TRANSPORT FOR NSW (TfNSW)

QA SPECIFICATION R126

HIGH MODULUS ASPHALT (EME2)

REVISION REGISTER

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Ed 1/Rev 0		First issue.	DCS	12.02.20
Ed 1/Rev 1	Global	References to "Roads and Maritime Services" or "RMS" changed to "Transport for NSW" or "TfNSW" respectively.	DCS	22.06.20
Ed 1/Rev 2	Annex L	Table L.2 – minimum frequency of testing for fillers in asphalt added.	MCQ	25.08.20
Ed 1/Rev 3	Annex L	Table L.2 – 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 R126

This document sets out the requirements for High Modulus Asphalt, also known as *Enrobés à Module Elevé Class 2*, with a nominal aggregate size of 14 mm, which is abbreviated as EME2 in this document.

When there is good pavement support, EME2 (as compared to current dense graded asphalt) has superior resistance to water sensitivity and plastic deformation while maintaining high stiffness and very good fatigue resistance.

The surface of an EME2 layer typically provides adequate skid resistance for temporary trafficking. In situations where the mix produces a flushed surface after rolling, gritting the surface to improve the skid resistance should be considered as part of the construction process. Additionally, the surface can be tested for skid resistance to confirm the suitability of surface for temporary trafficking situations.

For EME2 application, two different classes of binder may be used in France. These are 15/25 and 10/20 hard penetration grade binder conforming to EN 13924-1. The asphalt and bitumen industry in Australia supports the use of binder 15/25 and 10/20 penetration grades, and this document includes their requirements.

Transport for NSW

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IC-QA-R126

VERSION FOR:
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CLAUSE PAGE

FOREWORD

TFNSW COPYRIGHT AND USE OF THIS DOCUMENT

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REVISIONS TO PREVIOUS VERSION

This document has been revised from Specification TfNSW R126 Edition 1 Revision 2.

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 have been 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 R126

HIGH MODULUS ASPHALT (EME2)

1 GENERAL

1.1 SCOPE

This Specification sets out the requirements for High Modulus Asphalt, also known as *Enrobés à Module Elevé Class 2* (EME2), of 14 mm nominal size for use in:

(a) heavy duty pavement types;

(b) high stress locations such as traffic lights, stop/start locations, climbing lanes, roundabouts, etc.

EME2 is not suitable for use as a wearing course.

The requirements include:

(i) design of asphalt mix(es);

(ii) production and transport of asphalt;

(iii) application of tackcoat;

(iv) placement and compaction of asphalt;

(v) inspection and testing necessary to demonstrate that the quality requirements of this Specification have been achieved.

1.2 STRUCTURE OF THE SPECIFICATION

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

1.2.1 Project Specific Requirements

Project specific details of work are shown in Annexure R126/A.

1.2.2 Measurement and Payment

The method of measurement and payment is detailed in Annexure R126/B.

1.2.3 Schedules of HOLD POINTS and Identified Records

The schedule in Annexure R126/C lists the **HOLD POINTS** that must be observed. Refer to Specification TfNSW Q for the definition of **HOLD POINTS**.

The records listed in Annexure R126/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 R126/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.

1.2.5 Frequency of Testing

The Inspection and Test Plan must nominate the proposed frequency of testing to verify conformity of the item, which must not be less than the frequency specified in Annexure R126/L. Where a minimum frequency is not specified, nominate an appropriate frequency. Frequency of testing must conform to the requirements of TfNSW Q.

You may propose to the Principal a reduced 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 provisionally or permanently, at any time.

1.2.6 Referenced Documents

Unless otherwise specified, the applicable issue of a referenced document, other than a TfNSW Specification, 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 given in Annexure R126/M.

1.2.7 Guide Documents

Use the following documents as a guide when undertaking the Works:

(a) AAPA Implementation Guide No.3 (IG-3) "Asphalt Plant Process Control Guide";

(b) AS 2150 "Hot mix asphalt - A guide to good practice";

(c) Austroads AGPT04B "Guide to Pavement Technology Part 4B: Asphalt".

1.3 DEFINITIONS AND ACRONYMS

1.3.1 Definitions

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

Unless stated otherwise, all references in this Specification to the term "asphalt" mean "EME2".

"Total filler" in asphalt is the combined fraction of fines produced from the crushing of aggregates and any added filler which passes the 75 μm AS sieve.

An asphalt course may comprise one or more layers.

A "shift" is a period of continuous work not exceeding 12 hours.

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

1.3.2 Acronyms

The following acronyms apply to this Specification:

AAPA Australian Asphalt Pavement Association

EME2 *Enrobés à Module Elevé Class 2* (High Modulus Asphalt)

MTV Material Transfer Vehicle

MBV Methylene Blue Value

NATA National Association of Testing Authorities

PAFV Polished Aggregate Friction Value

RTFO Rolling Thin Film Oven

TSR Tensile Strength Ratio

2 SUPPLY OF ASPHALT

2.1 CONSTITUENT MATERIALS

2.1.1 General

All constituent 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 Contract.

2.1.2 Coarse Aggregate

Coarse aggregate must comply with Specification TfNSW 3152, except that fractured faces, flakiness index and Los Angeles value of the combined coarse aggregate must conform to Table R126.1.

Table R126.1 – Coarse Aggregate Requirements

Property	Unit	Test Method	Acceptance Criteria
Fractured faces, F_1 (1)	%	TfNSW T239	≥ 100
Flakiness index	%	AS 1141.15	≤ 25
Los Angeles value	%	AS 1141.23	≤ 25

Note:

(1) Percentage of aggregate with at least one fractured face.

When aggregates are specified to be from a specific source or type, or with a high PAFV or other special characteristics, 100% of the coarse aggregate (by mass) in the asphalt must comply with all the requirements specified under this Clause.

2.1.3 Fine Aggregate

Fine aggregate must comply with TfNSW 3152. Natural sand must not be used.

2.1.4 Recycled Materials

Recycled materials must not be used.

2.1.5 Filler

Added filler must conform to Specification TfNSW 3211.

Total filler (refer Clause 1.3.1 for definition of "total filler") in the asphalt must conform to Specification TfNSW 3211 and Table R126.2.

Table R126.2 – Total (Combined) Filler Requirements

Property	Unit	Test Method	Acceptance Criteria
Voids in dry compacted filler	%	AS/NZS 1141.17	28 – 45
Stiffening effect of filler on binder-filler mastic, using Delta ring and ball test, $\Delta_{R\&B}$ (1)	°C	EN 13179-1 (2) and AS 2341.18	8 – 16
Methylene Blue Value	mg/g	TfNSW T659	≤ 10

Notes:

(1) Test must use C170 bitumen and filler material passing the 0.125 mm sieve size.

(2) This test is exempt from the requirement in Clause 2.3.3 (d) for NATA accreditation.

