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SECTION 11 - HOT ASPHALT SURFACING

11.1 GENERAL

This section covers the requirements for the manufacture and placing of asphalt of Types T, V, H, N, L and R and of Sizes 7, 10, 14 and 20. The requirements relate to quality of materials, mix design, supply and placing of the asphalt. This specification accords with the VicRoads Specification Section 407 except as shown in *italics*.

11.2 DEFINITIONS

Hot Mix Asphalt (hereinafter referred to as Asphalt)

Asphalt is a designed and controlled, dense graded mixture of coarse and fine aggregates, filler and bitumen binder which is mixed, spread and compacted to a uniform dense mass while hot. Asphalt types are designated by the symbols T, V, H, N, L or R.

Asphalt Types

- Asphalt Type L - A light duty asphalt with low air voids and high durability used as wearing course in very lightly trafficked areas (e.g. residential streets and car parks).
- Asphalt Type N - A normal duty asphalt suitable for intermediate and wearing courses for light to moderately trafficked areas.
- Asphalt Type T - Similar to a Type N mix, but with increased stiffness for use in base, intermediate and wearing courses in moderate to heavily trafficked areas.
- Asphalt Type H - Similar to a Type T asphalt, but with higher quality coarse aggregates for use as a wearing course in very heavily trafficked areas.
- Asphalt Type V - Similar to Type H asphalt but with higher air voids for improved stability at very heavily trafficked signalised intersections or roundabouts.
- Asphalt Type R - Similar to Type T asphalt but with a higher bitumen content for use as a fatigue resistant base layer in deep strength or full depth asphalt pavements greater than 175 mm deep.

Asphalt Base Course

Asphalt base course is that part of an asphalt pavement supporting the intermediate and wearing courses. It rests directly on the subgrade or subbase pavement.

Asphalt Intermediate Course

Asphalt intermediate course is that part of the asphalt pavement immediately under the wearing course. It rests on the asphalt (or granular) base course.

Asphalt Regulating Course

Asphalt regulating course is an asphalt course of variable thickness applied to the road surface to adjust the shape prior to surfacing or re-surfacing.

Asphalt Wearing Course

Asphalt wearing course is the final part of the pavement upon which the traffic travels except for Open Graded Asphalt (OGA) where the wearing course is the layer beneath the OGA.

Asphalt Pavement

Asphalt pavement comprises the combined thickness of all asphalt courses as defined in clause 11.7 (d) or as otherwise specified.

Asphalt Course

An asphalt course comprises one or more layers of a single asphalt type.

Asphalt layer

An asphalt layer comprises a single paving run of uniform asphalt.

Binder

Binder is bitumen or the modified bituminous material used to hold a mixture of aggregates together as a cohesive mass.

Bulk Density

Bulk density is the mass per unit volume of the compacted mix (expressed in tonnes per cubic metre) where the volume is the gross volume of the mix including the total air voids.

Registered Mix

An Asphalt mix which has been placed on the VicRoads Asphalt Mix Design register after the supplier has produced evidence to show that the mix complies with the mix design requirements specified in clause 11.6.

Reclaimed Asphalt Pavement (RAP)

Asphalt which has been removed from an existing asphalt pavement, and processed by crushing and/or screening for addition as a component in a registered asphalt mix.

Coarse Aggregates

Coarse aggregates are aggregates retained on a 4.75 mm AS sieve.

Fine Aggregates

Fine aggregates are aggregates passing a 4.75 mm AS sieve.

Mineral Matter

Mineral matter includes coarse and fine aggregates, plus filler.

Placing

Placing is the spreading and compacting of asphalt, including operations necessary for preparation of the surface.

Assigned Los Angeles Abrasion Loss

The assigned Los Angeles Abrasion Loss is a hardness rating derived from Los Angeles Abrasion Loss test results and is assigned on the basis of past test data.

Assigned Polished Stone Value

The assigned Polished Stone Value is a friction rating derived from Polished Stone Value test results and is assigned to each source by VicRoads on the basis of past test data obtained from testing products.

11.3 AGGREGATES

(a) General

The combined aggregate mixture shall consist of crushed rock or a mixture of crushed rock and sand.

Aggregates shall consist of clean, hard, durable, angular rock fragments of uniform quality.

Sand aggregates shall consist of clean, hard, durable grains free from lumps, clay, mica and foreign matter.

(b) Source Rock

Unless otherwise approved by the Superintendent, only metamorphic or igneous rock shall be used. Source rock for the production of aggregates shall comply with the requirements specified in Tables 11.3.1, 11.3.2 and 11.3.3.

If at any time the Contractor proposes to obtain source rock from another quarry, the Superintendent shall be notified in time to undertake additional investigation as may be required.

