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1. Scope

- 1.1 Austroads Technical Specification ATS 3410 sets out the requirements for the manufacture and placement of asphalt used in road pavements. It is limited to the following asphalt types:
 - a) dense graded asphalt;
 - b) open graded asphalt;
 - c) stone mastic asphalt; and
 - d) high modulus asphalt (EME2).
- 1.2 The asphalt may be manufactured using either conventional or warm mix asphalt (WMA) technology.
- 1.3 The Contractor must ensure that the Asphalt Manufacturer complies with this Specification. The Contractor may be the same entity as the Asphalt Manufacturer.
- 1.4 Details of the process to obtain the approval/registration of the mix design may be obtained from the Principal.

2. Referenced Documents

- 2.1 The following documents are referenced in this Specification:

Australian/New Zealand Standards

AS 1141	Methods for sampling and testing aggregates
Method 11.1:	Particle size distribution – Sieving method
Method 17:	Voids in dry compacted filler
Method 66:	Methylene blue adsorption value of fine aggregate and mineral fillers
AS 1160	Bituminous emulsions for the construction and maintenance of pavements
AS 2008	Bitumen for pavements
AS 2150	Asphalt – A guide to good practice
AS 2341.18	Methods of testing bitumen and related roadmaking products, Method 18: Determination of softening point (ring and ball method)
AS/NZS 2891	Methods of sampling and testing asphalt
Method 1.1:	Sampling – Loose asphalt
Method 1.2	Sampling – Coring method
Method 2.2:	Sample preparation – Compaction of asphalt test specimens using a gyratory compactor
Method 3.1:	Binder content and aggregate grading – Reflux method
Method 3.3:	Binder content and aggregate grading – Pressure filter method
Method 5:	Compaction of asphalt by Marshall method and determination of stability and flow – Marshall procedure
Method 7.1:	Determination of maximum density of asphalt – Water displacement method
Method 8:	Voids and volumetric properties of compacted asphalt mixes
Method 9.2:	Determination of bulk density of compacted asphalt – Presaturation method
Method 9.3:	Determination of bulk density of compacted asphalt – Mensuration method
Method 10:	Moisture content of asphalt

Method 11:	Degree of particle coating
Method 14.2:	Field density tests – Determination of field density of compacted asphalt using a nuclear thin-layer density gauge
Method 14.3:	Field density tests – Calibration of nuclear thin-layer density gauge using standard blocks
Method 14.5:	Field density tests – Density ratio and percentage air voids of compacted asphalt
AS/NZS ISO 9001	Quality management systems – Requirements
AS ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories

Austroroads

AP-C87	Austroroads Glossary of Terms
AP-T219	Mastic Performance Assessment in Stone Mastic Asphalt
ATM-020	Random Selection of Sampling or Test Locations
ATM-030	Calculation of the Characteristic Value of a Lot
AGPT-T192	Characterisation of the Viscosity of Reclaimed Asphalt Pavement (RAP) Binder Using the Dynamic Shear Rheometer (DSR)
AGPT-T193	Design of Bituminous Binder Blends to a Specified Viscosity Value
AGPT-T220	Sample preparation – Compaction of asphalt slabs suitable for characterisation
ATM-231	Deformation resistance of asphalt mixtures by the wheel tracking test
ATM-232	Stripping potential of asphalt – Tensile strength ratio
AGPT-T234	Asphalt binder content (ignition oven method)
AGPT-T235	Asphalt binder drain-off
ATM-453	Surface Deviation Using a Straightedge
ATS 3110	Supply of Polymer Modified Binder
ATS 3125	Fillers for Asphalt
ATS 3130	Supply of Aggregates for Asphalt
ATS 3135	Supply of Reclaimed Asphalt Pavement Material
ATS 3050	Supply of Recycled Crushed Glass Sand
AP-PWT15	Asphalt production process control

Australian Flexible Pavement Association (AfPA)

AfPA AN7	Advisory Note 7: Guide to the selection, heating and storage of binders for sprayed sealing and hot mix asphalt
AfPA IG-3	Implementation Guide No.3 Asphalt Plant Process Control Guide

International Standards

ISO 3310-1	Test sieves – Technical requirements and testing – Part 1: Test sieves of metal wire cloth
EN 13179-1	Tests for filler aggregate used in bituminous mixtures – Part 1: Delta ring and ball test

3. Definitions

- 3.1 In addition to the definitions/abbreviations in AS 2150 and AP-C87, the following definitions/abbreviations apply to this Specification.

Asphalt Manufacturer:	The company that manufactures the asphalt mix and also satisfies the requirements of Clause 4.3.
Course:	One or more layers of asphalt of the same material type and nominal size within a pavement structure.
RAP Approval Level:	The designation that corresponds to the maximum amount of reclaimed asphalt pavement (RAP) material that has been approved for use in an asphalt mix design.
Registered Mix Design:	The mix design that has been registered/approved by the Principal.
Shift:	A period of continuous work not exceeding 12 hours.
Total filler:	The total of material that passes the 75 µm AS sieve, including fines produced from the crushing of aggregates, natural sand and any added filler that complies with ATS 3125.
AfPA	Australian Flexible Pavement Association
DGA	Dense graded asphalt
EME2	High modulus asphalt (also known as 'Enrobés à Module Elevé Class 2')
JASANZ	Joint Accreditation System of Australia and New Zealand
OGA	Open graded asphalt
PMB	Polymer modified binder
RAP	Reclaimed asphalt pavement (material)
SMA	Stone mastic asphalt
TSR	Tensile Strength Ratio
VMA	Voids in Mineral Aggregate

4. Quality System Requirements

- 4.1 The Contractor must prepare and implement a Quality Plan that includes the documentation in Table 4.1.

Table 4.1: Quality Plan

Clause	Description of Document
Manufacture of Asphalt	
4.3	Name of Asphalt Manufacturer and location of manufacturing plant
6.2	Management of the constituent materials
7.2	Production of asphalt
8.2	Sampling and testing of the production mix
Placement of Asphalt	
9.2	Transport of asphalt
11.2	Placement of asphalt
18.2	Sampling and testing of the placed asphalt mix

HOLD POINT 1	
Process Held	Commencement of asphalt manufacture.
Submission Details	The Quality Plan must be provided to the Principal at least 10 working days prior to the commencement of asphalt manufacture.

- 4.2 Asphalt must be manufactured under a Quality Management System that has been certified as complying with AS/NZS ISO 9001 by a JASANZ accredited organisation.

Prequalification Requirements

- 4.3 If the asphalt is to be placed in a jurisdiction where a prequalification scheme for companies supplying asphalt is in place, the Contractor and Asphalt Manufacturer must be prequalified under that scheme to the appropriate level and/or category for the work being undertaken.

5. Registered Mix Design

General

- 5.1 A Registered Mix Design ('Job Mix') must be used for the Works. The Registered Mix Design must:
- satisfy the requirements of this Specification and the Principal's mix design registration document;
 - be registered/approved (as applicable) by the Principal, or by an organisation that is acceptable to the Principal; and
 - be targeted during production of the asphalt.
- 5.2 A Registered Mix Design is:
- material specific, and substitution of constituent materials during production is not permitted;
 - design specific, and variation to the mix design submission is not permitted; and
 - asphalt plant specific, and except for component maintenance, changes in the components, configuration and/or locations of the plant is not permitted.

