
SECTION 407 - HOT MIX ASPHALT

407.01 GENERAL

This section covers the requirements for the manufacture and placement of hot mix asphalt, including quality of materials, mix design, supply and placing of the asphalt.

The following supplementary VicRoads Standard Sections shall be read in conjunction with this section where mixes other than dense graded asphalt are required:

Stone Mastic Asphalt (SMA)	Section 404
Regulation Gap Graded Asphalt (RGG)	Section 405
Ultra Thin Asphalt (UTA)	Section 410
Open Graded Asphalt (OGA)	Section 417
Bitumen Crumb Rubber Asphalt (BCRA)	Section 421
Lean Mix Asphalt (LMA)	Section 423

If any cold planing is undertaken in association with placing of asphalt, Section 402 - Cold Planing shall apply.

407.02 DEFINITIONS

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 pavement subbase.

Asphalt Course

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

Asphalt Intermediate Course

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

Asphalt Layer

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

Asphalt Pavement

Asphalt pavement comprises the combined thickness of all asphalt courses as defined in Clause 407.24 or as otherwise specified.

Asphalt Regulating Course

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

Asphalt Types (Dense Graded)

Dense graded asphalt types L, N, V and H series mixes primarily used for wearing and regulation courses, and Type S series mixes are primarily used as structural mixes for intermediate and base courses. A brief description for the various types of dense graded asphalt is shown in Table 407.021 together with the mix designations used in previous published editions of Section 407.

Table 407.021 - Types of Dense Graded Asphalt

Mix Designation	Description
L	A light duty Size 7 or 10 wearing course with low air voids and higher binder content for use in very lightly trafficked pavements.
N	A light to medium duty Size 7, 10 or 14 wearing course or regulating course for use in light to moderately trafficked pavements.
H	A heavy duty Size 7, 10 or 14 asphalt wearing course or regulating course for use in most heavily trafficked pavements.
V	A heavy duty Size 10 or 14 asphalt wearing course for heavily trafficked intersections.
HG	A multi purpose heavy duty Size 10 or 14 wearing course asphalt incorporating multigrade binder where a high resistance to deformation is required, particularly at heavily trafficked intersections.
HP	A high performance Size 10 or 14 heavy to very heavy duty wearing course asphalt incorporating a Polymer Modified Binder (PMB) where a high resistance to deformation and flexural cracking is required (formerly designated as Type Hm).
SI	A multi purpose Size 14 or 20 structural asphalt for intermediate course in heavy duty pavements or base course in medium duty pavements (formerly designated as Asphalt Type T).
SF	A fatigue resistant Size 20 structural base course asphalt for heavy duty asphalt pavements with a total asphalt thickness in excess of 175 mm (formerly designated as Asphalt Type R).
SP	A high performance heavy to very heavy duty Size 20 structural intermediate course asphalt incorporating a Polymer Modified Binder (PMB) for high resistance to deformation and flexural cracking.
SG	A multi purpose heavy duty Size 20 structural intermediate course asphalt incorporating a multigrade binder for high resistance to deformation particularly at very heavily trafficked intersections.
SS	A very stiff Size 20 structural intermediate course asphalt sometimes used to increase pavement stiffness for very large scale heavy duty asphalt pavements (formerly designated as Type T ₆₀₀).

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.

Assigned Polished Stone Value

Assigned polished stone value is a friction rating derived from test results and is assigned to each source by VicRoads on the basis of past test data obtained from testing products.

Binder

Binder is bitumen, multigrade binder or polymer modified binder (PMB) used to hold a mixture of aggregates together as a cohesive mass.

Binder Film Index

Binder film index is an empirical calculation of theoretical thickness of the binder film around each aggregate particle within the asphalt mix having regard to the aggregate grading, surface area of the aggregates and binder content.

Bulk Density

Bulk density is the mass per unit volume of the compacted mix where the volume is the gross volume of the mix including the air voids.

Coarse Aggregates

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

Cold Joints

Cold joints are where asphalt is placed against the exposed edge of an existing asphalt mat, where the existing mat has cooled to less than 80°C for bitumen and multigrade binders or to less than 100°C in the case of PMBs.

Filler

Filler is that portion of the aggregates passing the 0.075 mm sieve. It includes the combined mass of crusher dust, any added recycled fines from asphalt plant dust extraction filters and any added filler required to enhance the mix properties.