2.1.6 Binder

For binders, the requirements in Specification TfNSW 3253 apply, except that Table 3253.1 is replaced by Table R126.3.

Table R126.3 – Binder Property Requirements

Property	Unit	Test Method	Acceptance Criteria	
			15/25 (1)	**10/20** (1)
Penetration at 25°C, *Pen*	pu (2)	AS 2341.12	15 – 25	10 – 20
Penetration Index, PI (3)	-	N/A	Report	Report
Retained penetration (4)	%	AS/NZS 2341.10, AS 2341.12	≥ 55	Report
Softening point, SP	°C	AS 2341.18	56 – 72	59 – 79
Increase in softening point after RTFO treatment	°C	AS/NZS 2341.10, AS 2341.18	≤ 8	≤ 10
Viscosity at 60°C (5)	Pa.s	AS/NZS 2341.2	≥ 900	≥ 1050
Viscosity at 60°C after RTFO (5)	Pa.s	AS/NZS 2341.2, AS/NZS 2341.10	Report	Report
Percent increase in viscosity at 60°C after RTFO test	%	AS/NZ 2341.10	Report	Report
Viscosity at 135°C	Pa.s	AS/NZS 2341.2, AS 2341.3, AS/NZS 2341.4 or AG:PT/T111	≥ 0.6	≥ 0.7
Loss on heating	%	AG:PT/T103	≤ 0.5	Report

Property	Unit	Test Method	Acceptance Criteria	
			15/25 [1]	**10/20** [1]
Matter insoluble in toluene	% by mass	AS/NZS 2341.8	≤ 1.0	Report

Notes: Report = no conformity criteria exist, but test results must be reported

[1] Penetration Grade designation.

[2] One pu (penetration unit) equals 0.1 mm.

[3] Penetration Index (PI) calculated using the following equation (from Annexure A of EN 13924-1).

$$PI = \frac{(20 \times SP) + (500 \times \log Pen) - 1952}{SP - (50 \times \log Pen) + 120}$$

Where

SP = softening point according to AS 2341.18 (°C)

Pen = penetration at 25°C according to AS 2341.12 in pu (0.1 mm)

[4] Percentage change in penetration calculated using the following equation:

$$\frac{\text{Penetration at 25°C after RTFO} \times 100}{\text{Penetration at 25°C before RTFO}}$$

[5] Test performed using an Asphalt Institute vacuum capillary viscometer.

Provide documentary evidence of the binder conformity for each delivery used in the Works.

2.1.7 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 additive must not be used.

2.1.8 Bitumen Emulsion Tackcoat

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

2.1.9 Grit Material

Material used for surface gritting must consist of natural sand particles having a grading complying with Table R126.4, or other material(s) approved by the Principal.

Table R126.4 – Grading Limits for Grit (1)

AS Sieve Size	% Passing by Mass
4.75 mm	100
2.36 mm	90 – 100
600 μm	0 – 20
75 μm	0 – 1.0

Note:
(1) Determined in accordance with AS 1141.11.1.

Material used as grit must be dry, clean, hard, angular, durable, and free from clay, aggregations of fine material, soil, organic matter and any other deleterious material.

2.1.10 Sampling and Testing

The frequency of sampling and testing for constituent materials must be in accordance with Annexure R126/L.

2.2 DESIGN OF ASPHALT MIX

2.2.1 Volumetric and Mechanical Properties

The asphalt mix design must comply with the volumetric and mechanical properties shown in Table R126.5.

Table R126.5 – Volumetric and Mechanical Properties

Property	Unit	Test Method	Acceptance Criteria
Air voids in laboratory compacted mix, at 100 cycles	%	AS/NZS 2891.2.2 (1), AS/NZS 2891.7.1 or AS/NZS 2891.7.3, AS/NZS 2891.8, AS/NZS 2891.9.3 (2)	≤ 6.0
Resilient modulus at 25°C, 0.04 sec rise time	MPa	AS/NZS 2891.13.1	Report (3)
Deformation resistance, measured by wheel tracking depth (5)	mm	AS/NZS 2891.9.2 (4), AG:PT/T231	
at 60°C and 30,000 cycles (60,000 passes)			≤ 4
at 60°C and 5,000 cycles (10,000 passes)			≤ 2
Moisture sensitivity, measured by Tensile Strength Ratio (TSR)	%	AG:PT/T232 (6) or TfNSW T640	≥ 80
Flexural stiffness at 50 ± 3 με, 15°C and 10 Hz	MPa	AG:PT/T274 (4, 7, 8, 9)	≥ 14,000
Fatigue resistance at 20°C, 10 Hz and 1 million cycles	με	AG:PT/T274 (4, 7, 8)	≥ 150
Richness modulus	–	N/A (10)	≥ 3.4

Notes: Report = no conformity criteria exist, but test results must be reported

(1) Specimen requirements are as follows:
- diameter of specimen of 150 mm;
- nominal height of specimen between 100 mm and 150 mm;
- vertical loading stress of 600 ± 18 kPa;
- gyratory angle (internal) of 0.82° ± 0.02°;
- rate of gyration of 30 ± 0.5 revolutions per minute.

Laboratory compaction temperature for preparing test specimens determined in accordance with AS/NZS 2891.2.2 Appendix A.

(2) Bulk density determined (by mensuration in accordance with AS/NZS 2891.9.3) from average of minimum three test specimens.

(3) Report also the number of cycles to compact it to 5.0 ± 0.5% air voids.

(4) Specimens must be compacted to an air void content of 1.5% – 4.5% when determining the bulk density (by presaturation in accordance with AS/NZS 2891.9.2).

(5) This property is determined from the average of minimum two test specimens.

(6) Freeze/thaw moisture conditioning of specimens detailed in Section 5.2 of AG:PT/T232 is mandatory.

(7) When testing in accordance with AG:PT/T274, it must be noted that some software programs (using manually selected sinusoidal loading) defines strain levels differently to AG:PT/T274. These software programs may apply only half the stain level indicated on the input screen; i.e. a 280 με loading on the software input screen may equates to 140 με loading under AG:PT/T274. In this situation, appropriately adjusted strain levels must be used.

(8) Sinusoidal loading (instead of haversine loading) must be used.

(9) Flexural stiffness determined as average stiffness between 45th and 100th load repetition.

