

TRANSPORT FOR NSW (TfNSW)

QA SPECIFICATION R118

CRUMB RUBBER ASPHALT

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REVISION REGISTER

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
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Ed 1/Rev 1	2.1.3.2 2.2.1	Requirement for granulated glass aggregate to be washed added. Proportion of granulated glass aggregate in asphalt clarified.	MCQ	24.05.19
Ed 1/Rev 2	Global	References to “Roads and Maritime Services” or “RMS” changed to “Transport for NSW” or “TfNSW” respectively.	DCS	22.06.20
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Ed 1/Rev 4	Annex L	Table L.3 – Frequency of testing stated clarified to be for total filler used in asphalt production.	MCQ	10.09.20

GUIDE NOTES

(Not Part of Contract Document)

Using Specification R118

R118 is a QA specification and the use of QA specifications requires the implementation of a quality management system by the Contractor that meets the quality management system requirements specified in TfNSW Q. To comply with the intention of government policy as well as R118, asphalt works constructed using R118 require adequate surveillance and audit by the Principal.

Suitable Applications

Asphalt in accordance with this specification is suitable only for use as a single layer wearing course.

Crumb rubber asphalt in accordance with this specification is essentially a dense asphalt that is intended to reduce the risk of reflection cracking in asphalt overlays when placed over existing cracked asphalt, or cracked and/or jointed concrete pavements.

Clause 2.1.1 Coarse Aggregates

This specification relies on Materials Specification TfNSW 3152, and TfNSW Project Managers must complete Annexure 3152/A which addresses such matters as Minimum PAFV.

Clause 2.1.3.3 Crumb Rubber

The Contractor's WHS Plan should include the following minimum requirements in respect of crumb rubber asphalt fumes:

- (a) Combined dust and organic vapour respirators should be readily available for use by workers at all stages of the manufacturing and placing process. All respirators should conform to standards AS/NZ1715 and AS/NZS 1716.
- (b) With due regard to weather conditions, pavement temperature and haulage time, crumb rubber asphalt should be produced and placed at the lowest possible temperature to minimise fuming, provided the quality requirements of the specification are satisfied. The recommended maximum plant discharge temperature is 165°C.
- (c) Workers should move away from the paving machine during breaks and stand up wind.
- (d) For paving operations, it has been demonstrated that bitumen fume exposure, ranked in order of highest to lowest, is as follows:
 - (i) Paver operator;
 - (ii) Screed board operator;
 - (iii) Hand work operator;
 - (iv) Crew leader (ganger).

Where possible, workers subject to higher levels of exposure, particularly asphalt plant and paver operators, should be regularly rotated through other duties.

- (e) Paving operations are to be arranged so that there is a steady flow of mix through the paver as this minimises the need to agitate the mix in the paver hopper.

In addition to the above, your attention is drawn to the plant and equipment requirements detailed in Clauses 3.3.

Clause 2.4.1 Methods of Production

To allow adequate blending of the crumb rubber asphalt, it is recommended the wet mixing time in the plant batching process be increased compared to that for normal asphalt mix.

Clause 4.2 Course Thickness

Pavement designers must note that specified course thickness must be in accordance with Table R118.7.



Transport
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QA SPECIFICATION R118

CRUMB RUBBER ASPHALT

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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 R118 Edition 1 Revision 3.

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 R118

CRUMB RUBBER ASPHALT

1 GENERAL

1.1 OVERVIEW

This Specification sets out the requirements for crumb rubber asphalt, including:

- (a) use in heavy duty applications on highways where traffic loading is greater than 10^7 Equivalent Standard Axles (ESA's); and/or
- (b) at high stress locations such as traffic lights, stop/start locations, climbing lanes, roundabouts, etc.

The specified proportion of crumb rubber particle must be incorporated into the asphalt by a “dry process” in a batch type asphalt plant.

The asphalt may contain glass granulate aggregate and can be manufactured using either conventional or warm mix asphalt technology.

For all paving operations, a material transfer vehicle (MTV) must be used if specified in Annexure R118/A.

During the first 24 months after the Actual Completion Date:

- (i) the asphalt must not ravel, rut, shove, strip or bleed; and
- (ii) the asphalt for the first 12 months must comply with the surface shape requirements specified in Table R118.9.

1.2 SCOPE

The work to be executed under this Specification comprises the following:

- (a) design of the asphalt mix(es);
- (b) supply of materials, production and transport of the asphalt;
- (c) preparation and application of tackcoat on the surface on which the asphalt is to be placed;
- (d) placement and compaction of asphalt;
- (e) all inspection and testing necessary to demonstrate that the quality requirements of this Specification have been achieved.

1.3 STRUCTURE OF THE SPECIFICATION

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

1.3.1 Project Specific Requirements

Project specific requirements are shown in Annexure R118/A.

1.3.2 Measurement and Payment and Resolution of Nonconformities

The method of measurement and payment must comply with Annexure R118/B1.

Acceptance of materials and work must be in accordance with Annexure R118/B2.

1.3.3 Schedules of HOLD POINTS and Identified Records

The schedules in Annexure R118/C list the **HOLD POINTS** that must be observed. Refer to Specification TfNSW Q for the definition of **HOLD POINTS**.

The records listed in Annexure R118/C are **Identified Records** for the purposes of TfNSW Q Annexure Q/E.

1.3.4 Planning Documents

The **PROJECT QUALITY PLAN** must include each of the documents and requirements shown in Annexure R118/D and must be implemented.

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

Adopt the following documents for procedure(s) not specifically addressed in this Specification:

- (a) AS 2150 Hot mix asphalt – A guide to good practice; and
- (b) AGPT04B/07 Austroads Guide to Pavement Technology Part 4B: Asphalt.

1.3.5 Requirements for Technical Procedures

Details of calculation for insitu air voids and thickness are shown in Annexure R118/E.

1.3.6 Testing Procedures

The Inspection and Test Plan must nominate the proposed testing frequency to verify conformity of the item, which must not be less than the frequency specified in Annexure R118/L, except where the Principal has approved a reduced frequency of testing as per Clause 5.3.1.

Where a minimum frequency is not specified, nominate an appropriate frequency.

1.3.7 Referenced Documents

Unless specified otherwise or is specifically supplied by the Principal, the applicable issue of a referenced document, must be 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 given in Annexure R118/M.

1.4 DEFINITIONS AND ACRONYMS

1.4.1 Definitions

In this Specification:

- (a) The terms “you” and “your” mean “the Contractor” and “the Contractor's” respectively;

- (b) The term “crumb rubber asphalt” includes “dense asphalt”, “asphalt” and “mix”;
- (c) The term “dry process” means the addition of dry crumb rubber particle directly to the asphalt mixing plant pugmill, and excludes premixed rubber/bitumen blends.

Other definitions are in accordance with the Glossary of Austroads Terms.

1.4.2 Acronyms

The following acronyms apply to this Specification:

AAPA	Australian Asphalt Pavement Association
AC	Dense graded asphalt
ESA	Equivalent Standard Axel
IRI	International Roughness Index
MTV	Material Transfer Vehicle
MBV	Methylene Blue Value
NATA	National Association of Testing Authorities
N/A	Not Applicable
PAFV	Polished Aggregate Friction Value
PQP	Project Quality Plan
RAP	Reclaimed Asphalt Pavement
VMA	Voids in Mineral Aggregate
WHS	Work Health and Safety

2 SUPPLY OF ASPHALT

2.1 MATERIALS FOR ASPHALT

All materials used in the manufacture of asphalt must comply with the requirements of this Specification and maintain a uniform appearance for the duration of the work.

2.1.1 Coarse Aggregate

Coarse aggregate must comply with Specification TfNSW 3152.

