

SECTION 404 - STONE MASTIC ASPHALT

##This section cross-references Section 407.

If Section 407 is relevant, it should be included in the specification.

If Section 407 is not included in the specification, all references to it should be struck out, ensuring that the remaining text is still coherent:

404.01 GENERAL

This section shall be read in conjunction with Section 407 - Hot Mix Asphalt and covers special requirements for Size 10 mm Stone Mastic Asphalt (SMA) that are in addition to or override the requirements of Section 407. The section covers two types of SMA mixes; Normal Duty Size 10 mm (SMAN), and Heavy Duty Size 10 mm (SMAH).

SMA is a coarse graded asphalt containing a high proportion of binder and added filler with the addition of cellulose fibre.

404.02 CELLULOSE FIBRE ADDITIVE

Cellulose fibre additive shall be non toxic, and supplied in a powdered, fine fibrilled long fibred form manufactured from raw cellulose.

Cellulose fibre shall be supplied in bags of equal mass suitable for metered plant mixing, and shall be handled in accordance with the manufacturer's specifications.

Cellulose fibre additive may be supplied in loose or pelletised form, and may be incorporated with a binding agent. The binding agent can be either bituminous or non-bituminous.

404.03 AGGREGATES

Unless otherwise specified, properties of the aggregates used in SMA shall comply with the requirements for Type H asphalt as specified in Clause 407.03. Further to Clauses 407.03 and 407.09, no Reclaimed Asphalt Pavement (RAP) shall be added to SMA.

404.04 BINDER

Binder used in SMAN shall be either Class A15E PMB or Class A20E PMB or Class A25E PMB, and binder used in SMAH shall be Class A10E PMB all complying with the requirements specified in Clause 407.05(b).

404.05 MIX DESIGN

The mix to be used shall be a State Growth registered mix and shall comply with the requirements of Clause 407.06.

HP as *The Contractor shall only use asphalt mixes that are registered by State Growth as 'General' mixes at the time of placement, unless otherwise approved by the Superintendent.*

The Contractor shall also provide the following information:

- (a) Marshall Stability

- (b) The results of the Binder Paste Drain Off tests meeting the requirements of Clause 404.06(e) and the selected maximum mixing temperature to avoid excess binder drain off.
- (c) The Indirect Tensile Modulus of the mix is required to be submitted. The sample shall be prepared at 5% air voids.

404.06 MIX DESIGN REQUIREMENTS

- (a) The grading limits in the job mix shall lie within the limits specified in Table 404.061 below:

Table 404.061 - Grading Limits for Aggregates (including any filler)

Sieve Size AS (mm)	Percentage Passing (by mass)	
	SMAN	SMAH
19.0	100	100
13.2	100	100
9.5	90-100	90-100
6.70	45-65	25-45
4.75	30-50	18-32
2.36	21-31	15-30
1.18	16-25	13-24
0.600	14-22	12-21
0.300	12-19	10-18
0.150	9-15	9-15
0.075	8-12	8-12

- (b) The proportions of mineral matter, bitumen and cellulose fibre additive shall lie within the limits shown in Table 404.062 below:

Table 404.062 – Proportions of Mineral Matter, Binder and Cellulose Fibres

Material	Percentage (by total mass of mix)	
	SMAN	SMAH
Mineral Matter	93.4 - 92.4	93.7 - 92.7
Bitumen	6.5 - 7.5	6.0 - 7.0
Cellulose Additive	0.3	0.3

- (c) Further to the requirements of 407.04 and 407.06, the mix shall contain a minimum of 8% added filler for SMAN. The minimum proportion of added filler shall be 6% for SMAH.

- d) The Marshall cylinder test properties (50 blows each face compacted at $150^{\circ}\pm 3^{\circ}$ and using Class 170 binder) shall comply with Table 404.063.

Table 404.063 – Marshall Properties and Voids in Mineral Aggregate

Mix Size (mm)	Stability (kN) Minimum	Air Voids (%)		Voids in Mineral Aggregates Minimum
		Minimum	Maximum	
SMAN	5.5	3.5	5.0	18
SMAH	5.5	4.8	5.2	18

- (e) The Asphalt Binder Paste Drain-off test shall be performed at the design binder content to confirm that excessive binder drainage will not occur. The mass of binder paste drain off shall not exceed 0.3% of the total mass of the sample of mix tested.