(10) Richness modulus (K) of mix design calculated as follows:

$$K = \frac{\left(\frac{100B}{100 - B}\right)}{\alpha \sqrt[5]{\Sigma}}$$

Where:

B = Binder content (% by mass of the total asphalt mix)

$\alpha = 2.65/\rho_a$

ρ_a = Particle density of combined aggregate determined in accordance with AS/NZS 2891.8 (t/m^3)

$$\Sigma = \frac{(0.25G + 2.3S + 12s + 150f)}{100}$$

Where:

G = Percentage of aggregate particles greater than 6.30 mm

S = Percentage of aggregate particles between 6.30 mm and 250 μm

s = Percentage of aggregate particles between 250 μm and 75 μm

f = Percentage of aggregate particles less than 75 μm

(G, S and s may be interpolated from the grading curve obtained using AS sieves)

2.2.2 Other Requirements

(a) Combined Particle Size Distribution of Aggregate

100% of the aggregate (by mass) must pass the 19.0 mm sieve. There are no other specified requirements for combined particle size distribution of the mix design.

(b) Hydrated Lime

Hydrated lime may be added in the mix.

(c) Adhesion Agent

Bitumen adhesion agent not exceeding 1.0% by mass of binder may be added in the mix.

2.3 NOMINATED MIX DESIGN

2.3.1 General

Submit to the Principal for approval one nominated mix design for each asphalt mix specified in Annexure R126/A.

The submitted nominated mix design is:

(a) materials specific, and substitution of constituent materials during production is not permitted;

(b) design specific, and variation to the nominated mix design submission is not permitted;

(c) asphalt plant specific, and except for component maintenance, changes in the components, configuration and/or location of the plant is not permitted;

(d) contract specific, and past releases of the Nominated Mix Hold Point under another contract is not applicable to this Contract.

For each new establishment of an asphalt plant, submit a full nominated mix design.

Alternatively, you may propose to use a mix which is currently listed on the "Register of Roads and Maritime Asphalt Mixes", available at: http://www.rms.nsw.gov.au/documents/business-industry/partners-and-suppliers/register-of-materials/asphalt-register.pdf.

2.3.2 Production Trial

As part of your nominated mix design submission process, conduct a production trial to demonstrate conformity of the nominated mix.

Carry out the following testing:

(a) particle size distribution and bitumen content determined in accordance to AS/NZS 2891.3.1;

(b) gyratory compactor air voids in accordance to methods stated in Table R126.5;

(c) resilient modulus of the sample and the number of cycles to compact it to 5.0 ± 0.5% air voids when determined in accordance with AS/NZS 2891.13.1.

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.

2.3.3 Nominated Mix Design Submission Details

The nominated mix design submission must include the following details:

(a) Constituent Materials

(i) Coarse and fine aggregates: source, geological type. Aggregate of a different type or quality, even if from the same quarry face or from within the same quarry, will be regarded as from a different source.

(ii) Added filler: type, grade and source.

(iii) Binder: source, class or grade.

(iv) Additives: type, source, trade name and manufacturer's recommendations.

(v) Bitumen emulsion tackcoat: source, class of bitumen, any bitumen modification.

(vi) Surface grit material: source, geological type.

(b) Mix Design

For each nominated mix design:

(i) Proportion of each constituent by percentage of mass of total mix.

(ii) Design combined particle size distribution, and design binder content, and their allowable tolerances.

(iii) Nominated values and allowable tolerances for each requirement specified in Clause 2.2 where applicable.

(iv) Combined aggregate density, including calculations showing how this is determined.

(v) Type and identification number of the asphalt manufacturing plant, and mix identification.

(vi) Temperature at which the asphalt is manufactured.

(c) Production Trial

Test results from the production trial in accordance with Clause 2.3.2.

(d) Signed Statement

A signed statement certifying that each nominated mix, the associated production trial mix, and all constituent materials meet the requirements of Clauses 2.1 and 2.2. The statement must include NATA endorsed test results for all specified tests, except that the Delta ring and ball test result (refer Table R126.2) does not need to be NATA endorsed. Attach a copy of your completed verification checklist.

2.3.4 Tests

Unless specified otherwise, all asphalt and binder tests relating to the nominated mix design submission must not be older than three months prior to the date of submission to the Principal.

All other tests relating to the submission must not be older than 6 months prior to the date of submission to the Principal.

All phases of any particular test must be performed at the same laboratory.

2.3.5 Hold Point

HOLD POINT	
Process Held:	Commencement of paving using the nominated mix(es).
Submission Details:	Details specified in Clause 2.3.3, at least 7 working days prior.
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 24 months.

2.4 PRODUCTION OF ASPHALT

2.4.1 General

Your adopted method of production must:

(a) control the process and target the nominated mix design;

(b) supply a homogeneous and consistent product at the nominated manufacturing temperature.

You may vary the proportion of each constituent for the purpose of process control, provided that the asphalt produced remains uniform and of consistent quality, and subject to the production tolerances specified in Clause 2.4.2.

2.4.2 Production Tolerances

The actual combined particle size distribution and actual binder content may vary from their nominated values within the tolerances shown in Table R126.6.

Table R126.6 – Production Tolerances

Description	Tolerance (% by mass)
Permissible variation to nominated values during production, for each mix size:	
Combined particle size distribution (AS sieve) [1, 3]	
4.75 mm and larger	± 7
2.36 mm	± 5
1.18 mm	± 5
600 μm	± 4
300 μm	± 4
150 μm	± 2.5
75 μm	± 1.5
Binder content [2, 3]	± 0.3

Notes:

[1] % by mass of total aggregate.

[2] % by mass of total mix.

[3] Determined in accordance with AS/NZS 2891.3.1.

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 in the PROJECT QUALITY PLAN for the management and control of the moisture content of each constituent aggregate material.

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

2.4.4 Storage and Handling

(a) Binder

Include in the PROJECT QUALITY PLAN the procedures for acquisition, storage and handling of binder which identify and prevent segregation and/or contamination of the binder.

Heating and storage of binder must comply with the temperature and time limits provided by the bitumen manufacturer.

(b) Asphalt

Asphalt may be retained in hot storage silos for a period not exceeding 24 hours. You may propose for approval by the Principal a longer period, based on effective temperature management and oxidation suppression systems.

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. Thermometers must be readable and accurate to within ± 2°C.

Measure and record the temperature of the asphalt when:

(a) asphalt leaves the pugmill or mixing drum;

(b) asphalt is being discharged from the hot storage bin(s);

(c) in the delivery vehicles, prior to them leaving the plant.

The temperature of asphalt throughout the manufacturing process must not at any time exceed 190°C.

Include in the PROJECT QUALITY PLAN details of the project specific process temperatures and the frequency of recording.

2.4.6 Sampling and Testing

Verify conformity with this Specification by sampling and testing, and maintain records of your process control during asphalt production.

The frequency of sampling and testing must be in accordance with Annexure R126/L.

Take asphalt samples in accordance with AS 2891.1.1.

2.5 TRANSPORT OF ASPHALT

Transport of asphalt must be in accordance with AS 2150.

Include in the 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 continuous operation of the paver by providing sufficient transport capacity and ensuring efficient on-site management of asphalt deliveries.