When aggregates from a specific source or type, or when aggregate with a high PAFV or other special characteristics are specified, 100% of the coarse aggregate in the asphalt must comply with this requirement.

2.1.2 Fine Aggregate

Fine aggregate must comply with TfNSW 3152.

2.1.3 Recycled Materials

2.1.3.1 Reclaimed asphalt pavement (RAP) material

RAP material is not permitted.

2.1.3.2 Granulated Glass Aggregate

Granulated glass aggregate must be washed and comply with Specification TfNSW 3154.

2.1.3.3 Crumb Rubber

Crumb rubber must conform to Specification TfNSW 3256 and must be free from cord, wire, fluff and other deleterious material.

Notwithstanding the requirements of Specification TfNSW G22, address in your WHS Management Plan the work measures to deal with the effects of worker exposure to crumb rubber asphalt fumes, and all activities throughout the process.

2.1.4 Filler

The total filler in asphalt is the combined fraction of fines produced from the crushing of aggregates and any added filler which passes the 0.075 mm AS sieve.

Filler must meet the following requirements:

- (a) Added filler must conform to Specification TfNSW 3211;
- (b) Dry compacted voids content of the total filler fraction in asphalt determined in accordance with AS/NZS 1141.17 must be 40% or greater;
- (c) Methylene blue value (MBV) of the total filler in asphalt (excluding hydrated lime) determined in accordance with Test Method TfNSW T659 must not exceed 10 mg/g.

2.1.5 Binder

The class of binder used in the work must be as specified in Annexure R118/A, and, unless specified otherwise, the binder must be Class AR450. Except that, you may propose for use an alternative class of binder, subject to the approval of the Principal, for asphalt containing warm mix asphalt additive.

The binder must comply with the requirements of Specification TfNSW 3253 for the class of binder specified. Provide documentary evidence of the binder conformity for each delivery used in the work.

2.1.6 Additives

(a) Bitumen Adhesion Agent

Bitumen adhesion agent may be added to improve the resistance of the asphalt's propensity to stripping.

(b) Warm Mix Asphalt Additive

Warm mix asphalt additive may be added to asphalt to reduce the asphalt manufacturing temperature and/or to improve workability during the paving and compaction operations.

2.1.7 Bitumen Emulsion Tackcoat

Bitumen emulsion for use as a tackcoat must be CRS/170-60 complying with AS 1160, unless approved otherwise by the Principal.

2.2 REQUIREMENTS FOR ASPHALT**2.2.1 Proportions of Constituent Materials**

The proportions of constituent materials must be as follows:

(a) Combined Particle Size Distribution of Aggregate

The combined particle size distribution of asphalt aggregates, when determined in accordance with AS/NZS 2891.3.1, must conform to Table R118.1.

For the purpose of this clause, the crumb rubber in crumb rubber asphalt is part of the combined particle size distribution.

Table R118.1 – Combined Particle Size Distribution Limits for Different Nominal Size of Asphalt

AS Sieve Size	Combined Particle Size Distribution Passing Limits for Nominal Size of Asphalt (% by mass) (Asphalt Designation)	
	10 mm (CRA10)	14 mm (CRA14)
19.0 mm	–	100
13.2 mm	100	83 – 100
9.50 mm	83 – 100	58 – 82
6.70 mm	57 – 81	33 – 57
4.75 mm	29 – 53	23 – 47
2.36 mm	15 – 35	15 – 35
1.18 mm	9 – 28	9 – 28
0.600 mm	7 – 23	7 – 23
0.300 mm	0 – 12	0 – 12
0.150 mm	0 – 8.5	0 – 8.5
0.075 mm	0 – 5.5	0.5 – 5.5

(b) Binder

In the nominated mix design, the proportion of binder expressed as a percentage by mass of the total mix must comply with the requirements of Table R118.2.

Table R118.2 – Binder Content

Nominal Size of Asphalt (Asphalt Designation)	10 mm (CRA10)	14 mm (CRA14)
Binder Content (% by mass of total mix)	7.3 – 8.3	7.3 – 8.3

Note: The specified binder content range is applicable to commonly used natural sources of aggregates and sands for a known range of densities. If you propose to use constituents of substantially different density, then for the nominated design mix and use of the mix in the works, you may propose a nonconforming binder content subject to the approval of the Principal. You must demonstrate that the volumetric proportions are consistent with the intent of the Specification.

Determine the binder content in accordance with AS/NZS 2891.3.1.

Verify the binder content in asphalt by providing the Principal with certified copies of all individual batch weight records for each production Lot. In addition, for each production Lot, provide a statistical summary of the individual batch weight records, including:

- (i) Mean (A)
- (ii) Standard Deviation (SD)
- (iii) Coefficient of Variation (CV)
- (iv) Maximum Value (Max)
- (v) Minimum Value (Min)

(c) Crumb Rubber

The minimum crumb rubber content is 2.0% by mass of total mix.

(d) Granulated Glass Aggregate

The maximum proportion of granulated glass aggregate is:

- (i) 2.5% by mass of total mix in wearing course;
- (ii) 10% by mass of total mix in other than wearing course.

(e) Hydrated Lime

The proportion of hydrated lime must not be less than 1.5% by mass of total aggregate.

(f) Adhesion Agent

Asphalt may contain bitumen adhesion agent not exceeding 1.0% by mass of the binder.

(g) Warm Mix Asphalt Additive

The maximum proportion of additive must comply with Table R118.3:

Table R118.3 – Maximum Proportion of Additive in Warm Mix Asphalt

Additive	Maximum Proportion
Wax	2.0% by mass of binder
Surfactants	Nominated by Contractor
Water (either directly, or in the form of water containing crystals)	0.06% by mass of the total mix

2.2.2 Volumetric Characteristics

For all asphalt mixes:

- (a) air voids in laboratory compacted briquettes must be $\geq 3.0\%$ and $\leq 6.0\%$, when determined in accordance with Test Method TfNSW T662 (120 cycles of compaction), AS/NZS 2891.7.1 or AS/NZS 2891.7.3, AS/NZS 2891.8 and AS/NZS 2891.9.2;
- (b) voids in mineral aggregate (VMA) must be reported, when determined in accordance with Test Method TfNSW T662 at 120 cycles of compaction, AS/NZS 2891.7.1 or AS/NZS 2891.7.3, AS/NZS 2891.8 and AS/NZS 2891.9.2.

2.2.3 Moisture Content

For all mixes produced in a drum plant and/or containing a warm mix asphalt additive, the moisture content must be $< 0.5\%$ by mass of total mix, when determined in accordance with Test Method TfNSW T660.

2.2.4 Deformation Resistance

The rut depth, if specified in Annexure R118/A, when determined in accordance with Austroads AG:PT/T231, must be reported.

2.3 NOMINATED MIXES**2.3.1 Nominated Mix Design**

The submitted nominated mix design must:

- (a) satisfy the requirements of this Specification; and
- (b) be targeted during production of the asphalt.

The submitted nominated mix design is:

- (i) materials specific, and substitution of constituents is not permitted;
- (ii) design specific, and variation to the design nominated mix submission is not permitted;
- (iii) asphalt plant specific, and except for component maintenance, changes in the components, configuration and/or location of the plant is not permitted;
- (iv) contract specific, and release of the Nominated Mix Hold Point under another contract is not applicable to this Contract.

For each new establishment of a mobile asphalt plant, a full nominated mix submission is required.

2.3.2 Submission of Nominated Mix Design

Unless specified otherwise, all asphalt and binder tests relating to the submission must be carried out within a one month period prior to the date of submission to the Principal. All other tests relating to the submission must be carried out within a 6 month period prior to the date of submission to the Principal. All phases of any particular test must be performed at the same laboratory.

