrete surface.

For all other descriptions, definitions in Section 9 of the TfNSW Sprayed Sealing Guide will apply.

2 MATERIALS

2.1 BITUMINOUS MATERIALS

2.1.1 General

The binder for seals and reseals must be as specified in Annexure R106/A and conform to Specification TfNSW 3253.

Provide documentary evidence of the binder conformity for each delivery used in the work. Also sample at the point of delivery and provide a representative sample of the delivered binder to the Principal. Refinery cutback bitumen must conform to Specification TfNSW 3261.

2.1.2 Storage and Handling

Do not heat binder above 190°C or the manufacturer’s written recommendations, whichever is the lesser. Do not use in the Works:

- (a) any bituminous material that has been overheated; or
- (b) binder stored in violation of the temperature and time combinations specified in the manufacturer’s written recommendations.

Do not hold bituminous materials at temperatures within the ranges shown in Tables R106.2 and R106.3 for periods in excess of the manufacturer’s recommendations.

Implement procedures for storage and handling of binder that ensure prevention of segregation and contamination of the binder by flushing liquids or other materials.

2.2 AGGREGATE PRECOATING AGENT AND BITUMEN ADHESION AGENT

Aggregate precoating agents must conform to Specification TfNSW 3258.

Bitumen adhesion agents must conform to Specification TfNSW 3259.

2.3 OILS FOR REDUCING VISCOSITY OF BITUMEN

The oils for reducing the viscosity of bitumen must conform to AS 3568.

2.4 AGGREGATE

2.4.1 Properties

The supply and delivery of aggregate must conform to Specification TfNSW 3151.

Obtain test results for each Lot of aggregate, in accordance with TfNSW 3151, before aggregate from the Lot is incorporated in the Works. When requested, provide a sample to the Principal from the same Lot by riffing or quartering your own samples. The amount of material obtained for each sample must be in accordance with the nominal size of the aggregate as per AS 1141.3.

2.4.2 Stockpiles

Arrange and manage aggregate stockpiles in accordance with the following requirements:

- (a) The maximum Lot size is limited to 250 m³;
- (b) Each stockpile must be located on firm level ground and effectively separated from other stockpiles to prevent cross-contamination and interference with loading and/or precoating operations;
- (c) The quantity and type of each stockpile must be clearly signposted on the stockpile at all times;
- (d) Recovery from stockpiles must be such as to minimise segregation and contamination.

Rectify or replace stockpiles that exhibit visible segregation, contamination or weathering.

2.5 GEOTEXTILE

The geotextile must be a nonwoven needle punched fabric with a minimum melting point of 165°C, minimum mass of 130 g/m² and a minimum bitumen saturation of 0.9 L/m².

3 NOMINATED MATERIALS AND DESIGN OF BITUMINOUS SURFACING

3.1 GENERAL

Carry out the design of bituminous surfacing in accordance with TfNSW Form 395A or TfNSW Form 395K as appropriate and submit the design details including all results from texture testing for reseals and ball embedment tests for seals. Design application rates are the "nominated application rates" and materials used for the design are the "nominated materials".

3.2 PROPORTIONS OF CONSTITUENTS

The proportion of constituents in any bituminous surfacing must conform to the limits as specified in Table R106.1.

Table R106.1 Limits of Proportions of Constituent Materials

Constituent	Bituminous Surfacing	Limit
Bitumen Adhesion Agent	Prime/Primerseal Seal/Reseal	1 % maximum 0.5 - 1.0 % depending on the results of initial adhesion and stripping tests or anticipated weather
Cutter Oil	Prime/Primerseal Seal/Reseal	as per design as per TfNSW Form 382
Flux Oil	Seal/Reseal	Subject to the Principal's approval of your proposal, you may use up to 4%

3.3 SUBMISSION OF NOMINATED DESIGN

Submit to the Principal the nominated design together with certification for the nominated materials at least seven days prior to the commencement of sprayed bituminous surfacing works.

Include the following details in the submission:

- (a) Each constituent material;
- (b) Verification of conformity of the nominated materials;
- (c) Endorsement.

3.3.1 Each Constituent Material

- (a) Test results for all nominated materials, including stripping and initial adhesion for the combination of nominated materials;
- (b) Aggregates - source, geological type, particle size distribution, nominated average least dimension (ALD);
- (c) Precoating agent and bitumen adhesion agent - types and proportions;
- (d) Bitumen - refinery source;
- (e) Cutback bitumen - refinery source of bitumen, source of cutter oil;
- (f) Cutter Oil / Flux Oil - type and source; and
- (g) Geotextile - source, type and properties.

If you propose to change the source of supply of any constituent material, submit a new nominated design and details of the change to constituent material.

3.3.2 Verification of Conformity of the Nominated Materials

- (a) Submit test results to verify conformity to Clauses 2 and 3 of each constituent material proposed for the use in the Contract, including stripping and initial adhesion for the combination of nominated materials;
- (b) Carry out the sampling and testing of a nominated material within the six months period prior to the date of submission to the Principal. Perform all phases of any particular test at one laboratory.

3.3.3 Endorsement

Submit a statement signed by you stating that each design and its constituent materials meet the requirements of Clauses 2 and 3. The statement must include NATA endorsed test results for all specified tests. Attach a copy of your completed verification checklist.

HOLD POINT

Process Held:	Sealing operation using the proposed design.
Submission Details:	Documents referred to in Clause 1.2.4 and the proposed bituminous surfacing design together with certification for the nominated materials and design verification documentation at least seven days prior to the commencement of sprayed bituminous surfacing work.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

3.4 REVIEW OF NOMINATED APPLICATION RATES

Select the locations where each Lot of aggregate is to be incorporated in the Works.

Review the bituminous surfacing design at each location based on the actual ALD test result for the actual aggregate to be used instead of the ALD value of the nominated aggregate and using the appropriate TfNSW 395 design form. The revised application rates are “target application rates”.