3 PLACING ASPHALT

3.1 GENERAL

3.1.1 Provision for Traffic

Provide for traffic in accordance with the requirements of Specification TfNSW G10 when carrying out asphalt paving.

3.1.2 Surface Preparation

Prepare the surface to be paved in accordance with AS 2150, including removal of raised extruded thermoplastic road markings and raised pavement markers.

3.1.3 Protection of Road and Services Fixtures

Implement measures to prevent 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 adhering to road and services fixtures.

3.2 TACKCOAT

3.2.1 Existing Surface Condition

The existing surface must be clean, dry and free from loose material, prior to application of the tackcoat.

3.2.2 Application Rate

Apply the tackcoat evenly at a rate of between 0.15 and 0.30 litres of residual bitumen per square metre ensuring 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.

Determine the required volume by multiplying the nominated application rate of residual bitumen by the specified area of the surface to be tackcoated, including the faces of joints, kerbs and other structures.

3.2.3 Reduced Application Rate

You may propose in writing to the Principal a reduced application rate for the tackcoat, for reasons arising from the existing underlying pavement material. Support your proposal by examples of previous cases where this has been done, including locations and insitu material types and the current pavement performance.

3.2.4 Daily Record

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

3.2.5 Condition of Tackcoat at Commencement of Asphalt Placement

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

3.3 TEMPERATURE AND WEATHER CONDITIONS

3.3.1 Temperature and Wind Velocity Measurement

Measure and record the temperature of the surface to be paved over, and wind velocity at the point of asphalt placing. Document the method and frequency of measurement and recording in the PROJECT QUALITY PLAN.

3.3.2 Conditions Suitable for Placing Asphalt

Do not commence or continue placing asphalt if the temperature of the surface to be paved over, measured at existing surface level, is less than 5°C for a zero wind speed.

This minimum temperature is increased by 5°C for each 5 kph of wind speed above zero; however this minimum temperature must not exceed 30°C.

Do not place tackcoat and/or asphalt when the surface is wet, and/or when wet weather appears imminent.

3.4 METHOD OF PLACEMENT

3.4.1 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;

(c) achieve conformity within the specified tolerances stated in Clause 5.

Compact uniformly each layer of asphalt to achieve insitu air voids requirements before placing the next layer.

3.4.2 Equipment and Method

Place the asphalt using a self-propelled paver with the ability to be operated with automatic grade 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 paver is impractical.

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

3.4.3 Material Transfer Vehicle

If so specified in Annexure R126/A, use a Material Transfer Vehicle (MTV) in your paving operations to receive asphalt from the delivery vehicles and transfer the asphalt to the paver.

The MTV must be a self-propelled machine with independent controls and demonstrated capability to minimise temperature variation and material segregation. It must be equipped with:

(a) a receiving hopper compatible with delivery vehicles;

(b) conveying mechanisms capable of delivering asphalt to the paver at a minimum rate to suit the paving output;

(c) 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;

(d) capacity to store and remix asphalt if the time between loading the delivery vehicles at the asphalt plant and unloading at the Site is equal to or greater than 1.5 hours, or when the temperature of the surface to be paved is below the minimum specified in Clause 3.3.

The MTV must discharge into a holding bin in the paver hopper.

3.4.4 Echelon Paving

If so specified in Annexure R126/A, place the asphalt by echelon paving using a minimum of two pavers operating continuously in tandem. Plan the paving run layout, and the location of the hot joint between the two mats placed by the tandem pavers, to minimise the risk of cold joints developing within trafficked lanes, unless otherwise approved by the Principal.

3.5 PAVING AND COMPACTION TEMPERATURES

3.5.1 General

Include in the PROJECT QUALITY PLAN the temperatures at which asphalt can be placed and compacted to achieve the insitu air void requirements specified in Clause 5.3.

HOLD POINT

Process Held:	Commencement of paving using the nominated mix(es), including trial section (refer Clause 3.8).
Submission Details:	If not previously submitted, details of the following: (a) minimum temperature at which asphalt will be delivered to the paver; (b) minimum temperature at which initial compaction of the asphalt can still commence; (c) method of temperature measurement.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

3.5.2 Thermometer

Measure the asphalt temperature using a hand held or machine mounted infrared thermometer, which is readable and accurate to within ± 2°C, either at the point of discharge 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 upon the request of the Principal.

3.5.3 Temperature Variation

Do not incorporate in the Works asphalt that exhibits a temperature variation within the batch, unless it has been remixed to a consistent and adequate temperature for placing and compaction.

3.6 COURSE AND LAYER THICKNESSES

3.6.1 Course Thickness

The specified course thickness is either stated in Annexure R126/A, or shown on the Drawings.

Control the course thickness by maintaining the design levels during placing and the surface shape requirements specified in Clause 5.6.

3.6.2 Corrective Courses

Construct corrective courses in accordance with Specification TfNSW R116.

3.6.3 Layer Thickness

Where a course comprises more than one layer, and the layer thicknesses have not been specified by the Principal, nominate the thickness of each layer in the PROJECT QUALITY PLAN.

The nominated thickness of a layer of asphalt must be between 70 to 130 mm.

3.6.4 Nonconforming Layer Thicknesses

You may propose for approval by the Principal to place layers in thicknesses that does not conform to the specified thickness requirements of Clause 3.6.3.

HOLD POINT

Process Held:	Placing of asphalt in layer thicknesses that does not conform to specified layer thicknesses.
Submission Details:	Details of the following: (a) nominated layer thicknesses which does not conform to specified thicknesses; (b) work methods capable of producing a dense homogeneous layer at these thicknesses; (c) areas affected, and evidence that these areas are the absolute minimum necessary.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

3.7 JOINTS

3.7.1 Locations

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 otherwise approved 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 3.5.

3.7.2 Procedure

Include in the 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 details.

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 asphalt mat prior to placing the adjacent mat. Do not incorporate asphalt resulting from clean-up of process trimmings in the Works.

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 5.6.

3.7.3 Temporary Ramps at Joints

Construct temporary ramps at joints for safe trafficking of the work either by placement of asphalt complying with this Specification, or by cold milling the existing or new asphalt layer to form the ramp, as appropriate for the application.

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

3.7.4 Tie-ins to Existing Pavements

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

3.8 TRIAL SECTION

3.8.1 General

If so specified in Annexure R126/A, and prior to commencement of paving of the Works, construct a separate trial section using the plant and personnel proposed for the work for each nominated mix.

3.8.2 Location

Each trial section must be located remote from the Works, unless otherwise approved by the Principal. Limit the size of the trial section to the production which can be achieved in one shift (refer Clause 1.3.1 for definition of "shift").

3.8.3 Conformity Requirements

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

(a) homogeneity;

(b) insitu air voids;

(c) course thickness;

(d) course position;

(e) surface shape;

(f) joint quality;

(g) surface gritting application, where specified.