404.07 STORAGE OF CELLULOSE FIBRE AT THE MIXING PLANT

Packaged cellulose fibre products shall not be stored in the open or exposed to direct sunlight unless protected by a waterproof UV resistant covering. Any product that has become wet shall not be used.

404.08 MIXING PLANT

Batch pug mill type mixing plant may be used to produce SMA. Pressed packs of cellulose fibre shall only be used in batch mixing plants.

The Superintendent may allow drum type mixing plants to produce SMA where the drum plant is capable of incorporating the filler and fibre in a dedicated mixing chamber remote from the burner and the flow of exhaust gases from the plant. The Contractor shall provide information to show the asphalt plant is able to produce a well-mixed and uniform SMA that can be successfully placed, and produces a material comparable to SMA from batch plants.

Where any mixing plant has not yet proven its ability to produce conforming and consistent SMA, the Superintendent may require a trial of about 50 tonnes to assess the SMA.

404.09 MIXING SEQUENCE

Batch Mixing Plants

Cellulose Fibre press packs shall be added to the mixer during the metered addition of the hot aggregates. Cellulose Fibre press packs shall not be added to the mixer before the aggregates are added.

Cellulose Fibre press packs shall be added to the aggregates unopened. Dry mixing shall continue for a maximum of 15 seconds after the last Cellulose Fibre press pack has been added.

Binder shall be added after completion of the dry mixing as specified and mixing shall continue for a minimum of 20 seconds or longer period required to ensure that coarse aggregate particles are fully coated with bitumen and the Cellulose fibres are distributed homogeneously through the mix.

Drum Mixing Plants

The mixing sequence shall be determined by the Contractor and in accordance with fibre manufacturer's recommendations.

404.10 MIXING AND MIXING TEMPERATURES

The temperature of aggregates before mixing shall not exceed 190°C.

404.11 FREQUENCY OF INSPECTION AND TESTING AT THE MIXING PLANT

The production tolerances on the grading aim of the mix before compaction shall be as specified for Size 10 mm in Table 407.071. Notwithstanding the requirements of Clause 407.11, a reduced frequency is not permitted.

Further to Table 407.111 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 Asphalt and fibre content results shall be provided to the Superintendent.

404.12 CONDITIONS FOR PLACING STONE MASTIC ASPHALT

The Contractor should note SMA may be adversely affected by traffic during hot weather, and within 48 hours of placement. It is the Contractor's responsibility to ensure SMA is placed at such times that hot weather and traffic shall not affect the SMA by reducing the texture of the surface, or cause rutting of the surface. Detouring traffic shall not be used a method of managing risk of damage to the new surface.

404.13 COMMENCEMENT OF PLACING

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

404.14 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF COMPACTION

After placement, the SMA shall be immediately compacted to meet the requirements for testing and acceptance of compaction as detailed in Clause 407.21, except:

- work shall be tested for compaction density on a lot basis regardless of the quantity of material placed
- work represented by a lot of six tests shall be assessed as shown in Table 404.141
- work represented by either four or five cores shall be assessed as shown in Table 404.142.

Table 404.141 - Limits for Characteristic Density Ratio (Six Tests)

For layers less than 50 mm thickness	
Characteristic Value of the Density Ratio (Rc)	Assessment
96.0% or more	Accept lot
93.0% to 95.9%	Lot may be accepted at a reduced rate calculated by $P = 10 R_c - 860$

Table 404.142 - Mean Density Ratio (less than six cores)

For layers less than 50 mm thickness	
Mean Value of the Density Ratio (Rm)	Assessment
97.5% or more	Accept lot
94.5% to 97.4%	Lot may be accepted at a reduced rate calculated by $P = 10 R_m - 875$

Vibratory rollers may be used for a maximum of two passes only. Use of vibration shall be discontinued immediately if any breakdown of surface aggregate occurs. Pneumatic tyred rollers shall not be used.

HP *The Contractor shall not place traffic on the SMA until the Superintendent has agreed the temperature of the asphalt is less than 40°C and is trafficable.*