Technical Specification

Transport and Main Roads Specifications MRTS32 High Modulus Asphalt (EME2)

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1 Introduction

1.1 Overview

This Technical Specification sets out the requirements for high modulus asphalt EME Class 2 with a nominal aggregate size of 14 mm, abbreviated as EME2.

EME2 asphalt shall be constructed in accordance with the general requirements for dense graded asphalt specified in MRTS30 *Asphalt Pavements* and Annexure MRTS30.1, unless those requirements are specifically excluded or amended by this Technical Specification.

Where dense graded asphalt requirements are specified in MRTS30 *Asphalt Pavements* for a specific mix type (for example AC14M, AC20H, medium duty or heavy duty), these requirements do not apply to EME2 asphalt unless specifically stated otherwise.

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.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

EME2 is a high performance asphalt intended for use in heavy duty pavements. It is particularly suitable in the following situations:

a) pavements carrying large volumes of heavy vehicles, and

b) heavily trafficked areas, such as slow lanes, climbing lanes, and bus lanes, where there is a need for increased resistance to permanent deformation.

EME2 is predominantly used for structural asphalt layers, i.e. base layers; and is not intended for use as a permanent wearing course.

1.2 Performance requirements

The performance requirements stated in Clause 1.2 of MRTS30 *Asphalt Pavements* shall apply to this Technical Specification.

2 Definitions

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS30 *Asphalt Pavements*.

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
AGPT/T111	*Handling viscosity of polymer modified binders (Brookfield thermosel)*
AGPT/T191	*Extractions of bituminous binder from asphalt*
AGPT/T231	*Deformation resistance of asphalt mixtures by the wheel tracking test*

Reference	Title
AGPT/T232	*Stripping potential of asphalt – Tensile strength ratio*
AGPT/T274	*Characterisation of flexural stiffness and fatigue performance of bituminous mixes*
AP-T219	*Mastic performance assessment in stone mastic asphalt*
AS 2341.12	*Methods of testing bitumen and related roadmaking products – Determination of penetration*
AS 2341.18	*Methods of testing bitumen and related roadmaking products – Determination of softening point (ring and ball method)*
AS 2341.3	*Methods of testing bitumen and related roadmaking products – Determination of kinematic viscosity by flow through a capillary tube*
AS/NZS 2341.10	*Methods of testing bitumen and related roadmaking products – Determination of the effect of heat and air on a moving film of bitumen (rolling thin film oven (RTFO) test)*
AS/NZS 2341.2	*Methods of testing bitumen and related roadmaking products – Determination of dynamic viscosity by vacuum capillary viscometer*
AS/NZS 2341.4	*Methods of testing bitumen and related roadmaking products – Determination of dynamic viscosity by rotational viscometer*
AS/NZS 2341.8	*Methods of testing bitumen and related roadmaking products – Determination of matter insoluble in toluene*
AS/NZS 2891.2.2	*Methods of sampling and testing asphalt – Sample preparation – Compaction of asphalt test specimens using a gyratory compactor*
AS/NZS 2891.8	*Methods of sampling and testing asphalt – Voids and volumetric properties of compacted asphalt mixes*
AS/NZS 2891.9.2	*Methods of sampling and testing asphalt – Determination of bulk density of compacted asphalt - Presaturation method*
AS/NZS 2891.9.3	*Methods of sampling and testing asphalt – Determination of bulk density of compacted asphalt - Mensuration method*
ASTM D5/D5M	*Standard Test Method for Penetration of Bituminous Materials*
EN 12594	*Bitumen and bituminous binders – Preparation of test samples*
EN 13179–1	*Tests for filler aggregate used in bituminous mixtures – Part 1: Delta ring and ball test*
EN 13924	*Bitumen and bituminous binders – Specifications for hard paving grade bitumens*
MRTS17	*Bitumen*
MRTS30	*Asphalt Pavements*
MRTS101	*Aggregates for Asphalt*
MRTS102	*Reclaimed Asphalt Pavement Material*
MRTS103	*Fillers for Asphalt*
TN148	*Asphalt Mix Design Registration*

4 Standard test methods

In addition to the test methods listed in Clause 4 of MRTS30 *Asphalt Pavements*, the standard test methods given in Table 4 shall apply to this Technical Specification.

Table 4 – Standard test methods

Property to be Tested	Method No.
Aggregate and Filler	
Particle density of the combined mineral aggregates	AS/NZS 2891.8 or Q317
Filler	
Delta ring and ball [1]	EN 13179–1 [2,3] and AS 2341.18
Binder	
Penetration at 25ºC	ASTM D5/D5M or AS 2341.12
Softening point	AS 2341.18
Viscosity at 60ºC	AS/NZS 2341.2 [4]
Mass change	AS/NZS 2341.10
Retained penetration at 25ºC after RTFO treatment	AS/NZS 2341.10 and AS 2341.12
Increase in softening point after RTFO treatment	AS/NZS 2341.10 and AS 2341.18
Viscosity at 135ºC	AS/NZS 2341.2, AS 2341.3, AS/NZS 2341.4
Matter insoluble in toluene	AS/NZS 2341.8
Viscosity at 60ºC after RTFO	AS/NZS 2341.10 and AS/NZS 2341.2 [4]
Percentage increase in viscosity at 60ºC after RTFO test	AS/NZS 2341.10 and AS/NZS 2341.2
Preparation of test samples	EN 12594 [3]
Asphalt	
Wheel tracking	AGPT/T231
Fatigue resistance	AGPT/T274
Flexural stiffness	AGPT/T274
Water sensitivity	AGPT/T232
Air voids in specimens compacted by gyratory compactor	AS/NZS 2891.2.2 [5]

1. This test assesses the stiffening effect of the filler on the binder–filler mastic using the softening point test. C170 bitumen is used as the binder in this test.
2. More details on sample preparation are provided in AP-T219.
3. This testing is exempt from the requirement for NATA accreditation or Construction Materials Testing (CMT) registration.
4. Test shall be performed using an Asphalt Institute viscosity tube.
5. Modified test parameters are used. Refer Table 7.2.1 for details.

5 Quality system requirements

The quality system requirements stated in Clause 5 of MRTS30 *Asphalt Pavements* shall apply to this Technical Specification, except as varied through this Clause.

5.1 Asphalt Quality Plan

For works incorporating EME2, the Contractor must develop an Asphalt Quality Plan (AQP) in accordance with the requirements of Clause 5.2 of MRTS30 *Asphalt Pavements*. The specific use of EME2 in accordance with the requirements of this Technical Specification shall be reflected in the AQP.

5.2 Conformance requirements

The conformance requirements which apply to asphalt lots covered by this Technical Specification are summarised in Clause 7.1 of MRTS30 *Asphalt Pavements* and Clauses 7.2 and 9 of this Technical Specification.

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

5.3 Compliance testing

5.3.1 General

Compliance testing shall be carried out in accordance with Clauses 5.4.2 and 5.4.3 of MRTS30 *Asphalt Pavements* and Clauses 5.3.2 to 5.3.4 of this Technical Specification.

5.3.2 Asphalt compliance testing

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 the 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 Tables 5.3.2(a), 5.3.2(b), 5.3.2(c) and 5.3.2(d).

Table 5.3.2(a) – Minimum frequency for sampling and testing asphalt

Quantity of Asphalt Supplied in each Shift (tonnes)	Minimum Testing Frequency	Minimum Number of Tests
≤ 10		0 [1]
11 - 100	-	1
101 - 500	-	2 [2]
501 - 1000	1 per 250 tonnes	3
1001 - 2100	1 per 350 tonnes	5
> 2100	1 per 500 tonnes	6

[1.] Unless otherwise ordered by the Administrator, testing is not required.

[2.] The first sample shall be taken from within the first 40% of asphalt produced and the second sample from within the last 40% of asphalt produced for the lot.

Table 5.3.2(b) – Asphalt production

Clause	Property	Test Method / Procedure	Minimum Testing Frequency
7.1.5	Filler in asphalt - voids in dry compacted filler (combined filler)	AS/NZS 1141.17	Monthly for each mix design
7.1.5	Filler in asphalt - Delta ring and ball [1] (combined filler)	EN 13179–1 [2,3] and AS 2341.18	Monthly for each mix design
7.1.5	Filler in asphalt - Methylene blue value for the combined filler (excluding hydrated lime)	AS 1141.66	Monthly for each mix design that contains material which has a methylene blue value > 10 mg/g and ≤ 18 mg/g. Three monthly for each mix design that contains material which has a methylene blue value ≤ 10 mg/g
7.1.5	Filler in asphalt – Methylene blue value for the combined filler	AS 1141.66	Monthly for each mix design that contains material which has a methylene blue value for the combined filler (excluding hydrated lime) > 10 mg/g
7.2.2 and MRTS30 Clause 7.4.3.2	Combined particle size distribution	Q308A or AS/NZS 2891.3.1, AGPT/T234 or Q308D	As per Table 5.3.2(a)
MRTS30 Clause 7.4.3.2	Binder content (by mass)	Q308A, AS/NZS 2891.3.1, AGPT/T234 or Q308D	As per Table 5.3.2(a)
MRTS30 Clause 7.4.3.2	Maximum density	Q307A or AS/NZS 2891.7.1	As per Table 5.3.2(a)
7.4 and MRTS30 Clause 7.4.6	Production temperature of asphalt	The Contractor's documented procedure	Frequency to be nominated in the Contractor's ITP
7.4 and MRTS30 Clause 7.4.6	Dispatch temperature of asphalt	The Contractor's documented procedure	Each delivered load

1. This test assesses the stiffening effect of the filler on the binder-filler mastic using the softening point test.
2. More details on sample preparation are provided in AP-T219.
3. This testing is exempt from the requirement for NATA accreditation or Construction Materials Testing (CMT) registration.

Table 5.3.2(c) – Asphalt placement

Clause	Property	Test Method / Procedures	Minimum Testing Frequency
8.3	Pavement surface temperature	The Contractor's documented procedure	One measurement every two hours
MRTS30 Clause 8.8	Temperature of asphalt at initial compaction	The Contractor's documented procedure	Each delivered load
MRTS30 Clause 8.9	Tack coat application rate	The Contractor's documented procedure	Each lot
MRTS30 Clause 9.1	Homogeneity	Visual assessment	Each lot

Table 5.3.2(d) – Finished pavement

Clause	Property	Test Method	Lot Size	Minimum Number of Tests	Minimum Testing Frequency
9.1	Insitu air voids (mat) (EME2)	a) AS/NZS 2891.1.2 b) AS/NZS 2891.9.2, Q306B, Q306C or Q306E c) Q307A or AS/NZS 2891.7.1 and d) Q311 or AS/NZS 2891.8	≤ 50 m²	0 1 per layer	N/A
			51 – 500 m²	3 per layer	N/A
			501 – 1000 m²	4 per layer	N/A
			1001 – 5000 m²	5 per layer	1 per 500 m² per layer
			> 5000 m²	10 per layer	1 per 1000 m² per layer
9.2.1	Vertical levels (where level control is specified)	Survey	For each course – one test per 20 lineal metres at shoulder edge, lane lines and other changes in grade (where applicable)		
9.2.2	Layer thickness (average) (where thickness control is specified)	MRTS30 Clause 9.4.2.4 (a)	One calculation per lot where thickness control is specified		
	Layer thickness (individual locations) (where thickness control is specified)	MRTS30 Clause 9.4.2.4 (b)	a) coring: as specified for insitu air voids, or b) measured dips: for each layer - three points on cross section per 20 lineal metres Application: • layers where thickness control is specified and the layer is placed over one or more layers placed by the Contractor		
MRTS30 Clause 9.4.3	Horizontal position	Contractor's documented procedure	For each layer – one test per 20 lineal metres at shoulder edge, lane lines and other changes in grade (where applicable)		

Clause	Property	Test Method	Lot Size	Minimum Number of Tests	Minimum Testing Frequency
MRTS30 Clause 9.5	Surface shape (completed course level)	Q712 [3]	a) **within lane**: one per 20 metres along each paver run, unless otherwise approved by the Administrator [2]. Measurements shall be taken in both the transverse and longitudinal directions. b) **longitudinal joint**: one per 20 lineal metres along each joint, unless otherwise approved by the Administrator [2]. c) **transverse joint**: one measurement per joint in each wheel path in each lane. For all joints located within the works, place the straightedge on the road surface perpendicular to the joint. With the end of the straightedge directly over the joint, gradually move the straightedge across the joint for its full length and identify the point on the road surface that produces the largest deviation under the straightedge (between two points of contact). Record the deviation at this point. For all joints that tie the new works to existing pavement (not constructed under the Contract), place the straightedge on the road surface perpendicular to the joint. With the end of the straightedge directly over the joint and the other end located within the works, record the largest deviation under the straightedge (between two points of contact).		

1. Unless otherwise ordered by the Administrator, testing is not required.
2. The Administrator may approve the adoption of a reduced testing frequency of 1 per 50 m in 'mid-block' applications (i.e. areas of asphalt not located in the vicinity of intersections, roundabouts, steep grades and/or sharp curves).
3. This testing is exempt from the requirement for NATA accreditation or Construction Materials Testing (CMT) registration.

Where a minimum frequency of testing has not been specified, the Contractor shall nominate an appropriate testing frequency in accordance with Clause 8.5 of MRTS50 *Specific Quality System Requirements*.

5.3.3 Constituent material (excluding binder) compliance testing

Minimum testing frequencies for constituent materials excluding the EME2 binder are nominated in the relevant constituent material specifications:

- MRTS101 *Aggregates for Asphalt*,
- MRTS102 *Reclaimed Asphalt Pavement Material* and
- MRTS103 *Fillers for Asphalt*.

In addition, the minimum testing frequencies listed in Table 5.3.3 shall apply to reclaimed asphalt pavement (RAP) material.

Table 5.3.3 – Additional RAP material compliance testing requirements

Clause	Property	Test Method / Procedure	Minimum Testing Frequency
7.1.4	Binder extracted from the RAP - Penetration at 25°C	AGPT/T191 and ASTM D5/D5M or AS 2341.12	1 per 1000 tonnes of RAP material (Normal and Reduced Testing Level)
7.1.4	Binder extracted from the RAP - Softening point	AGPT/T191 and AS 2341.18	1 per 1000 tonnes of RAP material (Normal and Reduced Testing Level)

5.3.4 Binder compliance testing

For conformance testing of the EME2 binder, samples shall be prepared in accordance with test method EN 12594. This testing is exempt from the requirement for NATA accreditation or Construction Materials Testing (CMT) registration.

Binder sampling and testing shall be undertaken in accordance with the requirements of Clause 5.3.4.1 and 5.3.4.2 as a minimum.

5.3.4.1 Sampling and testing at the point of release from the manufacture:

Binder sampling and testing at the point of release from the manufacturer shall be undertaken by the manufacturer on the basis of a batch.

A batch shall be defined as the quantity of binder stored in a single tank by the manufacturer at any particular time. The binder in the storage tank shall be considered a new batch when either:

a) New binder is added to the storage tank, or

b) Binder has been stored in the tank for a period of 14 days without the addition of new binder to the storage tank.

The minimum frequency of sampling and testing performed by the manufacturer shall be in accordance with the requirements of Table 5.3.4.1.

Table 5.3.4.1 – Minimum binder sampling and testing frequencies at point of release from the manufacturer

Sampling and Testing Frequency	Properties to be tested
Each batch	Penetration at 25°C and softening point
First batch used in the works	all properties listed in Table 7.1.6
Every 3 months after first batch, or When there is a change in feed stock, whichever is more frequent	

5.3.4.2 Sampling and testing at the point of delivery

A compliance testing sample of at least one litre (1 L) of binder shall be taken from the binder storage tank immediately prior to the commencement of EME2 asphalt production for each work shift. Where requested by the Administrator, an additional sample of at least one litre (1 L) of binder shall be taken and forwarded to the Administrator.

Samples shall be labelled at the time of sampling and appropriately stored to avoid contamination or deterioration for a minimum of 12 months, or for the duration of the project's defect liability / correction period, whichever is greater.

The minimum testing frequencies for point of delivery testing are provided in Table 5.3.4.2.

A 'normal frequency' shall immediately change to an 'increased frequency' if a nonconforming sample has been detected. The frequency may return to the 'normal frequency' after no nonconformances have occurred in four consecutive compliance testing samples.

In addition to the requirements of MRTS50 *Specific Quality System Requirements*, and unless otherwise specified or agreed with the Administrator, the extents of conforming and nonconforming works shall be determined based on the midpoint between adjacent binder tests.

Table 5.3.4.2 – Minimum testing frequencies at point of delivery

Properties to be tested	Normal Frequency	Increased Frequency
Penetration at 25°C and softening point	• The first compliance testing sample and then every 10th compliance testing sample thereafter for a particular binder class (that is compliance testing sample 1, 11, 21, etc), until • the first compliance testing sample after the binder has been stored for a period of more than 14 days without the addition of new binder to the binder storage tank and then every 10th compliance testing sample thereafter	Each compliance testing sample

6 Asphalt contractor prequalification

The asphalt contractor prequalification requirements stated in Clause 6 of MRTS30 *Asphalt Pavements* shall apply to this Technical Specification.

7 Supply of asphalt

7.1 Materials for asphalt

7.1.1 General

The asphalt mix shall incorporate coarse aggregate, fine aggregate, filler, and binder complying with the requirements of Clauses 7.1.2 to 7.1.6. It may also contain an additive complying with the requirements of Clause 7.1.7.

7.1.2 Coarse aggregate

Coarse aggregate must comply with MRTS101 *Aggregates for Asphalt*, along with the additional requirements specified in Table 7.1.2.

Table 7.1.2 – Additional coarse aggregate requirements

Property	Test Method	Unit	Limit	Value
Flakiness index	Q201	%	Maximum	25

7.1.3 Fine aggregate

Fine aggregate shall comply with MRTS101 *Aggregates for Asphalt*, except that natural sand shall not be used in EME2 asphalt.

7.1.4 Reclaimed asphalt pavement (RAP) material

Up to 15% (by mass of total mix) of reclaimed asphalt pavement (RAP) material may be utilised in EME2 asphalt.

RAP material shall comply with MRTS102 *Reclaimed Asphalt Pavement Material*, along with the following additional requirements:

- the aggregate particles in the RAP shall have 100% passing the 19.0 mm AS sieve,
- the binder extracted from the RAP shall comply with the requirements specified in Table 7.1.4. The binder shall be extracted from a representative sample of each RAP stockpile in accordance with AGPT/T191.

Table 7.1.4 – RAP binder properties

Property	Test Method	Unit	Limit	Value
Penetration at 25 °C	ASTM D5/D5M or AS 2341.12	pu [1]	Minimum	5
Softening point	AS 2341.18	°C	Maximum	79

[1.] One pu equals 0.1 mm.

7.1.5 Filler

The combined filler in asphalt comprises the total 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 shall comply with MRTS103 Fillers for Asphalt, and

b) the combined filler shall comply with the requirements specified in Table 7.1.5.

EME2 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.

Table 7.1.5 – Combined filler requirements

Property	Test Method	Unit	Limit	Value
Voids in dry compacted filler	AS/NZS 1141.17	%	Minimum Maximum	28 45
Delta ring and ball [1]	EN 13179–1 [2,3] and AS 2341.18	°C	Minimum Maximum	8 16
Methylene blue value [4]	AS 1141.66	mg/g	Maximum	18 [5]

1. This test assesses the stiffening effect of the filler on the binder–filler mastic using the softening point test.
2. More details on sample preparation are provided in AP-T219.
3. This testing is exempt from the requirement for NATA accreditation or Construction Materials Testing (CMT) registration.
4. Test to be performed on combined filler excluding hydrated lime.
5. 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

The binder used in EME2 asphalt shall comply with the requirements specified in Table 7.1.6. The specific source and class of binder to be used in the mix shall be nominated on the asphalt mix design certificate.

The requirements of Clauses 7 and 8 of MRTS17 *Bitumen* and any additional recommendations from the binder manufacturer shall apply to binder incorporated into EME2.

Table 7.1.6 – EME2 binder requirements

Property	Test Method	Unit	Limit	Value	
				15/25 pen	10/20 pen
Penetration at 25°C (100 g, 5 s)	ASTM D5/D5M or AS 2341.12	pu [1]	Minimum Maximum	15 25	10 20
Softening point	AS 2341.18	°C	Minimum Maximum	56 72	59 79
Viscosity at 60°C [2]	AS/NZS 2341.2	Pa.s	Minimum	900	1050
Mass change	AS/NZS 2341.10	%	Maximum	0.5	Not Specified
Retained penetration [3]	AS/NZS 2341.10 and AS 2341.12	%	Minimum	55	Not Specified
Increase in softening point after RTFO treatment [4]	AS/NZS 2341.10 and AS 2341.18	°C	Maximum	8	10

Property	Test Method	Unit	Limit	Value	
				15/25 pen	10/20 pen
Viscosity at 135°C	AS/NZS 2341.2, AS 2341.3, AS/NZS 2341.4 or AGPT/T111	Pa.s	Minimum	0.6	0.7
Matter insoluble in toluene	AS/NZS 2341.8	% mass	Maximum	1.0	Not Specified
Penetration index	Note 5		Report		
Viscosity at 60°C after RTFO [2]	AS/NZS 2341.10 and AS/NZS 2341.2	Pa.s	Report		
Viscosity at 60°C, percentage of original after RTFO treatment	AS/NZ 2341.10 and AS/NZS 2341.2	%	Report		

1. One pu equals 0.1 mm.
2. Test shall be performed using an Asphalt Institute viscosity tube.
3. Retained penetration shall be calculated using the equation:
(Penetration at 25°C after RTFO x 100) / (Penetration at 25°C before RTFO).
4. Increase in softening point after RTFO treatment shall be calculated using the equation:
(Softening point after RTFO) – (softening point before RTFO).
5. Penetration Index (PI) shall be calculated as follows (viz. Annexure A of EN 13924-2006):

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

where:

SP = Softening point determined in accordance with AS 2341.18

Pen = Penetration determined in accordance with AS 2341.12 or ASTM D5/D5M

7.1.7 Additives

An additive that complies with the requirements of Clause 7.1.7 of MRTS30 *Asphalt Pavements* may be proposed provided that full details of the type of additive are provided and the mix design complies with the requirements of Clause 7.2 of this Technical Specification.

7.2 Requirements for asphalt

The requirements of Clause 7.2 of MRTS30 *Asphalt Pavements* do not apply for EME2 asphalt.

The requirements of Clauses 7.2.1 to 7.2.4 of this Technical Specification shall apply for all EME2 asphalt.

7.2.1 Mix design requirements

The EME2 mix design shall comply with the requirements given in Table 7.2.1 and Clauses 7.2.2 to 7.2.4.

Table 7.2.1 – Mix design criteria

Property	Test Method	Unit	Limit	Value
Air voids in specimens compacted by gyratory compactor at 100 cycles	AS/NZS 2891.2.2 [1,2]	%	Maximum	6
Water sensitivity	AGPT/T232 [3]	%	Minimum	80
Wheel tracking at 60°C and 30,000 cycles (60,000 passes)	AGPT/T231 [4,5]	mm	Maximum	4.0
Wheel tracking at 60°C and 5,000 cycles (10,000 passes)	AGPT/T231 [4,5]	mm	Maximum	2.0
Minimum flexural stiffness at 50 ± 3 με, 15°C and 10 Hz	AGPT/T274 [4,6,7]	MPa	Minimum	14,000
Fatigue resistance at 20°C, 10 Hz and 1 million cycles	AGPT/T274 [4,6]	με	Minimum	150
Richness modulus [8]	N/A	–	Minimum	3.4
Resilient modulus at 25°C, 0.04s rise time	AS/NZS 2891.13.1	MPa	Report	

1. Bulk density of gyratory compacted specimens shall be determined by mensuration in accordance with AS/NZS 2891.9.3. This property shall be determined from the average of three (minimum) test specimens.
2. Test parameters for AS/NZS 2891.2.2 shall be as follows: Vertical loading stress of 600 ± 18 kPa, gyratory angle (internal) of 0.82 ± 0.02° and a rate of gyration of 30 ± 0.5 revolutions per minute. Specimens should have a diameter of 150 mm and a thickness between 100 mm and 150 mm. Laboratory compaction temperature for preparing test specimens should be determined in accordance with AS/NZS 2891.2.2, Appendix A.
3. The free/thaw moisture conditioning of specimens detailed in Section 5.2 of AGPT/T232 is mandatory.
4. Specimens shall be compacted to an air void content of 1.5 – 4.5% when the bulk density is determined in accordance with AS/NZS 2891.9.2 or Q306B.
5. This property shall be determined from the average of two (minimum) test specimens.
6. Sinusoidal loading (instead of haversine loading) shall be used.
7. Flexural stiffness shall be determined as the average stiffness between the 45th and the 100th load repetition.
8. Refer to Clause 7.2.3 for details.

For flexural stiffness and fatigue resistance testing undertaken in accordance with AGPT/T274 the appropriate strain levels must be selected, noting in particular that some software (using manually selected sinusoidal loading) define strain levels differently to AGPT/T274. These software programs may only apply half the strain level indicated on the input screen (i.e. a 280 microstrain loading on the software input screen may equate to 140 microstrain loading according to AGPT/T274).

7.2.2 Particle size distribution of combined aggregate and filler

EME2 asphalt shall have 100% of the combined aggregate and filler particles passing the 19.0 mm AS sieve.

For the purpose of undertaking the asphalt mix design there are no other specific requirements for the particle size distribution of the combined aggregate and filler.

The target particle size distribution shall be nominated as part of the mix design submission and shall be shown on the asphalt mix design certificate.

During asphalt production, the tolerances stated in Table 7.4.3.2 of MRTS30 *Asphalt Pavements* shall apply to this target distribution.

7.2.3 Richness modulus

For the purpose of undertaking the asphalt mix design, the richness modulus (K) of the asphalt shall be calculated as follows:

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

where:

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

α = 2.65 / ρ_a

ρ_a = Particle density of the combined mineral aggregate determined in accordance with AS/NZS 2891.8 or Q317 (t/m³)

Σ = (0.25G + 2.3S + 12s + 150f) / 100

where:

G = Percentage of aggregate particles greater than 6.30 mm

S = Percentage of aggregate particles between 6.30 mm and 0.250 mm

s = Percentage of aggregate particles between 0.250 mm and 0.075 mm

f = Percentage of aggregate particles less than 0.075 mm

G, S and s may be interpolated using a linear relationship from the grading curve using Australian standard sieves.

7.2.4 Reclaimed asphalt pavement (RAP) material

The requirements of Clause 7.2.1.3 of MRTS30 *Asphalt Pavements* do not apply to EME2 asphalt.

Up to 15% (by mass of total mix) of reclaimed asphalt pavement (RAP) material may be utilised in EME2 asphalt. The RAP material shall comply with the requirements of Clause 7.1.4 of this Technical Specification.

7.3 Nominated mixes

7.3.1 Nominated mix design

The requirements of Clause 7.3.1 of MRTS30 Asphalt Pavements shall apply to this Technical Specification with the exception that the nominated mix is to be registered in accordance with the requirements of Clause 7.3.2 of this Technical Specification rather than Clause 7.3.2 of MRTS30 *Asphalt Pavements*.

7.3.2 Asphalt mix design registration

The process for EME2 asphalt mix design registration is defined in Technical Note TN148 *Asphalt Mix Design Registration*.

To register an EME2 asphalt mix design, the Prequalified Asphalt Contractor (PAC) shall conduct:

a) a laboratory based assessment to demonstrate the mix design fully complies with the requirements of this Technical Specification, and

b) a production trial to demonstrate the capability of the manufacturing plant to produce the mix design.

For the purpose of satisfying these mix design requirements, the production trial is intended to be undertaken 'offsite'.

7.3.3 Nomination of registered mix designs

The requirements for nomination of registered mix designs stated in Clause 7.3.3 of MRTS30 *Asphalt Pavements* shall apply to this Technical Specification.

7.4 Production of asphalt

The requirements for production of asphalt stated in Clause 7.4 of MRTS30 *Asphalt Pavements* shall apply to this Technical Specification, except that:

a) the constituent proportion limits specified in Table 7.4(a) shall apply, and

b) the maximum asphalt temperature specified in Table 7.4(b) shall apply.

Table 7.4(a) – Proportion limits for constituent materials used in production mix

Constituent	Maximum variation in constituent proportions from the nominated[1] proportion
Aggregate	± 5% absolute[2]
Added filler	± 0.5% absolute
RAP material	± 5% absolute

[1] The nominated proportion shall be the proportion used for the laboratory based assessment of the mix design.

[2] This requirement applies to each aggregate source when the aggregate comes from more than one aggregate source. This requirement does not apply when all the aggregate comes from the same source.

The proportion limits for added filler and RAP material used in production mix are in addition to the limits given in Clauses 7.1.4 and 7.1.5.

For example, where the nominated proportion of RAP material is 10%, the proportion of RAP material incorporated into the mix can vary between 5% and 15%. However, where the nominated proportion of RAP material is 15%, the proportion of RAP material incorporated into the mix can vary between 10% and 15%.

Table 7.4(b) – Maximum asphalt temperature

Asphalt Binder Type	Maximum Mix Temperature (°C)
10/20 and 15/25 pen bitumen	190

8 Placing of asphalt

The requirements for placing of asphalt specified in Clause 8 of MRTS30 *Asphalt Pavements* shall apply to this Technical Specification, except as varied through this clause.

While EME2 asphalt is similar in many ways to conventional dense graded asphalt, the Contractor's placement methodology for EME2 asphalt should recognise EME2 specific construction practices or conditions may need to be adopted for construction.

For example, experience has shown that EME2 asphalt may be more 'lively' during compaction in periods of hot weather and contractors may need to adjust their construction processes to manage this.

8.1 Method of placement

For EME2 asphalt, if specified in Clause 4 of Annexure MRTS30.1, a Material Transfer Vehicle (MTV) must be used in the paving process except for areas to be paved at tapers, turning lanes less than 100 m in length, roundabouts of radius less than 50 m and other areas approved to be excluded by the Administrator.

8.2 Course and layer thickness

The nominated layer thickness of a layer of EME2 asphalt must be within the limits specified in Table 8.2.

Table 8.2 – Nominated layer thickness limits

Asphalt Type	Layer Thickness (mm)	
	Minimum	Maximum
EME2	70	130

8.3 Pavement temperature and weather conditions

The requirements of Table 8.3 shall be read in conjunction with the requirements of Clause 8.7 of MRTS30 *Asphalt Pavements*.

Table 8.3 – Minimum pavement surface temperature for asphalt placement

Asphalt Type	Minimum Surface Temperature for Asphalt Placement (°C)
EME2	5

8.4 Placement trial

Where specified in Clause 6 of Annexure MRTS30.1, the Contractor shall undertake a placement trial in accordance with the requirements of Clause 8.11 of MRTS30 *Asphalt Pavements*.

8.5 Surface gritting

Areas of EME2 asphalt that require gritting shall be nominated by the Administrator.

The material used for gritting shall consist of natural sand particles having a grading complying with the requirements shown in Table 8.5, 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 8.5 - 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 spread rate to be adopted for grit material shall be nominated by the Contractor and be applied at a rate ≥ 0.2 kg/m². After consultation with the Administrator, the spread rate may be adjusted to ensure an adequate coverage of grit is achieved.

Prior to the pavement section being opened to traffic, any loose grit material shall be removed from the road surface and adjacent road features (such as kerb and channel).

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

9 Finished pavement properties

The requirements for finished pavement properties specified in Clause 9 of MRTS30 *Asphalt Pavements* shall apply to this Technical Specification, except as varied through this clause.

9.1 Requirements for insitu air voids

The asphalt must have a dense appearance. Each layer of asphalt must be uniformly compacted to achieve the specified characteristic value for insitu air voids specified in Table 9.1.

Table 9.1 – Insitu air voids requirements for EME2 asphalt

Location	Limits of Characteristic Value of the Insitu Air Voids (%)	
	Lower Limit (V_L)	Upper Limit (V_U)
Mat	Not Specified	5.5
Joints		8.5

Where an EME2 layer is intended to be trafficked (other than by construction vehicles), the Contractor's construction practices will need to provide a balance between achieving the required compaction standard and ensuring the surface does not become insufficiently textured.

As the insitu air voids reduce with additional compactive effort, the surface texture will typically also reduce.

9.2 Vertical tolerance

9.2.1 General

Unless otherwise stated in Clause 7 of Annexure MRTS30.1, level control shall be applied to EME2 layers.

EME2 asphalt mixes are intended to be more workable than conventional dense graded asphalt. The Contractor may need to take additional precautions in the field to ensure that the required vertical tolerances and surface shape are achieved.

This is particularly relevant where the edges of the mat are unsupported and/or the EME2 is placed in thick layers.

9.2.2 Level control

Where level control is specified, the requirements of MRTS30 *Asphalt Pavements* shall apply.

9.2.3 Thickness control

Where thickness control is specified, the requirements of Table 9.2.3 shall be read in conjunction with the requirements of Clause 9.4.2.3 of MRTS30 *Asphalt Pavements*.

Table 9.2.3 - Allowable tolerances for layer thickness (when thickness control is specified)

Asphalt Type	Layer Thickness Tolerance (mm)	
	Average Value	Individual Value
EME2	± 5	± 10

10 Asphalt contractor performance

The requirements for performance reporting specified in Clause 10 of MRTS30 *Asphalt Pavements* shall apply to this Technical Specification.

11 Supplementary requirements

The requirements of this Technical Specification are varied by the supplementary requirements given in Clause 9 of Annexure MRTS30.1.