Submission of the Registered Mix Designs

- 5.3 Prior to the asphalt being incorporated into the Works, the Contractor must submit to the Principal a copy of the certificate of registration/approval for each nominal size and type of asphalt mix to be used.

HOLD POINT 2	
Process Held	Commencement of the manufacture and placement of the asphalt.
Submission Details	At least 5 working days prior to the commencement of asphalt manufacture, the following must be submitted to the Principal: a) A copy of the mix design certificate(s) for each nominal size and type of asphalt; b) Proposed date and location for the commencement of asphalt placement.

- 5.4 Where more than one mix design certificate is submitted to the Principal for a nominal size and type of asphalt, the Contractor must nominate one 'primary' mix design to be used.
- 5.5 The Contractor may use a Registered Mix Design, other than the 'primary' mix design, provided the Contractor advises the Principal in writing of the change at least 24 hours prior to implementation.
- 5.6 At any time, a new Registered Mix Design may be submitted to the Principal to ensure ongoing compliance with requirements of this Specification. At least 5 working days prior to the proposed revised mix design being incorporated into the Works, the Contractor must submit a certified copy of an updated mix design certificate (and supporting documentation) for the revised mix design to the Principal and Hold Point 2 will reapply.

6. Constituent Materials

General

- 6.1 All materials used in the manufacture of asphalt must comply with the requirements of this Specification and maintain an essentially uniform appearance for the duration of the work.
- 6.2 The Quality Plan must include details/procedures for:
- a) Lot/stockpile size, method of defining each Lot and allocating a unique Lot number for each constituent material;
 - b) verifying that the constituent materials comply with this Specification; and
 - c) procurement, handling and storage of each constituent material (including RAP).

Aggregates

- 6.3 Aggregate must comply with ATS 3130. Natural sand must not be used in EME2 asphalt.
- 6.4 Recycled crushed glass sand must comply with ATS 3050 and meet Grading Classification Type G of ATS 3050.

Reclaimed Asphalt Pavement (RAP) Material

- 6.5 RAP material must comply with ATS 3135.
- 6.6 If the RAP material content of the mix design exceeds 25%, the RAP must be fractionated into at least two different size fractions prior to incorporation into the mix.
- 6.7 For the production of EME2:
- the RAP content of the mix (by mass of total mix) must not exceed 15%;
 - all of the aggregate particles in the RAP must pass the 19.0 mm sieve conforming to ISO 3310-1; and
 - the binder extracted from the RAP must be tested to demonstrate that either softening point and penetration at 25°C complies with Table 6.7; in addition, the viscosity must be determined and reported.

Table 6.7: Binder requirements for the production of EME2

Property	Test Method	Test Frequency	Acceptance Criteria
Softening point	AS 2341.18	One per stockpile and not exceeding 1,000 tonnes.	< 79 °c
Penetration at 25°C	ASTM D5/DSM or AS 2341.12		> 5 Pu
Viscosity of Reclaimed Asphalt Pavement (RAP) Binder	AGPT-T192		Report only

Filler

- 6.8 Fillers must comply with ATS 3125.
- 6.9 The total filler must comply form to Table 6.9.

Table 6.9: Total (combined) filler requirements

Property	Test Method	Test Frequency for Each Mix Design	Acceptance Criteria
Voids in dry compacted filler (combined)			
DGA, OGA and SMA mixes that do not contain hydrated lime	AS/NZS 1141.17	Monthly	≥ 38%
DGA, OGA and SMA mixes that contain hydrated lime			≥ 40%
EME2 Asphalt			≥ 28% and ≤ 45%
Stiffening Effect of Filler on Binder-Filler Mastic			
Delta ring and ball ⁽¹⁾	EN 13179-1 ⁽²⁾ and AS 2341.18	Monthly	≥ 8°C and ≤ 25°C
Methylene blue value (MBV) of total filler, but excluding hydrated lime			
Asphalt mixes that do not contain hydrated lime	AS 1141.66	Monthly	≤10 mg/g
Asphalt mixes that contain hydrated lime		3-Monthly	≤10 mg/g

Notes:

1. This test assesses the stiffening effect of the filler on the binder – filler mastic, NATA accreditation for the EN 13179-1 is not required. This test must be performed on the combined material passing the 0.125 mm sieve in accordance with EN 13179-1, using Class 170 bitumen instead of 70/100 grade bitumen. The softening point of the Class 170 bitumen used in the test, determined in accordance with AS 2341.18 must be between 43°C and 51°C.
2. More details on sample preparation are provided in AP-T219. This testing is exempt from the requirement for NATA accreditation.

Binder

- 6.10 Bitumen, including hard bitumen, must comply with AS 2008. PMB must comply with ATS 3110, unless approved otherwise as stated in the mix registration certificate.
- 6.11 The Contractor must submit documentary evidence to the Principal that the binder complies with Clause 6.10. Additional requirements for the binder may be specified in the Contract documents.
- 6.12 The class of binder must be as nominated on the mix registration certificate.

Binder in Mixes Containing RAP

- 6.13 If RAP is to be incorporated into the asphalt mix, the Asphalt Manufacturer must be approved or prequalified by the Principal at the appropriate level to manufacture asphalt incorporating RAP ('RAP Approval Level'). RAP must be managed in accordance with the conditions specified with the RAP Approval Level.

For dense graded asphalt mixes containing > 15% RAP but ≤ 30% RAP, the class of bitumen to be used in the mix is nominated in Table 6.13.

Table 6.13: Class of bitumen to be used in dense graded asphalt mixes containing > 15% RAP but ≤ 30%.

Bitumen Class Specified for the Works	Bitumen Class to be Used in Mix		
	Mix contains 20% RAP	Mix contains 25% RAP	Mix contains 30% RAP
Class 320	Class 240	Class 170 or Class 240	Class 170
Class 450	Class 320	Class 240 or Class 320	Class 240
Class 600	Class 450	Class 320 or Class 450	Class 320

- 6.14 For dense graded asphalt mixes containing > 30% RAP, the Contractor must monitor the binder viscosity and binder content of the RAP and adjust the RAP content, binder class or rejuvenating agent content to ensure the binder blend viscosity complies with the requirements of Table 6.14 in accordance with AGPT-T193. The Quality Plan must outline how this will be achieved. This approach may also be used, as an alternative to the requirements of Clause Table 0 for mixes containing > 15% RAP but ≤ 30% RAP.

Table 6.14: Binder blend viscosity requirements for dense graded asphalt mixes containing > 15% RAP

Specified Binder Class	Binder Blend Viscosity ⁽¹⁾ (MPa)
C320	320 – 500
C450	450 – 660
C600	600 – 880

Note:

1. Determined in accordance with AGPT-T192

- 6.15 Recovered binder viscosity for RAP must be determined in accordance with AGPT-T192.

