Project Specific Technical Specification

Transport and Main Roads Specifications
PSTS30 Asphalt Pavements

January 2015

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Contents

1 Introduction

1.1 Overview

This Technical Specification sets out the requirements for asphalt used in road pavements and includes the following asphalt types:

- Medium duty dense graded asphalt
- Heavy duty dense graded asphalt
- Stone mastic asphalt, and
- Open graded asphalt

The term dense graded asphalt is used throughout this Technical Specification to refer to medium duty and heavy duty dense graded asphalt.

Guidance on the selection of dense graded asphalt mix type and binder grade is provided in the table below.

Application	**Traffic Volume (average daily ESAs in the design lane in the year of opening)**		**Dense graded asphalt mix type**	**Typical Binders**
	Free Flowing	**High Shear[1]**		
Asphalt located within 100mm of the pavement surface	< 1000	< 300	Medium duty	C320
	< 3000	< 1000	Medium duty	C600[2,3]
	All	< 3000	Medium duty	A5S[4]
	All	300 to < 3000	Heavy duty	C600[2,3]
	≥ 3000	≥ 1000	Heavy duty	A5S[4,5]
Asphalt located more than 100 mm below the pavement surface	< 3000	< 1000	Medium duty	C320
	All	< 3000	Medium duty	C600[6]
	≥ 1000	300 to < 3000	Heavy duty	C320
	≥ 3000	≥ 1000	Heavy duty	C600[6]

[1] High shear areas include signalised intersections and approaches, and other areas with very slow moving heavy vehicles.

[2] M1000 and A0.6S could be considered for the proposed application. However, there has been limited experience with these binder types in these applications on TMR projects.

[3] C600 is generally not used as a surfacing course.

[4] A5S binder is typically used in situations where enhanced deformation and/or fatigue resistance is desired.

[5] A2V could be considered based on a project specific engineering assessment. A2V provides additional deformation resistance when compared to A5S but is more prone to cracking.

[6] M1000 could be considered for the proposed application. However, there has been limited experience with these binder types in these applications on TMR projects.

The asphalt can be manufactured using either conventional or warm mix asphalt (WMA) technology. In addition, dense graded asphalt may contain reclaimed asphalt pavement material.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

For projects that utilise this Technical Specification, the following personnel should have completed and have a certificate of attainment for the AAPA course "XXXXXXXXXXXXXXXXXXXXXX":

a) Contractor's Project Manager and Site Supervisor(s) for the asphalt (and sealing) works, and

b) Administrator and Inspector.

The Administrator should implement an audit and surveillance plan. Typically a minimum of 10% of asphalt lots should be audited on TMR projects. An increased or reduced frequency may apply based on the Contractor's and Asphalt Supplier's historical performance and the project's risk profile.

This Technical Specification is based on the principles outlined in *Austroads Guide to Pavement Technology Part 4B: Asphalt*. The Austroads Guide should be used by asphalt suppliers and Administrators, in conjunction with the material from the above mentioned AAPA course and Austroads Pavement Work Tips, as the first point of reference.

Further advice on interpretation of this Technical Specification can be obtained from the Principal Engineer (Asphalt and Surfacings).

1.2 Performance requirements

The asphalt must not ravel, rut, shove, strip or bleed for the first 24 months after the Date of Practical Completion, and the surface of the asphalt must comply with the surface shape requirements specified in Table 9.6.2 for the first 12 months after the Date of Practical Completion.

Areas of work the Contractor proposes to not be covered by these performance requirements must be identified in writing by the Contractor as part of their tender submission and considered as part of the tender assessment process. The Contractor's submission must include the exact location(s), layers/lots and written justification and evidence as to why this is the case.

A separable portion is typically formed for the asphalt works where it has reached a stage equivalent to Practical Completion prior to the remainder of the Works.

2 Definitions

The terms used in this Technical Specification are defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*, Table 2 of this Technical Specification and AGPT04B/14.

Table 2 - Definition of terms

Term	Definition
Asphalt mix design registrar	Person(s) nominated by the Deputy Chief Engineer (Pavements, Materials and Geotechnical) to register asphalt mix designs for use on Department of Transport and Main Roads projects.
Asphalt supplier registrar	Person(s) nominated by the Deputy Chief Engineer (Pavements, Materials and Geotechnical) to register contractors and/or subcontractors that may supply asphalt to Department of Transport and Main Roads projects.
Asphalt supplier registration system	The means by which asphalt manufacturers and paving organisations are registered to supply and lay asphalt on Department of Transport and Main Roads projects.
Registered asphalt supplier	An organisation which has current Department of Transport and Main Roads registration for asphalt manufacture and/or asphalt paving.
Registered mix design	The mix design, of a particular nominal size of asphalt, which has been submitted by a manufacturer and registered by the Department of Transport and Main Roads.

3 Referenced documents

Table 3 lists the documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Documents
Transport and Main Roads (TMR)	
Pavement Design Supplement	Pavement Design Supplement: Supplement to 'Part 2: Pavement Structural Design' of the Austroads Guide to Pavement Technology
Asphalt Supplier Registration System	System for Registration of Approved Asphalt Suppliers
Australian Standards (AS)	
AS 1141.11.1	Methods for sampling and testing aggregates – Particle size distribution – Sieving method
AS 1141.7	Methods for sampling and testing aggregates – Apparent particle density of filler
AS 1141.17	Methods for sampling and testing aggregates – Voids in dry compacted filler
AS 1141.66	Methods for sampling and testing aggregates – Methylene blue adsorption value of fine aggregate and mineral fillers
AS 1160	Bituminous emulsions for the construction and maintenance of pavements
AS 1289.1.4.2	Methods of testing soils for engineering purposes – Sampling and preparation of soils – Selection of sampling or test sites – Stratified random number method
AS 2150	Hot mix asphalt – A guide to good practice

Reference	Documents
AS/NZS 2891.1.1	Methods of sampling and testing asphalt – Sampling – Loose asphalt
AS 2891.1.2	Methods of sampling and testing asphalt – Sampling – Coring method
AS 2891.2.2	Methods of sampling and testing asphalt – Sample preparation – Compaction of asphalt test specimens using a gyratory compactor
AS/NZS 2891.3.1	Methods of sampling and testing asphalt – Binder content and aggregate grading – Reflux method
AS 2891.7.1	Methods of sampling and testing asphalt – Determination of maximum density of asphalt – Water displacement method
AS 2891.8	Methods of sampling and testing asphalt – Voids and density relationships for compacted asphalt mixes
AS 2891.9.2	Methods of sampling and testing asphalt – Determination of bulk density of compacted asphalt – Presaturation method
AS 2891.11	Methods of sampling and testing asphalt – Degree of particle coating
AS/NZS 2891.13.1	Methods of sampling and testing asphalt – Determination of the resilient modulus of asphalt – Indirect tensile method
Austroads	
AG:PT/T220	Sample preparation – Compaction of asphalt slabs suitable for characterisation
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/T233	Fatigue life of compacted bituminous mixes subject to repeated flexural bending
AG:PT/T234	Asphalt binder content (ignition oven method)
AG:PT/T235	Asphalt binder drain-off
AG:PT/T236	Asphalt particle loss
AG:PT/T237	Binder film index
AG:PT04B/14	Guide to Pavement Technology Part 4B: Asphalt
AP-PWT15	Asphalt Production Process Control
AP-PWT30	Asphalt shape correction
AP-PWT51	Asphalt tack coating
Australian Asphalt Pavement Association (AAPA)	
Advisory Note 7	Guide to the selection, heating and storage of binders for sprayed sealing and hot mix asphalt

Roads and Maritime Services (RMS)	
RMS T660	Moisture content of hot bituminous mixes (Mass loss method)
RMS T662	Compaction of asphalt test specimens (Using a gyratory compactor)

4 Standard test methods

The standard test methods given in Table 4 shall be used in this Technical Specification.

Further details of test numbers and test descriptions are given in Clause 4 of MRTS01 *Introduction to Technical Specifications*.

Table 4 – Standard test methods

Property to be Tested	Test Method Number
General	
Selection of sampling or test locations (random stratified sampling)	AS 1289.1.4.2 or Q050
Calculation of characteristic value of a lot	Q020
Aggregate	
Particle size distribution	AS 1141.11.1
Filler	
Voids in dry compacted filler	AS 1141.17
Methylene blue value	AS 1141.66
Asphalt	
Sampling of loose asphalt mix	AS/NZS 2891.1.1
Sampling of compacted asphalt – coring	AS 2891.1.2
Compaction of asphalt test specimens (using a Marshall compactor)	Q305[1]
Compaction of asphalt test specimens (using a gyratory compactor)	AS 2891.2.2[1] or RMS T662[1]
Compacted density	AS 2891.9.2[2], AS 2891.9.3, Q306B, Q306C, Q306D or Q306E
Asphalt binder drain-off	AG:PT/T235
Asphalt particle loss	AG:PT/T236
Maximum density	AS 2891.7.1 or Q307A
Mix volume ratio	Q318
Binder content and aggregate grading	AS/NZS 2891.3.1, Q308A, AG:PT/T234 or Q308D
Voids calculations for compacted asphalt	AS 2891.8 or Q311
Tensile strength and tensile strength ratio	Q315 or AG:PT/T232[1,3]
Texture depth	AG:PT/T250
Binder film index	AS 2891.8, AG:PT/T237 or Q317

Property to be Tested	Test Method Number
Compaction of asphalt slabs	AG:PT/T220
Deformation resistance	AG:PT/T231
Moisture content of bituminous mixes	RMS T660
Fixed binder fraction	Q321
Surface evenness	Q708B, Q708C or Q708D
Three metre straightedge	Q712
Degree of particle coating	AS 2891.11
Resilient modulus	AS/NZS 2891.13.1
Fatigue life	AG:PT/T233
Equivalent compaction temperature for warm mix asphalt	Q323
Design of bituminous binder blends to a specified viscosity value	Contractor to nominate

[1] The laboratory conditioning and compaction temperature to be used for WMA mixes shall be determined in accordance with Q323.

[2] AS 2891.9.2 and Q306B shall not be used where the water absorption of the test specimens is greater than 2.0%.

[3] The freeze/thaw moisture conditioning of specimens detailed in Section 5.2 of AG:PT/T232 is mandatory.