HOLD POINT

Process Held:	Sprayed sealing work for each work location.
Submission Details:	Aggregate Lot details and target application rates.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

4 PROCESS CONTROL

4.1 SAMPLING AND TESTING

Carry out sampling and testing of materials in accordance with the relevant material specifications in Clause 2 and AS 2008. Testing must comply with Annexure R106/L. The PROJECT QUALITY PLAN must nominate the proposed testing frequency, which must not be less than that specified in Annexure R106/L. Where a minimum frequency is not specified, nominate an appropriate frequency.

The Principal may conditionally agree to your proposal to reduce the specified minimum frequency of testing. The proposal must be supported by a statistical analysis verifying consistent process capability and product characteristics. The Principal may vary or restore the specified minimum frequency of testing, either selectively or permanently, at any time.

4.2 APPLICATION OF SPRAYED BITUMINOUS SURFACING

Carry out sprayed bituminous surfacing so as to:

- (a) provide a uniform application of binder with adequate adhesion to the underlying surface;
- (b) provide a uniform cover of aggregate particles (except for primes); and
- (c) achieve effective bond between binder and aggregate (except for primes).

Include in the PROJECT QUALITY PLAN details of the plant and equipment and methods to be used for sprayed bituminous surfacing.

4.3 PROCESS CONTROL CHART

Use process control charts, as shown in Annexure R106/E, for binder application rate for work where 10 or more sprayer runs greater than 1,000 litres are required. You may develop additional process control charts for the purpose of managing job specific risk(s) to quality. The process control charts must show the specified tolerances and plot the differences of individual results from the target value.

Take corrective action if any point is between 2% and 5% (inclusive) above or below the target over 5 successive runs.

If any point is greater than 5% above or below the target binder application rate, deductions will apply in accordance with Annexure R106/B2.

4.4 WORK RECORDS

Record the particulars of the work performed on TfNSW Form 500A or 500C (as appropriate). Record details of primer, primerbinder, binder and aggregate applied immediately after every sprayer run. Each form must be signed by your representative as a true record of the work performed. Supply the Principal with a copy of each completed form.

5 CONDITION FOR COMMENCEMENT

5.1 PRECOATING OF AGGREGATE

Apply the aggregate precoating agent to the aggregate in a manner and at a rate and time that provides a complete, light, uniform, effective cover of all aggregate particles at the time of spreading.

Do not precoat aggregate when rain is imminent. If aggregate has been precoated and rain appears imminent, the aggregate must be adequately covered to prevent the precoating material being washed from the aggregate particles.

Take precautions, such as covering stockpiles, to prevent settlement of dust, penetration of moisture or drying out of the precoating agent on the stockpiled aggregate. Include in the PROJECT QUALITY PLAN details of the precautions to be taken to protect aggregates.

5.2 PREPARATION OF PAVEMENT SURFACE

Before the application of primer, primerbinder or binder, sweep the pavement surface by the use of a rotary road broom or suction broom to provide a uniformly clean surface. If necessary, carry out

additional sweeping by hand, using stiff bass or similar brooms. Sweeping must 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, remove any remaining loose material from the pavement surface immediately adjacent to the swept areas. Include in the PROJECT QUALITY PLAN details of the arrangements for the removal of loose foreign materials.

Remove adherent patches of foreign material from the surface of the pavement. Mask or remove raised pavement markers. Mask large thermoplastic pavement markings if indicated in Annexure R106/A.

The pavement surface must be slightly damp for the spraying of primer or primerbinder.

5.3 PAVEMENT TEMPERATURE AND WEATHER CONDITIONS

Measure and record pavement temperatures at regular intervals during the course of work. For this purpose, place a spirit or mercury-in-glass thermometer or other suitable type of thermometer in direct contact with the pavement and allow it to remain in position until the reading becomes steady. Other certifiable means of temperature measurement may be used subject to the approval of the Principal. When a spirit or mercury-in-glass thermometer is used to measure pavement temperature, cover the bulb of the thermometer from direct sunlight with a small heap of grit or similar material.

If the pavement is partly in sun and partly in shade, take and record the temperatures for both conditions.

Undertake the spraying of primers, primerbinders and binders only if the pavement temperature has been at or above 10°C for at least one hour before commencement of spraying and does not fall below the specified minimum pavement temperature for spraying during the period of spraying. For temperatures slightly less than 10°C, the use of Fast Curing cutter oils may be considered.

Do not spray wet pavement or while rain appears imminent or during strong winds or dust storms.

5.4 PROTECTION OF SERVICES AND ROAD FIXTURES

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 over the binder, clean off or remove any sprayed surfacing material and leave the services and road fixtures in a condition equivalent to that existing when you commenced the sprayed surfacing work.

6 APPLICATION OF SPRAYED BITUMINOUS SURFACING

6.1 PLANT

Apply primer, primerbinder and binder by using a sprayer. The sprayer must have a current Sprayer Certificate (TfNSW Form 354) issued or accepted by Transport for NSW.

The spray nozzles must be of the make and type endorsed on the Sprayer Certificate. Replace any nozzles that are damaged or become unduly worn or defective with new nozzles of the same type and size. A sufficient number of nozzles for this purpose must be available at all times.

Spreading equipment (including box spreaders) must be used to spread aggregate and must be capable of achieving a uniform spreading rate.

Rollers used must be in accordance with Clause 8. Use of other types of rollers will be considered subject to your demonstration by way of an onsite trial that the proposed roller can effectively embed the aggregate into the binder while achieving mechanical interlock between the aggregate without breaking down/crushing the aggregate with the combinations of the relevant materials to be used and actual pavement conditions.

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 Specification.