Additives

- 6.16 Bitumen adhesion agent may be added to asphalt mixes to improve the adhesion between the bituminous binder and the aggregate. Bitumen adhesion agents must not reduce the viscosity of the binder.
- 6.17 An approved warm mix asphalt additive may be added to asphalt to reduce the asphalt manufacturing and placement temperature and to improve workability during the paving and compaction operations.
- 6.18 Cellulose fibre additives, or other types of fibres approved by the Principal, must be added to stone mastic asphalt to reduce binder drain-off at a minimum dosage rate of 0.3%. These fibres must also be added to open graded asphalt to reduce binder drain-off.
- 6.19 Asphalt rejuvenating agent may be added to asphalt mixes containing > 15% RAP such that the binder blend complies with specified viscosity requirements.

Bituminous Emulsion Tack Coat

- 6.20 Unless otherwise approved by the Principal, bituminous emulsion (where used) must comply with AS 1160. A grade of bituminous emulsion that provides a strong bond between the existing surface and new asphalt layer and results in minimal pick-up on truck tyres or paving equipment during paving operations must be selected.

7. Production of Asphalt

Method of Production

- 7.1 A method of production must be adopted that:
- a) controls the manufacturing process;
 - b) targets the Registered Mix Design, and
 - c) supplies an essentially homogeneous and consistent product at the nominated manufacturing temperature.
- 7.2 The Quality Plan must include details/procedures for:
- a) the method of defining each Lot for each nominated mix and allocating a unique Lot number;
 - b) calibration of the asphalt manufacturing plant, including all weigh scales, flowmeters and thermometers;
 - c) process control, including plant operating instructions, key temperature targets and records, and responses to process control charts;
 - d) acquisition, storage and handling of binder, including identification and prevention of segregation and/or contamination;
 - e) procedures for the management and control of the moisture content of each constituent aggregate material, including RAP material;
 - f) control of plant feed proportions, including regular checks on grading and moisture content;
 - g) details of the process temperatures and the frequency of recording temperatures;
 - h) contingency plans in the event of a plant breakdown and back up asphalt supply; and
 - i) a template for the daily asphalt manufacturing plan to ensure timely and uninterrupted progress on site.

Asphalt Manufacturing Plant

- 7.3 The asphalt manufacturing plant must be operated with adequate production process controls to produce asphalt of a consistent quality and conforming to the requirements of this Technical Specification. The production control system must produce auditable records of key process parameters including individual aggregate and filler feed rates/batch masses, binder feed rate/batch mass and various process temperatures.
- 7.4 The asphalt manufacturing plant must have sufficient capacity to supply asphalt for continuous operation of the paver.

Production Tolerances

- 7.5 The actual particle size distribution, binder content and maximum density of the production mix may vary from the nominated values within the limits shown in Table 7.5.

Table 7.5: Production tolerances

Description	Test Method	Tolerance
Permissible variation to nominated combined particle size distribution during production (Percentage Points ⁽¹⁾ by mass of total aggregate)		–
• Passing 4.75 mm and larger	AS/NZS 2891.3.1 or AGPT-T234 ⁽²⁾	± 7
• Passing 2.36 mm and 1.18 mm		± 5
• Passing 0.600 mm and 0.300 mm		± 4
• Passing 0.150 mm		± 2.5
• Passing 0.075 mm		± 1.5
Permissible variation to the nominated binder content during production (Percentage Points ⁽¹⁾ by mass of total mix)	AS/NZS 2891.3.1 or AGPT-T234 ⁽²⁾	± 0.3
Permissible variation to the nominated maximum density during production (t/m ³)	AS/NZS 2891.7.1	± 0.035 ⁽³⁾

Notes:

1. A 'Percentage Point' is the numerical difference between two percentages. For example, a change from 3% to 3.5% is a change of 0.5 Percentage Points.
2. If specified in the Contract documents, AS/NZS 2891.3.3 may be used.
3. Unless an alternative tolerance has been approved by the Principal and this is recorded on the mix design certificate.

- 7.6 For a particular mix design, the nominated design with the tolerances applied represents the job limits. The job limits for a particular design are stated on the asphalt mix design certificate.

Volumetric Properties

- 7.7 The production mix must conform with the requirements of Table 7.8.

Table 7.8: Volumetric properties

Property	Mix Type	Test Method	Acceptance Criteria
Air voids in laboratory compacted specimens ⁽¹⁾	All	AS/NZS 2891.2.2 or AS/NZS 2891.5, AS/NZS 2891.7.1, AS/NZS 2891.8 and AS/NZS 2891.9.2	Within ± 1.5% of design target
Air voids in laboratory compacted specimens after 350 cycles gyratory compaction	Heavy duty dense graded asphalt	AS/NZS 2891.2.2 AS/NZS 2891.7.1, AS/NZS 2891.8 and AS/NZS 2891.9.2	Refer Contract documents

Note:

1. The method of compaction (gyratory or Marshall compaction), the number of cycles or blows compaction and the nominated air voids content is stated in the Principal's mix design registration document.

Performance Properties

7.8 The production mix must comply with the requirements of Table 7.8.

Table 7.8: Performance properties

Property	Mix Type	Test Method	Acceptance Criteria
Moisture sensitivity: (1) Tensile Strength Ratio (TSR) (2) Average tensile strength of freeze/thaw group	Dense graded asphalt	ATM-T232	≥ 80% ≥ 600 kPa, unless otherwise specified in the Contract documents
Deformation resistance, measured by final rut depth:	Dense graded asphalt Stone mastic asphalt	ATM-T231 ⁽¹⁾	Refer Contract documents ⁽²⁾
Asphalt binder drain-off	Open graded asphalt Stone mastic asphalt	AGPT/T235	≤ 0.3%

Notes

1. Duplicate specimens must be prepared in accordance with AGPT-T220.
2. Requirement only applies where an acceptance criterion has been included in the Contract documents.

Particle Coating and Moisture Content

7.9 The production mix must comply with the requirements of Table 7.9.

Table 7.9: Particle coating and moisture content

Property	Test Method	Acceptance Criteria
Degree of particle coating, once discharged from the asphalt plant into delivery vehicles	AS/NZS 2891.11	≥ 99%
Moisture content, once discharged from the asphalt plant into delivery vehicles	AS/NZS 2891.10	< 0.5% by mass of total mix

7.10 The Quality Plan must describe the methodology for verifying compliance with Table 7.9. The Principal may direct the Contractor to undertake testing in accordance with Table 7.9.

RAP Material

7.11 RAP materials must be dispersed uniformly throughout the mix such that there is no apparent variability or temperature segregation in the mix. RAP materials incorporated into asphalt must be monitored for moisture content in accordance with AS/NZS 2891.10.

Storage and Handling of Binder

7.12 The heating and storage of binder must comply with the temperature and time limits set out in AfPA AN7 or in accordance with the manufacturer's recommendations.

7.13 At the asphalt manufacturing plant, PMB must be recirculated in delivery and/or storage tanks to a uniform consistency immediately prior to its use in the manufacturing process.