5 Quality system requirements

5.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are stated in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 5.1.

Table 5.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.2			Submission of Asphalt Quality Plan (seven days)
7.2.5	1. Recommencement of production after nonconforming Tensile Strength Ratio		
7.3.3			Submission of asphalt mix design certificate (seven days)
7.4.1	2. Incorporation of asphalt into the Works		
8.2.3		Marking out of cracks to be filled	
8.2.4		Marking out of areas on which strain alleviating fabric strips are to be applied	
8.6.2	3. Approval to place asphalt at a nonconforming layer thickness		Submission of work methods for the placement of asphalt at a nonconforming layer thickness (three days)
8.7	4. Approval to place asphalt at a nonconforming pavement temperature		
8.11	5. Placing of the nominated mix (after trial placement)		

5.2 Asphalt quality plan

The Contractor must develop an Asphalt Quality Plan for the asphalt work in accordance with the requirements of Clause 5 of MRTS50 *Specific Quality System Requirements*. In addition to these requirements, the plan must include the documents shown in Table 5.2. The Asphalt Quality Plan must be submitted to the Administrator for consideration at least seven days prior to work commencing and must be implemented **Milestone**.

Table 5.2 – Asphalt quality plan requirements

Clause	Planning Documents
5.5, 5.6 & 5.7	Inspection and test plan, including methods and frequencies of sampling, methods and frequencies of testing, verification checklists, and timeframe for submission of test results
7.1	For each constituent material, lot/stockpile sizes, method of defining each lot and allocating a unique lot number
	Procurement, handling and storage of each constituent material
	Nominated particle size distribution and tolerances for each constituent aggregate
7.3	Development, certification and authorisation of the nominated mix submission
7.4	For each nominated mix, the method of defining each lot and allocating a unique lot number
	Calibration of the asphalt manufacturing plant, including all weigh scales, flowmeters and thermometers
	Process control, including plant operating instructions, key temperature targets and records, and responses to process control charts
	Acquisition, storage and handling of binder, including identification and prevention of segregation and/or contamination
	Control of plant feed proportions, including regular checks on grading and moisture content
	Daily asphalt manufacturing plan to ensure timely and uninterrupted progress on site
7.5	Loading, delivery and unloading procedures that maintain adequate mix temperature and do not interrupt progress of the paving train
8	For each paving and related activity, the method of defining each lot and allocating a unique lot number
	Calibration of all thermometers and other measuring equipment
	Process control for surface preparation, tack coating, placing, joint construction, compaction and cleanup, including plant operating instructions, key temperature targets and records, patterns for paving and compaction operations, and process monitoring
8.3	Allocation of appropriate plant and equipment, including backup in case of breakdown
	Rolling pattern, including roller type and number of passes
8.6	Nominated layer thicknesses where these have not been specified in the Contract
8.6.2	Work method for placing corrective courses and tie-ins in nonconforming thicknesses (where applicable)
8.7	Measurement and recording of pavement temperatures and weather conditions
8.8	Paving and compaction temperatures

Clause	Planning Documents
8.10	Construction joints
8.11	Design, execution and quality verification of a placement trial
9.4	Requirements for course thickness

5.3 Quality records

In addition to the requirements of Clause 11 of MRTS50 *Specific Quality System Requirements*, the records detailed in Table 5.3 shall be supplied to the Administrator as nominated by the relevant Clause in the Technical Specification.

Table 5.3 – Summary of records to be supplied to the Administrator

Clause	Description of Record
5.2	Project specific asphalt quality plan
8.2 of PSTS108	Aggregate Production Procedure
5.1 of PSTS109	RAP Management Plan (where applicable)
7.1.6	Documentary evidence of the binder conformity for each delivery
7.3.2	Documents as detailed for each nominated asphalt mix
7.4.4	Asphalt manufacturing process parameters including process temperatures
8.7	Pavement temperature and weather conditions
8.8	Asphalt temperature at which initial compaction will be commenced
8.9	Notification of proposed application rates for tack coat
8.9	Daily record of the average tack coat application rate in each lot
8.11	Verification checklist and all listed test reports of the trial section for each combination of materials, mix proportions, equipment, rate of paving and methods for placement, compaction and finishing
9.6.1	The location and frequency of straight edge measurements including testing at longitudinal and transverse joints

5.4 Conformance requirements

5.4.1 General

The conformance requirements which apply to asphalt lots covered by this Technical Specification are summarised in Clauses 7.1, 7.2 and 9.

The Contractor shall verify conformity with this Technical Specification by sampling and testing, and providing records of process control.

5.5 Compliance testing

5.5.1 General

Compliance testing shall be carried out for each lot.

The Contractor is responsible for performing sufficient tests to ensure that the asphalt complies with this Technical Specification and requirements of the Contract.

However, the Contractor's testing program shall be such that the testing frequencies and number of tests are not less than those specified in Clause 1 of Annexure PSTS30.1.

The Contractor shall nominate an appropriate frequency in accordance with Clause 8.5 of MRTS50 *Specific Quality System Requirements* where a minimum frequency of testing is not specified.

5.5.2 Sampling

5.5.2.1 General

The Contractor shall nominate all sampling locations, frequencies and test methods in the Asphalt Quality Plan.

Sampling locations shall be determined using random stratified methods in accordance with AS 1289.1.4.2 or Q050 for the determination of in situ air voids, thickness of cores and deviation from a three metre straightedge.

Asphalt samples must be taken in accordance with AS/NZS 2891.1.1 or AS 2891.1.2 as appropriate.

5.5.2.2 Sub-lotting

In addition to the requirements of MRTS50 *Specific Quality System Requirements*, and unless otherwise specified or agreed with the Administrator, boundaries of sub-lots represented by a single tested sample are deemed to be the midpoints in production between the sample points.

5.5.3 Sampling and testing requested by the Administrator

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

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

5.6 Maximum lot size

The maximum lot size shall consist of asphalt of the same nominal size manufactured and supplied from the same plant to the same registered mix design. The material must be essentially homogeneous and be manufactured, placed and compacted under essentially uniform conditions during a single work shift.

5.7 Time for submission of test results

The Contractor shall report to the Administrator:

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

b) test results for in situ air voids, course thickness and course shape within three working days of placing the asphalt.

5.8 Process control

The Contractor shall employ a capable process and implement process control in accordance with or exceeding the requirements of AP-PWT15 – *Asphalt Production Process Control*.

5.9 Nonconformities

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

If a nonconformity is not accepted in accordance with the requirements of the Contract, the Contractor shall rectify or replace the lot so that the asphalt conforms to the requirements of this Technical Specification.

6 Asphalt supplier registration

Asphalt shall be manufactured, placed and compacted by registered asphalt suppliers. At least seven days before asphalt is to be incorporated into the Works, the Contractor shall notify the Administrator in writing of the identity and address of the registered asphalt supplier(s) who will undertake the manufacture, placement and compaction of asphalt that will be incorporated into the Works.

The criteria for registration as an asphalt supplier for asphalt manufacture and for asphalt placement and compaction are detailed in the *Asphalt Supplier Registration System*.

> TMR maintains an asphalt supplier register on its website. Administrators can check the registration status of a particular asphalt supplier using this register.

7 Supply of asphalt

7.1 Materials for asphalt

7.1.1 General

All materials used in the manufacture of asphalt must comply with the requirements of this Technical Specification and maintain an essentially uniform appearance for the duration of the Works.

7.1.2 Coarse aggregate

Coarse aggregate must comply with PSTS108 *Aggregates for Asphalt*.

7.1.3 Fine aggregate

Fine aggregate must comply with PSTS108 *Aggregates for Asphalt*.

> Fine aggregates for stone mastic asphalt are typically crushed. Use of natural (ie not crushed) sand should be minimised where possible.

7.1.4 Reclaimed asphalt pavement (RAP) material

RAP material may be utilised in dense graded asphalt and must comply with PSTS109 *Reclaimed Asphalt Pavement Material*. RAP material shall not be utilised in stone mastic and open graded asphalt.

7.1.5 Filler

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

Filler must meet the following requirements:

a) Added filler must comply with PSTS110 *Fillers for Asphalt*.

b) The combined filler must have voids in dry compacted filler determined in accordance with AS 1141.17 that comply with the following requirements:

   i. 40% or greater for dense graded asphalt, and.

   ii. 38% or greater for stone mastic asphalt and open graded asphalt.

c) Methylene blue value of the combined filler in asphalt (excluding hydrated lime) determined in accordance with AS 1141.66 must not exceed 18 mg/g. Where the methylene blue value of the combined filler in asphalt (excluding hydrated lime) exceeds 10 mg/g, the methylene blue value of the combined filler in asphalt (including hydrated lime) must not exceed 10 mg/g.

7.1.6 Binder

For open graded and stone mastic asphalt, A5S polymer modified binder shall be used unless otherwise specified in Clause 2 of Annexure PSTS30.1. For dense graded asphalt, the class of binder used in the Works must be as nominated in Clause 2 of Annexure PSTS30.1 or on the Drawings.

The Contractor may also propose an alternative class of binder, subject to the approval of the Administrator, provided the proposed change does not reduce the life of the pavement structure. The Contractor shall support the proposal with appropriate test data.

The binder must comply with the requirements of MRTS17 *Bitumen* or MRTS18 *Polymer Modified Binder* for the class of binder specified.

The Contractor shall provide documentary evidence to the Administrator, as specified in MRTS17 and MRTS18, of the binder conformity.

Guidance on binder selection is provided in Table Q6.7 of the TMR *Pavement Design Supplement*. Irrespective of the binder specified, the requirements of Clause 1.2 of this Technical Standard apply.

A Contractor's proposal to substitute a more deformation resistant binder would typically be accepted provided:

a) the binder proposed does not reduce the fatigue life of the asphalt pavement, and

b) the alternative binder is provided at no cost to TMR.

Where the Contractor proposes to substitute a binder that may reduce the deformation resistance or fatigue life of the asphalt, a risk assessment must be completed and the proposal evaluated against the risk profile and objectives of the project.

Proposals to adjust the binder grade should be submitted at the time of tender and considered as part of the tender assessment process.

For dense graded asphalt mix designs containing > 15% RAP, the Contractor may use lower viscosity bitumen binder to achieve a binder blend with the same viscosity at 60°C as the nominated binder grade. Mix designs meeting these requirements will be identified on the TMR mix design register.