3.8.4 New Trial Section

If there are nonconformities in the trial section, 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, carry out paving of a new trial section.

3.8.5 Nonconformities

Where a trial section forms part of the Works, manage all nonconformity in respect of materials, process and finished pavement properties in accordance with Clause 5.8.

HOLD POINT

Process Held:	Commencement of paving at locations other than trial section.
Submission Details:	Verification checklist and all relevant test results from the trial section demonstrating conformity to the specified requirements, at least 3 working days prior.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

3.9 PROTECTION OF WORK

Protect the asphalt until it has been fully compacted and cooled sufficiently to carry traffic without damage to the work.

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

3.10 SURFACE GRITTING

3.10.1 General

If nominated in Annexure R126/A that surface gritting is required, the grit areas will be nominated by the Principal.

The Principal will instruct you in writing of the areas to be gritted, following a review of your Traffic Management Plan and asphalt paving program. Submit your plans and program to the Principal for review at least 7 days prior to the commencement of the work.

HOLD POINT

Process Held:	Placing of surface grit.
Submission Details:	Traffic Management Plan and asphalt paving program at least 7 days prior.
Release of Hold Point:	The Principal will consider the submitted documents, and instruct you of the areas to be gritted, prior to authorising the release of the Hold Point.

3.10.2 Equipment

Use a purpose built spreader box to spread the grit. The spreader box must be attached to a steel-wheeled roller used to compact the asphalt.

3.10.3 Spreading

Spread the grit in a uniform manner over the hot asphalt surface to provide an even distribution of grit bonded to the asphalt after rolling is completed. Re-treat any bare or insufficiently covered areas as soon as possible with a further light spreading run or hand spreading.

Avoid overspreading or underspreading of the grit.

Remove from the pavement any loose grit prior to the pavement section being opened to traffic.

3.10.4 Surface Temperature and Spread Rate

Complete gritting before the surface temperature of the compacted asphalt falls below 70°C.

The initial spread rate must be between 0.2 to 0.5 kg/m^2. You may adjust the temperature range and spread rate for gritting to achieve an adequate coverage of grit and adequate adherence, and partially coated by the binder in the asphalt mix.

4 SAMPLING AND TESTING

4.1 GENERAL

Frequency of sampling and testing of placed asphalt must be in accordance with Annexure R126/L.

Show in the PROJECT QUALITY PLAN your method of determining the sampling locations, sampling and testing frequencies, and associated test methods.

4.1.1 Lot and Sub-Lot

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

The maximum Lot size must conform to TfNSW Q.

A Lot which is nonconforming may be divided into sub-Lots to exclude sections of the Lot which are conforming.

For the purpose of determining the quantity of nonconforming placed asphalt, the boundaries of a sub-Lot represented by a single tested sample will be the midpoints between the sample point in question, and adjacent sample points.

4.1.2 Samples for the Principal

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

Deliver all samples, including core samples, in sealed and labelled containers.

4.2 DETERMINATION OF INSITU AIR VOIDS

Calculate the characteristic values of insitu air voids in accordance with Annexure R126/E.

Determine the bulk density (BD) from either one of the following methods, but do not use the nuclear density gauge method (see item (b) below) when steel reinforcement exists within 300 mm of the surface of the layer.

(a) Cores

Take cores in accordance with AS 2891.1.2.

When trimming, do not reduce the core layer thickness by more than 5 mm.

Determine the bulk density of cores taken in accordance with AS/NZS 2891.9.2.

(b) Nuclear density gauge

Take measurements in accordance with AS/NZS 2891.14.2 and AS/NZS 2891.14.3.

Determine the bulk density of cores taken for density offset calculations in accordance with AS/NZS 2891.9.2.

Determine the density offset separately for every change in underlying pavement materials and layering within 300 mm of the surface and/or every change in nominated mix and specified layer thickness.

Report the density offset on the test reports.

Use as the reference density for the purpose of insitu air voids calculations 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.

4.3 DETERMINATION OF COURSE THICKNESS

4.3.1 From Cores

Determine the characteristic values and average value of thickness of the Lot using statistical techniques as specified in TfNSW Q from cores taken in accordance with AS 2891.1.2. The cores may be the same as those taken for determination of air voids (refer Clause 4.2), but the core layer thickness is determined prior to trimming of the core.

For the purpose of determining the course thickness from cores, the core diameter can be less than 95 mm and the test specimen may comprise more than one layer.

Calculate the minimum and maximum characteristic values of thickness for the Lot in accordance with Annexure R126/E.

4.3.2 By Survey

Carry out surveys for product conformity in accordance with Specification TfNSW G71.

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 the PROJECT QUALITY PLAN the statistical technique for verifying the consistency of the results.

4.4 DETERMINATION OF COURSE POSITION

4.4.1 Finished Surface Levels Not Specified

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

4.4.2 Finished Surface Levels Specified

Where finished surface levels are specified, determine the course position of each Lot by survey in accordance with TfNSW Q and TfNSW G71.

4.4.3 Survey Location for Determining Course Position

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.

4.5 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 but extended to include the adjacent longitudinal joints, transverse joints and tie-ins.

4.6 TIME FOR SUBMISSION OF TEST RESULTS

Submit to the Principal test reports for:

(a) combined particle size distribution, binder content and air voids in laboratory compacted mix – within one working day of placing the asphalt;

(b) insitu air voids, course thickness, course position and surface shape – within three working days of placement of the asphalt.

4.7 RESTORATION OF CORE HOLES

4.7.1 Materials

Materials for restoration of core holes must be a bituminous mix, and may be installed either hot or cold in accordance with the product manufacturer's recommendations and suitable for the intended purpose.

Hot dense graded asphalt may be used, provided that the normal hot asphalt temperatures required during transport and placement are maintained throughout the entire process.

Normal cold mix asphalt, and materials which have significantly different thermal response to the asphalt (e.g. concrete), must not be used.

Proprietary purpose-designed products may be used to reinstate core holes, subject to the approval of the Principal.

4.7.2 Core Hole Preparation

Prior to their backfilling, prepare the core holes by removing any dirt inside, then brush, sponge and/or vacuum the core hole clean and allow it to dry.

Apply by brush or spray, a heavy coating of rapid set bitumen emulsion or similar material, to the sides and floor of the core hole. Allow the coating material to break or cure prior to placing the fill material.

4.7.3 Core Hole Backfilling

Fill the core holes without segregation or contamination of the fill material in layers not exceeding 50 mm.

Compact each layer without crushing the aggregate particles, using suitable compaction equipment such as motorised hammer, plate compactor, and/or hand tampers.

The finish top surface of the backfill material must not be below the level of the existing pavement.

5 CONFORMITY

5.1 GENERAL

During the first 24 months after the Actual Completion Date, the placed asphalt must not ravel, rut, shove, strip or bleed.