Manufacturing Temperatures

- 7.14 The temperatures of constituent materials must be controlled using suitable thermometer elements placed in the flow of materials from the drier, and in the binder storage system or binder supply line.
- 7.15 The temperature of the asphalt must be measured and recorded when:
- a) the asphalt leaves the pugmill or mixing drum or
 - b) the asphalt discharges from the hot storage bin(s), or
 - c) in the trucks prior to leaving the plant.
- 7.16 The dispatch temperature of the asphalt must facilitate achieving the specified compaction level in the finished product.
- 7.17 The temperature of asphalt must not at any time in the process exceed the temperatures stated in Table 7.17 and not incorporated into the Works. The limits for hot mix asphalt apply unless warm mix asphalt has been specified elsewhere in the Contract documents. The temperature of each delivered load must be measured and included in the Lot records.

Table 7.17: Asphalt temperature limits

Binder Type	Maximum Temperature (°C) Hot Mix Asphalt	Maximum Temperature (°C) Warm Mix Asphalt
Bitumen	175	155
Polymer Modified Binder	175 ^(1,2)	165
EME 10/20 and EME 15/25	190	170

Notes:

1. For binders containing crumb rubber, the maximum asphalt temperature is limited to 165°C.
2. Unless otherwise approved by the Principal, a warm mix asphalt additive must be included in hot mix asphalt mixes that are placed at pavement temperatures below the minimum temperature stated in Table 13.2.

Storage and Handling of Asphalt

- 7.18 Asphalt that is retained in hot storage silos must be stored in such a manner that minimises oxidation of the binder and maintains temperature uniformity.
- 7.19 Dense graded asphalt mix may be retained in hot storage silos for a period not exceeding 30 hours.
- 7.20 Open graded and stone mastic asphalt mix must be loaded into delivery vehicles as soon as practical and the total storage and transportation time must not exceed 4 hours.
- 7.21 For each load of asphalt, the Contractor must record the time of manufacture, dispatch from the manufacturing plant and incorporation into the Works. This information must be recorded on a delivery docket that is submitted to the Principal with each delivery.

8. Sampling and Testing of the Production Mix

- 8.1 The Contractor must verify conformance of the asphalt by sampling and testing in accordance with this Specification and provide the results to the Principal. The report of test results must also include the results of the testing of the constituent materials (refer Clause 6) and provide traceability of each Lot of constituent material.
- 8.2 The Quality Plan must include details of:
 - a) the method verifying that the asphalt complies with the requirements of this Specification; and
 - b) all sampling locations, frequencies and test methods.

Compliance Testing

- 8.3 All testing to verify conformance with this Specification must be performed by a laboratory that is accredited to meet the requirements of AS ISO/IEC 17025 for the test method. The laboratory's accreditation body must be a signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC MRA) for testing laboratories. The National Association of Testing Authorities (NATA) and International Accreditation New Zealand (IANZ) are signatories to the ILAC MRA.
- 8.4 Compliance testing must be carried out for each Lot.
- 8.5 The minimum testing frequencies for constituent materials are nominated in the relevant specification for the supply of that constituent material specification and Clause 6.
- 8.6 The minimum sampling and testing frequencies for production mix are specified in the Contract documents. Where no indication is given in the Contract documents, the production mix must be sampled and tested at the frequencies given in Table 8.5.

Table 8.6: Minimum frequency for sampling and testing asphalt

Clause	Mix Type	Test Property	Minimum Sampling and Testing Frequencies		
			Quantity of Asphalt Supplied in each Shift (tonnes)	Minimum Testing Frequency	Minimum Number of Tests
7.6	All	Combined particle size distribution	≤ 20	–	0 ⁽²⁾
7.6		Binder content	21 – 100	–	1
7.6		Maximum density	101 – 400	–	2 ⁽³⁾
7.8		Air voids in laboratory compacted specimens ⁽¹⁾	> 400	1 per 200	3
7.8	Heavy duty dense graded asphalt	Air voids in laboratory compacted specimens after 350 cycles gyratory compaction ⁽⁴⁾	One per shift per mix type ⁽⁴⁾		
7.9	Heavy duty and polymer modified dense graded asphalt	Moisture sensitivity - Average tensile strength of freeze/thaw group - Tensile strength ratio	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. Testing is not required where < 500 tonnes of a particular mix type, nominal size and binder class will be incorporated into the Works.		
7.10	Heavy duty and polymer modified dense graded asphalt	Moisture content	One per shift per mix type ⁽⁵⁾		
7.17	All	Production temperature	As per Contractor's Quality Plan		
7.17	All	Dispatch temperature	Each delivered load		

Notes:

1. The method of compaction (gyratory or Marshall compaction) and the number of cycles or blows compaction to be used as well as the design air voids content is stated on the asphalt mix design certificate.
2. Testing not required unless directed by the Principal.
3. The first sample must be taken from within the first 40% of asphalt produced and the second sample from within the last 40% of asphalt produced for the Lot.
4. Testing for this property is only required if air voids in laboratory compacted specimens is determined using AS/NZS 2891.2.2.
5. Unless otherwise directed by the Principal, testing is only required when any of the following applies:
 - the mix is produced using a parallel flow drum plant;
 - the RAP content exceeds 15% in the mix design; or
 - the asphalt manufacturing temperature is less than 150°C.

Sampling

- 8.7 Asphalt samples must be taken in accordance with AS/NZS 2891.1.1 or AS 2891.1.2 as appropriate.
- 8.8 Unless otherwise specified or agreed with the Principal, boundaries of sub-Lots represented by individual tested samples are deemed to be the midpoint between the adjacent sample locations.

Sampling and Testing Requested by the Principal

- 8.9 When the Principal requests loose asphalt samples for testing, the Contractor must riffle and/or quarter the samples in accordance with AS/NZS 2891.1.1.
- 8.10 All samples, including core samples, must be delivered in sealed and labelled containers identifying the following:
- Lot number;
 - sample description;
 - sampler;
 - date produced and/or laid;
 - date sampled; and
 - any other quality system references, as appropriate.

Maximum Lot Size

- 8.11 A Lot:
- must comprise of asphalt of the same nominal size manufactured and supplied from the same plant to the same registered mix design;
 - must be essentially homogeneous and manufactured, placed and compacted under effectively uniform conditions;
 - must not comprise of asphalt placed during more than a single work shift; and
 - may comprise of multiple layers of asphalt, provided that:
 - the minimum testing frequencies are observed; and
 - and the tonnage of asphalt in each layer and the conformance of each layer are recorded separately.

Time for Submission of Test Results

- 8.12 For each Lot, the Contractor must submit the records in Table 8.12 to the Principal within the specified timeframe.

Table 8.12: Asphalt reporting requirements

Records to be Provided	Time from completion of asphalt placement (working days)
Preliminary test results for binder content, combined particle size distribution, maximum density and air voids in laboratory compacted mix:	1
Preliminary test results for moisture content and air voids after 350 cycles of compaction (where applicable) using a gyratory compactor:	1
Preliminary test results for moisture sensitivity and asphalt binder drain-off (where applicable):	5

- 8.13 The final test report for each test property must be submitted to the Principal within 3 working days of completion of the test.