7.1.7 Additives

7.1.7.1 Bitumen adhesion agent

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

7.1.7.2 Warm mix asphalt additive

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

Warm Mix Asphalt may be used on any project subject to the requirements of this Technical Specification being met.

7.1.7.3 Fibre additive

Cellulose fibre must be used in stone mastic asphalt. For stone mastic asphalt, the fibre content shall be not less than 0.3% by mass of the mix. Cellulose fibre may also be used in open graded asphalt.

The Contractor may propose and use, subject to a technical review by the Asphalt Mix Design Registrar, an alternative fibre additive provided that the Contractor submits, as part of the mix design submission, documented evidence of successful use or trial of such fibre additive under circumstances similar to those which exist under the Contract.

In all cases, the technical specification for the fibre additive and manufacturer's recommendations on the application, handling and incorporation of the additive into asphalt must be included in the mix design submission and the Contractor's Asphalt Quality Plan.

7.1.8 Bituminous emulsion tack coat

Unless otherwise approved by the Administrator, bituminous emulsion must comply with AS 1160. The Contractor shall select 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.

7.2 Requirements for asphalt

7.2.1 Constituent materials proportions

The constituent material proportions must comply with the requirements of Clauses 7.2.1.1 to 7.2.1.6.

7.2.1.1 Particle size distribution of combined aggregate and filler

The particle size distribution of the asphalt aggregate and filler must conform to Table 7.2.1.1-A for dense graded asphalt, and to Table 7.2.1.1-B for open graded asphalt and stone mastic asphalt. The particle size distribution of asphalt aggregate and filler shall be determined in accordance with AS/NZS 2891.3.1, Q308A, AG:PT/T234 or Q308.

Table 7.2.1.1-A – Particle size distribution limits for dense graded asphalt

AS Sieve Size (mm)	Particle Size Distribution Limits (% passing by mass) for Different Asphalt Nominal Size (Asphalt Designation)			
	7 mm (AC7)	10 mm (AC10)	14 mm (AC14)	20 mm (AC20)
26.5				100
19.0			100	80 – 100
13.2		100	80 – 100	65 – 93
9.50	100	80 – 100	#	#
6.70	80 – 100	65 – 90	55 – 80	45 – 70
4.75	#	#	#	#
2.36	45 – 65	35 – 65	25 – 45	20 – 40
1.18	#	#	#	#

AS Sieve Size (mm)	Particle Size Distribution Limits (% passing by mass) for Different Asphalt Nominal Size (Asphalt Designation)			
	7 mm (AC7)	10 mm (AC10)	14 mm (AC14)	20 mm (AC20)
0.600	15 – 40	15 – 35	10 – 30	5 – 25
0.300	#	#	#	#
0.150	#	#	#	#
0.075	3 – 11	3 – 11	2 – 8	2 – 8

The particle size distribution limits must be stated in the nominated design submission and in the test reports for the trial and production mixes.

Table 7.2.1.1-B – Particle size distribution limits for open graded asphalt and stone mastic asphalt

AS Sieve Size (mm)	Particle Size Distribution Limits (% passing by mass) for Different Asphalt Nominal Size (Asphalt Designation)			
	Open Graded Asphalt		Stone Mastic Asphalt[1]	
	10 mm (OG10)	14 mm (OG14)	10 mm (SMA10)	14 mm (SMA14)
19.0		100		100
13.2	100	85 – 100	100	84 – 100
9.50	85 – 100	44 – 76	85 – 100	40 – 65
6.70	45 – 75	23 – 47	40 – 62	25 – 45
4.75	24 – 46	12 – 30	25 – 45	18 – 32
2.36	6 – 20	5 – 17	18 – 31	14 – 28
1.18	4 – 16	3 – 14	14 – 28	12 – 24
0.600	#	#	12 – 24	10 – 20
0.300	2 – 10	1 – 9	10 – 20	9 – 17
0.150	#	#	8.0 – 17.0	7.5 – 14.5
0.075	0.5 – 5.5	0.5 – 5.5	6.5 – 12.5	6.5 – 12.5

[1] For stone mastic asphalt, where the apparent particle density of the combined filler is lower than the aggregate particle density (dry) by more than 0.4 t/m^3, the lower limit on the 0.075 mm sieve shall be reduced by 1% for density differences up to 0.8 t/m^3 and 2% for density differences greater than 0.8 t/m^3.

The particle size distribution limits must be stated in the nominated design submission and in the test reports for the trial and production mixes.

7.2.1.2 Binder

For the nominated asphalt mix design, the proportion of effective binder, expressed as a percentage by volume of the total mix, must comply with the requirements of Table 7.2.1.2-A for dense graded asphalt and Table 7.2.1.2-B for open graded asphalt and stone mastic asphalt. Effective binder volume shall be determined in accordance with Q311 or AS 2891.8.

Table 7.2.1.2-A –Minimum dense graded asphalt

Asphalt Type	Minimum Binder Content for Different Asphalt Nominal Size (Asphalt Designation)			
Nominal Size of Asphalt (Asphalt Designation)	7 mm (AC7)	10 mm (AC10)	14 mm (AC14)	20 mm (AC20)
Effective Binder Volume (%)	≥ 11.5 (≥ 11.0)	≥ 11.0 (≥ 10.5)	≥ 10.5 (≥ 10.0)	≥ 10.0 (≥ 9.5)

Values in brackets apply when the percentage of absorbed binder is determined using an established binder absorption/water absorption relationship referenced in Q311.

Table 7.2.1.2-B – Minimum open graded asphalt and stone mastic asphalt binder content

Asphalt Type	Minimum Binder Content for Different Asphalt Nominal Size (Asphalt Designation)			
	Open Graded Asphalt		Stone Mastic Asphalt	
Nominal Size of Asphalt (Asphalt Designation)	10 mm (OG10)	14 mm (OG14)	10 mm (SMA10)	14 mm (SMA14)
Effective Binder Volume (%)	≥ 9.0 (≥ 8.5)	≥ 8.0 (≥ 7.5)	≥ 14.5 (≥ 14.0)	≥ 13.5 (≥ 13.0)

Values in brackets apply when the percentage of absorbed binder is determined using an established binder absorption/water absorption relationship referenced in Q311.

7.2.1.3 Reclaimed asphalt pavement material

7.2.1.3.1 Dense graded asphalt mixes containing bitumen or multigrade bitumen

Where bitumen or multigrade bitumen is used as the binder in dense graded asphalt, the Contractor is permitted to use RAP material in the surfacing and other courses up to a maximum of 15% by mass (Approval Level 1 or 1S as shown in Table 7.2.1.3-A), subject to compliance with the testing requirements of Section A of Table 7.2.1.3-B.

Table 7.2.1.3-A – Prerequisites for allowable percentage of reclaimed asphalt pavement material in asphalt

RAP Approval Level	Maximum Percentage[(1)] (%)	Testing Required (Table 7.2.1.3B)	Performance Period
Surfacing Course			
1S	15	Section A	N/A
2S	20	Section B	3 years
Other than Surfacing Course			
1	15	Section A	N/A
2	25	Section B	2 years
3	30	Section C	3 years
4	40	Section C	5 years

[1] Determined as percentage by mass of RAP material to mass of total mix.

To progress from RAP Approval Level 1 or 1S to a higher Approval Level (which allows the inclusion of greater percentages of RAP), the asphalt manufacturer must demonstrate to the satisfaction of the Asphalt Mix Design Registrar:

a) compliance with this Technical Specification, including the requirements for RAP Level progression as specified in Table 7.2.1.3-B, and

b) a history of proven performance (the "Performance Period") and ability to produce conforming asphalt for the RAP Approval Level requested as shown in Table 7.2.1.3-A.

A history of 'proven performance' would typically involve demonstrating the following:

a) Performance testing demonstrating that the resilient modulus, fatigue, deformation resistance and moisture sensitivity are not adversely affected by the inclusion of the proposed RAP content and

b) Field investigation involving condition monitoring for the duration of the performance period and sampling and testing cores from the pavement at the end of the performance period.

The approval level applies to similar designs supplied from the same asphalt plant using the same binder grade.

Table 7.2.1.3-B – RAP level of progression criteria

Submission Type	Testing
Section A	
Mix design submission (to be resubmitted every 2 years)	Binder content and grading of RAP in accordance with Q308A or AS/NZS 2891.3.1
Contract frequency testing (each Lot of RAP used in asphalt production)	Binder content and grading of RAP in accordance with Q308A or AS/NZS 2891.3.1
Contract frequency testing (daily on RAP incorporated into asphalt)	a) Moisture content of RAP in accordance with RMS T660 b) Visual monitoring of incoming RAP by a person experienced in the process
Section B	
Mix design submission (to be resubmitted every 2 years)	All testing required in Section A, plus: a) Resilient modulus (refer Clause 7.2.6) b) Wheel tracking (refer Clause 7.2.7) c) Fatigue resistance (refer Clause 7.2.8) d) Recovered binder viscosity of RAP in accordance with the Contractor's nominated test method
Contract testing frequency	Recovered binder viscosity for RAP in accordance with the Contractor's nominated test method

Submission Type	Testing
Section C	
Mix design submission (to be resubmitted every 2 years)	All testing required in Sections A and B plus testing to confirm the suitability of the mix design based on performance testing of at least three separate samples of asphalt containing the nominated percentage of RAP.
Contract testing frequency	All testing required in Sections A and B

The percentage of RAP material must not exceed the percentages shown in Table 7.2.1.3-A for the RAP Approval Level at which the asphalt mix has been registered.

For RAP Approval Level 3 and Level 4, the following additional requirements apply:

a) Processed RAP material must be screened into at least two fractions (coarse and fine) and each fraction must be separately metered into the asphalt mixing process.

b) A statement must be provided in the RAP Management Plan detailing how the processed RAP material within a stockpile will be controlled at a moisture content which will not affect the asphalt properties.

c) Performance testing must be conducted to establish an optimised mix design.

The RAP approval level is stated on the asphalt mix design register.