Table 11.3.1 - Sound Rock

Rock Type	Test Value	
	Degradation Factor Source Rock (min)	Secondary Mineral Content (%) (max)
ACID IGNEOUS		
Granitic Rocks	50	-
Other Acid Igneous	45	-
INTERMEDIATE IGNEOUS		
Trachyte	50	-
Other Intermediate Igneous	45	-
BASIC IGNEOUS	50	25
Basaltic Rocks		
METAMORPHIC		
Hornfels	40	-
Other metamorphic	45	-

Table 11.3.2 - Marginal Rock

Rock Type	Test Value	
	Degradation Factor Source Rock (min)	Secondary Mineral Content (%) (max)
ACID IGNEOUS		
Granitic Rocks	35-49	-
Other Acid Igneous	35-44	-
INTERMEDIATE IGNEOUS		
Trachyte	30-49	-
Other Intermediate Igneous	35-44	-
BASIC IGNEOUS	30-49	25
Basaltic Rocks		
METAMORPHIC		
Hornfels	20-39	-
Other metamorphic	30-44	-

Table 11.3.3 Los Angeles Abrasion Loss

Rock Type	Los Angeles Value (max)
ACID IGNEOUS	
Granitic Rocks	30
Other Acid Igneous	20
INTERMEDIATE IGNEOUS	
Trachyte	25
Other Intermediate Igneous	20
BASIC IGNEOUS	25
METAMORPHIC	
Hornfels	20
Other Metamorphic	25

(c) Crushed Aggregate Products

- (i) The Flakiness Index of each separate sized coarse aggregate, with a nominal size of 10 mm or larger, shall comply with Table 11.3.4.
- (ii) Unsound rock and marginal rock in that fraction of the combined mixture retained on a 4.75 mm AS sieve shall not exceed the relevant percentages specified in Table 11.3.4. If no facilities exist at the mixing plant to sample the combined mixture, the unsound rock and marginal rock in that fraction of each aggregate retained on a 4.75 mm AS sieve shall not exceed the relevant percentages specified in Table 11.3.4.

Table 11.3.4

Type of Asphalt	Flakiness Index (%) max	Total of Marginal and Unsound Rock (% by mass) max	Unsound Rock (% by mass) max
V and H	35	8	3
T, N, L and R	35	10	5

(d) Crusher Fines

Crusher fines shall:

- (i) consist of a uniformly graded product of separate particles from the crushing of rock which complies with the requirements of Clause 11.3 (b) appropriate to the asphalt type being produced;
- (ii) be free from lumps and aggregations;
- (iii) comply with the grading limits specified in Table 11.3.5.

Table 11.3.5

Sieve Size AS (mm)	Percentage Passing (by mass)
6.70	100
4.75	70 - 100
0.600	20 - 55
0.075	5 - 20

- (iv) comply with the relevant requirements specified in Table 11.3.6

Table 11.3.6

Test Value	
Degradation Factor - Crusher Fines min	Plasticity Index max
60	3

(e) Aggregates for Asphalt Used as Wearing Course

- (i) Coarse aggregates shall be a mixture of separate one-sized aggregates.
- (ii) Coarse aggregates for Type T, H or V asphalt shall have a minimum assigned polished stone value of 48.
- (iii) Fine aggregates shall be a mixture of one or more natural sands and crusher fines such that the fraction of the job mix passing a 4.75 mm AS sieve shall contain not less than 20% and not more than 65% by mass of natural sands unless otherwise approved by the Superintendent.

(f) Aggregates for Asphalt Used as Intermediate or Base Course

The combined aggregates shall consist either wholly of crushed material or of a mixture of crushed material and natural sands provided that the fraction of the mix passing the 4.75 mm AS sieve shall contain not more than 50% by mass of natural sands unless otherwise approved by the Superintendent.

11.4 FILLER

Filler shall comply with Australian Standard 2357, Mineral Fillers for Asphalt.

The added filler required by Clause 11.7 to be included in wearing course mixes shall be hydrated lime, Portland cement or cement works flue dust.

11.5 BITUMINOUS MATERIALS

(a) Bitumen Class

Unless otherwise specified, the class of bitumen for each asphalt type shall be as specified in Table 11.5.1.

Table 11.5.1

Asphalt Type	Bitumen Class
L and N	170
T, H, V and R	320
T600	600

Bitumen shall comply with Australian Standard 2008, Residual Bitumen for Pavements and with the additional requirement specified in Table 11.5.2.

Table 11.5.2

Class of Bitumen	Durability *
	Minimum time to reach the specified apparent viscosity level (SAVL) days
170	9
320	7

* AS 2341.13 Determination of Durability of Bitumen

(b) Bitumen Recovered

The mean of three Viscosity tests taken on bitumen recovered from mixed asphalt, sampled from the paving site immediately prior to placement, or from the roadbed, shall comply with the requirement specified in Table 11.5.3.

Table 11.5.3

Class of Bitumen	Viscosity Range at 25°C kPa.s		
	Wearing Course	Intermediate Course	Base Course
170	200 - 600	200 - 1100	200 – 1600
320	500 – 1600	500 – 2300	500 – 3000
600	-	800 – 3200	800 – 3200

(c) Bitumen Emulsion

Bitumen emulsion shall be a cationic rapid setting type manufactured from Class 170 bitumen. It shall comply with Australian Standard 1160, Bitumen Emulsions for Construction and Maintenance of Pavements. Emulsion diluted with water shall contain a minimum bitumen content of 30%.