Process Control

- 8.14 The Asphalt Manufacturer must employ a capable process and implement process control in accordance with or exceeding the requirements of AP-PWT15 Asphalt Production Process Control.
- 8.15 Where the Asphalt Manufacturer can demonstrate that a Registered Mix Design has a history of conformance with the specified requirements, a proposal to reduce the rate of testing to those given in Clause 8.5 may be submitted to the Principal. The Principal is under no obligation to accept any such proposal and may impose conditions for acceptance.

Nonconformances

- 8.16 If a nonconforming Lot is not accepted in accordance with the requirements of the Contract, the Contractor must rectify or replace the Lot so that the asphalt conforms to the requirements of this Specification.

9. Transport of Asphalt

- 9.1 The transport of asphalt must be in accordance with the recommended practice in AS 2150.
- 9.2 The Quality Plan must include details/procedures for:
- a) loading, delivery and unloading to ensure that adequate mix temperature is maintained the progress of the paving train is not interrupted; and
 - b) the method of control and application of release agent to ensure a uniform, light coating of the transport vehicle's tray without causing ponding of surplus release agent. Diesel, or agents that cause foaming of surface waste runoff, must not be used as a release agent.
- 9.3 Continuous operation of the paving train must be facilitated as best as practicable by:
- a) providing and allocating sufficient transport capacity, and
 - b) ensuring efficient on-site management of asphalt deliveries.

10. Placement Trial

General

- 10.1 If specified in the Contract documents, the Contractor must construct a placement trial section using the plant and personnel proposed for the work for each nominated mix prior to commencement of paving of the Works.

Location

- 10.2 Each trial section may form part of the Works, unless otherwise directed by the Principal. The size of the trial section must be limited to the production that can be achieved in one Shift.

Conformity Requirements

- 10.3 The asphalt placed in the trial must be identical to the proposed production mix and demonstrate conformity with the Specification in respect of:
- a) homogeneity;
 - b) in situ air voids;
 - c) course thickness;
 - d) course position;
 - e) surface shape; and
 - f) joint quality.
- 10.4 For open graded asphalt, cores must be taken to determine the average compacted density of the layer. The density of cores must be tested in accordance with AS/NZS 2891.9.3.

New Trial Section

- 10.5 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, a new trial section must be constructed.

Nonconformities

- 10.6 Where a trial section forms part of the Works, any nonconformity in respect of materials, process and finished pavement properties must be managed in accordance with Clause 22.

HOLD POINT 3 (if applicable)

Process Held	Commencement of paving at locations other than trial section.
Submission Details	The verification checklist and all relevant test results from the trial section demonstrating conformity to the specified requirements must be provided to the Principal at least 3 working days prior to the commencement of paving at the other locations.

11. Asphalt Placement – General

- 11.1 The Contractor must:
- g) prepare the surface to be paved accordance with the recommended practice in AS 2150, including removal of raised extruded thermoplastic road markings and raised pavement markers;
 - h) 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; and
 - i) immediately after the asphalt has been placed, clean and remove any waste asphalt adhering to road and services fixtures.
- 11.2 The Quality Plan must include details, procedures and/or Inspection and Test Plans for:
- a) asphalt placement, for each paving and related activity, the method of defining each Lot (including length, width, area and location) and allocating a unique Lot number;
 - b) process control for surface preparation, tack coating, placing, joint construction, compaction and clean-up, including plant operating instructions, key temperature targets and records, patterns for paving and compaction operations, and process monitoring;

- c) allocation of appropriate plant and equipment, including backup in case of breakdown;
- d) compaction procedure and the factors affecting/determining rolling patterns;
- e) methodology for placing corrective courses and tie-ins in nonconforming thicknesses (where applicable);
- f) measurement and recording of pavement temperatures and weather conditions;
- g) paving and compaction temperatures;
- h) bituminous emulsion grade and application rate for tack coat;
- i) methodology of constructing joints to maximise joint density; including details of mechanised edge compaction or mechanised edge trimming details;
- j) design, execution and quality verification of a placement trial; and
- k) control and measurement of course thickness;
- l) where an EME2 layer is placed, the methodology to ensure that:
 - i) the surface of the layer will bond to the overlying layer; and
 - ii) if the layer will be temporarily trafficked, the surface texture enables vehicles to travel safely on the surface at speeds up to 80 km/hr.

12. Tack Coat

Existing Surface Condition

- 12.1 The Contractor must take all steps necessary to ensure a strong bond will be achieved between the existing pavement surface and the new asphalt layer. The existing surface must be clean, dry and free from loose material, prior to application of the tack coat.

Application Rate

- 12.2 The tack coat must be applied evenly and in a manner that ensures that it is effectively bonded to the surface, including at the following locations:
- a) at vertical edges between old and new asphalt pavements;
 - b) on top of existing asphalt layers; and
 - c) on top of new asphalt if the subsequent layer is not placed on the same day.
- 12.3 Unless specified otherwise in the Contract documents, the application rate is between 0.15 and 0.30 litres of residual bitumen per square metre. For joints and chases, the application rate must be doubled.

Reduced Application Rate

- 12.4 The Contractor may submit a proposal to the Principal for a reduced tack coat application rate to apply if appropriate for the existing underlying surface material. The proposal must be supported by examples of previous cases where this has been done, including locations and in situ material types and the current pavement performance. The Principal is under no obligation to accept any such proposal.

Daily Record

- 12.5 The Principal must be provided with a signed daily record of the average tack coat application rate applied to each Lot. The tack coat application rate must be reported in terms of residual bitumen and include the percentage dilution of the tack coat used during spraying.

Condition of Tack Coat During Asphalt Placement

- 12.6 The tack coat must have broken prior to the commencement of paving operations and remain intact during paving operations.

13. Temperature and Weather Conditions

Temperature and Wind Velocity Measurement

- 13.1 The temperature of the surface to be paved and wind velocity at the point of asphalt placing, must be measured and recorded in accordance with Table 13.1.

Table 13.1: Weather conditions

Weather Condition	Test Method	Test Frequency
The temperature of the surface to be paved over:	Measured at the existing surface level in accordance with the procedure in the approved Quality Plan.	At the commencement of each shift and one measurement every 2 hours thereafter.
Wind Velocity:	In accordance with the procedure in the approved Quality Plan. The measuring device must be capable of calculating and displaying the average wind velocity.	At the commencement of each shift

Conditions Suitable for Placing Asphalt

- 13.2 Unless approved otherwise by the Principal, asphalt placement must not commence or continue unless the temperature exceeds the temperature specified in the Contract Documents. If a temperature is not specified in the Contract Documents, the requirements given in Table 13.2 apply.

Table 13.2: Minimum temperature for asphalt placement

Minimum Pavement Temperature for Nominal Size of Asphalt (°C)				
≤ 14 mm			≥ 20 mm	
Bitumen binder	PMB	EME 10/20 and EME 15/25	Bitumen binder	PMB
10	15	5	5	10

- 13.3 Tack coat and/or asphalt must not be placed when the surface is wet, and/or when wet weather appears imminent.