Fine Aggregates

Fine aggregates are aggregates passing a 4.75 mm AS sieve.

Hot Mix Asphalt (Asphalt)

Asphalt is a designed and controlled mixture of coarse and fine aggregates, filler and binder which is mixed, spread and compacted to a uniform layer while hot. Asphalt types are designated by the use of symbols.

In situ Air Voids

In situ air voids represents the air voids in the field compacted mix on-site. It is based on a ratio of field density to maximum density.

Manufactured Sand

Manufactured sand is a material passing the 4.75 mm sieve produced by crushing igneous or metamorphic rock spalls or washed gravel.

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.

Reclaimed Asphalt Pavement (RAP)

Reclaimed asphalt pavement is asphalt removed from an existing asphalt pavement, and re-processed by crushing and/or screening for recycling into new asphalt.

Registered Mix

Registered mix is an asphalt mix which has been placed on the VicRoads Asphalt Mix Design Register.

Void Free Bulk Density (VFBD)

Void free bulk density is the maximum theoretical density of an asphalt mix if it were possible to compact it to zero air voids.

407.03 AGGREGATES

(a) General

The combined aggregate mixture shall consist of crushed rock or a mixture of crushed rock and sand or any RAP permitted under Clause 407.09.

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

(b) Source Rock

Source rock shall comply with the requirements of Section 801 - Source Rock for the Production of Crushed Rock and Aggregates.

(c) Crushed Aggregate Products

- (i) The Flakiness Index of each separate sized coarse aggregate fraction, with a nominal size of 10 mm or larger, shall comply with Table 407.031.
- (ii) The unsound and marginal rock in that fraction retained on a 4.75 mm AS sieve excluding any RAP, shall not exceed the relevant percentages specified in Table 407.031.

Table 407.031 - Quality of Coarse Aggregates

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

(d) Crusher Fines and Manufactured Sand

Crusher fines and manufactured sand shall:

- (i) consist of a uniformly graded product of separate particles from the crushing of rock which complies with the requirements of Clause 407.03(b) appropriate to the asphalt type being produced;
- (ii) be free from lumps and aggregations;
- (iii) comply with the grading limits specified in Table 407.032.

Table 407.032 - Grading of Crusher Fines and Manufactured Sand

Sieve Size AS (mm)	Crusher Fines Percentage Passing (by mass)	Manufactured Sand Percentage Passing (by mass)
6.70	100	100
4.75	70 – 100	80 – 100
0.600	20 – 55	30 – 70
0.075	5 - 23	0 – 10

- (iv) comply with the relevant requirements specified in Table 407.033.

Table 407.033 - Quality of Crusher Fines and Manufactured Sand

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

(e) Natural Sand

Natural sand extracted from natural sand deposits shall consist of clean, hard, durable grains free from lumps, clay, mica and organic or harmful matter.

Where natural sand is accepted as washed sand for the registered mix, the Sand Equivalent Value of any such sand supplied for asphalt production shall not be less than 45.

Where natural sand is accepted as unwashed sand for the registered mix, the Plasticity Index of any sand supplied for asphalt production shall not be more than 3.

(f) Aggregates for Asphalt Used as Wearing Course

- (i) Coarse aggregates shall be a mixture of separate one-sized aggregates blended together.
- (ii) Coarse aggregates for Type H, HG and HP asphalt shall have a minimum assigned Polished Stone Value (PSV) of 48. Coarse aggregates for Type V asphalt shall have a minimum PSV of 54.
- (iii) Fine aggregates shall be a mixture of one or more sands and crusher fines.

For mixes designed by the Marshall method, the fraction passing the 4.75 mm AS sieve shall contain not less than 20% of natural sand. For wearing course mixes designed by the Austroads method using gyratory compaction, the quantity of natural sand may be less than 20%.

No mix shall contain more than 65% by mass of natural sand.

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

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

407.04 FILLER

Mineral filler shall comply with the requirements of Tables 407.041 and 407.042.

If any of the following added fillers are specified or required, they shall comply with the corresponding additional requirements below:

- (a) hydrated lime complying with AS1672 - Lime and Limestone (Lime for Building) and the requirements of Table 407.042;
- (b) cement kiln dust complying with the requirements of Tables 407.041 and 407.042;
- (c) ground limestone complying with the requirements of Tables 407.041 and 407.042;
- (d) ground granulated blast furnace slag (GGBFS) complying with AS 3582.2 and the requirements of Table 407.042;
- (e) portland cement complying with AS 3972;
- (f) fly ash produced from the combustion of black coal complying with Tables 407.041 and 407.042.