(d) Polymer Modified Binder

Where polymer modified binder (PMB) is specified the Contractor shall comply with the following requirements:

- (i) PMB shall comply with the requirements of the Specification Framework for Polymer Modified Binders (Austroads APRG Report No. 19, May 1997).
- (ii) the material shall be handled in accordance with the manufacturer's specification;
- (iii) a certificate of quality from the manufacturer shall be submitted for each load of PMB received;
- (iv) the PMB shall be transported and stored in such a manner to avoid contamination.

(e) Where requested by the Superintendent the Contractor shall provide test certificates stating the quality of bitumen used. These certificates shall be issued by a laboratory registered by the National Association of Testing Authorities for the performance of such tests.

11.6 MIX DESIGN

The Contractor shall provide all mix designs.

VicRoads has established a register of asphalt mixes from asphalt manufacturers who have produced mix designs satisfying the requirements of this clause and clause 11.7. To apply for registration of an asphalt mix, the information listed below shall be submitted to *VicRoads* at least two weeks prior to the proposed date for the commencement of supply of the asphalt. No asphalt shall be supplied until the mix has been registered.

The Contractor shall be responsible for the performance of all registered mixes.

The Superintendent shall be notified of any proposed changes to the components or proportions of components used in the registered mix.

New mix designs shall be carried out:

- (a) where it is proposed to change the source grading or nature of the components or binders; and
- (b) when current registered mix designs are more than two years old.

For every application to register a mix, VicRoads will notify the Contractor in writing the result of the application within two weeks. The Contractor's mix identification number shall be recorded on the register to identify the mix. If a registered mix has unsatisfactory handling or field performance, the Contractor may request the Superintendent to de-register the mix. Alternatively, the Superintendent may de-register the mix pending a review of the design and immediately advise the Contractor of action taken.

A mix containing Polymer Modified Binder substituted for bitumen binder in an existing registered mix is regarded as a new mix and will require separate registration. PMB Asphalt shall have the design binder content increased by 0.3% by mass compared to the bitumen binder mix. The information required in paragraphs (i) to (k) of this clause including the class of PMB proposed shall be submitted when seeking registration of a PMB asphalt mix.

The following information shall be submitted to *VicRoads* for each new mix design:

- (a) grading test results for each component;
- (b) proportion of each component in the mix;
- (c) grading of the mix;
- (d) unsound and marginal rock content of the coarse aggregate fraction;
- (e) Flakiness Index of each separate coarse aggregate of size 10 and above;
- (f) Degradation Factor and Plasticity Index for the crusher fines component;

- (g) properties, as listed below, determined from tests performed on Marshall cylinders compacted at three different bitumen contents using Class 170 binder within the range specified in Table 11.7.2:
- (i) stability (kN)
 - (ii) flow (mm)
 - (iii) air voids (%)
 - (iv) voids in mineral aggregates (%)
 - (v) bulk density (t/m^3)
 - (vi) bitumen film thickness (microns).
- (h) graphs showing the properties listed in (g), plotted against the respective bitumen contents;
- (i) supply of five compacted cylinders of Size 14 and Size 20 Type T oven conditioned mixes at the design binder content to a density of between 96% and 98% Marshall density compacted using the gyratory compaction method;
- (j) the supplier and source of binder;
- (k) supply of three 63.5 ± 5 mm x 50 ± 5 mm x 400 ± 5 mm asphalt beams for a Size 20 Type T and a Size 14 Type T or H mix sawn from a slab compacted using a rolling wheel or segmental wheel compactor to between 96% and 98% Marshall density at the design binder content.

11.7 MIX DESIGN REQUIREMENTS

- (a) The grading of mineral matter and the proportions of mineral matter and bitumen in the mix after mixing but before compaction, shall lie within the limits specified in Table 11.7.1 and 11.7.2 for each size of asphalt unless otherwise approved by the Superintendent.

Table 11.7.1 - Grading of Mineral Matter (including any filler)

Sieve Size As (mm)	Percentage Passing (by mass)			
	Size 7 Mix	Size 10 Mix	Size 14 Mix	Size 20 Mix
26.5				100
19.0			100	95 - 100
13.2		100	85 - 100	77 - 90
9.5	100	90 - 100	70 - 85	63 - 80
6.70	80 - 100	70 - 90	60 - 75	52 - 65
4.75	70 - 90	58 - 76	50 - 70	45 - 55
2.36	45 - 65	40 - 58 *(40 - 46)	35 - 52 *(35 - 42)	30 - 43
1.18	34 - 55	27 - 48	24 - 40	20 - 35
0.600	22 - 45	17 - 38	15 - 30 *(15 - 26)	14 - 27
0.300	14 - 33	11 - 26	10 - 24	9 - 21
0.150	8 - 18	7 - 18	7 - 16	7 - 15
0.075	5 - 8	4 - 7	4 - 7	3 - 6
Total Mineral Matter	100	100	100	100

* For Asphalt Type T, V, H and N used for wearing course.