6.2 OPERATION OF THE SPRAYER

The type of spray nozzles to be used on the spray bar of the sprayer must 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 must be about 50 mm for special type end nozzles or intermediate nozzles set with a jig. If intermediate nozzles are to be used to overlap adjacent longitudinal sprays, set the nozzles in the normal manner for intermediate nozzles and the overlap must be at least 300 mm.

Each run of the sprayer must commence on a protective strip of heavy paper weighing not less than 120 grams per square metre laid across and held securely to the pavement surface before spraying commences. The sprayer must 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 must maintain a constant road speed throughout the length of each sprayer run.

Terminate each spraying run on a protective strip of paper laid across and held securely to the pavement surface before spraying commences. The width of paper at the commencement and/or termination of each run must not be less than that endorsed on the Sprayer Certificate.

Cease spraying immediately when any defect develops in the spraying equipment and do not recommence spraying until the defect has been rectified.

Where any blockage or partial blockage of nozzles occurs, cease spraying immediately. If the blockage is due to the condition of the binder being sprayed, do not use that load together with any binder from the same bulk tanker or supply unit.

Areas not within 5% of the target application rate of primer, primerbinder or binder constitute a 'Nonconformity' under the Contract.

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

After each sprayer run, check the quantity of binder sprayed against the area covered and make any necessary adjustments to ensure that the target application rate is achieved in subsequent runs. If the

actual application rate of binder for each of three consecutive runs differs by more than 5% from the target application rate, do not use the sprayer until a new Sprayer Certificate has been obtained.

6.3 TEMPERATURE

Measure and record the temperature using a mercury-in-steel dial thermometer, a maximum recording mercury-glass thermometer or other suitable means. The thermometer must be accurate to within 2.5% of the correct temperature.

If the temperature of the bituminous material is below the applicable lower limit from Table R106.2 or Table R106.3, the bituminous material may be heated providing safe heating practices are adopted. Do not use burners unless the level of the material in the heating tank is at least 250 mm above the tops of the heating tubes. Comply with the Rural Fires Act, 1997 and the Local Government Act 1993.

Two or more suitable fully-charged pressurised chemical fire extinguishers must be placed conveniently to the heaters at all times while heating is in progress. Refer to the Austroads Bitumen Sealing Safety Guide.

During heating, the temperature of the bituminous material must not exceed the applicable upper limit from Table R106.2 or Table R106.3. Check the temperature of the bituminous material just above the heating tubes at regular intervals to ensure that there is no local overheating.

Any bituminous material that has been overheated must not be used in the work.

6.4 GEOTEXTILE

Apply geotextile fabric where nominated in Annexure R106/A or as directed. After the tack coat application fix the fabric to the pavement smoothly and without wrinkles. The adjoining geotextile fabric must overlap the existing fabric by a minimum of 100 mm to ensure a continuum of fabric over the area treated. The joining fabric in the longitudinal direction under wheel path must be minimised.

The tack coat application at the overlap for the adjoining fabric is the fabric retention allowance, which is higher than the tack coat amount used for the non-overlap area of the adjoining fabric. This will ensure that the correct fabric retention allowance has been applied to the two layers of geotextile at the overlap. Deficiency of binder at the overlap may lead to stripping.

6.5 TRAFFIC MANAGEMENT

Provide for traffic in accordance with the requirements of Specification TfNSW G10 while undertaking the work and 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, use escort vehicles to ensure that traffic travels at an acceptable speed.

Take all necessary steps to avoid or minimise delays and inconvenience to road users during the course of the work. Where adequate detours or side tracks are included in the Contract or are otherwise available, temporarily divert traffic while the work is in progress.

If facilities for the diversion of traffic are not available, spray part width of the pavement in the one operation and make available to traffic the adjacent strip of roadway, except during the actual

spraying operation when all traffic movement through the work must cease. Traffic must not be permitted to encroach upon the edge of the sprayed bituminous material until such time as it is covered with aggregate.

6.6 BITUMEN TEMPERATURE REQUIREMENTS

Bitumen must be within the temperature range shown in Table R106.2 when cutter oil is incorporated.

Table R106.2 - Bitumen Temperature

Class	Temperature Range (°C)
170, Multigrade 600/170	160 – 190
320	170 – 200

Cutback bitumen must be within the temperature range shown in Table R106.3 at the time of spraying.

Table R106.3 - Cutback Bitumen Spraying Temperatures

Grade	Equivalent Cutter (%)	Temperature Range (°C)
AMC00	56	10 – 30
AMC0	44	35 – 55
AMC1	34	60 – 80
AMC2	27	75 – 100
AMC3	21	95 – 115
AMC4	16	110 – 135
AMC5	11	120 – 150
AMC6	7	135 – 160
AMC7	3	150 – 175
FC2	25	70 – 95
FC3	20	80 – 95
FC4	15	95 – 110
FC5	10	120 – 140
FC6	7	130 – 150
FC7	3	140 – 160

6.7 INCORPORATION OF CUTTER OIL, FLUX OIL AND BITUMEN ADHESION AGENT

6.7.1 Cutter Oil

Determine and record the proportion of cutter oil required for each sprayer load, using TfNSW Form 382 for seals and reseals and TfNSW Form 395A for primes and primerseals.

The cutter oil, without being previously heated, must be pumped into the sprayer, followed by the hot bitumen. Circulate the full sprayer load of cutback bitumen at a rate of at least 700 litres per minute for twenty minutes to ensure that the mixture is homogeneous.

If a part sprayer load of field cutback bitumen is unused on the date of mixing, and needs to be returned to the heater tanks, place it in an empty tank reserved for that purpose. Do not add bitumen or cutter oil to the returned cutback bitumen unless the tank is fitted with an effective mechanical mixing system. When the returned cutback bitumen is subsequently used as part of a sprayer load, make allowance for the cutter oil contained in the returned cutback bitumen.