14. Paving and Compaction Temperatures

Thermometer

- 14.1 The asphalt temperature must be measured using a handheld or machine mounted infrared thermometer, that is readable and accurate to within $\pm 2^{\circ}\text{C}$, either at the point of discharge from a tipper truck or at the distribution auger on the paver.
- 14.2 If requested by the Principal, the Contractor must demonstrate that the temperature measurement device achieves the level of accuracy specified in Clause 14.1.

Temperature Variation

- 14.3 Asphalt that exhibits a temperature variation within the batch must not be incorporated into the Works, unless it has been remixed to a consistent and adequate temperature for placing and compaction.

Minimum Compaction Temperature for Open Graded Asphalt and Thin Layers

- 14.4 Unless otherwise specified in the Contract Documents, the temperature of open graded asphalt and asphalt layers placed at a thickness of less than 30 mm must be not less than that given in Table 14.4.

Table 14.4: Minimum temperature at the commencement of rolling for asphalt layers

Binder Type in Asphalt Mix	Minimum Mix Temperature ($^{\circ}\text{C}$)	
	Hot Mix Asphalt	Warm Mix Asphalt
Bitumen binders:	115	105 ⁽¹⁾
Multigrade bitumen binders:	120	105 ⁽²⁾
A35P polymer modified binder:	125	105
A20E polymer modified binder:	135	115
Polymer modified binder classes other than A35P and A20E:	140	120

Notes:

1. Minimum temperature limit may be reduced to 95°C when a surfactant additive is used.
2. Minimum temperature limit may be reduced to 100°C when a surfactant additive is used.

15. Method of Placement

General

- 15.1 The method of placing and finishing the asphalt must:
- a) produce a homogeneous product with a tightly bound surface that is free of segregation, cracking, ravelling, bony/fatty material or damage from the construction process;
 - b) achieve a uniform bond to the surface below; and
 - c) achieve the finished pavement properties, specified in Clause 18.1.
- 15.2 Each layer of asphalt must be compacted uniformly to achieve in situ air voids requirements before placing the next layer.

- 15.3 For open graded asphalt, acceptance of compaction must be based on the adoption of approved placing procedures. Such procedures must include not less than 5 passes with a steel wheeled roller with a minimum overall mass of 6 tonnes.
- 15.4 An EME2 pavement layer must not be subjected to traffic, unless it is not practicable to avoid trafficking that layer.

Equipment and Method

- 15.5 Asphalt must be placed using a self-propelled paver with the ability to be operated with automatic grade control and automatic joint matching facility.
- 15.6 Hand placement of asphalt is only permitted for minor corrections of the existing surface and in areas where placement with a paver is impractical.
- 15.7 The Quality Plan must include the method of achieving conforming compaction, including roller type, number of passes and rolling pattern.

Material Transfer Vehicle

- 15.8 If specified in the Contract documents, a Material Transfer Vehicle (MTV) must be used in the paving operations to receive asphalt from the delivery vehicles and transfer the asphalt to the paver.
- 15.9 The MTV must:
- a) be a self-propelled machine with independent controls;
 - b) have a minimum storage capacity of 15 tonnes; and
 - c) have a demonstrated capability to minimise temperature variation and material segregation.
- 15.10 The MTV 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) anti-segregation devices for remixing and homogenising the temperature of the asphalt; and
 - d) 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.
- 15.11 The MTV must discharge into a holding bin in the paver hopper.
- 15.12 The Contractor may propose in writing to the Principal the use of an alternative transfer vehicle. The proposal must include supporting information that address the controls that will be put in place to minimise asphalt temperature segregation during paving operations. MTVs without the capacity to store and remix will not be accepted 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 13.2.

Echelon Paving

- 15.13 If specified in the Contract documents, the asphalt must be placed by echelon paving using a minimum of two pavers operating continuously in tandem.
- 15.14 Where echelon paving is used, the paving run layout and the location of the hot joint between the two mats placed by the tandem pavers must be planned to minimise the risk of cold joints developing within trafficked lanes, unless otherwise approved by the Principal.

16. Course and Layer Thicknesses

- 16.1 Where a course comprises more than one layer and the layer thicknesses have not been specified on the Drawings, the thickness of each layer must be nominated in the Quality Plan.
- 16.2 The nominated thickness of a layer of asphalt must be within the limits specified in Table 16.2.

Table 16.2: Nominated layer thickness limits

Asphalt Type	Nominal Size of Asphalt	Layer thickness (mm)	
		Minimum	Maximum
Dense graded asphalt	7 mm	25	35
	10 mm	35	50
	14 mm	45	70
	20 mm	60	100
Open graded asphalt	10 mm	25	35
	14 mm	35	45
Stone mastic asphalt	7 mm	25	35
	10 mm	35	40
	14 mm	50	60
EME2	14 mm	70	130

- 16.3 For corrective courses and tie-ins to an existing pavement, the Contractor may submit a proposal to the Principal to place layers in thicknesses that does not conform to the specified thickness requirements of Clause 16.2. The proposal must include the following details:
- any nominated layer thicknesses that do not conform to specified thicknesses;
 - work methods capable of producing a dense homogeneous layer at these thicknesses;
 - areas affected, and evidence that these areas are the absolute minimum necessary.

HOLD POINT 4

Process Held	Placing asphalt in layers outside of the specified layer thicknesses.
Submission Details	The proposal must be provided to the Principal at least 5 working days prior to the commencement of placing the asphalt.

17. Joints

Locations

- 17.1 Unless shown otherwise on the drawings:
- Longitudinal joints must be:
 - offset by 150 mm from the joint in the underlying layers;
 - located within 150 mm of the line of change in crossfall; and
 - coincident with final traffic markings, unless otherwise approved by the Principal.

b) Transverse joints must be:

- i) located at a minimum of 25 m from the transverse joint in the adjoining paving run;
- ii) offset by a minimum of 1 m from the joint in the underlying layer;

17.2 Transverse joints must be formed:

- a) at the commencement of each paving run; and
- b) when a delay in paving causes asphalt temperature to fall below the initial compaction temperature nominated in Clause 14.

Procedure

17.3 Hand tamping of edges is permitted where the use of a machine is impractical. Excess material resulting from hand preparation of edges must not be spread on the surface of the work.

17.4 All loose, cracked and/or bony material at the edge of a paved asphalt mat must be removed to achieve a sound vertical face prior to placing the adjacent mat. Asphalt resulting from clean-up of process trimmings must not be incorporated into the Works.

17.5 Each joint must be finished with a smooth, planar surface coinciding with the surface of the rest of the mat and satisfying the surface shape requirements specified in Clause 21.7.

Temporary Ramps at Joints

17.6 Temporary ramps at joints for safe trafficking of the work must be constructed by 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.

Tie-ins to Existing Pavements

17.7 Permanent tie-ins to existing pavement must be constructed by the placement of asphalt complying with this Specification.

18. Sampling and Testing of Placed Asphalt

General

18.1 Unless specified otherwise, the Contractor must verify that the placed asphalt mix meets the specified requirements for compaction, course thickness, course position, surface shape and ride quality.

18.2 The Quality Plan must include:

- a) details the method of determining the sampling locations, sampling and testing frequencies;
- b) details of the test methods to demonstrate conformity with this Specification; and
- c) procedure/methodology for inspecting the asphalt to ensure that it is homogeneous.