5.2 HOMOGENEITY

Placed asphalt must be homogeneous in appearance, and must not exhibit segregation, cracking, ravelling, bony or fatty material, or have been damaged during construction.

5.3 INSITU AIR VOIDS

The characteristic values of insitu air voids for the Lot must be within the limits shown in Table R126.7:

Table R126.7 – Insitu Air Voids Requirements

Characteristic Values of Insitu Air Voids	
Lower Limit	**Upper Limit**
1.0%	5.5%

5.4 COURSE THICKNESS

5.4.1 Finished Surface Levels Not Specified

Where the course is a single layer and is placed over an existing pavement constructed by others, the average compacted course thickness for each Lot must be within the tolerances specified in Table R126.8.

Where the layer or course is placed over one or more layers which have been placed by you, the characteristic values of the course thickness for the Lot must be within the tolerances specified in Table R126.8.

Table R126.8 – Allowable Tolerances for Course Thickness

Nominal Size of Asphalt (mm)	**Tolerances** (mm)
14	–0 / +8

5.4.2 Finished Surface Levels Specified

Refer Clause 3.6.1.

The course thickness is deemed to conform if the actual surface levels of the placed asphalt course conforms under Clause 5.5.1 and comply with Clause 4.3.2.

5.5 COURSE POSITION

5.5.1 General

The actual surface levels of the placed asphalt course as determined by survey must not deviate from the design levels by more than the tolerances shown in Table R126.9.

Table R126.9 – Course Surface Level Tolerances

Course	**Tolerances** (mm)
Top intermediate course	–5 / +10
Other intermediate course	–10 / +10

Note: Minus (–) is below design level and plus (+) is above design level.

5.5.2 Matching Existing Surface Levels

Where the new asphalt wearing course is required to match the surface levels of an existing road structure (e.g. tie-in to existing pavement or bridge joints, pavement gutter, utility access point, etc.), construct the pavement such that its surface levels match the surface levels of the existing road structure and its surface does not pond water, unless otherwise directed by the Principal.

5.6 SURFACE SHAPE

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

The surface shape of the course within and across traffic lanes must not deviate from the bottom of the straightedge (refer Clause 4.5) laid in any direction by more than the tolerances shown in Table R126.10.

Table R126.10 – Maximum Deviation From Straightedge Placed Within and Across Traffic Lanes

Course	**Through Carriageway < 70 kph Traffic Speed, Ramps and Roundabouts**	**Through Carriageway ≥ 70 kph Traffic Speed**
At Actual Completion Date		
Intermediate Course	10 mm	5 mm
12 months after		
Intermediate Course	13 mm	8 mm

5.7 RIDE QUALITY

Not applicable.

5.8 TREATMENT OF NONCONFORMITIES

5.8.1 General

Where a Lot is nonconforming, submit to the Principal a Nonconformity Report and your proposed disposition for the Lot.

Dispositions for nonconformity of a placed layer must be approved and implemented before a subsequent layer is placed.

Where the surface shape of a surface to be paved has deviations from a straightedge (refer Clause 5.6) exceeding 10 mm, carry out rectification of those areas before the subsequent layer is placed, unless directed otherwise by the Principal.

5.8.2 Non-homogeneous Work

You may propose to the Principal that placed asphalt which is non-homogeneous and/or contains segregated material be accepted. Any such proposal must be in writing and must:

(a) state the technical reasons for acceptance;

(b) show that the asphalt comply with the remaining requirements of this Specification;

(c) sets out the extent of the nonconforming sub-Lots, taking into account any risk to the ride quality and future performance of the pavement structure.

5.8.3 Nonconforming Particle Size Distribution, Binder Content and Insitu Air Voids

You may propose to the Principal in writing that Lots that are nonconforming with respect to combined particle size distribution, binder content and insitu air voids be accepted with the pre-determined deductions specified in Annexure R126/B2, but subject to the limitations stated in Annexure R126/B2.

5.8.4 Rectification and Replacement

Notwithstanding Clauses 5.8.2 and 5.8.3, the Principal is not bound to accept any proposals for acceptance of nonconforming Lots.

Nonconforming Lots which are not accepted must be either rectified or replaced.

HOLD POINT

Process Held:	Rectification or replacement of a nonconforming Lot.
Submission Details:	Nonconformity Report and details of your proposal to rectify or replace the Lot.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

Rectification, and removal and replacement of pavement course must comply with the requirements of this Specification.

5.8.5 Cost of Rectification

The costs of rectifying, or removal and replacement, of nonconforming Lots, including any restoration work to any underlying or adjacent surface or structure which becomes necessary as a result of such rectification or replacement, will be borne by you.

ANNEXURE R126/A – PROJECT SPECIFIC REQUIREMENTS

Refer to Clause 1.2.1.

NOTES TO TENDER DOCUMENTER: (Delete this boxed text after customising Annexure R126/A)

Complete the tables below by deleting whichever option is not applicable and filling in the required details. Where "Yes / No" or other options are shown in the table, delete whichever option that is not applicable.

Where the pavement design details are shown on the Drawings, delete the table under the heading "Table R126/A.1 …" in its entirety and replace the table with "As shown on the Drawings". Retain the heading "Table R126/A.1 …" to provide the context.

Where the pavement design details are not shown on the Drawings, and there are multiple pavement designs, extend Table R126/A.1 as required to show the details of each pavement design.

Table R126/A.1 – Pavement Design Details

Course	**Nominal Size of Asphalt** (mm)	**Class of Binder**	**Specified Thickness** (mm)
Location: ……..			
Intermediate Layer 1			
Intermediate Layer 2			
Location: ……..			
Intermediate Layer 1			
Intermediate Layer 2			

Table R126/A.2 – Other Requirements

Clause	**Description**	**Requirement**
3.4.3	Material Transfer Vehicle required	Yes / No
3.4.4	Placing by echelon paving required	Yes / No
3.8.1	Trial section required	Yes / No
3.10.1	Surface gritting required [(1)]	Yes / No
Annex B1	Measurement of asphalt quantity for payment purposes by	Mass / Area

Note:

[(1)] The areas where surface gritting is required will be nominated by the Principal, following a review of your Traffic Management Plan and asphalt placing program.

Other Project Specific Requirements:

List here other project specific requirements.

ANNEXURE R126/B – MEASUREMENT AND PAYMENT AND RESOLUTION OF NONCONFORMITIES

Refer to Clause 1.2.2.

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

Measurement for payment of asphalt is either by mass or by area, as specified in Table R126/A.2 in Annexure R126/A.

(a) Measurement by Mass

Where the quantity of asphalt for payment purposes is measured by mass, 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 weighbridge dockets 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

Where the quantity of asphalt for payment purposes is measured by area, the unit of measurement is the "square metre".