Table 11.7.2 – Proportions of Mineral Matter and Bitumen

Material	Percentage (by mass)			
	Size 7 Mix	Size 10 Mix	Size 14 Mix	Size 20 Mix
Mineral Matter	95.0 - 92.5	95.5 - 93.0	95.5 - 93.5	96.0 - 93.5
Bitumen	5.0 - 7.5	4.5 - 7.0	4.5 - 6.5	4.0 - 6.5
Total Mix	100	100	100	100

- (b) The Marshall cylinder test properties of the mix for asphalt Types T, V, H, N and L shall comply with Tables 11.7.3 and 11.7.4 - Asphalt Type T, V, H and N.

Table 11.7.3 - Asphalt Type T, V, H, and N

Mix Size (mm)	Stability (kN) min	Flow (mm)		Air Voids (%)				Voids in Mineral Aggregate min	Bitumen film Thickness (micron) min
				Type V		Type H, N, T			
		min	max	min	max	min	max		
7	5.5	1.5	3.5			4.9	5.3	17	7.5
10	6.5	1.5	3.5	5.9	6.3	4.9	5.3	17	7.5
14	6.5	1.5	3.5	5.9	6.3	4.9	5.3	16	7.5
20	6.5	1.5	3.5			4.9	5.3	15	7.5

Asphalt Type R (Size 20)

The properties of the mix for asphalt Type R shall be established from the relevant Size 20 Type N mix with an increase in bitumen content of 1.0% by mass of the total mix.

Table 11.7.4 - Asphalt Type L

Mix Size (mm)	Stability (kN) min	Flow (mm)		Air Voids (%)		Voids in Mineral Aggregates min	Bitumen film Thickness (micron) min
		Min	max	min	max		
7	4.5	1.5	3.5	3.8	4.2	16	8.0
10	5.5	1.5	3.5	3.8	4.2	16	8.0

- (c) For wearing course asphalt, and any asphalt containing aggregates of coarse or medium grained acid igneous rocks (e.g. granite, adamellite, granodiorite, quartz porphyry) shall contain not less than 1% added filler. Where acid igneous aggregates are used in a drum mixing plant, the added filler shall be 1% hydrated lime.
- (d) Asphalt requirements for the Contract are as set out in the Schedule of Details in Section 1.5.

11.8 PRODUCTION TOLERANCES

The production tolerances on the grading aim of the mix before compaction shall be as specified in Table 11.8.1.

Table 11.8.1

Sieve Size AS (mm)	Tolerance on Percentage Passing (by mass)			
	Size 7 Mix	Size 10 Mix	Size 14 Mix	Size 20 Mix
26.5	Nil	Nil	Nil	Nil
19.0	Nil	Nil	Nil	±6
13.2	Nil	Nil	±6	±6
9.5	Nil	±6	±6	±6
6.70 - 4.75	±6	±6	±6	±6
2.36 - 0.600	±5	±5	±5	±5
0.300 - 0.150	±3	±3	±3	±3
0.075	±1.0	±1.0	±1.0	±1.0

The production tolerances on the grading aim of the mix after compaction shall be as specified in Table 11.8.1 except that the positive tolerance shall be increased by one percentage point.

The tolerance on the bitumen content in the mix shall be ±0.3% of the total mix by mass.

11.9 MIXING AND MIXING TEMPERATURES

The temperature of bitumen and aggregates at the mixing plant and the temperature of the asphalt as it is discharged from the mixing plant shall not exceed the limits specified in Table 11.9.1

Table 11.9.1

Material	Temperature °C (max)
Bitumen delivered into plant storage	185
Bitumen delivered into mixer	165
Aggregates before mixing	200
Asphalt at discharge from mixing plant	175

The mixing period shall be such that at least 95% of the coarse aggregate particles are fully coated with bitumen.

After completion of mixing the moisture content of the mix shall not exceed 0.5%.

Asphalt which has been manufactured at temperatures in excess of limits specified in Table 11.9.1 or which has been stored in an insulated bin for more than 18 hours for Class 170 and 320 bitumen binders (and not more than 4 hours for Class 600 bitumen binder and PMB) shall be rejected and recycled unless the Contractor can demonstrate that excessive binder hardening or a significant change in mix performance properties has not occurred. Material recycled from within the plant may be used in the mix at a proportion not greater than 5% by mass of the total aggregates.

11.10 ASPHALT RECYCLED FROM RECLAIMED ASPHALT PAVEMENT

(a) General Requirements

Unless otherwise specified, Reclaimed Asphalt Pavement (RAP) may be re-cycled by adding it to new asphalt during the mixing process subject to the following requirements:

- (i) all asphalt containing RAP shall comply with all aspects of Section 11 for the size and type of asphalt specified for use;
- (ii) RAP shall consist of milled or excavated asphalt pavement free of foreign material such as unbound granular base, broken concrete or other contaminants and shall be crushed and screened to a maximum size not exceeding the size of asphalt produced;
- (iii) the asphalt manufacturing process shall provide for addition of RAP to a batch plant pugmill or drum mixer separately from other mix components by a method that avoids damage to the mix by overheating.