7.2.1.3.2 Dense graded asphalt mixes containing polymer modified binder

For dense graded asphalt containing polymer modified binder (PMB), the RAP Approval Level cannot progress beyond Level 1 or 1S as defined in Table 7.2.1.3-A. RAP shall not be included in PMB mixes that are used in the lowest asphalt layer (other than corrector or pavement repairs) to be constructed as part of the Works unless the Contractor can demonstrate to the satisfaction of the Asphalt Mix Design Registrar that the inclusion of RAP will not adversely affect the performance characteristics of the asphalt . The Contractor shall support any such application with appropriate test data. RAP may be used in PMB mixes in all other situations.

Where the pavement design is reliant on the enhanced fatigue performance of the polymer modified binder, this Technical Specification does not allow RAP to be included in these mixes unless the Contractor can demonstrate the performance characteristics of the asphalt mix have not been adversely affected by the inclusion of RAP. Fatigue and resilient modulus testing of the mix, with and without RAP, would typically be required to demonstrate the performance characteristics of the asphalt mix have not been adversely affected. Mix designs meeting these requirements will be identified on the asphalt mix design register.

7.2.1.4 Hydrated lime

Dense graded asphalt manufactured using an asphalt plant that reincorporates baghouse fines into the mix must contain, by mass of total aggregate, not less than 1.0% hydrated lime.

Dense graded asphalt manufactured using an asphalt plant that does not reincorporate baghouse fines into the mix must contain, by mass of total aggregate, not less than 1.5% hydrated lime.

Stone mastic asphalt, must contain, by mass of total aggregate, not less than 1.0% hydrated lime if the combined filler (excluding hydrated lime) has a methylene blue value >10 mg/g and ≤18 mg/g.

Open graded asphalt must contain, by mass of total aggregate, not less than 1.0% hydrated lime.

All hydrated lime incorporated into asphalt mixes must comply with the requirements of PSTS110 *Fillers for Asphalt.*

7.2.1.5 Adhesion agent

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

7.2.1.6 Warm mix asphalt additive

The maximum proportion of additive shall comply with Table 7.2.1.6.

Table 7.2.1.6 – Maximum proportion of additive in warm mix asphalt

Additive	Maximum Proportion
Wax	2.0% by mass of binder
Surfactants	Nominated by Contractor
Water (either directly, or in the form of water containing crystals)	3% by mass of the binder

7.2.2 Volumetric characteristics

Asphalt mix must comply with the following requirements:

a) Air voids in laboratory compacted specimens as stated in Table 7.2.2.

b) For dense graded asphalt, the filler - binder ratio of the design mix, measured as the ratio of the percentage passing 0.075 mm AS sieve by mass of total aggregate to the percentage of binder by mass of total mix, shall be ≥ 0.8 and ≤ 1.4. In production, the filler – binder ratio shall be ≤ 1.6.

c) For stone mastic asphalt, the fixed binder fraction of the design mix must be ≤ 0.55 when determined in accordance with Q321.

d) For dense graded asphalt, the binder film index of the design mix must be greater than 7.5 microns when determined in accordance with Q317, AS 2891.8 or AG:PT/T237.

e) For open graded asphalt, the binder film index of the design mix must be greater than 15.0 microns when determined in accordance with Q317, AS 2891.8 or AG:PT/T237.

The workability of stone mastic asphalt mixes at placement temperatures reduces as the fixed binder fraction of the binder-filler mastic increases. Although the maximum specification limit is set at 0.55, mixes with a fixed binder fraction exceeding 0.50 may also exhibit poor workability.

Table 7.2.2 – Requirements for laboratory compacted specimens

Asphalt Type	Laboratory Compaction Method	Air Voids in Laboratory Compacted Specimens	Applicable Test Methods
Medium duty dense graded asphalt	Marshall compaction (50 blows per face) or Gyratory compaction (120 cycles)	≥ 3.0%	• AS2891.2.2, RMS T662 or Q305

Asphalt Type	Laboratory Compaction Method	Air Voids in Laboratory Compacted Specimens	Applicable Test Methods
Heavy duty dense graded asphalt	Marshall compaction (50 blows per face) OR	≥ 4.0%	• AS 2891.7.1 or Q307A • AS 2891.8 or Q311 and • AS2891.9.2, Q306B or Q306C
	Gyratory compaction (120 cycles) and (350 cycles)	≥ 3.0% ≥ 2.0%	
Stone mastic asphalt	Marshall compaction (50 blows per face)	≥ 2.0%	• Q305 • AS 2891.7.1 or Q307A • AS 2891.8 or Q311 and • AS2891.9.2 or Q306B
Open graded asphalt	Marshall compaction (50 blows per face)	≥ 20.0%	• Q305 • AS 2891.7.1 or Q307A • AS 2891.8 or Q311 and • AS2891.9.3 or Q306D

For dense graded asphalt and stone mastic asphalt, air voids below the minimum value(s) may lead to rutting, flushing, bleeding and/or mix instability. Factors that influence the performance of the asphalt include:

- the magnitude of the nonconformance,
- traffic loading,
- depth of the layer from the pavement surface and
- the binder used in the asphalt mix.

Isolated nonconformances for air voids are typically accepted subject to:

- The Contractor taking corrective action to prevent a recurrence of the non-conformance
- The air voids not being more than 0.5% below the minimum value,
- The asphalt complying with the performance standards listed in Clause 1.2, and
- The Contractor agreeing to remove and replace the nonconforming asphalt (as well as any overlying asphalt) if the performance standards listed in Clause 1.2 are not met.

7.2.3 Moisture content

For all mixes produced in a drum plant and/or containing a warm mix asphalt additive and/or containing RAP, the moisture content must be < 0.5% by mass of total mix when determined in accordance with RMS T660. The Contractor need not have NATA accreditation for this test.

7.2.4 Particle coating

For all mixes, the degree of particle coating shall be not less than 99%, when determined in accordance with AS 2891.11, once discharged from the asphalt plant into delivery vehicles.

7.2.5 Moisture sensitivity

For dense graded asphalt, the tensile strength ratio (TSR) must be ≥ 80% and the average tensile strength of the freeze/thaw group must be greater than 600 kPa when determined in accordance with Q315 or AG:PT/T232. The procedures detailed in Table 7.2.5 apply to accepted nonconformities in Tensile Strength Ratio. However, when the TSR is less than 70% and the air voids in laboratory compacted mix are nonconforming, the nonconformity will not be accepted except for warm mix asphalt.

Table 7.2.5 – Procedures for nonconforming TSR

Condition	Action Required
70% ≥ TSR < 80% and previous result ≥ 80%	a) Promptly implement corrective action and b) Test after implementing corrective action and report results to the Administrator within 4 working days
70% ≥ TSR < 80% and previous result < 80%	Observe Hold Point 1
TSR < 70%	Observe Hold Point 1
Tests not carried out at required frequency or test results not reported within specified timeframe or corrective action not promptly implemented	Observe Hold Point 1

Where a Hold Point is required to be observed, the Contractor shall investigate the causes of the nonconformity and propose corrective action to prevent recurrence of the nonconformity. The Contractor shall submit:

a) test results covering the same Lot for insitu air voids and all characteristics specified in Clause 9.2 of PSTS30, and

b) the proposed corrective action to achieve conformity.

The Administrator shall consider the submitted documents prior to authorising the release of the Hold Point allowing recommencement of asphalt production **Hold Point 1**. The Contractor shall not recommence production of asphalt until the corrective action is implemented. The Contractor shall test the tensile strength ratio after implementing corrective action, and report results within 4 working days of the resumption of production.

For warm mix asphalt, moisture sensitivity requirements do not apply but the results must be reported.

Moisture sensitivity test results are typically lower for warm mix asphalt than for hot mix asphalt. However, field evidence suggests that the reduction in TSR does not necessarily lead to increased moisture sensitivity (stripping) and appropriate specification limits for warm mix asphalt have yet to be determined. Although there are no moisture sensitivity requirements applicable to warm mix asphalt at this time, the Contractor should monitor the results and take corrective action, where necessary.

7.2.6 Resilient modulus

For dense graded asphalt containing in excess of 15% RAP material and/or containing warm mix asphalt additive, and any other mix design where resilient modulus testing is requested by the Asphalt Mix Design Registrar, three test specimens shall be prepared in accordance with AS 2891.2.2 or RMS T662 (to 5.0 ± 0.5% air voids) and tested in accordance with AS/NZS 2891.13.1. The number of cycles and the resilient modulus must be reported as part of the mix design submission.

7.2.7 Deformation resistance

For dense graded asphalt mixes containing in excess of 15% RAP material and/or containing warm mix asphalt additive and stone mastic asphalt mixes, two test specimens shall be prepared in accordance with AG:PT/T220 and tested in accordance with AG:PT/T231. The final rut depth of the specimens must be reported as part of the mix design submission. For stone mastic asphalt, the final rut depth must be ≤ 2.5 mm.

Where specified in Clause 3 of Annexure PSTS30.1, two test specimens of production mix shall be prepared in accordance with AG:PT/T220 and tested in accordance with AG:PT/T231. The final rut depth of the specimens must be reported to the Administrator.

7.2.8 Fatigue resistance

For dense graded asphalt containing in excess of 15% RAP material, three test specimens shall be tested in accordance with AG:PT/T233 using the standard reference conditions. The fatigue life of the sample must be reported as part of the mix design submission.

7.2.9 Asphalt binder drain-off

For open graded asphalt and stone mastic asphalt, a sample of production mix shall be prepared and tested in accordance with AG:PT/T235. The asphalt binder drain-off shall be ≤ 0.3%. The results shall be reported as part of the mix design submission and at a frequency not less than that specified in Table 1C of Annexure PSTS30.1.

7.2.10 Asphalt particle loss

For open graded asphalt containing binder other than A5S polymer modified binder, three test specimens of production mix shall be prepared and tested in accordance with AG:PT/T236. The asphalt particle loss shall be ≤ 20%. The results shall be reported as part of the mix design submission and at a frequency not less than that specified in Table 1C of Annexure PSTS30.1.

7.2.11 Mix volume ratio

For stone mastic asphalt, the mix volume ratio of the mix shall be calculated using the grading and air voids test results. The compacted unit mass of the coarse aggregate shall be determined from the same stockpile of coarse aggregate as that used for asphalt production. The coarse aggregate sample shall be prepared by combining the current raw materials in the production mix proportions.