Submit to the Principal one nominated mix design for each asphalt mix specified in Annexure R118/A. The nominated mix design submission must include the following details:

(a) Constituent Materials

- (i) Coarse and fine aggregates: source, geological type.
Aggregate of different type or quality from the same quarry face or within a quarry will be regarded as a different source.
- (ii) Added filler: type, grade and source.
- (iii) Binder: source, class or grade.
- (iv) Recycled materials: type, source and manufacturer's recommendations.
- (v) Additives: type, source, trade name and manufacturer's recommendations.
- (vi) Bitumen emulsion tackcoat: source, class of bitumen, any bitumen modification.

(b) Mix Design

- (i) Proportion of each constituent by percentage of mass of total mix.
- (ii) For each nominated mix design, the nominating values and allowable tolerances, where required, for each requirement for the asphalt specified in Clause 2.2.
- (iv) Graphical representation of the nominated combined particle size distribution with control points as required by the limits of Table R118.1 and the production tolerances in accordance with Table R118.4.
- (v) Type and identification number of the asphalt mixing plant.
- (vi) Temperature at which the asphalt is manufactured.

(c) Production Trial

All production trial tests on each nominated mix must be from one trial batch. The tests on the constituent materials must represent the materials used in this trial batch.

(d) Signed Statement

A signed statement certifying that each nominated and production trial mix including all constituents meet the requirements of Clauses 2.1 and 2.2. The statement must include NATA endorsed test results for all specified tests. Attach a copy of your completed verification checklist.

(e) Warm Mix Asphalt Additives

When using warm mix asphalt additives, provide details of the additive(s) in the nominated mix design submission. Include evidence acceptable to the Principal that the additive is designed and has proven performance for the purpose described in this Specification.

The nominated mix design will be rejected if the nature, intended purpose and dosage of the warm mix asphalt additive are not clear in your nominated mix design submission.

Clearly state in your submission:

- (i) any proposed amendments to the mix design procedure, operational processes and/or test methods as a result of the inclusion of a warm mix asphalt additive; and
- (ii) the classification of the warm mix asphalt additive.

HOLD POINT

Process Held: Placing of the nominated mix(es).

Submission Details: Documents as detailed in Clause 2.3.2 at least 7 working days before the nominated mix(es) is (are) proposed to be placed.

Release of Hold Point: The Principal will consider the submitted documents prior to authorising the release of the Hold Point. This Hold Point release is valid for a maximum period of 12 months.

2.3.3 Proprietary Information

This Specification sets minimum technical standards and requires that details of constituents, design and quality verification be provided.

Clearly identify those details that are not provided because you consider it to be proprietary information, and propose for each item of such details, an alternative method of risk management on behalf of the Principal.

2.4 PRODUCTION OF ASPHALT

2.4.1 Method of Production

Your adopted method of production must:

- (a) control the process and targets the nominated mix design; and
- (b) supply a homogeneous and consistent product at the nominated manufacturing temperature.

2.4.2 Production Tolerances

2.4.2.1 Proportions of Constituents

The proportion of each constituent may be varied for the purpose of process control, provided that:

- (a) the proportion of each constituent, with the exception of added filler, must not vary by more than 10% from the value nominated; and
- (b) the proportion of each added filler must not vary by more than 15% from the value nominated.

2.4.2.2 Combined Particle Size Distribution and Binder Content

The actual combined particle size distribution may vary from the nominated value within the limits shown in Table R118.4, provided that the actual values also remain within the limits of Table R118.1.

Table R118.4 – Production Tolerances

Description	Tolerance
Permissible variation to nominated combined particle size distribution during production (% by mass of total aggregate, AS/NZS 2891.3.1) for each mix size:	
Pass 4.75 mm AS sieve and larger	± 7
Pass 2.36 mm and 1.18 mm	± 5
Pass 0.600 mm and 0.300 mm	± 4
Pass 0.150 mm	± 2.5
Pass 0.075 mm	± 1.5

2.4.2.3 Binder Content

Subject to Clause 2.2.1(b), the proportion of binder will be conforming when:

- (a) A does not exceed ± 0.2 of the value in the nominated mix; and
- (b) SD does not exceed 0.1.

2.4.3 Asphalt Manufacturing Plant

Operate the asphalt manufacturing plant with adequate production process controls to produce asphalt of a consistent quality and conforming to the requirements of this Specification. The production control system must produce auditable records of key process parameters including individual aggregate and filler feed rates/batch masses, binder application rate/batch mass and various process temperatures.

Implement a documented procedure for the management and control of the moisture content of each constituent aggregate material. Moisture content must be determined at least daily, and the asphalt manufacturing process controls adjusted accordingly.

The asphalt manufacturing plant must have sufficient capacity to supply asphalt for a continuous operation of the paver.

2.4.4 Storage and Handling**(a) Binder**

Heating and storage of binder must comply with the temperature and time limits set out in Advisory Note 7 published by the Australian Asphalt Pavement Association.

Provide details in your PROJECT QUALITY PLAN of the procedures for the acquisition, storage and handling of binder which identify and prevent contamination of the binder.

(b) Asphalt

Crumb rubber asphalt must be retained at manufacturing temperatures in silos or on trucks for 1 hour prior to paving. Crumb rubber asphalt must not be placed more than 3 hours after it has been manufactured.

2.4.5 Manufacturing Temperatures

Control the temperatures of constituent materials in response to suitable thermometer elements placed in the flow of materials from the drier, and in the binder storage system or binder supply line. Thermometer registrations must be readable and accurate to within $\pm 2^{\circ}\text{C}$.

Measure and record the temperature of the asphalt when:

- (a) the asphalt leaves the pugmill; or
- (b) the asphalt discharges from the hot storage bin(s); or
- (c) in the trucks prior to leaving the plant.

The despatch temperature of the asphalt must facilitate the specified density in the finished product. Provide details of the project specific process temperatures and the frequency of recording in your PROJECT QUALITY PLAN.

The temperature of asphalt must not at any time in the process exceed 175°C .

2.4.6 Sampling

Asphalt samples must be taken in accordance with AS/NZS 2891.1.1 at the frequency specified in Annexure R118/L.

2.5 TRANSPORT OF ASPHALT

The transport of asphalt must be in accordance with the requirements in AS 2150.

State in your PROJECT QUALITY PLAN the method of application and control of release agent to ensure a uniform, light coating of the vehicle's tray without ponding of surplus release agent.

Facilitate the continuous operation of the paving train by:

- (a) providing and allocating sufficient transport capacity; and
- (b) ensuring efficient on-site management of asphalt deliveries.

3 PLACING ASPHALT

3.1 GENERAL

Your method of placing and finishing the asphalt must:

- (a) produce a homogeneous product with a tightly bound surface;
- (b) achieve a uniform bond to the surface below; and
- (c) achieve the finished pavement properties, specified in Clause 4, within the specified tolerances.

Do not induce rapid cooling in the asphalt by the application of water at any stage in the process, including preparation for trafficking.

3.2 PREPARATION OF PAVEMENT

Prior to placing asphalt, prepare the surface to be paved in accordance with the requirements in AS 2150, including removal of raised extruded thermoplastic road markings and raised pavement markers.

3.3 METHOD OF PLACEMENT

The asphalt must be placed by a self-propelled paving machine equipped and operated with automatic thickness control and automatic joint matching facility.

Hand placement of asphalt is only permitted for minor corrections of the existing surface and in areas where placement with a paving machine is impractical.

State in your PROJECT QUALITY PLAN the method of achieving conforming compaction including roller type, number of passes and rolling pattern.

If specified in Annexure R118/A, a Material Transfer Vehicle (MTV) must be used in your paving operations. The MTV must be a self propelled machine with independent controls which will receive asphalt from delivery vehicles, store, remix and transfer the asphalt to the paving machine without contact and be equipped with:

- (a) a receiving hopper compatible with delivery vehicles;
- (b) conveying mechanisms and anti-segregation devices for remixing asphalt;
- (c) conveying mechanisms capable of delivering asphalt to the paver at a minimum rate to suit the paving output;
- (d) a minimum nominal on-board storage capacity of 15 tonnes;
- (e) an additional holding bin in the paving machine hopper; and
- (f) sufficient power output from the motor to operate with full load on grades up to 6% and travel in tandem with the paver, either directly in front or in an offset position.

If specified in Annexure R118/A, place the asphalt by echelon paving using a minimum of two paving machines operating continuously in tandem. The paving run layout must be such that the hot joint is located to minimise cold joints within the trafficked carriageway, unless approved otherwise by the Principal.

3.4 PROTECTION OF WORK

Provide for traffic in accordance with the requirements of Specification TfNSW G10 while undertaking the work.

Protect the work until the required thickness of asphalt has been placed, compacted and cooled sufficiently to carry traffic without damage to the work.

3.5 PROTECTION OF SERVICES AND ROAD FIXTURES

Do not allow asphalt or other material used on the work from entering or adhering to grates, hydrants or valve boxes, service covers, bridge joints and other road fixtures. Immediately after the asphalt has been placed, clean and remove all waste asphalt from the affected services and road fixtures.

3.6 COURSE AND LAYER THICKNESSES

A course of asphalt must comprise one layer only.

3.6.1 Nominated Layer Thickness

The nominated thickness of a layer of asphalt must be within 3.0 to 5.0 times the nominal mix size.

3.7 PAVEMENT TEMPERATURE AND WEATHER CONDITIONS

Measure and record the pavement surface temperature and wind velocity at the point of asphalt placing. Document the method of measurement and recording in your PROJECT QUALITY PLAN.

Do not commence or continue placing asphalt, unless the pavement surface temperature complies with the requirements in Table R118.5.

Table R118.5 – Minimum Asphalt Laying Temperature

Wind Speed (km/h)	Minimum Pavement Surface Temperatures (°C)
0 – 5	13 and rising
6 – 10	20
11 – 15	25
> 15	30

Note: Wind speed must remain constant over a period of 15 minutes

Do not place tackcoat and/or asphalt when the pavement surface is wet and/or rain is imminent.

3.8 PAVING AND COMPACTION TEMPERATURES

Your PROJECT QUALITY PLAN must document the temperatures at which the asphalt is placed and compacted to achieve the insitu air void requirements specified in Clause 4.1.1.

HOLD POINT

Process Held: Placing of the nominated mix (including placement trial).

Submission Details: Nominate in writing:

- (a) the minimum temperature at which asphalt is to be delivered to the paver; and
- (b) the minimum temperature at which initial compaction of the asphalt is to commence; and
- (c) the method of temperature measurement.

Release of Hold Point: The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

Do not incorporate asphalt that exhibits a temperature variation into the Works unless it has been remixed to a consistent and adequate temperature for compaction.

Measure and monitor paving and compaction temperatures as described in your PROJECT QUALITY PLAN with a hand held or machine mounted infrared thermometer readable and accurate to within $\pm 2^{\circ}\text{C}$ at the discharge point from a tipper truck or at the distribution auger on the paver.

Carry out verification of the accuracy of the infrared thermometer and determine the correlation factor daily at the commencement of work, and at any other time at the request of the Principal.

3.9 TACKCOAT

Prior to applying the tackcoat, the existing surface must be clean, dry and free from loose material.

Apply the tackcoat evenly at a rate of between 0.15 and 0.30 litres of residual bitumen per square metre so that it is effectively bonded to the surface. For joints and chases, double the application rate. Nominate in writing to the Principal your proposed tackcoat application rate prior to applying the tackcoat.

You may propose in writing to the Principal a reduced application rate for the tackcoat due to the existing underlying pavement material. Your proposal must be supported by examples of previous cases where this has been done, including locations and insitu material types and the current pavement performance.

Provide to the Principal a daily record with your endorsement, of the average tackcoat application rate applied to each Lot. Report the tackcoat application rate in terms of residual bitumen and state the percentage dilution of the tackcoat used during spraying.

The tackcoat must be intact at the commencement of asphalt placement.

3.10 JOINTS

Describe in your PROJECT QUALITY PLAN the procedure for the construction of joints. Your procedure must maximise joint density and include mechanised edge compaction or mechanised edge trimming. Hand tamping of edges is permitted where the use of a machine is impractical. Do not spread excess material resulting from hand preparation of edges on the surface of the work.

Remove all loose, cracked and/or boney material at the edge of a paved mat prior to placing the adjacent mat. Do not incorporate asphalt resulting from clean-up of process trimmings in the work.

Finish each joint with a smooth, planar surface coinciding with the surface of the rest of the mat and satisfying the surface shape requirements specified in Clause 4.4.

Longitudinal joints must be:

- (a) offset by 150 mm from the joint in the underlying layers;
- (b) located within 150 mm of the line of change in crossfall;
- (c) coincident with final traffic markings, unless approved otherwise by the Principal.

Transverse joints must be:

- (i) located at a minimum of 25 m apart;
- (ii) offset by a minimum of 1 m from the joint in the underlying layer;
- (iii) formed at the commencement of each paving run;
- (iv) formed when a delay in paving causes asphalt temperature to fall below the initial compaction temperature nominated in Clause 3.8.

3.11 PLACEMENT TRIAL

If specified in Annexure R118/A, carry out a separate placement trial using the plant and personnel proposed for the work for each nominated mix prior to commencing work.

Each placement trial must be located remote from the work, unless approved otherwise by the Principal. The size of the placement trial is to be limited to one production shift.

Design the trial to implement all the procedures described in your PROJECT QUALITY PLAN and demonstrate conformity with the Specification in respect of:

- (a) homogeneity;
- (b) insitu air voids;
- (c) course thickness;
- (d) course position;
- (e) surface shape;
- (f) joint quality; and
- (g) ride quality, where specified.

HOLD POINT

Process Held: Placing of the nominated mix.

Submission Details: Verification checklist and all relevant test results from the placement trial demonstrating conformity to the Specification, at least 3 working days prior to further placing of your nominated mix on the work.

Release of Hold Point: The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

In the event of a nonconformity in the placement trial, or when the Principal determines that a previous trial is not representative of the materials, asphalt mix proportions, temperature, plant, rate of output and/or method of placement, a new trial must be implemented.

Where a placement trial forms part of the work, manage all nonconformity in respect of materials, process and finished pavement properties in accordance with Clause 5.

3.12 TEMPORARY RAMPS AND TIE-INS TO EXISTING PAVEMENT AND STRUCTURES

Temporary ramps at joints for the safe trafficking of the work, must be constructed either by placement of asphalt complying with Specification TfNSW R116 or TfNSW R117 as appropriate for the application, or by cold milling of existing or new asphalt layer to form the ramp.

The length and grade of temporary ramps must be equivalent to those specified for treatment at edges and structures described in Specification TfNSW R101.

Construct permanent tie-ins to existing pavement by placement of asphalt complying with this Specification.

4 FINISHED PAVEMENT PROPERTIES

4.1 INSITU AIR VOIDS

4.1.1 Requirements for Insitu Air Voids

The layer of asphalt must be uniformly compacted to achieve the specified characteristic values of insitu air voids before the next layer is placed.

The asphalt must have a dense appearance with the cut or cored faces of samples exhibiting few, if any, surface voids.

Do not test asphalt layers less than or equal to 30 mm nominated thickness for insitu air voids.

The characteristic values of insitu air voids for the Lot must comply with Table R118.6.

Table R118.6 – Insitu Air Voids Standard

Limits for Characteristic Values of Insitu Air Voids	
Specified layer thickness > 30 mm and < 50 mm	Specified layer thickness ≥ 50 mm
$V_L = 3.0\%$ and $V_U = 8.0\%$	$V_L = 3.0\%$ and $V_U = 7.0\%$

Note: V_L is the lower limit of characteristic value of insitu air voids and V_U is the upper limit of characteristic value of insitu air voids.

4.1.2 Determination of Insitu Air Voids

Carry out compaction control on Lots using statistical techniques as specified in TfNSW Q.

The calculation for determining the insitu air voids is set out in Annexure R118/E. Determine the bulk density either from cores in accordance with AS/NZS 2891.9.2 or from nuclear density measurements taken in accordance with AS/NZS 2891.14.2 and using the calibrated procedure described in AS/NZS 2891.14.3. Use only one of these methods to calculate the bulk density.

Cores must be taken in accordance with AS/NZS 2891.1.2. Determine the layer thickness prior to trimming of cores. Trimming must not reduce the core layer thickness by more than 5 mm.

In situ air void measurement by nuclear density gauge is not applicable where steel reinforcement exists within 300 mm of the surface of the layer being measured.

The reference density for the purpose of insitu air voids calculations is the mean maximum density of the Lot where the individual values are determined in accordance with AS/NZS 2891.7.1 or AS/NZS 2891.7.3.

The bulk density of cores taken for density offset calculations is determined in accordance with AS/NZS 2891.9.2.

The density offset is separately determined for:

- (i) every change in underlying pavement materials and layering within 300 mm of the surface of the layer being measured; and
- (ii) every change in nominated mix and specified layer thickness.

4.2 COURSE THICKNESS**4.2.1 Requirement for Course Thickness**

The specified course thickness is detailed in Annexure R118/A.

(a) Where finished surface levels are not specified

Comply with EITHER of the following:

- (i) Where the single layer of asphalt is placed over an existing pavement constructed by others, the average compacted course thickness for each Lot must not be less than the specified course thickness or greater than the specified course thickness plus the tolerance specified in Table R118.7 for the nominal size of asphalt;

OR

- (ii) Where asphalt is placed over one or more layers placed by you, the Lot is deemed to be conforming if the lower characteristic value of thickness (T_L) for the Lot is not less than the specified course thickness as shown on the Drawings or specified in Annexure R118/A and the upper characteristic value of thickness (T_U) for the Lot is not more than the specified course thickness plus the tolerance specified in Table R118.7 for the nominal size of the asphalt.

Table R118.7 – Allowable Tolerances for Course Thickness

Nominal Size of Asphalt (mm)	Specified Course Thickness (mm)	Tolerance (mm)
10	35	+ 6
14	45	+ 8

(b) Where finished surface levels are specified

Control the course thickness by maintaining the design levels and the surface shape requirements specified in Clause 4.4, provided that:

- (i) The average compacted course thickness of each Lot calculated from surveys must be consistent with the average compacted course thickness of the respective Lot determined from cores. Include in your PROJECT QUALITY PLAN the statistical technique for verifying the consistency of the results; and
- (ii) The average compacted course thickness of each Lot of the wearing course is within 10% of the specified course thickness.

4.2.2 Determination of Course Thickness

Determine the characteristic values and average value of thickness of the Lot on the basis of statistical techniques as specified in TfNSW Q on cores taken in accordance with AS/NZS 2891.1.2 where:

- (a) core layer thickness is determined prior to trimming of the core;
- (b) the core diameter can be less than 95 mm;
- (c) the test specimen may comprise more than one layer.

The calculation of the upper and lower characteristic values of thickness for the Lot is shown in Annexure R118/E2.

4.3 COURSE POSITION

4.3.1 Determination of Course Position

Where finished surface levels are specified, measure the course position of each Lot by survey in accordance with TfNSW Q.

Where finished surface levels are not specified, determine the course position by reference to existing pavement surface and road fixtures.

Determine the course position within 72 hours of the installation of the Lot.

4.3.2 Requirement for Vertical Level

The levels of the top surface of the course must not vary from the design levels determined from the Drawings by more than the tolerance shown in Table R118.8.

Where the new asphalt wearing course is required to match the surface levels of a road structure (e.g. tie-in to existing pavement or bridge joints, pavement gutter, utility access point, etc), the pavement must be constructed so as to drain the surface of water and match the surface levels of the existing road structure, unless directed otherwise by the Principal.

Table R118.8 – Allowable Tolerances for Survey Levels

Course	Below Calculated Level (mm)	Above Calculated Level (mm)
Wearing Course	0	10

4.3.3 Requirement for Horizontal Location

The survey location of any point on the surface of a course for level determination must be located within 25 mm from the corresponding point determined from the Drawings.

4.4 SURFACE SHAPE

4.4.1 Determination of Surface Shape

Determine and report the surface shape in accordance with Test Method TfNSW T183.

The maximum Lot size must be in accordance with TfNSW Q and extended to include the adjacent longitudinal joints, transverse joints and tie-ins. Carry out testing at the frequency as specified in Table R118/L.5 of Annexure R118/L.

4.4.2 Requirement for Surface Shape

The surface of the course including longitudinal and transverse joints must not pond water.

The surface shape of the course within the traffic lane must not deviate from the bottom of a straightedge laid in any direction by more than the tolerances shown in Table R118.9. Where the

deviations from a straightedge for an existing surface exceed 10 mm, carry out rectification of those areas before a new asphalt layer is placed, unless directed otherwise by the Principal.

Correct any nonconformities before testing ride quality.

Table R118.9 – Maximum Deviation From Straight Edge Placed Within Traffic Lane (mm)

Wearing Course	Ramps, Roundabouts and Through Carriageway < 70 kph Traffic Speed	Through Carriageway ≥ 70 kph Traffic Speed
At Actual Completion Date	5	3
12 months after	8	6

4.5 RIDE QUALITY

4.5.1 Determination of Ride Quality

If specified in Annexure R118/A, determine the ride quality from measurements of longitudinal profile taken by a vehicular laser profilometer where the ride quality is the International Roughness Index (IRI_s) determined in accordance with Test Method TfNSW T188 and the Lot is a Section within the test lane as defined in the Test Method.

Develop an Inspection and Test Plan (ITP) for ride quality that meets the requirements of the Specification. Define the Lots and the start and end locations for testing in your ITP.

Supply the Principal with copies of the TfNSW Accreditation Certificates for each vehicular laser profilometer driver and operator proposed for use in the Works.

4.5.2 Requirement for Ride Quality

The surface of the wearing course must have a smooth longitudinal profile, and

- (a) when construction of the underlying pavement forms part of the Contract; or
- (b) when asphalt is placed in more than one layer, including any corrective course over a pavement constructed by others;
- (c) when the scope of the work targets a ride quality;

The ride quality of each Lot must not exceed an IRI_s of 1.56 m/km.

Where a single layer of asphalt is placed over pavement constructed by others, the ride quality of each Lot must not exceed the IRI_{sa} values determined as follows:

$$IRI_{sa} = 0.2 + (0.6 \times IRI_{sb}), \text{ or } 1.56 \text{ m/km, whichever is the greater}$$

where: IRI_{sa} is the IRI_s after placing the asphalt layer (m/km)

IRI_{sb} is the IRI_s before placing the asphalt layer (m/km)

Where a single layer of asphalt is placed over a pavement constructed by others, determine and report the ride quality of the existing surface prior to the work. Lots of the existing surface must be selected such that they coincide with Lots of the finished work.

4.6 TEXTURE DEPTH

At the time of construction, the texture depth when determined in accordance to Test Method TfNSW T240 must be equal to or greater than 1.0 mm.

5 CONFORMITY

Verify conformity with the Specification by sampling and testing, and providing records of process control.

5.1 HOMOGENEITY

All asphalt must be homogeneous in appearance.

Areas of asphalt that exhibit segregation, cracking, ravelling, bony or fatty material, or have been damaged during construction must be rectified or replaced.

Any proposal by you that the Principal accepts non-homogeneous and/or segregated material or work must be in writing and must show:

- (a) the technical reasons for acceptance;
- (b) compliance with the Specification; and
- (c) sub-Lotting that minimises performance risk to the surface and structure of the pavement.

5.2 SAMPLING

Nominate all sampling locations, frequencies and test methods in your PROJECT QUALITY PLAN.

In addition to the requirements of Annexure Q/L of TfNSW Q, and unless specified otherwise or agreed with the Principal, boundaries of sub-Lots represented by a single tested sample are deemed to be the midpoints in production between the sample points for the purpose of Clause B2 in Annexure R118/B of this Specification.

When the Principal requests loose asphalt samples for testing, you must riffle and/or quarter the samples.

All samples, including core samples, must be delivered in sealed and labelled containers.

5.3 TESTING

5.3.1 Minimum Frequency of Testing

The minimum frequency of testing is specified in Annexure R118/L. Nominate an appropriate frequency where a minimum frequency of testing is not specified.

You may propose in writing to the Principal that a reduced minimum frequency of testing be accepted in accordance with TfNSW Q. Support your proposal with a statistical analysis verifying consistent process capability and product characteristics.

In the event of a nonconformity, a reduced frequency of testing must revert immediately back to the specified minimum frequency of testing. You can request a reduction in the minimum frequency of testing when you can demonstrate again by statistical analysis that you have gained a consistent process capability and product characteristics.

5.3.2 Maximum Lot Size

The maximum Lot size must conform to TfNSW Q.

5.3.3 Time for Submission of Test Results

Complete and report to the Principal:

- (i) the tests for binder content, combined particle size distribution and air voids in laboratory compacted mix within one working day of placing the asphalt.
- (ii) the results for insitu air voids, course thickness and course shape within three working days of placing the asphalt.

5.4 PROCESS CONTROL

Employ a capable process and implement process control in accordance with or exceeding the requirements of Australian Asphalt Pavement Association Implementation Guide IG-3.

5.5 NONCONFORMITIES

If a Lot fails to conform to the Specification, such failure will constitute a nonconformity under the Contract.

If a nonconformity is not accepted in accordance with Annexure R118/B2, rectify or replace the Lot.

ANNEXURE R118/A – PROJECT SPECIFIC REQUIREMENTS

The requirements below apply to the following pavement types in the project:

NOTES TO TENDER DOCUMENTER: (Delete this boxed text after customising Annexure R118/A)

Insert in the table below the asphalt to be used.

Repeat the table for requirements of each pavement design.

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

Location:

Course	Nominal Size of Asphalt (mm)	Class of Binder (Clause 2.1.5)	Specified Course Thickness (mm) (Clause 4.2.1)
Wearing			

Clause	Description	Requirement
2.2.4	Performance testing required: - Wheel Tracking	Yes / No
3.3	Material Transfer Vehicle required:	Yes / No
3.3	Paving in echelon required:	Yes / No
3.11	Placement trial required:	Yes / No
4.5.1	Measurement of ride quality of pavement required:	
	- existing pavement	Yes / No
	- finished pavement	Yes / No

Measure the following pay items by area (refer Annexure R118/B):

List here pay items to be measured by area.

Other Project Specific Requirements:

List here other project specific requirements.

ANNEXURE R118/B – MEASUREMENT AND PAYMENT AND RESOLUTION OF NONCONFORMITIES

Refer to Clause 1.3.2.

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.

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.

Measurement and payment of asphalt is made on the basis of either mass or area as follows:

(a) Measurement by Mass

Unless specified otherwise in Annexure R118/A, the quantity of asphalt must be measured by mass and the unit of measurement is the “tonne”.

The Principal may approve measurement by batch weights using certified scales. The quantity of asphalt in place in the final work must be mutually agreed using the TfNSW Contract Quantity Agreement Sheet using the tally of the weigh bridge docket of delivered asphalt less the quantity of asphalt not incorporated in the Works.

Truck weighbridge dockets must be issued at a weighbridge certified by the NSW Office of Fair Trading and collected at the point of delivery.

(b) Measurement by Area

If specified in Annexure R118/A, the quantity of asphalt is measured by area and the unit of measurement is square metre.

The area will be determined from the dimensions shown on the Drawings or as specified for the work in Annexure R118/A.

The measurement of tackcoat sprayed is based on the quantity of residual bitumen. The unit of measurement is the litre determined from sprayer tanker dippings.

Pay Item R118P1 – Supply and Application of Tackcoat (Including Preparation of Surface)

Unless specified otherwise in Annexure R118/A, the quantity of tackcoat used in the work is determined by volume and the unit of measurement is a litre of residual bitumen.

Determine the volume by multiplying the nominated application rate of residual bitumen by the specified area of the road surface to be tackcoated.

Tackcoat applied to faces of joints, kerbs and other structures is deemed to be included in the rate.

Pay Item R118P2 - (Not Used)

Pay Item R118P3 – (Not Used)

Pay Item R118P4 – Crumb Rubber Asphalt in Wearing Course

R118P4.1 10 mm Nominal Size

R118P4.2 14 mm Nominal Size

**Pay Item R118P5 – Crumb Rubber Asphalt over Existing Pavement
(No Levels Specified)**

R118P5.1 10 mm Nominal Size

R118P5.2 14 mm Nominal Size

**Pay Item R118P6 – Crumb Rubber Asphalt over Existing Pavement
(Levels Specified)**

R118P6.1 10 mm Nominal Size

R118P6.2 14 mm Nominal Size

Pay Item R118P7 – Incentives and Deductions in accordance with Annexure R118/B

R118P7.1 All deductions calculated as per Tables R118/B.1, R118/B.2 and R118/B.5

R118P7.2 All incentives calculated as per Tables R118/B.6

Incentives and deductions under this pay item are not subject to rise and fall adjustments.

Pay Item R118P8 – Miscellaneous Items

R118P8.1 Wheel Tracking Test if specified in Annexure R118/A (rate for each nominated mix)

B2 RESOLUTION OF NONCONFORMITIES

B2.1 General

If the nonconformity is not accepted in accordance with Annexure R118/B2.2, the nonconforming material must be replaced or the nonconforming section of 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, will be borne by you. Materials removed from the site by you must be replaced with materials that conform to this Specification.

B2.2 Acceptance of Nonconformities

You may propose in writing to the Principal that pre-determined dispositions be applied to nonconformities for the following properties:

- (a) Combined particle size distribution and binder content in asphalt;
- (b) Insitu air voids;
- (c) Ride quality.

Deductions apply to the schedule rate for the quantity of asphalt represented by the test sample and will be recorded against Pay Item R118P7.1.

B2.2.1 Combined Particle Size Distribution and Binder Content

Deductions in accordance with Table R118/B.1 will be applied to accepted nonconformities in combined particle size distribution and binder content provided that:

- (a) For any individual sieve size and the binder content, nonconformities greater than twice the production tolerance specified in Table R118.4 will not be accepted, and
- (b) Deductions are cumulative and nonconformities will not be accepted if combined deductions exceed 20%.

Table R118/B.1 – Deductions for Combined Particle Size Distribution and Binder Content

	% by which nonconformity exceeds production tolerance (Clause 2.4.2)	Deductions (in % of schedule rate)
Combined Particle Size Distribution Element	(% by mass of total aggregate)	
Pass 37.5 mm AS sieve	Each 2 or part thereof	1
Pass 26.5 mm AS sieve	Each 2 or part thereof	1
Pass 19.0 mm AS sieve	Each 2 or part thereof	1
Pass 13.2 mm AS sieve	Each 2 or part thereof	1
Pass 9.50 mm AS sieve	Each 2 or part thereof	1
Pass 6.70 mm AS sieve	Each 2 or part thereof	1
Pass 4.75 mm AS sieve	Each 2 or part thereof	1
Pass 2.36 mm AS sieve	Each 1 or part thereof	1
Pass 1.18 mm AS sieve	Each 1 or part thereof	1
Pass 0.600 mm AS sieve	Each 1 or part thereof	1
Pass 0.300 mm AS sieve	Each 1 or part thereof	2
Pass 0.150 mm AS sieve	Each 0.5 or part thereof	2
Pass 0.075 mm AS sieve	Each 0.5 or part thereof	2
Binder Content for	(% by mass of total asphalt mix)	
20 mm asphalt or smaller	Each 0.1 or part thereof	3

B2.2.2 Insitu Air Voids

Deductions in accordance with Table R118/B.2 will be applied to accepted nonconformities in excess of the upper characteristic insitu air voids provided that nonconformities will not be accepted when the upper characteristic insitu air voids exceeds the specified limit by more than 1.5%.

Table R118/B.2 – Deductions for Nonconforming Insitu Air Voids

Insitu air voids in excess of specified limit V_U by	Deduction (in per cent of value of Lot)
< 0.5%	5%
0.5% – 1.0%	30%
1.1% – 1.5%	50%
> 1.5%	Reject

Where a Hold Point is required to be observed, investigate the causes of the nonconformity, and propose corrective action to prevent recurrence of future nonconformity.

HOLD POINT

Process Held:	Manufacture of the nominated mix (Rejected Lots).
Submission Details:	A proposal for corrective action to achieve conformity.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

Do not recommence production of asphalt until the corrective action is implemented. Test after implementing corrective action and report results within 4 working days of the resumption of production.

B2.2.3 (Not Used)**B2.2.4 (Not Used)****B2.2.5 Ride Quality**

Deductions in accordance with Table R118/B.3 must be applied to accepted nonconformities in ride quality provided that the nonconformities will not be accepted when the ride quality exceeds the specified limit by more than 0.80 m/km.

Table R118/B.3 – Deductions for Ride Quality

Ride quality in excess of specified limit by (m/km)	Deduction (in per cent of value of Lot)
< 0.25	2
0.25 – 0.43	4
0.44 – 0.61	8
0.62 – 0.80	16

B3 INCENTIVES

It may be proposed in writing to the Principal that pre-determined incentives be applied in accordance with Table R118/B.4 to the ride quality of the asphalt wearing course, provided that:

- (a) The Lot conforms to all requirements of this Specification; and
- (b) For all three adjacent Lots in all directions, the ride quality is conforming.

Table R118/B.4 – Incentives for Ride Quality

Ride quality below specified limit by (m/km)	Incentive (in per cent of value of Lot)
< 0.44	0
0.44 – 0.61	1
0.62 – 0.80	2
> 0.80	3

Incentives apply to the schedule rate for the quantity of asphalt represented by the test sample and must be recorded against Pay Item R118P7.2.

ANNEXURE R118/C – SCHEDULES OF HOLD POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.3.3.

C1 SCHEDULE OF HOLD POINTS

Clause	Description
2.3.2	Submission of nominated mix design details
3.8	Submission of paving and compaction temperature details to achieve conformity
3.11	Submission of verification checklists and test results from placement trial
B2.2.2	Submission of proposed corrective actions

C2 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
2.1.5	Documentary evidence of the binder conformity for each delivery
2.3.2	Documents as detailed for each nominated asphalt mix
2.3.3	Documents as detailed for proprietary information
2.4.3, 2.4.5	Asphalt manufacturing process parameters including process temperatures
3.7	Pavement temperature and weather conditions
3.8	Measure asphalt paving and compaction temperature
3.9	Daily record of the average tackcoat application rate in each Lot
3.11	Verification checklist and all listed test reports of the trial section for each combination of materials, mix proportions, equipment, rate of paving and methods for placement, compaction and finishing
4.4.1	The location and frequency of straight edge measurements including testing at longitudinal and transverse joints
5.3.1	Test reports of all specified properties and characteristics at the minimum frequency of testing

ANNEXURE R118/D – PLANNING DOCUMENTS

Refer to Clause 1.3.4.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. Review the requirements of this Specification and others included in the Contract to determine additional documentation requirements.

Clause	Description
1.3.4	Manufacturer's written recommendations.
2.1	For each constituent material, Lot/stockpile sizes, method of defining each Lot and allocating a unique Lot Number.
	Procurement, handling and storage of each constituent material.
	Nominated particle size distribution and tolerances for each constituent aggregate.
2.3	Development and authorisation of the nominated mix submission.
2.4	For each nominated mix, method of defining each Lot and allocating a unique Lot Number.
	Calibration of the asphalt manufacturing plant, including all weigh scales, flowmeters and thermometers.
	Process control, including plant operating instructions, key temperature targets and records, and response to process control charts.
	Acquisition, storage and handling of binder, including identification and prevention of segregation and/or contamination.
	Control of plant feed proportions, including regular checks on grading and moisture content.
	Daily asphalt manufacturing plan to ensure timely and uninterrupted progress on site.
2.5	Loading, delivery and unloading procedures that maintain adequate mix temperature and do not interrupt progress of the paving train.
3	For each paving and related activity, method of defining each Lot and allocating a unique Lot Number.
	Calibration of all thermometers and other measuring equipment.
	Process control for surface preparation, tackcoating, placing, joint construction, compaction and cleanup, including plant operating instructions, key temperature targets and records, patterns for paving and compaction operations, and process monitoring.
3.3	Allocation of appropriate plant and equipment, including backup in case of breakdown.
	Rolling pattern, including roller type and number of passes.
3.6	Nominated layer thicknesses where these have not been specified by the Principal.
3.7	Measurement and recording of pavement temperatures and weather conditions.
3.8	Paving and compaction temperature to achieve insitu air void requirements.
3.9	Proposed application rates for tackcoat.

Clause	Description
3.10	Construction joints.
3.11	Design, execution and quality verification of a placement trial.
4.2.1	Requirements for course thickness.
5.2 & 5.3	Inspection and test plan, including methods and frequencies of sampling, methods and frequencies of testing, verification checklists, and timeframe for submission of test results.

ANNEXURE R118/E – CALCULATIONS

E1 CALCULATION OF CHARACTERISTIC VALUES OF INSITU AIR VOIDS

Calculate the upper (V_U) and lower (V_L) characteristic values of insitu air voids of the Lot as follows:

$$V_U = \bar{a} + ks \quad V_L = \bar{a} - ks$$

where: s = the standard deviation of sub-Lot air voids expressed as a percentage

k = value stated in TfNSW Q Annexure Q/L Clause L3.2

\bar{a} = the arithmetic mean of insitu air voids expressed as a percentage for all sub-Lots

$$\text{and } a = \left(\frac{MD - BD}{MD} \right) \times 100\%$$

MD = mean maximum density of the Lot determined in accordance with AS/NZS 2891.7.1 or AS/NZS 2891.7.3

BD = bulk density of the sub-Lot determined in accordance with

(i) AS/NZS 2891.9.2 for cores

(ii) AS/NZS 2891.14.2 and AS/NZS 2891.14.3 for nuclear density gauge

Round and report the values of V_U and V_L to the nearest 0.1%.

E2 CALCULATION OF CHARACTERISTIC VALUE OF THICKNESS

Calculate the upper (T_U) and lower (T_L) characteristic values of thickness for the Lot as follows:

$$T_U = \bar{x} + ks \quad T_L = \bar{x} - ks$$

where: s = the standard deviation of sub-Lot attribute test results

k = value stated in TfNSW Q Annexure Q/L Clause L3.2

x = the average height of a core (mm) based on measurements taken at four equidistant points at the circumference of the core.