Refer to the Austroads Bitumen Sealing Safety Guide for guidance on safe handling procedures.

6.7.2 Flux Oil

Where flux oil is to be included, add it to the bitumen in the sprayer and circulate the mixture at a rate of at least 700 litres per minute for fifteen minutes before spraying.

6.7.3 Bitumen Adhesion Agent

Where bitumen adhesion agent is to be included, add it to the bitumen in the sprayer and circulate the mixture at a rate of at least 700 litres per minute for fifteen minutes before spraying.

7 APPLICATION OF PRIMER, PRIMERBINDER AND BINDER

7.1 GENERAL

Limit the area to be sprayed with primerbinder or binder to the area that can be covered with aggregate at the target application rate within fifteen minutes of spraying bitumen or cutback bitumen.

7.2 PRIMER AND PRIMERBINDER

The class and grade of primer and primerbinder must be as specified in Annexure R106/A.

Apply nominated and target application rates and quantities of primer and primerbinder to the whole material, including cutter oil, measured at 15°C.

After application of a primer, a period of at least 48 hours, or such longer period as determined to be necessary for the primer to become completely dry, must elapse before the binder for a seal is applied. Keep all traffic off the primed surface.

Where bitumen adhesion agent and/or cutter oil have been added to the binder, adjust the application rate of the total binder at 15°C, using TfNSW Form 500A, to allow for the quantities of bitumen adhesion agent and/or cutter oil in the mixture.

After application of a primerbinder, a period of at least twelve months must elapse before the binder for a seal is applied, unless the hardness of the primerseal measured using Test Method TfNSW T271 is less than 2.5 mm.

7.3 BINDER

The class of bitumen or grade of cutback bitumen must be as specified in Annexure R106/A.

Base nominated and target application rates and quantities of binder on the volumes of bitumen measured at a temperature of 15°C and do not include any bitumen adhesion agent and/or cutter oil. If flux oil has been added to the bitumen, include the quantity of flux oil as part of the binder.

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

Determine the hot application rate of total binder, including bitumen adhesion agent and/or cutter oil, using TfNSW Form 382.

Where refinery cutback bitumen is used as the binder, increase the target application rate of binder to allow for the cutter oil in the mixture in accordance with Table R106.4.

Table R106.4 - Adjustment of Refinery Cutback Bitumen

Grade of Refinery Cutback Bitumen	Approx. Amount of Cutter Oil in Grade (%)	Increase to Target Application Rate (%)	Permissible Ranges of Pavement Temperature (°C) Aggregate Precoated	
			No Moisture on Aggregate	Moisture on Aggregate
AMC4	16	19	–	10 – 15
AMC5	11	12	12 – 17	17 – 28
AMC6	7	8	22 – 27	27 – 38
AMC7	3	3	32 – 37	37 – 48
FC4	15	18	–	9 – 18
FC5	10	11	15 – 20	20 – 30
FC6	7	8	22 – 27	27 – 38
FC7	3	3	32 – 37	37 – 48

8 APPLICATION AND INCORPORATION OF AGGREGATE

Use only precoated aggregate for seals and primerseals.

The application of aggregate, where required, must proceed after spraying of the binder has commenced and must be completed within fifteen minutes of spraying bitumen or cutback bitumen.

Do not use aggregate containing surface moisture or free surface water.

Apply the aggregate of the specified nominal size and at the target aggregate application rate. The method to determine the actual aggregate spread rate must conform to Test Method TfNSW T274 or a method approved by the Principal and detailed in the PROJECT QUALITY PLAN. Report the aggregate spread rate as actual rate using TfNSW Form 500C. Sufficient loaded and measured trucks of dry aggregate must be at the site to provide full cover for the area sprayed.

Spread the aggregate uniformly over the sprayed surface by means of suitable spreading equipment (including box spreaders). Payment is at the target application rate. Any bare or insufficiently covered areas must be re-run by the spreader or covered by hand as necessary to give a uniform coverage at the target application rate.

After the aggregate has been applied to each section of the work, carry out initial rolling with two or more dual axle smooth pneumatic tyred multi-wheel rollers of mass greater than 7 tonnes without ballast and minimum tyre pressure of 550 kPa. Continue initial rolling until the aggregate is firmly embedded in the primerbinder or binder.

Roll the cover aggregate with pneumatic tyred multi-wheel rollers at not less than eight passes within one hour of spraying at every point on the surface. There must be sufficient rollers on site and in use to complete the specified minimum amount of rolling as a continuous operation with successive spray runs.

If the aggregate is not evenly distributed over the surface of the pavement, traverse the surface 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, defer or eliminate the drag brooming. Substitute light hand brooming where drag brooming is eliminated.

When the aggregate has been evenly spread and embedded in the binder, remove any remaining loose particles of aggregate from the pavement. Include in the PROJECT QUALITY PLAN details of the method and timing of removal of loose aggregate and traffic control to protect persons and property.

9 SWEEPING AND LOOSE AGGREGATE REMOVAL (10 MM AND 14 MM SEALS/ RESEALS ONLY)

After final sweeping and prior to the work being opened to traffic at the pre-existing signposted speed, the number of loose aggregate particles (per m²) not including aggregate particles from any scatter coat, determined in accordance with Test Method TfNSW T277 must not exceed the values shown in Annexure R106/A. The test location must be representative of the section and as agreed by the Principal. Include the reporting system to be used to record test results of loose aggregate after final brooming in the PROJECT QUALITY PLAN. If values are not specified in Annexure R106/A, the values shown in Table R106.5 apply.

Areas where speed limits exceed 60 km/h and that are opened to traffic prior to final sweeping must have temporary speed zone 'loose stones' and 'slippery' warning signs and temporary 60 km/h speed zoning in place until the maximum allowable loose aggregate requirement is met.