18.3 For the determination of bulk (or field) density and thickness of cores, sampling locations must be selected using random stratified methods in accordance with ATM 020.

18.4 For the determination of levels, horizontal position, thickness and deviation from a 3 m straightedge, sampling locations must be selected using the minimum nominated frequency.

Time for Submission of Test Results

18.5 Test reports must be submitted to the Principal within the timeframe specified in Table 18.5.

Table 18.5: Submission of test reports

Record to be Provided	Timeframe
In situ air voids; Course thickness; and Course shape	Within 3 working days of placing the asphalt.

Restoration of Core Holes

18.6 Materials used for restoration of core holes must be either:

- a) hot dense graded asphalt, provided that the normal hot asphalt temperatures required during transport and placement are maintained throughout the entire process; or
- b) proprietary purpose-designed products, subject to the approval of that product by the Principal.

18.7 Cold Mix asphalt based on cut back or fluxed binder, and materials that have significantly different stiffness and thermal response to the asphalt (such as concrete), must not be used.

18.8 The preparation of the core holes must be undertaken in accordance with the following:

- a) any dirt must be removed;
- b) the hole must be brushed, sponged and/or vacuumed and allowed it to dry;
- c) a heavy coating of rapid set bitumen emulsion or similar material must be applied to the sides and floor of the core hole by brush or spray; and
- d) the coating material must be allowed to break or cure prior to placing the fill material.

18.9 The backfilling of the core holes must be undertaken in accordance with the following:

- a) the fill materials must be free of segregation or contamination;
- b) each layer must not exceed 50 mm;
- c) each layer must be compacted without crushing the aggregate particles, using suitable compaction equipment such as motorised hammer, plate compactor, and/or hand tampers; and
- d) the finish top surface of the backfill material must not be below the level of the surrounding pavement.

19. In Situ Air Voids

Acceptance Criteria for In Situ Air Voids

19.1 The lower limit of characteristic values of in situ air voids (V_L) and upper limit of characteristic values of in situ air voids (V_U) must be within the limits shown in Table 19.1 for each Lot. However, for asphalt layers placed as part of a corrector courses, acceptance will be based on the average value of in situ air voids in lieu of the characteristic value.

Table 19.1: In situ air voids requirements.

Location	Layer	Characteristic Value of In situ Air Voids (%)	
		Nominated Layer Thickness > 30 mm and < 50 mm	Nominated Layer Thickness ≥ 50 mm
Dense Mix Asphalt			
Mat	Surfacing layer and layer below surfacing	V _L = 3.0 and V _U = 8.0	V _L = 3.0 and V _U = 7.0
	Layer covered by two layers of asphalt	V _L = 2.5 and V _U = 8.0	V _L = 2.5 and V _U = 7.0
	Layer covered by three or more layers of asphalt	V _L = 2.0 and V _U = 8.0	V _L = 2.0 and V _U = 7.0
Joints ⁽¹⁾	All	V _U = 11.0	V _U = 10.0
Stone Mastic Asphalt			
Mat	—	V _L = 3.0 and V _U = 7.0	V _L = 2.0 and V _U = 6.0
Joints ⁽¹⁾	—	V _U = 10.0	V _U = 9.0
EME2 Asphalt			
Mat	—	V _L = 1.0 and V _U = 5.5	V _L = 1.0 and V _U = 5.5
Joints ⁽¹⁾	—	V _L = 1.0 and V _U = 8.5	V _L = 1.0 and V _U = 8.5

Note:

1. At least two tests per joint must be undertaken as part of the placement trial. Otherwise, testing is only required if directed by the Principal. Only asphalt constructed as part of the Works is to be tested (including asphalt abutting existing pavement or other infrastructure).

Determination of In Situ Air Voids

19.2 Asphalt layers with thickness ≤ 30 mm are not required to be tested for bulk (or field) density.

19.3 Asphalt layers with thickness > 30 mm must be tested for compliance with Table 19.1 at the frequency in Table 19.3.

Table 19.3: Frequency of bulk (or field) density testing

Lot Size (m ²)	Minimum Rate/Number of Tests
≤ 50	1 ⁽¹⁾
50 – 500	3
500 – 1000	4
1000 – 5000	1 per 500 m ² (min. 6)
> 5000	1 per 1000 m ² (min. 10)

Note:

1. May be reduced to 0 if approved by the Principal.

19.4 Unless specified otherwise in the Contract documents, the bulk density must be determined by coring in accordance with the following:

- a) cores must be taken in accordance with AS 2891.1.2;
 - b) when trimming, the core layer thickness must not be reduced by more than 5 mm; and
 - c) the bulk density of the cores is determined in accordance with AS/NZS 2891.9.2.
- 19.5 A nuclear density gauge may only be used for conformance verification if approved by the Principal. If used, the Contractor must establish an asphalt density offset on the first Lot for each mix design and pavement layer combination constructed as part of the Works.
- 19.6 The following applies if field density is determined by a nuclear density gauge:
- a) a nuclear density gauge must not be used when steel reinforcement exists within 300 mm of the surface of the layer;
 - b) measurements must be taken in accordance with AS/NZS 2891.14.2 and AS/NZS 2891.14.3;
 - c) the bulk density of cores taken for density offset calculations must be determined in accordance with AS/NZS 2891.9.2; and
 - d) the density offset must be included in all test reports.
- 19.7 Following the completion of the first Lot for each pavement layer, the following must be submitted to the Principal prior to the nuclear gauge being used for compliance testing of subsequent Lots:
- a) all relevant test results and records from the nuclear gauge;
 - b) AS/NZS 2891.9.2 measurements; and
 - c) the proposed asphalt density bias to be used.
- 19.8 Nuclear gauge density offset checks must also be undertaken in accordance with the requirements of AS/NZS 2891.14.2 Appendix B. The results of these density offset checks must be submitted to the Principal within 1 day of the density offset check being carried out.
- 19.9 The characteristic values of in situ air voids for the Lot must be determined in accordance with ATM-030 and AS/NZS 2891.14.5 using the following test results:
- a) the bulk (or field) density determined in accordance Clause 19.4 or Clause 19.6 (as appropriate); and
 - b) the mean maximum density for the Lot, with individual maximum density values determined in accordance with Clause 7.5 and Clause 8.6.

20. Thickness of an Asphalt Layer

Determination of Course Thickness

- 20.1 Unless otherwise specified in the Contract documents, the Contractor must determine the course thickness by cores or survey in accordance with Clause 20.2, Clause 20.3 or Clause 20.4, as appropriate. However, if specified in the Contract documents that the thickness of the wearing course or an overlay is to be determined by volumetric calculation, then Clause 20.4 applies.
- 20.2 The following applies where thickness is determined from cores:
- a) The cores may be the same as those taken for determination of air voids (refer Clause 19.4), but the core layer thickness is determined prior to trimming of the core;
 - b) where the asphalt is placed in one or more layers to form a single course, the course thickness is determined by adding the average thickness from cores of the lower and upper layers; and
 - c) 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.
- 20.3 The following applies where thickness is determined from survey:

- a) a sampling plan for conformity verification surveys must be prepared;
- b) surveys for product conformity must be carried out in accordance with the survey requirements included in the Contract documents; and
- c) 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 (where specified).