(b) Restrictions on the Use of RAP

- (i) No RAP shall be added to Asphalt Types H, T or V wearing courses or any asphalt containing Class 600 bitumen or PMB.
- (ii) Up to 10% of RAP by mass may be added to Type L and N wearing courses.
- (iii) Up to 20% RAP by mass may be added to Type N and T intermediate courses and Types R and T base courses.

11.11 FREQUENCY OF INSPECTION AND TESTING AT THE MIXING PLANT

The frequency shall not be less than that shown in Table 11.11.1, except that the Superintendent may agree to a lower frequency where the Contractor has implemented a system of statistical process control and can demonstrate that such lower frequency is adequate to assure the quality of the product.

Table 11.11.1

Checks Required	Minimum Frequency
Scrutiny for segregation, uncoated particles, separated bitumen, excess bitumen or overheating before despatch from the plant	Each loaded truck
Temperature of asphalt before despatch from the plant	Each loaded truck or at intervals of 15 minutes if more than one truck is despatched in 15 minutes
Unsound rock content	On each day: One test on each component unless certification of specification compliance is received for each delivery to the mixing plant.
Degradation Factor of crusher fines	At monthly intervals
Plasticity Index of crusher fines	At monthly intervals
Flakiness Index of coarse aggregate 10 mm and larger	At monthly intervals
Bitumen Content and Full Sieve Analysis of Asphalt (full extraction test)	On each day: One test per 250 tonnes or part thereof of the asphalt plant production on a representative sample taken from a delivery truck

Checks Required	Minimum Frequency
Viscosity of Bitumen	Certification of specification compliance for each delivery of bitumen supplied to the mixing plant.
Viscosity at 165°, Torsional Recovery, and Softening Point of PMB	At weekly intervals: For batches of PMB stored in excess of a week in binder storage tanks at the asphalt plant.
Recovered Binder Viscosity	Three tests on samples of asphalt taken from the paving site on the first 500 tonnes of any registered mix which has not been previously supplied to VicRoads. This requirement only applies to Size 14 Type T or H, and Size 20 Types T, R and T600.

Note: The Contractor shall make available for inspection at the plant all work sheets and results of checks carried out.

11.12 RATE OF DELIVERY

Asphalt shall be placed at the highest practicable rate in order to minimise the time traffic is disrupted and to avoid intermittent paving. *Unless otherwise directed or approved by the Superintendent, the Contractor shall commence, and shall continue, to supply and place asphalt conforming with this specification in quantities not less than the hourly and daily quantities specified below:*

Minimum daily rate: 300 tonnes

Minimum hourly rate: 30 tonnes

Asphalt which does not comply with the specification, is segregated or appears to have been overheated or which is too cold, or which contains separate bitumen or uncoated particles shall be removed from the site at the Contractor's expense.

11.13 AMBIENT CONDITIONS FOR PLACING

The surface on which asphalt is to be placed shall be essentially dry and free from puddles.

(a) Intermediate and Base Courses

Asphalt shall not be placed when the majority of the area to be paved has a surface temperature of less than 5°C except that asphalt containing Class 600 bitumen or PMB shall not be placed when the majority of area to be paved has a surface temperature less than 10°C.

(b) Wearing Course

Wearing course asphalt shall not be placed when the majority of the area to be paved has a surface temperature of less than 10°C, except that for mixes containing PMB where the majority of the area to be paved has a surface temperature above 15°C.

11.14 INITIAL TREATMENT OF PAVEMENT

Unless otherwise approved by the Superintendent, the top course of crushed rock pavement shall be treated prior to surfacing as set out in Table 11.14.1.

Table 11.14.1

Surfacing	Under Traffic Conditions	Not Under Traffic Conditions
Single layer hot mix asphalt (wearing course - as specified)	Primerseal followed by asphalt layer (min 3 months [summer], 12 months [winter])	Prime** followed by asphalt layer (min 24 hrs, max 72 hrs)
Two layer hot mix asphalt (base course and wearing course - as specified)	Prime* followed by base layer (min 24 hrs, max 72 hrs), immediately followed by wearing course (min 3 months, max 12 months in private subdivisions)	Prime** followed by base layer (min 24hrs, max 72 hrs), immediately followed by wearing course (min 3 months, max 12 months in private subdivisions)

Primerseal: *The application of SP1000 binder or equivalent with 7mm basalt cover aggregate (refer Section 12 of the Specification).*

Prime: *The application of a cutback bitumen primer without cover aggregate (refer Section 12 of the Specification).*

* *Provided the road is not excessively steep, a prime is not essential beneath two layers of asphalt.*

** *Where a prime is not possible due to damp pavement, the application of a bitumen emulsion binder of Grade ARS or CRS manufactured from Class 170 bitumen complying with AS 1160 with 7mm basalt cover aggregate shall be used. The asphalt course shall be placed within seven (7) days of applying the bitumen emulsion seal.*

11.15 SURFACE PREPARATION

Prior to tack coating and placing of asphalt, the Contractor shall remove all deleterious material and sweep clean the area upon which asphalt is to be placed.