Table R106.5 – Maximum Allowable Loose Aggregate Particles

Urban areas	20 particles/m ²
Other medium to high traffic (>250 v/l/d)	30 particles/m ²
Low traffic (≤ 250 v/l/d)	40 particles/m ²

WITNESS POINT

Process Witnessed: Final sweeping and loose aggregate measurement prior to opening to traffic.

Submission Details: Notification of the time and location prior to commencement.

ANNEXURE R106/A – DETAILS OF WORK AND SUPPLEMENTARY INFORMATION

NOTES TO TENDER DOCUMENTER: (Delete this boxed text after completing Annexure R106/A)

Complete the tables below by filling in the required details.

Where “Yes / No” option is shown below, delete whichever is not applicable.

Section		Prime	Geotextile	Primerseal		Seal or Reseal	
From	To			Binder	Aggregate	Binder	Aggregate

Clause	Description	Requirement
5.2	Masking of thermoplastic pavement markings required	Yes / No
9	Maximum Allowable Loose Aggregate Particles	
	Nominal Aggregate Size	_____ mm
	Maximum Loose Aggregate after final sweeping	_____ / m ²
	Nominal Aggregate Size	_____ mm
	Maximum Loose Aggregate after final sweeping	_____ / m ²

ANNEXURE R106/B – MEASUREMENT AND PAYMENT AND RESOLUTION OF NONCONFORMITIES

B1 MEASUREMENT AND PAYMENT

Payment will be made for all costs associated with completing the work detailed in this Specification in accordance with the following Pay Items.

Payment for work associated with the sprayed bituminous waterproofing membrane, including primer, over concrete bridge decks, will be made under the pay item in Specification TfNSW B344.

Where no specific pay items are provided for a particular item of work, the costs associated with that item of work are deemed to be included in the rates and prices generally for the Work Under the Contract.

Unless specified otherwise, a lump sum price for any of these items will not be accepted.

Pay Item R106P1 - Supply and Spray Primer, Primerbinder (including Preparation of Surface)

The unit of measurement is the litre measured at 15°C.

The quantities (in litres) must be determined by multiplying the target application rate of the combined mixture of all materials (including any field or refinery incorporated cutter or flux) at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres).

A separate unit rate is to be given for each type of primer and primerbinder specified in Annexure R106/A, as follows:

R106P1.1	AMC00
R106P1.2	AMC0
R106P1.3	AMC1
R106P1.4	AMC2
R106P1.5	AMC3
R106P1.6	AMC4
R106P1.10	Field Cutback Primer/Primerbinder

Pay Item R106P2 - Supply and Spray Binder - Class 170 Bitumen (including Adhesion Agent where required and Preparation of Surface)

The unit of measurement is the litre of Class 170 bitumen at 15°C.

The quantities (in litres) must be determined by multiplying the target application rate of Class 170 bitumen at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres).

The quantity of bitumen used for tack coating the geotextile must be included in the measurement.

R106

Sprayed Bituminous Surfacing (with Cutback Bitumen)

Pay Item R106P3 - Supply and Spray Binder - Class 320 Bitumen (including Adhesion Agent where required and Preparation of Surface)

The unit of measurement is the litre of Class 320 bitumen at 15°C.

The quantities (in litres) must be determined by multiplying the target application rate of Class 320 bitumen at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres).

Pay Item R106P4 - Supply and Spray Binder - Multigrade 600/170 Bitumen (including Adhesion Agent where required and Preparation of Surface)

The unit of measurement is the litre of Multigrade 600/170 bitumen at 15°C.

The quantities (in litres) must be determined by multiplying the target application rate of Multigrade 600/170 bitumen at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres).

Pay Item R106P5 - Supply, Incorporate and Spray Cutter Oil in Binder

The unit of measurement is the cold litre.

The quantities (in cold litres) must be determined from the target percentage of cutter oil added in the field to produce the binder for each sprayer run of Seal and Reseal.

Pay Item R106P6 - Supply, Incorporate and Spray Flux Oil in Binder

The unit of measurement is the cold litre.

The quantities (in cold litres) must be determined from the target percentage of flux oil added in the field to the binder of Seal and Reseal.

Pay Item R106P7 - Supply, Precoat, Apply and Incorporate Aggregate

R106P7.1	5 mm Aggregate (precoated)
R106P7.2	7 mm Aggregate (precoated)
R106P7.3	10 mm Aggregate (precoated)
R106P7.4	14 mm Aggregate (precoated)

The unit of measurement is the cubic metre.

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

Aggregate application rate is paid at the design target rate and any additional aggregate applied is at no cost to the Principal.

A separate unit rate must be given for each nominal size of aggregate precoated as specified.

Pay Item R106P8 - Supply and Incorporate Geotextile

The unit of measurement is the square metre. Measurement must exclude laps.

Payment excludes supply and application of binder and aggregate.

Pay Item R106P9 - Deductions in accordance with Annexure106/B2

R106P9.1 Bitumen

R106P9.2 Refinery Cutback Bitumen

Deductions must be made on the target application rate and must not be subject to adjustment for rise and fall in costs.

B2 RESOLUTION OF NONCONFORMITIES

B2.1 General

If the nonconformity is not acceptable in accordance with Annexure R106/B2, the nonconforming material must be replaced or the nonconforming section of sprayed bituminous surfacing work must be either replaced or corrected.

The cost of rectifying nonconformities, including any restoration work to any underlying or adjacent surface or structure, which becomes necessary as a result of such replacement or correction, must be borne by you. Replace materials removed from the site by you with materials that conform to this Specification.

B2.2 Rectification or Replacement of Nonconforming Bituminous Surfacing

Replace bituminous surfacing removed from the Works by intervention of weather or misuse of plant with bituminous surfacing conforming to the requirements of this Specification.

Use a method of rectification which avoids damage to, and does not affect the performance of, the underlying structures, utilities, utility covers and similar structures.