20.4 Where volumetric calculation is used, the average compacted thickness of the layer must be determined using the following formula:

$$TA = 1000 \times M / (D \times A)$$

Where:

TA = average thickness of compacted layer, in millimetres.

M = mass of asphalt in the Lot, in tonnes.

D = average compacted density of the Lot, in tonnes per cubic metre. For open graded asphalt, the average compacted density is assumed to be the average compacted density of cores, measured in accordance with AS/NZS 2891.9.3, as part of the pavement trial.

A = area of the Lot, in square metres.

Tolerances for Layer Thickness

20.5 The average compacted layer thickness for each Lot and the thickness of the compacted layer at any point (if the layer being placed is over one or more layers placed by the Contractor) must not vary from the nominated layer thickness by more than tolerance specified in Table 20.5.

Table 20.5: Tolerances for layer thickness

Asphalt Type	Nominal Size of Asphalt	Layer Thickness Tolerance (mm)	
		Average Value	Individual Value ⁽¹⁾
Dense graded asphalt	7 mm	± 3	± 5
	10 mm	± 3	± 5
	14 mm	± 4	± 7
	20 mm	± 5	± 10
Open graded asphalt	10 mm	± 3	± 5
	14 mm	± 4	± 7
Stone mastic asphalt	10 mm	± 3	± 5
	14 mm	± 4	± 7
EME2	14 mm	± 5	± 10

Note:

1. An individual value only applies to layers placed over one or more layers placed by the Contractor.

20.6 In addition to the requirements of each layer, the total thickness of constructed asphalt pavement must be within ± 10 mm of the total thickness specified.

21. Surface Level of an Asphalt Course

General

- 21.1 Where the work is designed to levels, 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 21.1.

Table 21.1: Course surface level tolerances

Course	Tolerances (mm) ⁽¹⁾
Wearing course	Where abutting kerb and channel: -0 / +5 Elsewhere: -0 / +10
Intermediate course	-5 / +10
Base Courses ⁽²⁾	± 10
Corrective course (where permitted)	± 10

Notes:

1. Minus (-) is below design level and plus (+) is above design level.
2. The Contract documents may specify an additional tolerance for the level at the underside of the bottom asphalt layer if the layer is the critical design layer.

Matching Existing Surface Levels

- 21.2 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), the pavement must be constructed such that its surface levels match the surface levels of the existing road structure within a tolerance of -0, +5 mm and its surface does not pond water.

Determination of Course Position

- 21.3 Where finished surface levels are not specified, the course position of each Lot must be determined by reference to existing pavement surface and road fixtures.
- 21.4 Where finished surface levels are specified, the course position of each Lot must be measured by survey in accordance with the survey requirements included in the Contract documents.
- 21.5 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.

Surface Shape

- 21.6 The surface of the wearing course, including longitudinal and transverse joints, must not pond water.
- 21.7 The surface shape of the course within and across traffic lanes must not deviate from the bottom of the straightedge laid in any direction by more than the tolerances shown in Table 21.7 when measured in accordance with ATM-453.

Table 21.7: Maximum deviation from straightedge (mm)

	Through Carriageway < 70 kph Traffic Speed, Ramps and Roundabouts	Through Carriageway ≥ 70 kph Traffic Speed
Immediately after placing:		
Course immediately below the wearing course (where the wearing course is OGA)	5	5
Course immediately below the wearing course (where the wearing course is DGA or SMA)	10	5
Wearing course	5	3
All other courses	10	10
Any time prior to the expiry of the Performance Period⁽¹⁾:		
Wearing course	6	4

Note:

1. Unless specified otherwise in the Contract documents, the Performance Period is 12 months and commencing at the completion of the placement of conforming wearing course.

21.8 The minimum frequency of testing in accordance with ATM-453 is specified in Table 21.8.

Table 21.8: Minimum frequency of testing for shape

Position	Minimum Frequency of Testing
Within lane	One measurement in longitudinal direction and one measurement in transverse direction every 60 m ² .
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.

21.9 The surface shape must be determined prior to placing the next overlying course. Any non-conformities must be dealt with in accordance with Clause 22. NATA accreditation is not required for testing in accordance with ATM-453.

22. Treatment of Nonconformities

General

- 22.1 Where a Lot is nonconforming, a Nonconformity Report and the proposed disposition for the Lot must be submitted to the Principal.
- 22.2 Dispositions for nonconformity of a placed layer must be approved and implemented before a subsequent layer is placed.
- 22.3 Where the surface shape of a surface to be paved over has deviations from a straightedge exceeding the maximum deviations stated in Clause 21.7, rectification of those areas must be carried out before the subsequent layer is placed, unless otherwise approved by the Principal.

22.4 If specified in the Contract documents, the Contractor may submit a written proposal to the Principal to accept a Lot that is nonconforming in respect of:

- a) in situ air voids;
- b) ride quality; and/or
- c) production mix properties such as binder content, grading and air voids in laboratory compacted specimens.

If accepted by the Principal, a pre-determined deduction to payment will apply to the nonconforming Lot.

Non-homogeneous Work

22.5 The Contractor may propose to the Principal that placed asphalt that is non-homogeneous and/or contains segregated material be accepted. The Principal is under no obligation to accept any such proposal. A proposal must be in writing and must:

- a) state the technical reasons for acceptance;
- a) show that the asphalt complies with all other requirements of this Specification; and
- b) 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.

Cost of Rectification

22.6 The Contractor bears the cost of rectifying, or removal and replacement, of nonconforming Lots, including any restoration work to any underlying or adjacent surface or structure that becomes necessary as a result of such rectification or replacement.

23. Performance Warranty

23.1 For a period of 12 months (or such other period specified in the Contract documents), commencing at the completion of the placement of conforming wearing course, the wearing course must comply with the surface shape requirements specified in Table 21.7.

23.2 For a period of 2 years (or such other period specified in the Contract documents), commencing after the placement of conforming asphalt, the asphalt the asphalt must not ravel, rut, shove, strip, bleed or delaminate from the underlying pavement surface.

Annexure A: Summary of Hold Points, Witness Points and Records

The following is a summary of the Witness Points/Hold Points that apply to this Specification and the Records that the Contractor must submit to the Principal to demonstrate compliance with this Specification.

CLAUSE	HOLD POINT	WITNESS POINT	RECORD
4.1	1. Manufacture of asphalt		Quality Plan
5.3	2. Commencement of the manufacture and placement of the asphalt.		Mix design certificate and proposed commencement date and location.
10.6	3. Commencement of paving at locations other than trial section (if applicable)		Verification checklist and all relevant test results from the trial section.
16.3	4. Placing asphalt in layers outside the specified layer thicknesses.		Details of proposal regarding non-compliant layer thickness.
18.5			Report of completed pavement properties.

Amendment Record

Amendment no.	Clauses amended	Action	Date
-	New specification	New	February 2025

Key

Format	Change in format
Substitution	Old clause removed and replaced with new clause
New	Insertion of new clause
Removed	Old clauses removed