Surface preparation shall include sweeping and hand chipping and the removal of rich fatty areas before applying the tack coat. No asphalt shall be placed on any areas which contain an excess of binder in such quantity that there is a possibility of the excess binder coming to the surface of the new work, until all such excess binder has been removed.

11.16 TACK COAT

A tack coat shall be applied to the cleaned surface on which asphalt is to be placed.

Tack coat shall consist of cationic bitumen emulsion and shall be applied only to a clean, essentially dry surface, free from puddles.

Tack coat shall be sprayed in a uniform film over the entire road surface.

Unless otherwise directed, the application rate for bitumen emulsion tack coat shall be 0.15 to 0.3 litres/m² (60% Bitumen content) or 0.3 to 0.6 litres/m² (30% bitumen content) except for joints and chases where rates shall be doubled.

Before asphalt is placed a period of time sufficient to allow the tack coat to set up and become tacky shall elapse.

Any tack coat not covered by asphalt shall be covered with clean grit or sand before the road is opened to traffic.

Where asphalt is to be spread over clean, freshly laid asphalt, or over a clean, primed surface, or where the depth of the layer exceeds 50 mm, the Contractor may omit the tack coat unless otherwise directed or specified.

Prior to placing asphalt, tack coating shall be inspected by the Superintendent.

The use of a lance or squeegee will be permitted only in those areas inaccessible to a sprayer or where a varying application rate is required.

When spraying the tack coat, all necessary precautions shall be taken to protect kerbs, channels, adjoining structures, traffic and parked vehicles.

11.17 DELIVERY

(a) General

Delivery shall only be made during the hours of possession of site. Asphalt delivered to the site, which is segregated, has been overheated, is too cold, contains separated bitumen or uncoated particles which does not comply with the Specification shall be removed from the site at the Contractor's expense.

(b) Delivery Dockets

Delivery dockets shall show:

- (i) name of supplier and location of plant;
- (ii) docket number;
- (iii) name of user;
- (iv) project name and location (or contract number);
- (v) registered number or fleet number of the vehicle;
- (vi) date and time of loading;
- (vii) size and type of asphalt;
- (viii) empty and loaded mass of the vehicle, or the total of the electronically measured batch weights printed on the docket;
- (ix) class of bitumen, or proprietary name of modified binder;
- (x) temperature of load at mixing plant when measured.

Where asphalt is scheduled for measurement by mass, a copy of the delivery docket for each load shall be given to the Superintendent at the point of delivery, or delivered or mailed to the Superintendent at the end of each day's work.

Where asphalt is measured by other means and for Lump Sum Contracts, the Contractor shall make delivery dockets available for inspection on request by the Superintendent.

11.18 JOINTS AND JUNCTIONS

(a) General

The location of all joints shall be planned before work commences to achieve the specified offsets between layers and the final position of joints in the wearing course.

The number of joints shall be minimised by adopting good asphalt paving practices. If requested by the Superintendent, the Contractor shall produce drawings showing the location of longitudinal joints of asphalt layers in respect to the traffic lane lines.

All joints shall be well bonded and sealed and the surface across the joint shall meet the requirements of Clause 11.24

Where fresh asphalt is to be placed against the exposed edge of existing asphalt on a longitudinal joint which has not been placed the same day, or against the exposed edge of a transverse joint where existing asphalt has cooled to below 100°C, it shall be considered a cold joint.

All cold joints between adjacent runs and abutting concrete edges shall be heavily tack coated.

Where cold joints are constructed, any loose or poorly compacted existing asphalt on the exposed edge shall be trimmed back to produce a face of fully compacted asphalt along the exposed edge before fresh asphalt is placed.

(b) Transverse Joints

- (i) Transverse joints in adjoining paver runs shall be offset by not less than 2 m.
- (ii) Transverse joints shall be offset from layer to layer by not less than 2 m.

(c) Longitudinal Joints

- (i) Longitudinal joints in the wearing course shall coincide with traffic lane lines.
- (ii) Longitudinal joints in intermediate and base courses shall be offset from layer to layer by not less than 150 mm and shall be within 300 mm of the traffic lane line or the centre of traffic lane.
- (iii) Longitudinal joints shall be parallel to the traffic lanes unless otherwise specified.

- (iv) Unless otherwise specified, or approved by the Superintendent, hot or warm joints shall be constructed either by paving in echelon or by matching up all longitudinal joints over the full width of the carriageway each day.

Subject to approval by the Superintendent, a longitudinal joint in the wearing course may be located up to 300 mm from the traffic lane line or the centre of a traffic lane to achieve the minimum clearance between the paver screed and the traffic path of 1.2 metres and the minimum traffic path width of 2.8 metres.

(d) Junctions

At junctions where the new asphalt mat is required to match the level of existing pavement surface at the limits of work, chases shall be cut into the existing pavement.