B2.3 Acceptance of Nonconformities

Nonconformities may be accepted by the Principal subject to deductions to the schedule rate, as specified hereunder, applied to the quantity of material represented by the failed sample.

(a) Bitumen

In the case of bitumen having a viscosity at 60°C within the specified limits but having any other property outside the limits specified in Specification TfNSW 3253, a deduction of 2% of the schedule rate for the supply and spraying of bitumen applies.

In the case of Class 170 bitumen, Class 320 bitumen or Multigrade 600/170 having a viscosity at 60°C outside the limits specified in Specification TfNSW 3253, the deductions shown in Table R106/B.1 apply.

Report viscosity to the nearest whole number.

(b) Refinery Cutback Bitumen

In the case of a cutback bitumen having a viscosity at 60°C within the specified range according to Table 3261.1 of Specification TfNSW 3261 but having any property (other than viscosity at 60°C) outside the range specified by AS 2157, a deduction of 2 % of the schedule rate for the supply and spraying of cutback bitumen applies.

In the case of cutback bitumen having a viscosity at 60°C outside the range specified in Table 3261.1 of Specification TfNSW 3261, the deductions shown below apply:

Viscosity in range of next adjoining grade	-	a deduction of 10% of schedule rate
Viscosity in range of next but one adjoining grade	-	a deduction of 25% of schedule rate
Viscosity beyond next but one adjoining grade	-	a deduction of 50% of schedule rate

The viscosity as determined by any method allowed by AS 2157 must be rounded to two significant figures in the direction favouring you. The range allowed in Specification TfNSW 3261 Table 3261.1 includes an allowance for the repeatability of the test. No attempt must be made to include another allowance for repeatability.

Table R106/B.1 - Deduction for Actual Viscosity at 60°C (Pa.s)

Viscosity at 60°C (Pa.s)			Deduction
Class 170	Multigrade 600/170	Class 320	(% of Schedule Rate)
Under 120	Under 285	Under 220	50
120 – 124	285 – 314	220 – 229	25
125 – 129	315 – 339	230 – 239	10
130 – 134	340 – 369	240 – 249	5
135 – 139	370 – 399	250 – 259	2
140 – 200	400 – 600	260 – 380	Nil
201 – 210	601 – 630	381 – 400	2
211 – 220	631 – 660	401 – 420	5
221 – 230	661 – 690	421 – 440	10
231 – 240	691 – 720	441 – 460	25
Over 240	over 720	Over 460	50

(c) Sprayed Binder

For sprayed binder runs greater than 1000 L, the deductions shown in Table R106/B.2 apply where the amount of actual binder sprayed on any run differs from the target spray rate by more than 5%.

Table R106/B.2 - Deduction for Actual Sprayed Binder*

Difference from Target Spray Rate (%)	Deduction (% of Schedule Rate)
±6	4
±7	8
±8	12
±9	16
±10	20

* Applies to sprayer runs using more than 1,000 L of binder

ANNEXURE R106/C – SCHEDULES OF HOLD POINTS, WITNESS POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.2.3.

C1 SCHEDULE OF HOLD POINTS

Clause	Description
3.3.3	Submission of planning documents and proposed design.
3.4	Aggregate details and target application rates.

C2 SCHEDULE OF WITNESS POINTS

Clause	Description
9	Final sweeping and loose aggregate measurement prior to opening to traffic.

C3 SCHEDULE OF IDENTIFIED RECORDS

The records listed below are Identified Records for the purposes of TfNSW Q Annexure Q/E.

Clause	Description of Identified Record
3.3	Proposed bituminous surfacing design together with certification for the nominated materials and design verification documentation.
3.4	Aggregate Lot details and target application rates.
4.4	Copy of completed forms showing details of primer, primerbinder, binder and aggregate applied for every sprayer run, signed by your representative as a true record of the work performed.

ANNEXURE R106/D – SCHEDULE OF KEY QUALITY PLANNING ACTION POINTS

Key Points to be implemented and shown in the Inspection and Test Plan/Checklists, and also additional requirements that are to be included in your quality planning documents:

H = Hold Point Release

I = Inspection Point

J = Joint Inspection Point

M = Measurement Point for payment

N = Notice to Principal

T = Test Point

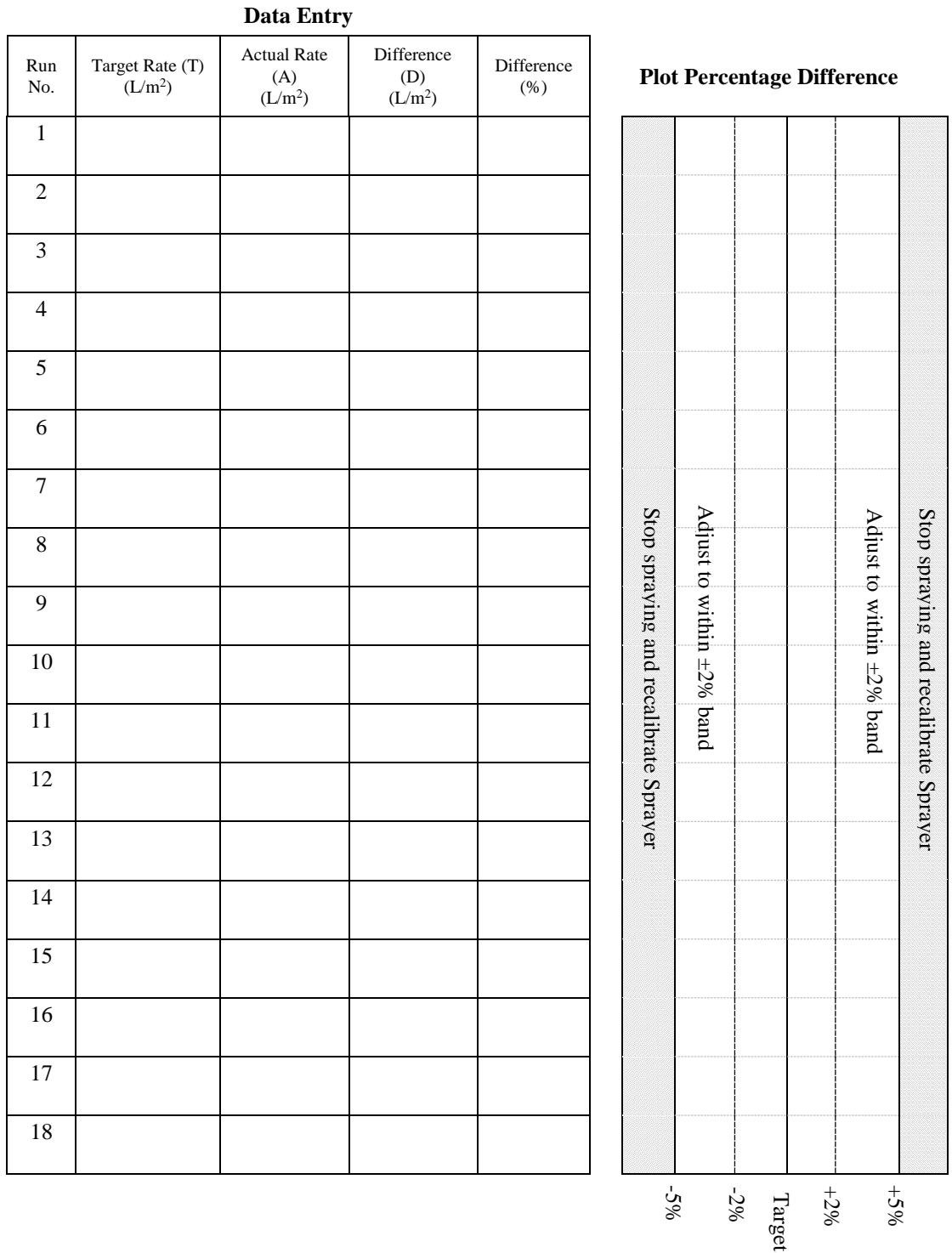
R = Additional requirements to be shown in the PROJECT QUALITY PLAN

W = Witness Point

Clause	Description	Action Point (ISO 9001)
TfNSW Q	Quality management system fully complying and functional	R
1.2	List of all documents to be held on site	I
	Materials:	
2	Proposed materials properties conforming to Specification	I, T
2	Risks to consistent supply quality identified, discussed with subcontractor/Supplier, addressed and documented	T
1.2.4	Manufacturer's written recommendations attached to PROJECT QUALITY PLAN	R
	Procedures and ITP's for:	
	Management and traceability of each materials Lot to its incorporation into bituminous surfacing	R
	On-going verification of materials conformity	R
	Assessment and audit of subcontractor/Supplier quality management systems	R
	Design:	
3.3	Full design details submitted to Principal in agreed format	R
3.2	Constituent proportions established and conforming	R
3.3	Submission of planning documents and nominated design together with certification for the nominated materials at least 7 days prior to the commencement of sprayed bituminous surfacing work	N
3.3	Hold Point on submitted nominated design has been released before work proceeds	I, H
3.4	Submission of aggregate Lot details and target application rates	N
3.4	Hold Point on aggregate Lot details and target application rates released before work proceeds	I, H
	Process Control:	
2.1.2	Manufacturer's written recommendations for temperatures of binder attached to PROJECT QUALITY PLAN	R
Annexure R106/L	Minimum frequency of testing included in PROJECT QUALITY PLAN	R

Clause	Description	Action Point (ISO 9001)
4.3	Control charting system functional prior to commencement of work	R
6.6	Process temperature conforming	R
9	Reporting system for recording test results of loose aggregate after final brooming.	R
9	Final sweeping and loose aggregate measurement prior to opening to the traffic	W
1.2.4	Procedures and ITP's for:	
	Management and traceability of each Lot to its incorporation into the pavement	R
	Calibration and NATA certification of laboratory equipment and procedures	R, T
	Submission of test results including timeframe constraints	R
	Management of stockpiles	R, I
	Handling, storage and transporting of binder	R
	Calibration of sprayer and precoating equipment	R, T
	Spraying small areas or areas of irregular shape	R
	Joints	R
	Calibration of thermometers	R, T
	Details of work performed must be recorded in the appropriate TfNSW Forms	R
	Procedure for precoating of aggregate	R
	Preparation of pavement surface	R
	Preparation of bitumen binder	R, T
	Spraying of bituminous surfacing	R, I
	Protection of services and road fixtures	R
	Removal of loose aggregate	R, T
	End Product Criteria:	
	Procedure and ITP's for:	
	Aggregate spread rate	R, T
	Binder sprayed rate	R, T
	Loose aggregate	R, T
	Surface texture	R

ANNEXURE R106/E – PROCESS CONTROL CHART



Calculations:

Difference (D) = T - A (L/m²)

Percentage Difference = $\left[\frac{D}{T} \right] \times 100$ (%)