The area will be determined from the dimensions shown on the Drawings or by measurements on site if not shown on the Drawings.

Pay Item R126P1 – Tackcoat

The rate must cover all costs associated with the application of the tackcoat in accordance with Clause 3.2, including supply of material and preparation of the surface to be paved.

The quantity of tackcoat for payment purposes is measured by volume and the unit of measurement is the "litre" of residual bitumen. The volume of residual bitumen is determined by applying a factor to the volume of bitumen used as obtained from sprayer tanker dippings.

Pay Item R126P2 – (Not Used)

Pay Item R126P3 – Asphalt (EME2) in Intermediate Courses

R126P3.2 14 mm Nominal Size

Pay Item R126P4 – (Not Used)

Pay Item R126P5 – Asphalt (EME2) Over Existing Pavement (Levels Not Specified)

R126P5.4 14 mm Nominal Size

Pay Item R126P6 – Asphalt (EME2) Over Existing Pavement (Levels Specified)

R126P6.4 14 mm Nominal Size

Pay Item R126P7 – Deductions in accordance with Annexure R126/B

R126P7.1 All deductions in accordance with Annexure R126/B.2

Deductions under Pay Item R126P7 are not subject to rise and fall adjustments.

Pay Item R126P8 – (Not Used)

B2 DEDUCTION FOR NONCONFORMITIES

Refer Clause 5.8.3.

The deduction is applied to the schedule rate for the quantity of nonconforming asphalt in the Lot (or sub-Lot) represented by the test sample(s) and recorded against Pay Item R126P7.1.

B2.1 Combined Particle Size Distribution and Binder Content

Lots which are nonconforming with respect to combined particle size distribution and binder content will not be accepted under the following circumstances:

(a) where the measured value is more than twice the production tolerance specified in Table R126.6 (refer Clause 2.4.2);

(b) where the cumulative deductions for each nonconformity with respect to combined particle size and binder content exceed 20%.

For other cases, the deductions shown in Table R126/B.1 will be applied to those nonconforming Lots with respect to combined particle size distribution and binder content which are accepted by the Principal.

Table R126/B.1 – Deductions for Nonconforming Combined Particle Size Distribution and Binder Content (1)

Description	**Production Tolerance Exceedance** (2)	**Deductions** (in % of Schedule Rate)
Combined particle size distribution (AS sieve)		
19.0 mm	Each 2% or part thereof	1%
13.2 mm	Each 2% or part thereof	1%
9.50 mm	Each 2% or part thereof	1%
6.70 mm	Each 2% or part thereof	1%

Description	**Production Tolerance Exceedance** [2]	**Deductions** (in % of Schedule Rate)
4.75 mm	Each 2% or part thereof	1%
2.36 mm	Each 1% or part thereof	1%
1.18 mm	Each 1% or part thereof	1%
600 μm	Each 1% or part thereof	1%
300 μm	Each 1% or part thereof	2%
150 μm	Each 0.5% or part thereof	2%
75 μm	Each 0.5% or part thereof	2%
Binder content		
14 mm asphalt or smaller	Each 0.1% or part thereof	3%

Notes:

[1] Refer Clause 2.4.2 and Table R126.6 for production tolerances.

[2] For combined particle size distribution: % by mass of total aggregate.
For binder content: % by mass of total asphalt mix.

B2.2 Insitu Air Voids

Lots which are nonconforming with respect to insitu air voids will not be accepted when the maximum characteristic value of insitu air voids exceeds the specified upper limit in Table R126.7 by more than 1.5%.

For other cases, the deductions shown in Table R126/B.2 will be applied to those nonconforming Lots with respect to characteristic insitu air voids which are accepted by the Principal.

Table R126/B.2 – Deductions for Nonconforming Insitu Air Voids

Exceedance of Specified Upper Limit	**Deduction** (in % of Schedule Rate)
< 0.5%	5%
0.5% – 1.0%	30%
1.1% – 1.5%	50%
> 1.5%	Reject

B2.3 (Not Used)

B2.4 (Not Used)

B2.5 (Not Used)

ANNEXURE R126/C – SCHEDULES OF HOLD POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.2.3.

C1 SCHEDULE OF HOLD POINTS

Clause	Description
2.3.5	Submission of nominated mix design details
3.5.1	Submission of paving and compaction temperature details to achieve conformity
3.6.4	Placing of asphalt in nonconforming layer thicknesses
3.8.5	Submission of verification checklists and test results from trial section
3.10.1	Submission of Traffic Management Plan and asphalt laying program for placing of surface grit
5.8.4	Submission of Nonconformity Report and proposed disposition

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
2.1.6	Documentary evidence of binder conformity
2.3.3	Nominated mix design details
2.4.3, 2.4.5	Asphalt manufacturing process parameters including process temperatures
3.2.4	Daily record of average tackcoat application rate in each Lot
3.3.1	Surface temperature and weather conditions at time of paving
3.5.2	Asphalt temperature at time of initial compaction
3.8	Verification checklist and all listed test reports of trial section for each combination of materials, mix proportions, equipment, rate of paving and methods for placement, compaction and finishing

ANNEXURE R126/D – PLANNING DOCUMENTS

Refer to Clause 1.2.4. 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	Planning Documents
1.2.4	Manufacturer's recommendations for constituent materials
2.1	For each constituent material, Lot/stockpile sizes, method of defining each Lot and allocating a unique Lot Number
	Handling and storage of each constituent material
	Nominated particle size distribution and tolerances
2.3	Development and authorisation of 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
	Storage and handling of binder, including identification and prevention of segregation and/or contamination
	Process control, including plant operating instructions, key temperature targets and records, and response to process control charts
	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
	Method of application and control of release agent
3	For each paving and related activity, method of defining each Lot and allocating a unique Lot Number
	Process control for surface preparation, tackcoating, placing asphalt, joint construction, compaction and clean up, including plant operating instructions, key temperature targets and records, patterns for paving and compaction operations, and process monitoring
3.3.1	Measurement and recording of pavement temperatures and weather conditions
3.4	Allocation of appropriate plant and equipment, including backup in case of breakdown
	Rolling pattern, including roller type and number of passes
3.5	Paving and compaction temperatures
	Calibration of all thermometers and other measuring equipment
3.6	Nominated layer thicknesses where these have not been specified by the Principal
3.7.2	Procedure for construction joints
3.8	Design, execution and quality verification of trial section
4	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 R126/E – CALCULATIONS

E1 CALCULATION OF CHARACTERISTIC VALUES OF INSITU AIR VOIDS

Calculate the minimum (lower) and maximum (upper) characteristic values, designated V_L and V_U respectively, for insitu air voids of the Lot as follows:

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

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

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

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_L and V_U to the nearest 0.1%.