Table 407.041 - Grading Limits (Fillers other than Hydrated Lime, Cement and GGBFS)

AS Sieve Size (mm)	Percentage Passing by Mass
0.600	100
0.300	95 – 100
0.075	75 – 100

Table 407.042 - Test Requirements for Filler

Filler Type	Test	Test Limit (%)
Total Combined Filler *	Dry Compacted Voids	38 (Min)
All Added Fillers	Moisture Content	3 (Max)
Cement Kiln Dust	Water Soluble Fraction	20

Note on Table 407.042

* The total combined filler is the total amount of all filler in the mix including any added filler.

407.05 BITUMINOUS MATERIALS**(a) Binders**

Unless otherwise specified, the class of binder for each asphalt type shall be as specified in Table 407.051.

Table 407.051 - Class of Binder

Asphalt Type	Binder Class
L and N	C170 or C320 *
H, V, SI and SF	C320
HG and SG	M600/170
HP and SP	A10E ** PMB
SS	C600

Notes on Table 407.051

* C170 Binder shall be used if the mix contains more than 10% RAP.

** PMB Grade A10E shall be used unless otherwise specified in Clause 407.24(e).

Classes 170, 320 and 600 bitumen used for production of asphalt shall comply with Australian Standard 2008, Residual Bitumen for Pavements. Bitumen used for Asphalt Types L, N, V and H shall comply with the additional requirement specified in Table 407.052.

Table 407.052 - Durability of Bitumen

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

Note on Table 407.052

* Test for resistance to hardening when exposed to heat and air.

The viscosity of bitumen recovered from a sample of mixed asphalt prior to placement or from the roadbed after compaction, shall comply with the requirements specified in Table 407.053 and tested at the frequency specified in Table 407.111.

Table 407.053 - Viscosity Range of Bitumen Recovered from Mixed Asphalt

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 - 5500	800 – 5500

(b) Polymer Modified Binder (PMB) and Multigrade Binder

All PMB and multigrade binders shall comply with the test requirements specified in the Austroads Specification Framework for Polymer Modified Binders and Multigrade Bitumens as listed in Section 175.

The Contractor shall comply with the following requirements in regard to supply and handling multigrade binder and PMB:

- (i) material shall be handled in accordance with the manufacturer's requirements;
- (ii) a product quality certificate and test report from the manufacturer shall be obtained for each delivery of material;
- (iii) material shall be transported and stored in such a manner to avoid contamination and/or deterioration of the product to the extent that it no longer complies with specified test properties.

(c) Bitumen Emulsion

Bitumen emulsion used for tack coating shall be a cationic rapid setting type complying with Australian Standard 1160, Bitumen Emulsions for Construction and Maintenance of Pavements. Emulsion diluted with water shall have a bitumen content of not less than 30%.

407.06 MIX DESIGN

All asphalt mixes proposed for use on VicRoads works shall be registered in accordance with VicRoads Code of Practice RC500.01.

All mix designs registered with VicRoads are issued a status according to compliance as:

General	Complies with the requirements of Code of Practice RC500.01.
Non Standard	Proprietary and other mixes that do not comply in all respects with the requirements of Code of Practice RC500.01 but where successful field trials have been undertaken for a period of at least three years and the mix performance continues to be closely monitored.
Conditional	Mixes which do not comply in all respects with the requirements of Code of Practice RC500.01 but which are considered appropriate for use subject to conditions attached to the registration.
Experimental	A mix that does not comply with the requirements of Code of Practice RC500.01 and for which there is little or no history of successful performance and requires more trials to be undertaken and monitored before it is registered as a Non Standard or Conditional mix.
Superseded	Superseded by another registered mix but details are retained for record purposes.
Withdrawn	Withdrawn from use because of unsatisfactory field performance but details are retained for record purposes.

HP No asphalt shall be supplied until the mix has been registered and the Superintendent approves the mix for use. The Contractor shall only use asphalt mixes that are registered by VicRoads as 'General' mixes unless approved by the Superintendent.

Approval of a registered mix for use under the Contract does not guarantee the handling properties or performance of the mix nor relieve the Contractor from contractual obligations in regards to rectification of defects.