The mix volume ratio shall be ≤ 1.04. The results shall be reported as part of the mix submission and at a frequency not less than that specified in Table 1C of Annexure PSTS30.1.

7.2.12 Marshall Stability, Stiffness and Flow

Where the Marshall method is used for the design of dense graded asphalt, test specimens shall be prepared and tested in accordance with Q305 for Stability, Stiffness and Flow. The results shall be reported as part of the mix submission and comply with the following requirements:

- Stability: for AC7 mixes ≥ 6.0 kN and for AC10, AC14 and AC20 mixes ≥ 7.5 kN
- Flow: for all mixes ≥ 2.0 mm, and
- Stiffness: for AC7, AC10, AC14 and AC20 mixes ≥ 2.0 kN/mm.

7.3 Nominated mixes

7.3.1 Nominated mix design

The nominated mix design to be used for the Works must:

a) satisfy the requirements of this Technical Specification

b) be registered in accordance with the requirements of the *Asphalt Supplier Registration System* and Clause 7.3.2, and

c) be targeted during production of the asphalt.

Nominated mix designs are:

a) materials specific, and substitution of constituents is not permitted

b) design specific, and variation to the registered mix design 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.

7.3.2 Submission of mix designs for registration

Unless specified otherwise, all tests (except PAFV) relating to the submission must be carried out within a three month period prior to the date of submission to the Asphalt Mix Design Registrar. PAFV tests must be carried out within a twelve month period prior to the date of submission to the Asphalt Mix Design Registrar. All phases of any particular test must be performed at the same laboratory.

Details of the mix design must be submitted to the Asphalt Mix Design Registrar not less than 28 days prior to the commencement of the asphalt mix being incorporated into the Works. An additional day shall be allowed for each additional mix design submitted concurrently. The mix design submission must include the details outlined in Clauses 7.3.2.1 to 7.3.2.5.

7.3.2.1 Constituent materials

The following information must be supplied for the constituent materials:

a) Quarry Registration Certificate for each coarse and fine aggregate source

b) Added filler: type, grade and source for each filler

c) Binder: source and class or grade

d) RAP material: binder content and grading. Where the Contractor proposes to include more than 15% RAP in the mix, the viscosity of the recovered RAP binder shall also be provided.

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

7.3.2.2 Mix design

The following information must be supplied for the mix design:

a) Proportion of each constituent as a percentage by mass of total mix

b) Where RAP material is a constituent, the RAP Approval Level requested and a copy of the Contractor's RAP Management Plan

c) For each nominated mix design, the nominated values and allowable tolerances, where required, for each requirement for the asphalt specified in Clause 7.2

d) Graphical representation of the nominated mix design particle size distribution with control points as required by the limits of Table 7.2.1.1 and the production tolerances of Table 7.4.3.2

e) Type and identification number of the asphalt mixing plant, and

f) Temperature at which the asphalt is to be manufactured.

7.3.2.3 Production trial

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

7.3.2.4 Signed asphalt mix design certificate

An asphalt mix design certificate, that has been signed by the Contractor's mix designer, certifying that the mix design complies with the requirements of PSTS30 shall be included as part of the mix design submission. The mix design certificate shall contain the following information:

a) Registered supplier's name

b) Plant location and/or identification number

c) Mix design code number

d) Specification that the mix design complies with

e) Description of all constituent materials, their sources, grade/class (for binder) and proportions within the mix, and

f) Target grading, binder content and maximum density as well as their job limits for the mix design.

The Contractor must also attach a copy of the NATA endorsed test results for all specified tests.

7.3.2.5 Warm mix asphalt additives

When using warm mix asphalt additives, the asphalt supplier must provide details of the additive(s) nominated in the mix design submission. In addition, evidence acceptable to the Asphalt Mix Design Registrar that the additive is designed, supplied and has proven performance for the purpose described in this Technical Specification must be provided.

The proposed mix design will not be registered if the nature, intended purpose and dosage of the warm mix asphalt additive are not clear in the nominated mix design submission. The submission must clearly state:

a) any proposed amendments to the mix design procedure, operational processes and/or test methods as a result of the inclusion of a warm mix asphalt additive and

b) the classification of the warm mix asphalt additive.

Where warm mix asphalt additives are included in a mix design, Q323 test results should be included in the mix design submission demonstrating the appropriate temperature to be adopted for compacting laboratory specimens.

7.3.2.6 Asphalt mix design registration

Within seven days of the date of submission the Asphalt Mix Design Registrar will advise in writing whether or not the mix design will be registered. An additional day shall be allowed for each additional mix design submitted concurrently.

7.3.3 Nomination of registered mix designs

At least seven days before asphalt is to be incorporated into the Works, the Contractor shall submit to the Administrator a copy of one mix design certificate for each nominal size of asphalt mix to be incorporated into the Works **Milestone**. The asphalt mix design must be listed on the TMR asphalt mix design register and only asphalt complying with that mix design shall be incorporated into the Works.

TMR maintains an asphalt mix design register on the TMR website. Administrators can check the currency of an asphalt mix design certificate using this register.

7.4 Production of asphalt

7.4.1 General

Asphalt shall be produced by a registered asphalt manufacturer from the nominated asphalt plant in accordance with the nominated mix design for the Works. Asphalt shall not be incorporated into the Works until the following documents have been received and reviewed by the Administrator:

a) identity of the registered asphalt supplier(s) who will undertake the asphalt production, placement and compaction and the address of the asphalt plant that will produce the asphalt

b) the mix design certificate, which holds current registration with TMR, for each mix design to be used in the Works

c) the Contractor's Asphalt Quality Plan

d) the Contractor's Aggregate Production Procedure, and

e) the Contractor's RAP Management Plan (where applicable) **Hold Point 2**.

These documents shall be submitted to the Administrator not less than seven days prior to the commencement of asphalt being incorporated into the Works.

7.4.2 Method of production

A method of production shall be adopted that:

a) controls the process and targets the nominated mix and

b) supplies an essentially homogeneous and consistent product at the nominated manufacturing temperature.

7.4.3 Production tolerances

7.4.3.1 Proportions of constituents

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

a) the asphalt produced remains essentially uniform and consistent and in compliance with the nominated mix submission, and

b) the proportion of RAP does not exceed the maximum allowed for the RAP Approval Level nominated on the asphalt mix design registration certificate.

7.4.3.2 Combined particle size distribution and binder content

The actual particle size distribution and maximum density of the production mix may vary from the nominated value within the limits shown in Table 7.4.3.2, provided that the actual values also remain within the limits of Table 7.2.1.1-A or Table 7.2.1.1-B, as appropriate.

The actual binder content of the production mix may vary from the nominated value within the limits shown in Table 7.4.3.2.

For a particular mix design, the nominated design with the tolerances applied is called the job limits.

Table 7.4.3.2 – Production tolerances

Description	Tolerance
Permissible variation to nominated combined particle size distribution during production (% by mass of total aggregate, Q308A, AS/NZS 2891.3.1, AG:PT/T234 or Q308D) for each mix size:	
Passing 4.75 mm and larger	± 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 (% by mass of total mix, Q308A, AS/NZS 2891.3.1, AG:PT/T234 or Q308D)	± 0.3
Permissible variation to the nominated maximum density during production (t/m^3, Q307A or AS 2891.7.1)	± 0.035[1]

[1] A larger tolerance may apply provided the Contractor can demonstrate to the satisfaction of the Asphalt Mix Design Registrar that a larger tolerance is appropriate for the particular design. The limits applicable to a particular design shall be stated on the mix design certificate.

7.4.4 Asphalt manufacturing plant

The asphalt manufacturing plant shall 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 application rate/batch mass and various process temperatures.

A documented procedure for the management and control of the moisture content of each constituent aggregate material, including RAP material, shall be implemented and the asphalt manufacturing process controls adjusted accordingly.

RAP materials where added must be dispersed uniformly throughout the mix such that there is no apparent variability or temperature segregation in the mix.

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

7.4.5 Storage and handling

7.4.5.1 Binder

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

The Contractor shall provide details in the Asphalt Quality Plan of the procedures for acquisition, storage and handling of binder which identify and prevent segregation and/or contamination of the binder and implement them.

At the asphalt manufacturing plant, binder supplied in accordance with MRTS18 *Polymer Modified Binder* must be recirculated in delivery and/or storage tanks to a uniform consistency immediately prior to its use in the manufacturing process.

7.4.5.2 Asphalt

Asphalt that is retained in hot storage silos shall be stored in such a manner that minimises oxidation of the binder and maintains temperature uniformity.

Dense graded asphalt mix may be retained in hot storage silos for a period not exceeding 30 hours, unless otherwise approved by the Administrator.

Open graded and stone mastic asphalt mix shall be loaded into delivery vehicles as soon as practical and the total storage and transportation time shall not exceed 4 hours unless otherwise approved by the Administrator.

Storing asphalt at elevated temperatures may lead to excessive degradation of the binder and a reduced service life for the asphalt. The specification provides for overnight storage of hot dense graded asphalt if unexpected events (such as wet weather or traffic management issues on the job site) mean that all the asphalt produced during a day's production cannot be incorporated into the Works during that work shift. Provided the asphalt is stored in such a way that minimises oxidation, does not cool excessively and maintains temperature uniformity, it may be incorporated into the Works on the following day. Some plants may be able to achieve longer storage times without causing excessive degradation of the asphalt. In these cases, the Contractor must demonstrate to the satisfaction of the Administrator that the extended storage time does not cause excessive degradation of the asphalt.

7.4.6 Manufacturing temperatures

The temperatures of constituent materials shall 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. Thermometer readings must be readable and accurate to within ± 2°C.

The temperature of the asphalt shall be measured and recorded when:

a) the asphalt leaves the pugmill or mixing drum, and

b) the asphalt discharges from the hot storage bin(s) and/or in the trucks prior to leaving the plant.

The dispatch temperature of the asphalt must facilitate the specified compaction level in the finished product. Details of the project specific process temperatures and the frequency of recording must be provided in the Asphalt Quality Plan.

The temperature of asphalt must not at any time in the process exceed the lesser of the following:

a) 175°C for binders complying with MRTS17

b) 185°C for binders complying with MRTS18, and

c) unless otherwise approved by the Administrator, the maximum mixing temperature stated in AAPA *Advisory Note 7*.