E2 CALCULATION OF CHARACTERISTIC VALUE OF THICKNESS

Calculate the minimum (lower) and maximum (upper) characteristic values, designated T_L and T_U respectively, for thickness of the Lot as follows:

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

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

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

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

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

Round and report the values of T_L and T_U to the nearest whole millimetre.

ANNEXURES R126/F TO R126/K – (NOT USED)

ANNEXURE R126/L – FREQUENCY OF TESTING

The minimum frequency of testing of constituent materials, and of asphalt during production, placing and in the finished pavement, must be as shown in Tables R126/L.1 to R126/L.5.

Table R126/L.1 – Constituent Material Properties

Clause	Constituent	Minimum Frequency of Testing
2.1.2	Coarse aggregates	As per TfNSW 3152
2.1.3	Fine aggregates	
2.1.5	Added fillers	As per TfNSW 3211
2.1.6	Binder	As per TfNSW 3253
2.1.8	Bitumen emulsion tackcoat	As per AS 1160

Table R126/L.2 – Production Asphalt Properties

Clause	Property	Test Method	Minimum Frequency of Testing
2.1.5	Total filler in asphalt		
	- Dry compacted voids	AS 1141.17	One per 10,000 tonnes or part thereof used in asphalt production, and at change in source of mineral matter
	- Methylene Blue Value	TfNSW T659	
2.2.1	Resilient modulus	AS/NZS 2891.13.1	One test for up to 2,000 tonnes or part thereof and thence one test per 5,000 tonnes or part thereof of the production mix
2.4.2	Combined particle size distribution	AS/NZS 2891.3.1	As per Table R126/L.3
	Binder content		
2.4.5	Production temperature of asphalt	Your documented procedure	As specified in PROJECT QUALITY PLAN
	Despatch temperature of asphalt		Each delivered load

Table R126/L.3 – Minimum Frequency of Testing of Asphalt

Quantity of Asphalt Supplied in Each Shift [(1)]	Minimum Frequency of Testing
Less than 100 tonnes	One per 100 tonnes or part thereof
101 to 300 tonnes	One per 150 tonnes or part thereof
301 to 600 tonnes	One per 200 tonnes or part thereof
Over 600 tonnes	One per 300 tonnes or part thereof

Note:

[(1)] Refer Clause 1.3.1 for definition of “shift”.

Table R126/L.4 – During Asphalt Placing

Clause	Property	Test Method	Minimum Frequency of Testing
3.2	Tackcoat application rate	Your documented procedure	Each paving Lot
3.3	Surface temperature		One measurement every two hours
	Wind velocity		
3.5	Temperature at point of delivery		Each delivered load

Table R126/L.5 – Placed Asphalt Properties

Clause	Property	Test Method	Minimum Frequency of Testing
5.2	Homogeneity	Visual assessment	Each paving Lot
5.3	Insitu air voids	Clause 4.2	As specified for relative compaction > 100.0% in TfNSW Q Clause L3.1
5.4	Course thickness	Clause 4.3	
5.5	Course position	Clause 4.4	TfNSW G71
5.6	Surface shape	TfNSW T183	
	- Within lane		One measurement in longitudinal direction and one measurement in transverse direction every 60 m^2 for up to 350 m^2 and thence one measurement every 100 m^2 or part thereof
	- Longitudinal joint excluding crowns		One measurement per 20 lineal metres or adjacent to within lane measurements whichever is the lesser
	- Transverse joint		One measurement in each wheel path in each lane except at the boundaries of the Site

ANNEXURE R126/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.6.

TfNSW Specifications

TfNSW G10	Traffic Management
TfNSW G71	Construction Surveys
TfNSW Q	Quality Management System
TfNSW R101	Cold Milling of Road Pavement Materials
TfNSW R116	Heavy Duty Dense Graded Asphalt
TfNSW 3152	Aggregates for Asphalt
TfNSW 3211	Cements, Binders and Fillers
TfNSW 3253	Bitumen for Pavements

TfNSW Test Methods

TfNSW T183	Surface Deviation Using a Straightedge
TfNSW T239	Fractured Faces of Coarse Aggregate
TfNSW T640	Propensity for Moisture Damage in Asphalt (Specimens Compacted in the Laboratory)
TfNSW T659	Methylene Blue Adsorption Value of Road Construction Material

Australian Standards

AS 1141	Methods for sampling and testing aggregates
AS 1141.11.1	Particle size distribution - Sieving method
AS 1141.15	Flakiness index
AS/NZS 1141.17	Voids in dry compacted filler
AS 1141.23	Los Angeles value
AS 1160	Bituminous emulsions for the construction and maintenance of pavements
AS 2150	Hot mix asphalt - A guide to good practice
AS 2341	Methods of testing bituminous and related roadmaking products
AS/NZS 2341.2	Determination of dynamic viscosity by vacuum capillary viscometer
AS 2341.3	Determination of kinematic viscosity by flow through a capillary tube
AS/NZS 2341.4	Determination of dynamic viscosity by rotational viscometer
AS/NZS 2341.8	Determination of matter insoluble in toluene
AS/NZS 2341.10	Determination of the effect of heat and air on a moving film of bitumen (rolling thin film oven (RTFO) test)
AS 2341.12	Determination of penetration
AS 2341.18	Determination of softening point (ring and ball method)

AS 2891	Methods of sampling and testing asphalt
AS 2891.1.1	Sampling - Loose asphalt
AS 2891.1.2	Sampling - Coring method
AS/NZS 2891.2.2	Sample preparation - Compaction of asphalt test specimens using a gyratory compactor
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 volumetric properties of compacted asphalt mixes
AS/NZS 2891.9.2	Determination of bulk density of compacted asphalt - Presaturation method
AS/NZS 2891.9.3	Determination of bulk density of compacted asphalt - Mensuration method
AS/NZS 2891.13.1	Determination of the resilient modulus of asphalt - Indirect tensile 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

Austroads Documents

AG:PT/T103	Pre-treatment and Loss on Heating of Bitumen, Multigrade and Polymer Modified Binders (Rolling Thin Film Oven (RTFO) Test)
AG:PT/T111	Handling Viscosity of Polymer Modified Binders (Brookfield Thermosel)
AG:PT/T231	Deformation Resistance of Asphalt Mixtures by the Wheel Tracking Test
AG:PT/T232	Stripping Potential of Asphalt - Tensile Strength Ratio
AG:PT/T274	Characterisation of Flexural Stiffness and Fatigue Performance of Bituminous Mixes
AGPT04B	Guide to Pavement Technology Part 4B: Asphalt

AAPA Guides

IG-3	Asphalt Plant Process Control Guide

European Standards

EN 13179-1	Tests for filler aggregate used in bituminous mixtures – Part 1: Delta ring and ball test
EN 13924-1	Bitumen And Bituminous Binders - Specification Framework for Special Paving Grade Bitumen - Part 1: Hard Paving Grade Bitumens