- (i) If cold planing is specified, a wedge of asphalt tapering from 0 to a depth of 2.5 times the nominal size of the asphalt shall be removed from the existing pavement to the minimum width as follows:
- side streets and median openings - 600 mm
 - through carriageways with a speed limit of 75 km/h or less - 3 m
 - through carriageways with a speed limit of more than 75 km/h - 6 m.
- (ii) If cold planing is not specified, a 40 mm wide by 20 mm deep chase shall be cut from the existing pavement and where directed, angled at about six transverse to one longitudinal to the direction of travel.

(e) Treatment of Exposed Edges under Traffic

On completion of each day's work and prior to opening to traffic, the following treatment of exposed edges shall be adopted for asphalt work.

(i) Longitudinal Edges

All longitudinal joints within the trafficked area shall be matched up between paver runs except for a short section required to achieve the minimum offset between transverse joints. Any exposed longitudinal edges within the trafficked area shall be ramped down at a slope of not steeper than 5 horizontal to 1 vertical by constructing a temporary wedge of hot mixed or cold mixed asphalt. In unusual situations such as the sudden onset of inclement weather, a longer length of longitudinal joint may be exposed provided it is ramped down as specified.

(ii) Transverse Edges

At the end of the paving run in the transverse direction, the new asphalt mat shall be squared up to a straight line and ramped down by constructing a temporary wedge of hot mixed or cold mixed asphalt. Temporary ramping shall not be steeper than 20 horizontal to 1 vertical for traffic speeds of more than 75 km/h or 10 horizontal to 1 vertical for traffic speeds of 75 km/h or less.

(iii) Removal of Temporary Ramping

Before commencement of each day's work, all temporary ramping shall be removed by cutting back along a straight line to expose a vertical face of fully compacted asphalt at the specified layer depth.

11.19 COMMENCEMENT OF PLACING

HP The placement of any asphalt layer shall not commence until the consent to proceed is obtained from the Superintendent.

11.20 REGULATING COURSE

A regulating course of asphalt of the type and size specified shall be placed for correction of longitudinal and transverse pavement shape so that the resulting surface is parallel with the finished surface.

The maximum compacted thickness of any one layer of the regulating course shall not exceed five times the asphalt size.

11.21 SPREADING

(a) General

Asphalt shall be spread in layers at the compacted thicknesses shown on the drawings or specified.

All asphalt shall be spread with an asphalt paver except for small areas where use of a paver is not practicable.

(b) Level Control

(i) General

Unless otherwise specified, asphalt paver screed levels shall be controlled by a suitable combination of manual and automatic controls operating from fixed or moving references.

(ii) Manual Control

Manual control is permitted except where automatic level control is specified.

The Superintendent may direct that for the wearing course layer on new construction, the paver screed level controls shall remain at a fixed setting or that a joint matching shoe shall be used.

(iii) Automatic Control

1. Fixed Level Control

Where fixed level control is specified, the paver screed shall be automatically controlled by reference to stringline or other approved system.

2. Moving Reference Control

Where moving reference control is specified, both sides of the paver screed shall be automatically controlled by reference device. Levelling beams shall be supported independently of the paver and provide a minimum of 8 separate contact points over a minimum length of 9 metres.

(c) Spreading by Paver

Asphalt shall be spread without tearing or gouging.

The Contractor shall conduct spreading operations to ensure that the paver speed matches the rate of supply so that the number of paving stops are minimised.

If the paver is required to stop and asphalt in front of the screed cools to below 120°C, a transverse joint shall be constructed.

For asphalt work carried out on a road to be opened for traffic at the completion of work each day, each layer of asphalt shall cover the full width of the trafficked area. The requirements of Clause 11.18 (e) shall be followed in respect of the treatment required for exposed edges.

(d) Spreading by Hand

Hand spreading shall only be used for small awkward areas where it is not practical to use a paver.

(e) Echelon Paving

Unless specified otherwise, two pavers in echelon shall be used in locations where a full carriageway wider than 6 m is available clear of traffic.

Where the width of the mat to be placed in a single paving run exceeds 6.0 metres, two or more pavers shall be used in echelon.

11.22 COMPACTION

Asphalt shall be uniformly compacted to the standards specified in Clause 11.23 as soon as the asphalt has cooled sufficiently to support the roller without undue displacement.

11.23 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF COMPACTION

(a) General

Work shall be tested and accepted for compaction on either a lot basis as provided in Clause 11.23(b) or on a procedural basis as provided in Clause 11.23(c). If not otherwise specified or directed, acceptance of compaction where the quantity of the particular size or type of asphalt to be supplied exceeds 300 tonne, shall be on a lot basis. For all other works, acceptance of compaction shall be on a procedural basis.

(b) Testing and Acceptance of Compaction on a Lot Basis

A lot presented for testing consists of that part of a particular layer of asphalt which is placed in one day under uniform conditions and is essentially homogeneous in respect to material and appearance.

Sites for density testing shall be selected on an essentially random basis provided that no site shall be selected within 200 mm of a joint constructed against a cold edge.