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:

- where it is proposed to change the source grading or nature of the components or binders; and
- when current registered mix designs are more than two years old unless the Superintendent agrees to an extension of this period.

If a registered mix has unsatisfactory handling or field performance, the Contractor or Superintendent may request the mix be de-registered in accordance with Code of Practice RC500.01.

407.07 TOLERANCES ON MIX PRODUCTION

The production tolerances on the grading aim of the mix before compaction shall be as specified in Table 407.071. The tolerance on the binder content in the mix shall be $\pm 0.3\%$ of the total mix by mass.

Table 407.071 - Production Tolerances for Mix Grading

Sieve Size AS (mm)	Tolerance on Percentage Passing (by mass)			
	Tolerance for Asphalt Types L, N, V, S and H series (% by Mass)			Tolerance for Asphalt Type S series (% by Mass)
	Size 7	Size 10	Size 14	Size 20
37.5	Nil	Nil	Nil	Nil
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

Note on Table 407.071

If post compaction grading is checked by binder extraction and sieve analysis after placement, the positive tolerances shall be increased by one percentage point.

407.08 PRODUCTION OF ASPHALT**(a) Temperatures**

The temperature of binder 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 407.081. Asphalt manufactured at temperatures in excess of the limits specified in Table 407.081 shall not be used.

Table 407.081 - Maximum Mixing Temperatures

Material	Temperature °C (max)
Binder plant storage	185 *
Aggregates before binder is added	200
Asphalt at discharge from mixing plant	175

Note on Table 407.081: * This limit may vary for PMBs in accordance with the supplier's recommendations.

(b) Mixing

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

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

(c) Hot Storage of Mixed Asphalt

Asphalt types with PMB, multigrade and C600 binders shall not be stored in hot bins for more than 8 hours prior to use. All other asphalt types shall not be stored in hot bins for more than 18 hours prior to use. Asphalt that is deemed unsuitable for use may be recycled by re processing and adding it to a new mix at a proportion not greater than 5% by mass of the total aggregates. Alternatively, it may be added to the RAP stockpile and re-processed to comply with the requirements of Clause 407.09.

407.09 ASPHALT RECYCLED FROM RECLAIMED ASPHALT PAVEMENT**(a) General Requirements**

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

- (i) all mixes containing RAP shall be registered mixes;
- (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 manufacturing process shall provide for addition of RAP to a batch plant pug mill or drum mixer separately from other mix components by a method that avoids damage to the mix by overheating;
- (iv) no RAP shall be added to Asphalt Types V, HP, HG, SS or SP.

(b) Unconditional use of RAP

The following mix types may contain the following maximum quantities of RAP provided that all relevant specification requirements are met for each mix type:

- (i) Type L - Up to 20% by mass;
- (ii) Type N - Up to 15% by mass;
- (iii) Types H - Up to 10% by mass;
- (iv) Type SI & SG - Up to 20% by mass;
- (v) Type SF – Up to 30% by mass.

(c) Higher Percentages of RAP with Additional Performance Testing

The Superintendent may approve the use of a registered mix containing percentages of RAP up to 10% above the limits specified in Clause 407.09(b).

Representative samples of production asphalt shall be taken and tested at a frequency not less than that specified in Table 407.091.

The test results will be assessed on the basis of a 'rolling average' where the mean of the last 3 test results for the mix shall be within the specified range or in the case of asphalt particle loss, the value determined for the same mix without RAP inclusion. Test specimens for each test type shall be compacted to an air voids content as specified in VicRoads Code of Practice RC500.01 for that test type. Test specimens for Asphalt Particle Loss shall be prepared at the air voids content specified for the Moisture Sensitivity test.

The results shall be presented in such a way that trends can be readily ascertained for each asphalt type so corrective action can be taken when required.

Table 407.091 – Frequency of Testing for Mixes with High Percentages of RAP

Check Required	Minimum Frequency
Indirect Tensile Modulus	In each production month - One per 2,000 tonnes or part thereof.
Moisture Sensitivity (Minimum Wet Strength and Tensile Strength Ratio)	In each production quarter - One per 10,000 tonnes or part thereof.
Mix Cohesion (Asphalt Particle Loss Test on moisture conditioned and unconditioned specimens)	In each production quarter - One per 10,000 tonnes or part thereof.