7.5 Transport of asphalt

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

The Contractor shall state in the Asphalt 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.

Continuous operation of the paving train shall be facilitated by:

a) providing and allocating sufficient transport capacity, and

b) ensuring efficient on-site management of asphalt deliveries.

8 Placing of asphalt

8.1 General

The Contractor's method of placing and finishing the asphalt must:

a) produce a homogeneous product with a tightly bound surface

b) achieve a strong bond to the surface below, and

c) achieve the finished pavement properties, specified in Clause 9, within the specified tolerances.

The application of water to induce rapid cooling in the asphalt shall not be used at any stage in the process, including preparation for trafficking, unless approved by the Administrator.

8.2 Preparation of pavement

8.2.1 General

The Contractor shall carry out the preparation work detailed in Clauses 8.2.2 to 8.2.4 on existing surfaces on or against which the asphalt is to be placed.

8.2.2 Preparation

The surface of the pavement base/bridge deck or existing substrate shall be dry, and shall be thoroughly swept using a rotary broom to remove any loose material or other deleterious material which may be present. Any deleterious material which still adheres to the surface after sweeping shall be removed by other means. Following mechanical sweeping:

a) areas of oil or fuel spillage shall be cleaned with detergent, flushed with clean water and allowed to dry prior to application of the tack coat, and

b) cracks, joints or holes in the pavement/bridge deck shall be rectified as stated in Clause 8.2.3.

Frames for manhole covers, gully gratings, kerbs and other structures shall have joint surfaces cleaned free of any extraneous material.

Raised extruded thermoplastic road markings and raised pavement markers shall be removed prior to tack coating and placing asphalt.

8.2.3 Crack filling

In areas shown in the Drawings or stated in Clause 4 of Annexure PSTS30.1, cracks greater than 2 mm wide shall be filled prior to placement of any asphalt. The Contractor shall mark out in the presence of the Administrator, the extent of crack filling to be carried out **Witness Point**.

Prior to filling of cracks, the existing cracks shall be cleaned.

Cracks shall be filled level with the surrounding surface with a polymer modified sealant approved by the Administrator.

8.2.4 Strain alleviating fabric strips

In the areas shown on the Drawings or stated in Clause 5 of Annexure PSTS30.1, strain alleviating fabric strips shall be applied to existing cracks prior to placement of any asphalt.

The Contractor shall mark out, in the presence of the Administrator, the extent of the strain alleviating fabric strips to be applied **Witness Point**.

Strain alleviating fabric strips shall be non-woven polyester fabric strips precoated with a rubberised bitumen adhesive base.

Prior to application of the fabric strips, the existing surface shall be swept clean so that it is free of dust, grit, surface moisture and vegetation. Any cracks or joints wider than 2 mm shall be filled as detailed in Clause 8.2.3.

The surface to which the strain alleviating fabric strip is to be applied shall be sprayed with a bituminous emulsion tack coat or proprietary primer. The fabric strips shall be laid to cover a minimum width of 250 mm (normally 125 mm on each side of the crack).

Placement of the strain alleviating fabric strip shall be carried out only under the following conditions:

a) the pavement temperature is sufficient for a strong bond to be achieved between the fabric and the pavement surface and rain is not likely to fall prior to completing the installation, and

b) the pavement surface is clean and dry.

Installation, including overlapping of joints, shall be in accordance with the manufacturer's recommendations.

After placement, the strain alleviating fabric strip shall be rolled with at least one pass of a pneumatic-tyred roller to ensure proper adhesion. The strain alleviating fabric strip shall be placed free of wrinkles and creases.

Traffic shall not be permitted to transverse the strain alleviating fabric strip for at least 20 minutes after rolling.

Prior to placing the asphalt, the normal application of bituminous emulsion tack coat shall be applied over the strain alleviating fabric strip, unless otherwise approved by the Administrator.

8.3 Method of placement

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

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

The Contractor must state in the Asphalt Quality Plan the method of achieving conforming compaction including roller type, number of passes and rolling pattern.

If specified in Clause 6 of Annexure PSTS30.1, a Material Transfer Vehicle (MTV) must be used in the paving process except for areas to be paved at tapers, turning lanes or roundabouts of radius less than 50 m and other areas approved to be excluded by the Administrator.

> Technical Note 28 *Material Transfer Vehicles in Asphalt Paving* provides guidance on the selection and use of a MTV in the paving process. The Administrator should asses these guidelines prior to specifying the use of a MTV in the asphalt Works.

The MTV must be a self-propelled machine with independent controls which will receive asphalt from delivery vehicles, and store, remix and transfer the asphalt to the paving machine without contact and be equipped with:

a) a receiving hopper compatible with delivery vehicles

b) conveying mechanisms and anti-segregation devices for remixing asphalt

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

d) a minimum nominal on-board storage capacity of 15 tonnes

e) an additional holding bin in the paving machine hopper or the paver hopper enclosed by other means to prevent asphalt from falling out of the front of the paver during paving operations, and

f) sufficient power output from the motor to operate with full load on grades up to 6% and travel in tandem with the paver, either directly in front or in an offset position.

Where asphalt paving occurs across structures, the Contractor shall control the gross mass of the MTV to the maximum permissible loadings as set out in Clause 7 of Annexure PSTS30.1. If specified in Clause 8 of Annexure PSTS30.1, the asphalt shall be placed by echelon paving using a minimum of two paving machines operating continuously in tandem. The paving run layout must be such that the hot joint is located to minimise cold joints within the trafficked carriageway, unless otherwise approved by the Administrator.

8.4 Protection of work

Traffic shall be controlled in accordance with the requirements of MRTS02 *Provision for Traffic* while undertaking the Works.

The Works shall be protected until the required thickness of asphalt has been placed, compacted and cooled sufficiently to carry traffic without damage to the Works.

It is the Contractor's responsibility to ensure the asphalt has cooled sufficiently prior trafficking to minimise deformation of the asphalt. The Contractor should consider the traffic management requirements outlined in MRTS02 *Provision for Traffic* and the requirements of this clause when developing the construction program.

8.5 Protection of services and road fixtures

Asphalt or other material used in the Works shall not be allowed to enter or adhere to grates, hydrants or valve boxes, service covers, bridge joints and other road fixtures. Immediately after the asphalt has been placed, any affected services and road fixtures shall be cleaned to remove all waste asphalt.

8.6 Course and layer thicknesses

A course of dense graded asphalt may be comprised of more than one layer. Where a course is comprised of more than one layer, and the layer thicknesses have not been specified by the Principal, the Contractor shall nominate the thickness of each layer in the Asphalt Quality Plan.

8.6.1 Nominated layer thickness

The nominated thickness of a layer of asphalt must be within the limits specified in Table 8.6.1.

Table 8.6.1 – Nominated layer thickness limits

Asphalt Type	Nominal Size of Asphalt (Asphalt Designation)	Layer Thickness (mm)	
		Minimum	Maximum
Asphalt Type	7 mm (AC7)	25	35
	10 mm (AC10)	35	50
	14 mm (AC14)	50	70
	20 mm (AC20)	60	100
Open Graded Asphalt	10 mm (OG10)	25	35
	14 mm (OG14)	35	45
Stone Mastic Asphalt	10 mm (SMA10)	35	40
	14 mm (SMA14)	50	60

8.6.2 Corrective courses and tie-ins to existing pavement

For corrective courses and tie-ins to an existing pavement, the Contractor may be required to implement a layer thickness that does not conform to the thickness requirements of Clause 8.6.1.

Where this is required, the Contractor shall submit details of the work methods to be adopted at least three days prior to implementation. These work methods shall provide a layer that is essentially dense and homogeneous **Milestone**.

Placing of asphalt in a nonconforming layer thickness shall not occur unless approved by Administrator **Hold Point 3**.

8.7 Pavement temperature and weather conditions

The pavement surface temperature shall be measured and recorded at the point of asphalt placement. The Contractor shall document the method of measurement and recording in the Asphalt Quality Plan. Unless otherwise accepted by the Administrator, asphalt placement shall not commence or continue, unless the pavement surface temperature complies with the requirements of Table 8.7. **Hold Point 4**.

Tack coat and/or asphalt shall not be placed during weather conditions that will lead to the formation of a poor bond between the new asphalt and the underlying pavement, the minimum rolling temperatures cannot be achieved, and/or essentially homogeneous and conforming air voids cannot be achieved in the compacted asphalt.

Tack coat and/or asphalt shall not be placed when the pavement surface is frozen, wet or rain is imminent.

Table 8.7 – Minimum pavement surface temperature for asphalt placement

Asphalt Type	**Nominal Size of Asphalt (Asphalt Designation)**	**Minimum Surface Temperature for Asphalt Placement (°C)**	
		Binders complying with MRTS17	**Binders complying with MRTS18**
	7 mm (AC7)	15	20
	10 mm (AC10)	10 (5)	15 (10)
	14 mm (AC14)	10 (2)	15 (5)
	20 mm (AC20)	5 (2)	10 (5)
Open Graded Asphalt	10 mm (OG10)	-	15 (10)
	14 mm (OG14)	-	15 (10)
Stone Mastic Asphalt	10 mm (SMA10)	-	15 (10)
	14 mm (SMA14)	-	15 (5)

The minimum surface temperature requirements shown in brackets apply when the Contractor uses a material transfer vehicle as part of the asphalt paving process.

The Administrator may consider accepting the placement of asphalt at temperatures below the temperatures nominated in Table 8.7 in situations where the Contractor can demonstrate to the satisfaction of the Administrator that their construction process ensures a strong bond is formed between the new asphalt and the underlying pavement, the specified level of compaction is achieved and the air voids in the compacted asphalt is essentially homogeneous. These objectives are typically demonstrated by:

- Extracting cores from the pavement to show that a strong bond has been achieved;
- For dense graded asphalt (with a nominal size not less than 10 mm) and stone mastic asphalt, adopting a testing frequency not less than twice the minimum frequency nominated in Table 1D of Annexure PSTS30.1 for in situ air voids to show the air voids in the compacted asphalt is essentially homogeneous and conforming, and
- For open graded asphalt, the minimum temperature at the commencement of rolling requirement is being achieved.

Acceptance of paving asphalt at temperatures below the minimum values stated in Table 8.7, does not discharge the Contractor's responsibilities under Clause 1.2.