\bar{x} = the arithmetic mean of attribute test results for all sub-Lots

(Note: \bar{x} , x and s are in mm and T is rounded to the nearest whole millimetre.)

ANNEXURES R118/F TO R118/K – (NOT USED)

ANNEXURE R118/L – MINIMUM FREQUENCY OF TESTING

The minimum frequency of testing of the materials, production, placing and finished pavement are listed in Tables R118/L.1 to R118/L.5.

Table R118/L.1 – Minimum Frequency of Testing of Asphalt

Quantity of Asphalt Supplied in Each Shift	Minimum Frequency of Testing
Less than 100 tonnes	One per 50 tonnes or part thereof
101 to 300 tonnes	One per 100 tonnes or part thereof
301 to 600 tonnes	One per 150 tonnes or part thereof
Over 600 tonnes	One per 200 tonnes or part thereof

Note: A "shift" must be continuous work not exceeding a period of 12 hours.

Table R118/L.2 – Constituents

Clause	Constituent	Minimum Frequency of Testing⁽²⁾
2.1.1	Coarse aggregates	As per TfNSW 3152
2.1.2	Fine aggregates	As per TfNSW 3152
2.1.3	Crumb Rubber	As per TfNSW 3256
2.1.3	Glass granulate aggregate	As per TfNSW 3154
2.1.4	Added fillers	As per TfNSW 3211
2.1.5	Binder	As per TfNSW 3253
2.1.7	Bitumen emulsion tackcoat	As per AS 1160

Notes:

- ⁽¹⁾ The nominated mix design submission must also include complying test results for each specified characteristic of each constituent.
- ⁽²⁾ The minimum frequency of testing must be in accordance with the specific TfNSW Test Method or Australian Standard.

Table R118/L.3 – Asphalt Production

Clause	Characteristic	Test Method / Procedure	Minimum Frequency of Testing
2.1.4	Total filler in asphalt – Dry compacted voids	AS/NZS 1141.17	One per 10,000 tonnes or part thereof used in asphalt production, and at change in source of mineral matter
2.1.4	Total filler in asphalt – Methylene blue value	TfNSW T659	One per 10,000 tonnes or part thereof used in asphalt production, and at change in source of mineral matter
2.2.1	Binder content	AS/NZS 2891.3.1	As per Table R118/L.1
2.2.1	Binder content verification	Clause 2.2.1(b)	Each production Lot
2.2.1	Combined particle size distribution	AS/NZS 2891.3.1	As per Table R118/L.1
2.2.2	VMA and air voids in laboratory compacted mix (120 cycles)	TfNSW T662 AS/NZS 2891.7.1 or AS/NZS 2891.7.3 AS/NZS 2891.8 AS/NZS 2891.9.2	As per Table R118/L.1
2.2.3	Moisture content	TfNSW T660	As per Table R118/L.1
2.2.4	Deformation resistance	AG:PT/T231	One test with each nominated mix submission (if specified in Annexure R118/A)
2.4.5	Production temperature of asphalt	Your documented procedure	As specified in PROJECT QUALITY PLAN
2.4.5	Despatch temperature of asphalt	Your documented procedure	Each delivered load

Table R118/L.4 – Asphalt Placing

Clause	Characteristic	Test Method / Procedure	Minimum Frequency of Testing
3.7	Pavement temperature	Your documented procedure	1 measurement every 2 hours
3.7	Wind velocity	Your documented procedure	1 measurement every 2 hours
3.8	Temperature at initial compaction	Your documented procedure	Each delivered load
3.9	Tackcoat application rate	Your documented procedure	Each paving Lot
5.1	Homogeneity	Visual assessment	Each paving Lot

Table R118/L.5 – Finished Pavement Properties

Clause	Characteristic	Clause / Test Method	Minimum Frequency of Testing
4.1	In situ air voids	Clause 4.1.2	As specified for relative compaction > 100.0 in TfNSW Q L3.1
4.2	Course thickness	Clause 4.2.2	As specified for relative compaction > 100.0 in TfNSW Q L3.1
4.3	Course position	Clause 4.3.2 & Clause 4.3.3	TfNSW Q
4.4	Surface Shape	TfNSW T183	<p>(a) Within lane: one measurement in longitudinal direction and 1 measurement in transverse direction every 60 m²</p> <p>(b) Longitudinal joint excluding crowns: one measurement per 10 lineal metres</p> <p>(c) Transverse joint: one measurement in each wheel path in each lane except at the boundaries of the contract</p>
4.5	Ride quality	TfNSW T188	Each Lot as defined in TfNSW T188
4.6	Texture Depth	TfNSW T240	1 test per 100 m of traffic lane length, or part thereof.

ANNEXURE R118/M – REFERENCED DOCUMENTS

Refer to Clause 1.3.7.

TfNSW Specifications

TfNSW G10	Traffic Management
TfNSW G22	Work Health and Safety (Construction Work)
TfNSW Q	Quality Management System
TfNSW R101	Cold Milling of Road Pavement Materials
TfNSW R116	Heavy Duty Dense Graded Asphalt
TfNSW R117	Light Duty Dense Graded Asphalt
TfNSW 3152	Aggregates for Asphalt
TfNSW 3154	Granulated Glass Aggregate
TfNSW 3211	Cements, Binders and Fillers
TfNSW 3253	Bitumen for Pavements
TfNSW 3256	Crumb Rubber
TfNSW 3259	Bitumen Adhesion Agent (for Bitumen)

TfNSW Test Methods

TfNSW T183	Surface Deviation Using a Straightedge
TfNSW T188	Project Ride Quality (Vehicular Laser Profilerometer)
TfNSW T230	Resistance to Stripping of Aggregates and Binders
TfNSW T649	P propensity for Moisture Damage in Asphalt (Cores)
TfNSW T659	Methylene Blue Value of Road Construction Material
TfNSW T660	Moisture Content of Bituminous Mixes (Mass Loss Method)
TfNSW T662	Compaction of Asphalt Test Specimens (using a Gyratory Compactor)

Australian Standards

AS/NZS 1141.17	Methods for sampling and testing aggregates – Voids in dry compacted filler
AS 1160	Bituminous emulsions for the construction and maintenance of pavements
AS/NZS 1715	Selection, use and maintenance of respiratory protective equipment
AS/NZS 1716	Respiratory protective devices
AS 2150	Hot mix asphalt – A guide to good practice
AS/NZS 2891	Methods of sampling and testing asphalt:
AS/NZS 2891.1.1	Sampling – Loose asphalt
AS/NZS 2891.1.2	Sampling – Coring method

AS/NZS 2891.3.1	Binder content and aggregate grading – Reflux method
AS/NZS 2891.7.1	Determination of maximum density of asphalt – Water displacement method
AS/NZS 2891.7.3	Determination of maximum density of asphalt – Methylated spirits displacement
AS/NZS 2891.8	Voids and voluminous properties of compacted asphalt mixes
AS/NZS 2891.9.2	Determination of bulk density of compacted asphalt – Presaturation method
AS/NZS 2891.14.2	Field density tests – Determination of field density of compacted asphalt using a nuclear thin-layer density gauge
AS/NZS 2891.14.3	Field density tests – Calibration of nuclear thin-layer density gauge using standard blocks

Austrroads Test Methods and Guides

AG:PT/T231	Deformation resistance of asphalt mixtures by the wheel tracking test
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AAPA Guides

Advisory Note 7	Guide to the Selection, Heating and Storage of Binders for Sprayed Sealing and Hot Mixed Asphalt
IG-3	Asphalt Plant Process Control Guide