~~407.10 – RED ASPHALT~~ ~~###(strikethrough this clause if not required):~~

~~The works include the provision of red asphalt at the sites listed in Contract specific clauses.~~

~~Red asphalt shall consist of the following:~~

~~**Coloured Aggregate**~~

~~Further to Clause 407.03 the coarse aggregate for the red asphalt shall be sourced from the pink aggregate at Granite Rock Quarry, Deptford Road Granite Rock. Alternative aggregate sources may be considered by the Superintendent depending on the aggregate meeting the requirements of Section 801, and the ability of the aggregate to provide red coloured asphalt to the satisfaction of the Superintendent.~~

~~**Binder**~~

~~Further to Clause 407.05 the binder for the red asphalt shall be colourless, not black binder such as Mexphalte C – Shell pigmentable bitumen. Alternative binders may be considered by the Superintendent depending on the mix design properties and colour of the asphalt.~~

~~**Pigment**~~

~~Minox F201 shall be used to colour the asphalt mix. The asphalt mix shall contain a minimum 1.0% by mass of the pigment. Alternative pigments and minimum percentage by mass, may be considered by the Superintendent depending on the mix design properties and colour of the asphalt.~~

~~All costs for providing alternative aggregate, testing aggregates, and providing alternative binder, and providing alternative pigments and preparing coloured asphalt samples, shall be borne by the Contractor.~~

~~Red asphalt shall be registered in accordance with Clause 407.06.~~

407.11 FREQUENCY OF INSPECTION AND TESTING AT THE MIXING PLANT

The frequency shall not be less than that shown in Table 407.111, 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 407.111 - Frequency of Inspection and Testing

Checks Required	Minimum Frequency
Unsound rock content and particle size distribution of each aggregate and sand component including processed RAP	On each production 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 and natural sand supplied as unwashed sand	At monthly intervals.
Sand Equivalent of natural sand supplied as washed sand	At monthly intervals.
Flakiness Index of coarse aggregate 10 mm and larger	At monthly intervals.
Viscosity of bitumen and multigrade binder at 60°C	Certification of specification compliance for each delivery of bitumen supplied to the mixing plant. At weekly intervals: where bitumen has been stored above 150°C for more than 14 days without the storage tank being topped up by more than 50% of its capacity. In cases where two or more bitumen classes are blended together to correct the viscosity, a viscosity test at 60°C shall be taken prior to use and at weekly intervals thereafter.
Viscosity at 165°, Torsional Recovery, and Softening Point of PMB	At weekly intervals: For PMB that has been stored above 165° for more than three days or between 140°C and 165°C for more than seven days without the storage tank being topped up by more than 50% of its capacity.
Scrutiny for segregation, uncoated particles, separated binder, excess binder or overheating before dispatch from the plant	Each loaded truck.
Temperature of asphalt before dispatch from the plant	Each loaded truck or at intervals of 15 minutes if more than one truck is dispatched in 15 minutes.
Binder Content and Full Sieve Analysis of Asphalt (full extraction test)	On each production day: One test per 250 tonnes or part thereof of the asphalt plant production on a representative sample taken from a delivery truck.
Moisture Content, Binder Content and Full Sieve Analysis of RAP (full extraction test)	At weekly intervals: One test on a representative sample of each 1,000 tonnes of RAP prior to use.
Viscosity of Recovered Bitumen at 25°C	As directed by the Superintendent – the average of three tests where asphalt Type V, H or Type SS is reasonably suspected of being over-heated or over-mixed.

The Contractor shall make available all completed work sheets, check lists and test reports for inspection at the mixing plant.

407.12 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.

407.13 AMBIENT CONDITIONS FOR PLACING

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

(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. Asphalt mixes with PMB and Class 600 binder 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. Asphalt mixes with polymer modified binder shall not be placed when the majority of the area to be paved has a surface temperature less than 15°C.

407.14 SURFACE PREPARATION AND RAISING OR LOWERING OF MANHOLE AND VALVE COVERS

Where specified in Clause 407.24(d), all manhole and valve covers shall be raised or lowered to the new surface level prior to asphalt work commencing. Temporary ramping around each cover shall be provided and removed in accordance with the requirements of Clause 407.17(e) prior to asphalt surfacing being placed.

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

407.15 TACK COAT

A tack coat shall be applied to the cleaned asphalt or sealed surface on which asphalt is to be placed unless the unsealed surface has been primed.

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

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 0.30 litres/m² (60% Bitumen content) or 0.30 to 0.60 litres/m² (30% bitumen content), except for joints and chases where rates shall be doubled.

Before asphalt is placed, sufficient time shall be allowed for the free water to evaporate and for the tack coat to cure and change in colour from brown to black.

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.

407.16 DELIVERY

(a) General

Delivery shall only be made during the hours listed for possession of site. Asphalt delivered to the site, which is segregated, has been overheated, is too cold, contains separated binder 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 docket 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 binder, and 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's representative 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.

407.17 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 407.23.

All cold joints 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

All 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 the location of intended 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. Where new pavement abuts an existing pavement, the existing pavement shall be removed in steps to achieve an offset from layer to layer of not less than 150 mm.
- (iii) Longitudinal joints shall be parallel to the traffic lanes.
- (iv) Cold joints shall be avoided either by matching up all longitudinal joints over the full width of the carriageway each day or such lesser period depending on the rate of cooling of asphalt placed in the preceding run or by paving with two or more pavers in echelon.

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 300 mm from the centre of a traffic lane.

(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 by cold planing as specified in Section 402.

The chase shall be cut by removal of a wedge of asphalt tapering from zero to a depth of 2.5 times the nominal size of the asphalt from the existing pavement to the minimum width as follows:

- at side streets and median openings - 600 mm
- on through carriageways with a speed limit of 80 km/h or less - 3 m
- on through carriageways with a speed limit of more than 80 km/h - 6 m.

(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 shown in Table 407.171.

Table 407.171 – Maximum Grade of Temporary Ramping

Posted Speed Limit (km/hr)	Maximum Ramp Grade (Horizontal to Vertical)
40	20 to 1
60	30 to 1
80	40 to 1
> 80	50 to 1

(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.

407.18 COMMENCEMENT OF PLACING

HP The placement of asphalt on the sub-base or granular base for a new pavement or for an overlay of an existing bituminous surfaced pavement shall not commence until approval to proceed is obtained from the Superintendent.

407.19 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.

407.20 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

Asphalt paver screed levels shall be controlled by a suitable combination of manual and automatic controls operating from fixed or moving references.

(c) Spreading

All asphalt shall be spread with a purpose designed asphalt paving machine to form a uniformly smooth asphalt mat complying with the requirements of Clause 407.23 without segregation, tearing or gouging.

The Contractor shall conduct spreading operations to ensure that the paver speed matches the rate of supply so that stoppages 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 407.17(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 areas where it is not practical to use a paver.

(e) Echelon Paving

Where specified in Clause 407.24(g) two pavers in echelon shall be used in locations where a full carriageway wider than 6 m is available clear of traffic.

The width of a single paving run shall not exceed 6 metres unless paving in echelon is proposed.

407.21 COMPACTION

Asphalt shall be uniformly compacted to the standards specified in Clause 407.22 as soon as the asphalt has cooled sufficiently to support the rollers without undue displacement.

407.22 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF COMPACTION

(a) General

Work shall be tested and accepted for compaction on either a test lot basis as provided in Clause 407.22(b) or on an approved procedural basis as provided in Clause 407.22(c). Where the total quantity of the particular size and/or type of asphalt supplied under the contract exceeds 300 tonnes, compaction shall be tested and accepted on a test lot basis. Acceptance of compaction for all other asphalt work will be on a procedural basis.

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

For small lots, the test procedure specified in Section 173 shall apply.

The density of extracted cores for the purposes of determining the bulk density for acceptance purposes or to check or assign offsets to a nuclear gauge shall be undertaken in accordance with VicRoads Codes of Practice 500.05 and 500.16.

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 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.

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 407.221.

Table 407.221 - Limits for Characteristic Density Ratio (Six Tests)

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 may be accepted at a reduced rate calculated by $P = 10 R_c - 840$	91.0% to 95.9%	Lot may be accepted at a reduced rate calculated by $P = 6 R_c - 476$

(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 Clause 40.2 of the General Conditions of Contract - Valuation of Variations.

Where one or more individual core thicknesses are less than the relevant values shown in Table 407.222, they shall be discarded and the acceptance assessment modified in accordance with Table 407.223 provided that there remain at least 4 test values.

Table 407.222 - Minimum Thickness of Cores Extracted from the Pavement

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

Table 407.223 - Mean Density Ratio (less than six cores)

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 may be accepted at a reduced rate calculated by $P = 10 R_m - 855$	92.0% to 95.9%	Lot may be accepted at a reduced rate calculated by $P = 6 R_m - 482$

(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%.