8.8 Paving and compaction temperatures

The Contractor's Asphalt Quality Plan must document the temperatures at which the asphalt is placed and compacted to achieve the in situ air voids requirements specified in Clause 9.2.1. The Contractor shall nominate the following requirements in the Asphalt Quality Plan:

a) The minimum temperature at which asphalt is to be delivered to the pavement

b) The minimum temperature at which initial compaction of the asphalt is to commence, and

c) The method of temperature measurement.

The Contractor must not incorporate asphalt in the Works that exhibits a temperature variation unless it has been remixed to a consistent and adequate temperature for compaction.

The temperature of dense graded asphalt with a nominal size less than 10 mm and open graded asphalt at the commencement of rolling shall be not less than that stated in Table 8.8.

Table 8.13 – Minimum temperature at commencement of rolling for dense graded asphalt with a nominal size less than 10 mm and open graded asphalt

Asphalt Mix Type (Asphalt Designation)	Minimum Mix Temperature (°C)
Dense graded asphalt (AC7)	115°C
Open graded asphalt (OG10, OG14)	120°C

For open graded asphalt the Contractor's compaction procedure shall include not less than 5 passes of the steel-wheeled roller.

For dense graded asphalt and stone mastic asphalt, each asphalt mix design has its own optimal temperature range for compaction and therefore specific temperature limits are not stated in this specification. However, the objective of the asphalt placement and compaction process is to achieve an asphalt layer that is relatively uniform in thickness and density. Achieving a relatively uniform density requires the asphalt to be placed and compacted at relatively uniform temperatures. Intermittent supply of asphalt to the paver is a common cause for stop/start paving and significant temperature variation at the commencement of rolling. Such variations should be avoided wherever possible, as they often lead to variation in density (air voids) and premature distress. Areas may be sub-lotted and tested separately to confirm they comply with the specification requirements for air voids.

For open graded asphalt and dense graded asphalt with a nominal size less than 10 mm insitu air voids is not typically tested. For this reason, a minimum temperature at the commencement of rolling is specified.

The Contractor shall measure and monitor paving and compaction temperatures as described in the Asphalt Quality Plan with a hand held or machine mounted infrared thermometer or other suitable temperature measuring device readable and accurate to within ± 2°C at the discharge point from a tipper truck or at the distribution auger on the paver.

Verification of the accuracy of the infrared thermometer and the determination of a correlation factor must be undertaken daily at the commencement of work and at any other time at the request of the Administrator.

8.9 Tack coat

Prior to applying the tack coat, the existing surface must be clean, dry and free from loose and other deleterious material.

The tack coat shall be evenly applied at a rate that achieves a strong bond between pavement layers.

The tack coat shall be applied to the pavement surface at a rate between 0.10 and 0.20 litres of residual bitumen per square metre prior to the placement of dense graded asphalt and stone mastic asphalt. For joints and chases, the application rate shall be doubled.

The tack coat shall be allowed to break prior to laying asphalt.

Where asphalt is placed directly over a new sprayed bituminous surfacing, a tack coat is not required.

The Contractor shall nominate in writing to the Administrator the proposed tack coat application rate prior to applying the tack coat.

It is the Contractor's responsibility to ensure that the tack coat type and application rate achieve a strong bond to the underlying pavement and between asphalt layers. The Contractor may propose in writing to the Administrator a tack coat application rate outside the range nominated in this Technical Specification. AP-PWT51 – *Asphalt Tack Coating* should be used by the Administrator to assess the suitability of the Contractor's proposed application rate.

A sprayed bituminous surfacing (instead of a tack coat) is typically placed immediately below open graded asphalt to waterproof the underlying pavement.

The Contractor shall provide an endorsed daily record to the Administrator, of the average tack coat application rate applied to each lot. The tack coat application rate shall be reported in terms of residual bitumen and the percentage dilution of the tack coat used during spraying shall be stated.

Tack coat shall be applied by spray bar fitted to a mechanical sprayer. Hand spraying shall be carried out only in those areas where it is impractical to use a sprayer. Precautions shall be taken to protect kerbs, channels, adjoining structures, traffic and parked vehicles from tack coat spray.

The tack coat must be intact at the commencement of asphalt placement.

The tack coated surface shall not be opened to public traffic.

8.10 Joints

The Contractor shall describe in the Asphalt Quality Plan the procedure for the construction of joints. The Contractor's procedure must maximise joint density and include mechanised edge compaction or mechanised edge trimming. Hand tamping of edges is permitted where the use of a machine is impractical. Excess material resulting from hand preparation of edges must not be spread on the surface of the Works.

All loose, cracked and/or boney material at the edge of a paved mat must be removed prior to placing the adjacent mat. Asphalt resulting from the clean-up of process trimmings shall not be used in the Works.

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 9.6.

Longitudinal joints must be:

a) offset by 150 mm from the joint in the underlying layers

b) coincident within 150 mm of the line of change in crossfall, and

c) coincident with final traffic markings, unless otherwise approved by the Administrator.

Unless otherwise approved by the Administrator, transverse joints must be:

a) located a minimum of 25 m apart

b) offset by a minimum of 1 m from the joint in the underlying layer

c) formed at the commencement of each paving run, and

d) formed when a delay in paving causes asphalt temperature to fall below the initial compaction temperature nominated in Clause 8.8.

8.11 Placement trial

If specified in Clause 9 of Annexure PSTS30.1 and prior to commencing work, the plant and personnel proposed for use for the Works must be subjected to a placement trial.

Each nominated mix must be subjected to a separate placement trial. Each placement trial may be located within the Works. The size of the placement trial must be limited to one production shift. The Contractor must design the trial to implement all the procedures described in the Asphalt Quality Plan and demonstrate conformity to this Technical Specification in respect of:

a) homogeneity

b) in situ air voids

c) course thickness

d) course position

e) surface shape

f) joint quality, and

g) ride quality, where specified.

The Contractor shall submit a copy of the verification checklist and all relevant test results from the placement trial demonstrating conformity to this Technical Specification prior to further placing of the Contractor's nominated mix in the Works. Further placing of asphalt shall not occur unless approved by the Administrator **Hold Point 5**.

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

Where a placement trial forms part of the Works, all nonconformities in respect of materials, process and finished pavement properties shall be managed in accordance with Clause 5.

8.12 Temporary ramps and tie-ins to existing pavement and structures

8.12.1 General

Temporary ramps that are constructed for the safe trafficking of the Works must be constructed by placement of asphalt complying with this Technical Specification as appropriate for the application, or by cold milling of existing or new asphalt.

The dimensions of ramps must be as nominated in Clauses 8.12.2 to 8.12.4.

8.12.2 Transverse joints

A minimum taper length of 2.5 metres shall be provided for each 50 mm variation in levels (or part thereof) for areas where the speed limit exceeds 60 km/h.

A minimum taper length of 1.5 metres shall be provided for each 50 mm variation in levels (or part thereof) for areas where the speed limit is less than or equal to 60 km/h.

8.12.3 Longitudinal joints

Where traffic is required to travel on a longitudinal edge, a ramp of minimum 1.0 m length shall be provided for each 50 mm variation in levels (or part thereof).

8.12.4 Interface with structures

Asphalt ramps shall be formed and compacted around manholes, gully grates, utility covers or other similar structures unless otherwise directed by the Administrator. The ramps must have a minimum taper length of 1.5 metres for each 50 mm variation in levels (or part thereof).

8.12.5 Permanent tie-ins

Permanent tie-ins to existing pavement shall be constructed by placement of asphalt complying with this Technical Specification.

8.13 Surface gritting

Stone mastic asphalt shall be gritted unless otherwise directed by the Administrator. The material used for gritting shall consist of natural sand particles having a grading complying with the requirements shown in Table 8.13, or other material as approved by the Administrator. The grit shall be dry, clean, hard, angular, durable, and free from clay and other aggregations of fine material, soil, organic matter and any other deleterious material.

Table 8.13 – Particle size distribution limits for grit material

AS Sieve Size (mm)	% Passing by Mass
4.75	100
2.36	90 – 100
0.600	0 – 20
0.075	0 – 1.0

The grit shall be uniformly spread and rolled into the surface of the hot asphalt during the compaction process. The temperature at which the grit material is applied shall be such that the grit forms a strong bond with, and is partially coated by, the binder in the asphalt mix. The grit material shall be applied at a rate ≥ 0.3 kg/m^2 for SMA14 and ≥ 0.2 kg/m^2 for SMA10.

9 Finished pavement properties

9.1 Homogeneity

All asphalt must be homogenous in appearance.

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

Any proposal by the Contractor that the Administrator accept non-homogeneous and/or segregated material or work must be in writing and must show:

a) the technical reasons for acceptance

b) compliance with this Technical Specification, and

c) sub-lotting that minimises performance risk to the surface and structure of the pavement.

9.2 In situ air voids

9.2.1 Requirements for in situ air voids

The asphalt must have a dense appearance. Each layer of asphalt must be uniformly compacted to achieve the specified characteristic values of in situ air voids.

Asphalt layers ≤ 30 mm thickness shall not be tested for in situ air voids.

The characteristic values of in situ air voids for the lot must comply with Table 9.2.1-A for dense graded asphalt, and with Table 9.2.1-B for stone mastic asphalt.

Joints are not usually tested unless the Administrator suspects the specified requirements have not been achieved. Where this occurs, the Administrator may order tests to confirm compliance.

Table 9.2.1-A – In situ air voids requirements for dense graded asphalt

Location	Limits of Characteristic Values of In situ Air Voids	
	Specified layer thickness ≥ 30 mm and < 50 mm	**Specified layer thickness ≥ 50 mm**
Mat	V_L = 3.0% and V_U = 8.0%	V_L = 3.0% and V_U = 7.0%
Joints[1]	V_L = 3.0% and V_U = 11.0%	V_L = 3.0% and V_U = 10.0%

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

[1] Only asphalt constructed as part of the Works shall be tested (including asphalt abutting existing pavement or other infrastructure).