ANNEXURES R106/F TO R106/K – (NOT USED)**ANNEXURE R106/L – MINIMUM FREQUENCY OF TESTING**

Clause	Characteristic Analysed	Test Method	Minimum Frequency of Testing
1.1	Surface Texture	TfNSW T240	Five measurements every 250 m and at changes in aggregate size or heavy patches (shoulder, wheelpaths, between wheelpaths and centre line) per lane of sprayed bituminous surfacing work ⁽¹⁾
2.1	Properties of Residual Bitumen	AS 2341	As set out in TfNSW 3253
2.1	Properties of Cutback Bitumen	AS 2341	As set out in TfNSW 3261
2.2	Resistance to Stripping of Adhesion Agent	TfNSW T230	As set out in TfNSW 3259
2.2	Initial Adhesion and Resistance to Stripping of Precoating Agent	TfNSW T238 TfNSW T230	As set out in TfNSW 3258
2.3	Properties of Cutter Oils and Flux Oils	ASTM D611 ASTM D1319 ASTM D1298 ASTM D86 AS 2106 AS 2341.9 ASTM D445	As set out in AS 3568
2.4	Aggregate Properties	TfNSW T203 TfNSW T230 TfNSW T238 TfNSW T239 AS 1141.11 AS 1141.6.1 AS 1141.14 AS 1141.20.1 AS 1141.20.2 AS 1141.22 AS 1141.41	1 per 250 m ³ of aggregate ⁽¹⁾ 1 per 6 months and at change of quarry face 1 per 6 months and at change of quarry face 1 per 250 m ³ of aggregate ^{(1), (3)} 1 per 250 m ³ of aggregate ⁽¹⁾ 1 per 6 months and at change of quarry face 1 per 250 m ³ of aggregate ⁽¹⁾ 1 per 250 m ³ of aggregate ⁽¹⁾ 1 per 250 m ³ of aggregate ⁽¹⁾ 1 per 500 m ³ of aggregate ^{(1), (2)} 1 per 6 months and at change of quarry face
8	Measurement of Aggregate Spread Rate	TfNSW T274	2 per day

Clause	Characteristic Analysed	Test Method	Minimum Frequency of Testing
9	Measurement of Loose Aggregate on Sprayed Seals	TfNSW T277	1 per 500 m lane length or part thereof

Notes:

- (1) Frequency of testing may be reduced in accordance with TfNSW Q subject to the Principal's agreement.
- (2) Provided that all of the six previous tests have met specification requirements for both wet strength and wet/dry strength variation then the following reduced frequencies apply:
 - where all wet/dry variation results < 25% : 1 per 6,500 m³
 - where all wet/dry variation results < 30% : 1 per 2,500 m³
 - where all wet/dry variation results < 35% : 1 per 1,250 m³
- (3) Aggregate sourced from 'drill and blast' quarries may be exempted providing that all other tests have met Specification requirements.

ANNEXURE R106/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.5.

TfNSW Specifications

TfNSW G10	Traffic Management
TfNSW Q	Quality Management System
TfNSW B344	Sprayed Bituminous Waterproofing Membranes
TfNSW 3151	Aggregate for Sprayed Bituminous Surfacing
TfNSW 3253	Bitumen for Pavements
TfNSW 3258	Aggregate Precoating Agent (for Bitumen)
TfNSW 3259	Bitumen Adhesion Agent (for Bitumen)
TfNSW 3261	Cutback Bitumen

TfNSW Test Methods

TfNSW T103	Pretreatment of Samples of Road Materials by Artificial Weathering
TfNSW T203	Materials Finer than 75 µm in Aggregates (by washing)
TfNSW T230	Resistance to Stripping of Cover Aggregates and Binders
TfNSW T238	Initial Adhesion of Cover Aggregates and Binders
TfNSW T239	Fractured Faces of Coarse Aggregate
TfNSW T240	Texture Depth of Coarse Textured Road Surfaces
TfNSW T271	Ball Penetration Test
TfNSW T274	Measurement of Aggregate Spread Rate During Sealing (field method)
TfNSW T277	Measurement of Loose Aggregate on Sprayed Seals
TfNSW T506	Penetration of Bituminous Material
TfNSW T590	Homogeneity of Liquid Bituminous Additives
TfNSW T703	Flash Point by Pensky-Martens Closed Tester
TfNSW T1005	Qualitative Analysis using The Infra-Red Spectrophotometer

TfNSW Forms

TfNSW 354	Sprayer Certificate
TfNSW 382	Sprayed Bituminous Surfacing Cutback Chart
TfNSW 395A	Cutback Bitumen (or Tar) Prime and Primerseal – Design Calculation Sheet
TfNSW 395K	Cutback Bitumen Seal and Reseal – Design Calculation Sheet
TfNSW 500A	Cutback Bitumen (or Tar) Prime and Primerseal – Daily Record
TfNSW 500C	Cutback Bitumen Seal and Reseal – Daily Record

TfNSW Guides

TfNSW Sprayed Sealing Guide

Australian Standards

AS 1141	Methods for sampling and testing aggregates:
AS 1141.6.1	Particle density and water absorption of coarse aggregate – Weighing-in-water method
AS 1141.11	Particle size distribution by sieving
AS 1141.14	Particle shape, by proportional calliper
AS 1141.20.1	Average least dimension – Direct measurement (nominal size 10 mm and greater)
AS 1141.20.2	Average least dimension – Direct measurement (nominal sizes 5 mm and 7 mm)
AS 1141.22	Wet/dry strength variation
AS 1141.41	Polished aggregate friction value – Horizontal bed machine
AS 1152	Test sieves
AS 2008	Residual bitumen for pavements
AS 2106	Methods for the determination of the flash point of flammable liquids (closed cup)
AS 2157	Cutback bitumen
AS 2341	Methods of testing bitumen and related roadmaking products
AS 3568	Oils for reducing the viscosity of residual bitumen for pavements

Austrroads Test Methods

SDT 03	Absorption of bituminous binder into aggregate
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Austrroads Guides

Austrroads Bitumen Sealing Safety Guide

American Society for Testing and Materials

ASTM D86	Method for Distillation of Petroleum Products
ASTM D445	Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the calculation of dynamic viscosity)
ASTM D611	Test Method for Aniline Point and Mixed Aniline Point of Petroleum Products and Hydrocarbon Solvents
ASTM D1298	Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
ASTM D1319	Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption