SECTION 418 - HIGH MODULUS ASPHALT (EME2)‑

##This section cross-references Sections 407 and 175 and must be included in the contract documents.

418.01 GENERAL

Section 418 shall be read in conjunction with Section 407 – Dense Graded Asphalt and covers the requirements for Size 14 mm High Modulus Asphalt (EME2) that are in addition to or override the requirements of Section 407.

418.02 STANDARDS

Documents referred to in Section 418 are listed in Table 418.021.

Any reference made to ‘VicRoads’ or ‘Department of Transport’ are taken to mean Department of Transport and Planning.

**Table 418.021: Referenced Documents**

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| Australian Standards |
| AS 1141.17 | Methods for sampling and testing aggregates Voids in dry compacted filler |
| AS/NZS 2341.2 | Determination of dynamic viscosity by vacuum capillary viscometer |
| AS 2341.3 | Determination of kinematic viscosity by flow through a capillary tube |
| AS 2341.4 | Determination of dynamic viscosity by rotational viscometer |
| AS/NZS 2341.8 | Determination of matter insoluble in toluene |
| AS/NZS 2341.10 | Determination of the effect of heat and air on a moving film of bitumen (rolling thin film oven (RTFO) test) |
| AS 2341.12 | Determination of penetration |
| AS 2341.18 | Determination of softening point (ring and ball method) |
| AS/NZS 2891.2.2 | Sample preparation - Compaction of asphalt test specimens using a gyratory compactor |
| AS/NZS 2891.8  | Voids and volumetric properties of compacted asphalt mixes |
| AS/NZS 2891.9.2 | Determination of bulk density of compacted asphalt - Presaturation method |
| AS/NZS 2891.9.3 | Determination of bulk density of compacted asphalt - Mensuration method |
| AS/NZS 2891.11 | Methods of sampling and testing asphalt Degree of particle coating |
| AS/NZS 2891.13.1 | Determination of the resilient modulus of asphalt - Indirect tensile method |
| Austroads |
| AP-T219 | Mastic performance assessment in stone mastic asphalt |
| AGPT/T231 | Deformation resistance of asphalt mixtures by the wheel tracking test |
| ATM T232 | Stripping potential of asphalt – Tensile strength ratio |
| AGPT/T274 | Characterisation of flexural stiffness and fatigue performance of bituminous mixes |
| European Standards |
| 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 - 2006 | Bitumen and bituminous binders – Specifications for hard paving grade bitumens |
| VicRoads |
| RC 500.01 | Registration of Bituminous Mix Designs |

Section 175 details the revision dates of the relevant references in Section 418.

418.03 AGGREGATES AND FILLER

No Reclaimed Asphalt Pavement (RAP) shall be incorporated into EME2.

The asphalt mix shall incorporate coarse aggregate, fine aggregate and filler complying with the following requirements:

1. Coarse Aggregates

Coarse aggregates shall comply with the requirements of Clause 407.06 for Type S asphalt, except the Flakiness Index of each separate sized coarse aggregate fraction, with a nominal size of 10 mm or larger, shall be up to a maximum of 25%.

1. Fine Aggregates

Fine aggregates shall comply with the requirements of Clause 407.06 except that natural sand or recycled crushed glass sand shall not be used.

1. Filler

The combined filler shall comply with the requirements of Clause 407.07, except that the voids in dry compacted filler (dry compacted voids), and the Delta ring and ball shall meet the requirements specified in Table 418.031.

**Table 418.031 Combined Filler Requirements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Material Property** | **Test Method** | **Value** | **Testing Frequency** |
| Voids in dry compacted filler | AS1141.17 | Min 28%Max 45% | 1 per monthproduction testing  |
| Delta ring and ball **(1)** | EN 13179-1**(2,3)** andAS 2341.18 | Min 8oCMax 16oC | 1 per monthproduction testing |
| **Notes Table 418.031:**1. This test assesses the stiffening effect of the filler on the binder-filler mastic using the softening point test. The asphalt supplier need not have NATA accreditation for the EN test.
2. The test shall be performed on the combined material passing the 0.125 mm sieve in accordance with EN13179-1, using Class 170 bitumen instead of 70/100 grade bitumen. The softening point of the Class 170 bitumen used in the test, determined in accordance with AS 2341.18, shall be between 43⁰C and 51⁰C.
3. Additional details on sample preparation are provided in Austroads Report AP-T219.
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418.04 BINDER

The binder used in EME2 shall be 10/20 or 15/25 penetration grade binder, as specified in Table 418.041.

**Table 418.041 Binder Requirements**

|  |  |  |
| --- | --- | --- |
| **Material Property** | **Test Method** | **Penetration Grade Binder** |
| **10/20** | **15/25** |
| Penetration at 25°C (100g 5s) | AS 2341.12 | Min 10pu **(1)**Max 20pu | Min 15pu **(1)**Max 25pu |
| Softening Point | AS 2341.18 | Min 59oCMax 79oC | Min 56oCMax 72oC |
| Mass Change | AS/NZS 2341.10 | - | + 0.5% |
| Retained Penetration **(2)** | AS/NZS 2341.10 and AS 2341.12 | - | Min 55% |
| Increase in softening point after RTFO treatment **(3)** | AS/NZS 2341.10 and AS 2341.18 | Max 10oC | Max 8oC |
| Viscosity at 60°C **(4)** | AS/NZS 2341.2 | Min 1050 Pa.s | Min 900 Pa.s |
| Viscosity at 135°C | AS 2341.3 or AS 2341.4 | Min 0.7 Pa.s | Min 0.6 Pa.s |
| Matter insoluble in toluene | AS 2341.8 | - | Max 1% by mass |
| Penetration Index **(5)** | Not available | Report with design submission | Report with design submission |
| Viscosity at 60°C after RTFO | AS/NZS 2341.10 and AS/NZS 2341.2 | Report with design submission. Pa.s | Report with design submission. Pa.s |
| Viscosity at 60°C, percentage of original after RTFO test | AS/NZS 2341.10 and AS/NZS 2341.2 | Report with design submission. % | Report with design submission. % |

**Notes to Table 418.041:**

(1) One (1) pu equals 0.1 mm.

(2)Retained penetration shall be calculated using the following equation:

 (Penetration at 25°C (100g, 5s) after RTFOx100) / (Penetration at 25°C (100g, 5s) before RTFO)

(3) Increase in softening point after RTFO treatment shall be calculated using the equation:

 (Softening point after RTFO – softening point before RTFO)

(4) Test shall be performed using an Asphalt Institute viscosity tube.

(5) Penetration Index

Penetration Index (PI) shall be calculated as follows (viz. Annexure A of EN 13924‑2006):

|  |  |
| --- | --- |
| *P I* =  | (20 x *SP*) + (500 x *logPen*) - 1952 |
|  *SP* – (50 x *logPen*) + 120 |

where: SP = Softening point determined in accordance with AS 2341.18

 Pen = Penetration determined in accordance with AS 2341.12

418.05 MIX DESIGN

All asphalt mixes proposed for use in the works shall be registered in accordance with RC 500.01.

**HP All asphalt mixes proposed for use in the works shall have a mix design registered by Department of Transport and Planning as ‘General’, unless otherwise approved by the Department of Transport and Planning. The registration for all mixes incorporated into the works shall be current at the time of their use. The Contractor shall submit documentation to the Superintendent nominating the asphalt mixes to be supplied no less than 7 days prior to their use.**

The Contractor shall be responsible for the development of a mix design to comply with the requirements of the specification.

418.06 MIX DESIGN CRITERIA

(a) The mix design shall comply with the requirements of Table 418.061.

**Table 418.061 Mix Design Criteria**

|  |  |  |
| --- | --- | --- |
| **Mix Property** | **Test Method** | **Value** |
| Air voids in specimens compacted by gyratory compactor at 100 cycles | AS/NZS 2891.2.2 **(2)** | Max 4.5% **(1)** |
| Water sensitivity | ATM T232 **(3)** | Min 80% |
| Wheel tracking at 60°C and 5,000 cycles (10,000 passes) (4) (5) | AG:PT/231 | Max 2.0 mm |
| Wheel tracking at 60°C and 30,000 cycles (60,000 passes) **(4)** **(5)** | AG:PT/231 | Max 4.0 mm |
| Minimum flexural stiffness at 50 ± 3 µε, 15°C and 10 Hz **(4)** **(6)** **(7) (9)** | AG:PT/T274 | Min 14,000 MPa |
| Fatigue resistanceat 20°C, 10 Hz and 1 million cycles **(4)** **(6) (9)** | AG:PT/T274 | Min 150με |
| Indirect Tensile Modulus | AS/NZS 2891.13.1 | Report |
| Richness modulus **(8)** | - | Min 3.4 |

 **Notes to Table 418.061**:

1. Bulk density of gyratory compacted specimens shall be determined by presaturation in accordance with AS/NZS 2891.9.2. This property shall be determined from the average of three (minimum) test specimens. The Contractor shall also report the bulk density of gyratory compacted specimens determined by mensuration in accordance with AS/NZS 2891.9.3.
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 shall be determined in accordance with AS 2891.2.2, Appendix A.
3. The freeze/thaw moisture conditioning of specimens detailed in ATM T232 shall be undertaken.
4. Specimens shall be compacted to an air void content between 1.5 – 4.5% where the bulk density is determined in accordance with AS 2891.9.2.(Presaturation method).
5. Determined from the average of two (minimum) test specimens.
6. Sinusoidal 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 418.06(c) for details.
9. For flexural stiffness and fatigue resistance testing undertaken in accordance with AG:PT/T274, the appropriate strain levels must be selected.

(b) Grading

The Contractor shall nominate the target grading as part of the mix design submission. All aggregates must pass the 19.0 mm sieve (by mass).

(c) Richness Modulus

The richness modulus (K) of the mix design shall be calculated as follows:



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

 α = 2.65 / ρa

 ρa = Particle density of the combined mineral aggregate determined in accordance with AS/NZS 2891.8 (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.

418.07 MIXING TEMPERATURES

The temperature of binder and aggregates and the temperature of the asphalt as it is discharged from the asphalt plant shall not exceed the limits specified in Table 418.071.

**Table 418.071: Maximum Material Storage, Mixing and Asphalt Discharge Temperatures**

|  |  |
| --- | --- |
| **Material** | **Temperature °C****(max)** |
| Binder plant storage | 190 |
| Aggregates before binder is added | 200 |
| Asphalt at discharge from asphalt plant | 190 |

418.08 TOLERANCES ON MIX PRODUCTION

The production tolerances on the target grading of the mix before compaction shall be as specified in Clause 407.10.

418.09 FREQUENCY OF INSPECTION AND TESTING AT THE MIXING PLANT

(a) Binder

For conformance testing of the binder, samples shall be prepared in accordance with EN 12594. NATA accreditation to EN 12594 is not required.

The maximum batch size shall comprise the discrete quantity of binder in the manufacturer’s storage tank. The binder in the storage tank shall represent a new batch when either:

1. binder is added to the storage tank, or
2. binder has been stored for a period of 1 month without the addition of new binder to the storage tank.

The minimum frequency of sampling and testing from the manufacturer’s storage tanks shall be as follows:

1. each batch - penetration at 25°C and softening point, then
2. 3 monthly and at change in feed stock thereafter – all properties as listed in Table 418.041.

 Sampling at the point of delivery (binder storage tank at the asphalt plant) shall be undertaken for each new load delivered into the binder storage tanks. Samples shall be tested for penetration and softening point and shall comply with the requirements of Table 418.041.

Additional samples shall be taken and tested when the binder has been stored for a period of more than 14 days without the addition of new binder to the binder storage tank. Samples shall be tested for penetration and softening point and shall comply with the requirements of Table 418.041.

(b) Asphalt

Further to Table 407.151 the minimum frequency for Binder Content and Full Sieve Analysis of Asphalt (full extraction test) shall be one test per 150 tonnes or part thereof of the asphalt plant production on a representative sample taken from a delivery truck. The Binder Content and Full Sieve Analysis of the Asphalt results shall be provided to the Superintendent.

The degree of particle coating shall be not less than 99% once discharged from the asphalt plant into delivery vehicles. Where requested by the Superintendent, testing for particle coating shall be undertaken in accordance with AS/NZS 2891.11.

418.10 CONDITIONS FOR PLACING

The surface on which the EME2 is to be placed shall be essentially dry and free from surface water.

EME2 shall not be placed when the majority of the area to be paved has a surface temperature of less than 5°C.

418.11 COMMENCEMENT OF PLACING

**HP The placement of EME2 shall not commence until approval is obtained from the Superintendent.**

**418.12 LAYER THICKNESS AND TRAFFICKING**

EME2 shall be placed in layers between 70 mm and 130 mm in thickness.

The Contractor shall nominate the maximum surface temperature that the layer can be trafficked without deformation.

418.13 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF COMPACTION

After placement, the EME2 shall be immediately compacted to meet the requirements for testing and acceptance of compaction as detailed in Clause 407.27, except:

(a) work shall be tested for density on a lot basis regardless of the quantity of material placed with the maximum lot size being 4000 m2

(b) each lot shall be represented by a set of six test sites which shall be assessed in accordance with Table 418.131

(c) Air voids shall be calculated in accordance with Clause 407.27(b), sub-section (v).

**Table 418.131 Limits for Characteristic Density (Six tests)**

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| --- |
| **Characteristic Value of In-situ Air Voids (%)** |
| **Location** | **Upper Limit (Vu)** |
| Matt | 5.5 |
| Joints | 8.5 |