For each lot, density tests shall be performed on core samples taken from the layer except that for a layer on nominal thickness 50 mm or greater a nuclear gauge may be used to measure density in-situ.

For core sample tests, the layer thickness is the mean thickness of the core samples and for nuclear gauge tests, the layer thickness is the nominal layer thickness.

The Contractor shall within 48 hours of the test coring, backfill and compact the core holes with the same type material as was removed so that the reinstated holes match the quality of surrounding asphalt.

Asphalt Density Ratio is defined as the percentage ratio of the field bulk density to the assigned bulk density of the approved laboratory mix design.

The Characteristic Value of Density Ratio is the calculated value of $\bar{x} - 0.92S$ for six tests per lot where \bar{x} and S are respectively the mean and standard deviation of the individual density ratio test values for the lot.

The work represented by a lot of six tests shall be assessed as shown in Table 11.23.1.

Table 11.23.1

For layers less than 50 mm thickness		For layers 50 mm thickness or greater	
Characteristic Value of the Density Ratio (Rc)	Assessment	Characteristic Value of the Density Ratio (Rc)	Assessment
94.0% or more	Accept lot	96.0% or more	Accept lot
91.0% to 93.9%	Lot will be accepted at a reduced rate calculated by $P = 10 Rc - 840$	91.0% to 95.9%	Lot will be accepted at a reduced rate calculated by $P = 6 Rc - 476$

(Rc) is the Characteristic Value of the density ratio for the lot and (P) is the percentage of the relevant scheduled rate to be paid which shall not be greater than 100%.

Where the Contract is a lump sum Contract the relevant scheduled rate will be that shown in the "Rates for Variation Purposes" schedule accompanying the lump sum tender. If no such rate is provided a variation will be considered in accordance with the General Conditions of Contract - Valuation of Variations.

Where one or more individual core thicknesses are less than the relevant values shown in Table 11.23.2, they shall be discarded and the acceptance assessment modified in accordance with Table 11.23.3 provided that there remain at least 4 test values.

Table 11.23.2

Size of Asphalt	Individual Core Thickness (mm) min
7	14
10	20
14	28
20	40

Table 11.23.3

For layers less than 50 mm thickness		For layers 50 mm thickness or greater	
Mean Value of the Density Ratio (Rm)	Assessment	Mean Value of the Density Ratio (Rm)	Assessment
95.5% or more	Accept lot	97.0% or more	Accept lot
92.5% to 95.4%	Lot will be accepted at a reduced rate calculated by $P = 10 Rm - 855$	92.0% to 95.9%	Lot will be accepted at a reduced rate calculated by $P = 6 Rm - 482$

(Rm) is the mean of the individual density ratios for the lot and (P) is the percentage of the relevant scheduled rate to be paid which shall not be greater than 100%.

(c) Acceptance of Compaction on a Procedural Basis

Acceptance of work as far as compaction is concerned shall be based on the adoption of approved placing procedures and a density test check plan that provides for a minimum test frequency of 5% of relevant lots to be tested. The test check plan shall provide for additional testing to demonstrate correction of non-conformance. If not otherwise agreed, placing procedures shall be in accordance with Australian Standard AS 2734 Asphalt (Hot-Mixed) Paving - Guide to Good Practice.

11.24 SURFACE FINISH, AND CONFORMITY WITH DRAWINGS AND SPECIFICATION

The finished surface of asphalt wearing course shall be of uniform appearance, free of dragged areas, cracks, open textured patches and roller marks.

Each asphalt course shall, after final compaction, comply within the following limits to the levels, lines, grades, thicknesses and cross-sections as specified or shown on the Drawings.

(a) Level of each Asphalt Course

The level of the top of each course shall not differ from the specified level by more than 10 mm, except that where asphalt is placed against kerb and channel the surface at the edge of the wearing course shall be flush with or not more than 5 mm above the lip of the channel unless otherwise specified or shown on the Drawings.

(b) Shape

No point on the finished surface of the wearing course shall lie more than 4 mm below a 3 m straight edge laid either parallel to the centreline of the pavement or, except on crowned sections, at right angles to the centreline. For intermediate and base course layers, the distance below the straight edge shall not exceed 6 mm and 10 mm respectively.

(c) Thickness of Asphalt Pavement for New Pavement Construction

Where a uniform thickness of new asphalt pavement construction is specified, the mean thickness of a lot of asphalt shall be not less than the combined thickness of all asphalt courses specified in Clause 11.25 or shown on the Drawings. For the purpose of this clause a lot shall be defined as an area of up to 4000 m².

(d) Alignment

Where asphalt pavement is not placed against a concrete edging, the edge of asphalt layers shall not be more than 50 mm inside nor more than 100 mm outside, the designed offset from centreline or design line. Within these tolerances, the rate of change of offset of the edge of layer shall not be greater than 25 mm in 10 m.

(e) Width

Where asphalt pavement is not placed against a concrete edging, the width of asphalt layers shall not be less than the design or specified width of layer by more than 50 mm or greater than the design or specified width by more than 100 mm and the average width over any 300 m shall not be less than the design or specified width.