Table 9.2.1-B – In situ air voids requirements for stone mastic asphalt

Location	Limits of Characteristic Values of In situ Air Voids	
	SMA10	**SMA14**
Mat	V_L = 2.0% and V_U = 7.0%	V_L = 2.0% and V_U = 6.0%
Joints (1)	V_L = 2.0% and V_U = 10.0%	V_L = 2.0% and V_U = 9.0%

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

(1) Only asphalt constructed as part of the Works shall be tested (including asphalt abutting existing pavement or other infrastructure).

For dense graded asphalt and stone mastic asphalt, in situ air voids below the minimum value may lead to rutting, flushing, bleeding and/or mix instability. Factors that influence the performance of the asphalt include traffic loading, depth of the layer from the pavement surface and the binder used in the asphalt mix.

In situ air voids above the maximum value may lead to accelerated hardening of the binder (through oxidation), ravelling, ingress of moisture and/or stripping of the asphalt layer.

9.2.2 Determination of in situ air voids

The characteristic value of in situ air voids for dense graded asphalt and stone mastic asphalt shall be determined using the following process:

a) Extract cores from the pavement in accordance with AS 2891.1.2 and determine the layer thickness prior to trimming cores. Trimming must not reduce the core layer thickness by more than 5 mm.

b) For dense graded asphalt, determine the bulk density either from cores in accordance with AS 2891.9.2, Q306B or Q306C, or from nuclear gauge density measurements taken in accordance with Q306E. The nuclear gauge density method is not to be used when steel reinforcement exists within 300 mm of the surface of the layer.

c) For stone mastic asphalt, determine the bulk density either from cores in accordance with Q306C, or from nuclear gauge density measurements taken in accordance with Q306E. The

nuclear gauge density method is not to be used when steel reinforcement exists within 300 mm of the surface of the layer.

d) Determine the reference density for the purpose of in situ air voids calculations as the mean maximum density of the lot, where the individual values are determined in accordance with Q307A or AS 2891.7.1.

e) Calculate the characteristic value of in situ air voids in accordance with Q311 or AS2891.8 and Q020.

9.3 Surface texture

The average surface texture depth of stone mastic asphalt after gritting shall not be less than:

- 0.7 mm for SMA10, and
- 1.1 mm for SMA14.

9.4 Course and layer thickness

9.4.1 Requirement for course and layer thickness

The specified course thickness shall be as detailed on the Drawings.

9.4.2 Where finished surface levels are not specified

Unless otherwise approved by the Administrator, asphalt shall be placed at an essentially uniform thickness over the areas to be paved, with due consideration given to the shape of the surface to be paved over.

The average compacted layer thickness for each lot, when determined in accordance with Clause 9.4.4 (a), shall not vary from the nominated layer thickness by more than the average value tolerance given in Table 9.4.2.

In addition, where asphalt is placed over one or more layers placed by the Contractor, the thickness of the compacted layer at any point, when determined in accordance with Clause 9.4.4 (b), shall not vary from the nominated layer thickness by more than the individual value tolerance given in Table 9.4.2. The use of isolated areas of corrector does not constitute a layer.

Table 9.4.2 – Allowable tolerances for course thickness

Asphalt Type	Nominal Size of Asphalt (Asphalt Designation)	Layer Thickness Tolerance (mm)	
		Average Value	Individual Value[1]
Dense Graded Asphalt	7 mm (AC7)	± 3	± 5
	10 mm (AC10)	± 3	± 5
	14 mm (AC14)	± 4	± 7
	20 mm (AC20)	± 5	± 10
Open Graded Asphalt	10 mm (OG10)	± 3	± 5
	14 mm (OG14	± 4	± 7
Stone Mastic Asphalt	10 mm (SMA10)	± 3	± 5
	(14 mm (SMA14)	± 4	± 7

[1] Individual value only applies to layers placed over one or more layers placed by the Contractor.

9.4.3 Where finished surface levels are specified

The course thickness shall be controlled by maintaining the design levels and the surface shape requirements specified in Clause 9.6 provided that:

a) the average compacted thickness of each lot calculated from surveys is consistent with the average compacted thickness of the respective lot determined using the formula provided in Clause 9.4.4 (a)

b) the average compacted thickness of each lot of the surfacing course is within 10% of the nominated course thickness, and

c) the compacted thickness of the surfacing and intermediate courses at any point is within 20% of the nominated course thickness.

For new pavements, finished surface levels are typically specified and are shown on the Drawings.

For asphalt placed over existing pavement (including mill and fill situations), the finished surface levels may or may not be specified. Where these levels are specified, they are shown on the Drawings and 'levels specified' is nominated in the relevant work item(s).

9.4.4 Determination of layer thickness

The thickness of the lot shall be determined as follows:

a) the average compacted layer thickness of the lot shall be determined using the following formula:

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

where:

T_A = average thickness of compacted layer, in millimetres.

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

D = the average compacted density of the lot, in tonnes per cubic metre.

A = area of the lot, in square metres.

b) the compacted layer thickness at any point shall be determined using one of the following methods:

i. cores sampled in accordance with AS 1289.4.2 or Q050, and AS 2891.1.2 where:

- core layer thickness is determined prior to trimming of the core
- the core diameter can be less than 95 mm, and
- the test specimen may comprise more than one layer.

OR

ii. where compaction testing is determined using a nuclear density gauge, measured dip records taken in accordance with procedures documented in the Contractor's Asphalt Quality Plan where measured loose dip measurements are converted to a compacted thickness value using the mean bulk density for the lot.

9.5 Course position

9.5.1 Determination of course position

Where finished surface levels are specified, the course position of each lot shall be measured by survey by the Contractor.

Where finished surface levels are not specified, the course position shall be determined by the Contractor with reference to the existing pavement surface and road fixtures.

The course position shall be determined within 72 hours of the installation of the lot.

9.5.2 Requirement for vertical level

The levels of the top surface of any course shall be calculated from the design finished surface levels less the total course thickness(es) overlying that course. The measured levels determined by survey must not vary from the calculated levels for any course by more than 10 mm.

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

Dispositions for nonconformity must be approved before a subsequent course is placed over a nonconforming course accepted by the Administrator.

> It is common practice to place multiple layers of asphalt that make up an asphalt course within a single work shift. Level nonconformities are usually assessed on the surface of each course rather than on individual layers.

9.5.3 Requirement for horizontal location

The survey location of any point on the surface of a course for level determination must be located within 50 mm from the corresponding point determined from the Drawings. However, where alignment

of the pavement with an existing road or other existing road structure is necessary, the new work shall be joined to the existing work in a smooth manner as shown in the Drawings.

9.6 Surface shape

9.6.1 Determination of surface shape

The surface shape shall be determined and reported in accordance with Q712.

The maximum lot size must be in accordance with Clause 5.6 and extended to include the adjacent longitudinal joints, transverse joints and tie-ins. Testing shall be conducted at the frequency not less than that specified in Clause 1 of Annexure PSTS30.1.

9.6.2 Requirement for surface shape

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

The surface shape of the course within the traffic lane must not deviate from the bottom of a straightedge laid in any direction by more than the tolerances shown in Table 9.6.2 with due allowance being made for design shape, where relevant. Where the deviations from a straightedge for an existing surface exceed 10 mm, rectification of those areas shall be carried out before a new asphalt layer (other than corrector) is placed, unless directed otherwise by the Administrator.

Shape correction is typically completed using an asphalt corrector course under Work Item 9501P or milling (which is not covered by the Technical Specification). Further guidance about asphalt shape correction can be found in AP-PWT30 – *Asphalt Shape Correction*.

Any nonconformities shall be corrected before testing ride quality and before a subsequent course is placed.

Table 9.6.2 – Maximum deviation from a straightedge placed within or across traffic lanes

Course	Maximum Deviation from a Three Metre Straight-edge (mm)	
	Through Carriageway < 70 km/h Traffic Speed	**Through Carriageway ≥ 70 km/h Traffic Speed[2]**
At Actual Completion Date		
Surfacing course	5	3
Course immediately below the surfacing course	10[1]	5
All other courses	15	10
12 months after Date of Practical Completion		
Asphalt surface	8	6

[1] Maximum deviation shall be reduced to 5 mm where the surfacing is open graded asphalt.

[2] Requirements for < 70 km/h traffic speed apply for roundabouts and signalised intersections (including approaches).

9.7 Ride quality

9.7.1 Determination of ride quality

Unless otherwise specified in Clause 10 of Annexure PSTS30.1, the ride quality (R) shall be determined from measurements of longitudinal profile in accordance with Q708B, Q708C or Q708D.

Each trafficked lane of the Works shall be tested and a lot shall be not less than 100 m or greater than 500 m long. Areas of pavement affected by roundabouts, railway lines, bridge joints and inspection pit covers may be excluded from ride quality assessment.

An Inspection and Test Plan (ITP) for ride quality that meets the requirements of this Technical Specification shall be developed. The lots and the start and end locations for testing shall be defined in the ITP.

9.7.2 Requirement for ride quality

The surfacing course must have a smooth longitudinal profile.

Where the construction of the underlying pavement forms part of the contract or asphalt is placed in more than one layer, including any full length, full width corrective course over a pavement constructed by others, or where only isolated correction to section of the pavement has been placed, the ride quality of each lot of the asphalt surfacing must not exceed the road roughness count rate given in Clause 10 of Annexure PSTS30.1. Where not stated in Clause 10 of Annexure PSTS30.1, the road roughness count rate shall not exceed 50 counts per kilometre.

Where a single layer of asphalt is placed over pavement constructed by others, the ride quality for each lot must not exceed the Ra values determined as follows:

$R_a = 0.6 \times R_b + 5$, or the value nominated in Clause 10 of Annexure PSTS30.1, whichever is the greater.

where: R_a is the road roughness count rate after placing the asphalt layer (counts/km)

R_b is the road roughness count rate before placing the asphalt layer (counts/km)

Where a single layer of asphalt is placed over a pavement constructed by others, the surface evenness of the existing surface prior to the Works shall be determined and reported by the Contractor. Lots of the existing surface must be selected such that they coincide with lots of the finished work.

10 Asphalt supplier performance

An Asphalt Supplier Performance Report shall be prepared in accordance with the requirements of the *Asphalt Supplier Registration System* Manual. An Asphalt Supplier Performance Report is not required for a project or program of works that involves less than 2000 tonnes of asphalt.

11 Supplementary requirements

The requirements of PSTS30 are varied by the supplementary requirements given in Clause 11 of Annexure PSTS30.1.