In situ Air Voids and Characteristic In situ Air Voids shall be reported for each lot.

Percentage In situ Air Voids is defined as the ratio of In situ Air Voids to the Voids Free Bulk Density. Percentage In situ Air Voids represents the Air Voids of the compacted asphalt as placed onsite, and shall be determined as follows:

$$\text{In situ Air Voids} = \frac{\text{VFBD} - \text{field bulk density}}{\text{VFBD}} \times 100$$

The Characteristic Value of In situ Air Voids is the calculated value of $\bar{x} + 0.92S$ for six tests per lot where \bar{x} and S are the mean and standard deviation of the individual In situ Air Void test values for the lot, respectively.

(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 2150 – Hot-Mix Asphalt.

407.23 SURFACE FINISH AND CONFORMITY WITH DRAWINGS

(a) General

For all asphalt works the following requirements shall apply for conformance with location, shape, alignment, and width.

(i) Surface Finish

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

(ii) Kerb and Channel

Where asphalt is placed against kerb and channel the surface at the edge of the wearing course shall be either flush with or not more than 5 mm above the lip of the channel unless shown otherwise on the drawings.

(iii) 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.

(iv) 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.

(v) 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. The average width over any 300 m shall not be less than the design or specified width.

(b) Conformity with Drawings for New Pavements and Major Pavement Rehabilitation Projects

For pavement works where design drawings show the finished surface level and thickness of each pavement course, the surface level of each asphalt course shall be measured in accordance with the requirements of Section 173. Every test lot shall meet either a Scale A, B or C requirement as specified in Clause 407.24.

Unless otherwise specified in Clause 407.24(f), the maximum lot size for measurement and assessment of surface level shall be 4000 m².

(i) Scale A and B Surface Level Requirements

Each level measurement shall be taken at random locations over the area of the lot in accordance with the relevant Test Method and the number of measurements taken within each lot shall not be less than the number specified in Table 407.231.

The mean surface level and the variation in surface level for the base, intermediate and wearing courses within each lot shall meet the requirements of Table 407.232.

Table 407.231 - Minimum Number of Level Measurements per Lot

Scale of Surface Level Measurement	Minimum Number of Measurements Per Lot
Scale A	80
Scale B	40

Table 407.232 - Average Surface Level Tolerances for the Sub-base and Pavement Courses

Scale of Surface Level Measurement	Granular or Cement Treated Subbase		Asphalt Layers	
	\bar{x} Range (mm)	Max. S (mm)	\bar{x} Range (mm)	Max. S (mm)
Scale A	+4 to -8	8	± 5	8
Scale B	+6 to -12	13	± 8	10

Notes on Table 407.232

\bar{x} is the mean value of all level readings taken in the lot (a negative value designates a measured departure below the design level and positive value designates a surface level above the design level)

S is the standard deviation of all level readings taken in the lot.

For Scale A and Scale B level requirements, the Superintendent may agree to accept a lot which does not conform with the limits of Table 407.232 at a reduced payment, in accordance with Table 407.233. The value of the lot of work shall be calculated from the unit rates for pavement construction as specified in Clause 407.24(c).

Table 407.233 - Payment Deduction for Surface Level

Variation	Payment reduction
Mean (\bar{x}) outside the specified limit up to a maximum of 25% of the limit.	8% plus 4% reduction for each 1 mm the mean value extends outside the tabulated limit
Standard Deviation (S) exceeding the specified limit up to a maximum of 35% of the limit.	8% plus 4% reduction for each 1 mm the Standard Deviation extends outside the tabulated limit

Note to Table 407.233

If both (\bar{x}) and (S) vary by more than the specified limit, the payment reduction shall be the sum of the payment reductions for both (\bar{x}) and (S).

(ii) Scale C Surface Level and Thickness Requirements

Surface level and thickness measurements shall be taken in accordance with the procedure specified in Section 173 – Examination and Testing of Materials and Work (Roadworks).

The level of the top of each asphalt course shall not differ from the specified level by more than 15 mm for intermediate and base courses and 10 mm for wearing course.

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 407.24 or shown on the Drawings. For the purpose of this clause, the maximum lot size shall be not more than 4,000 m² of pavement area.

(c) Asphalt Overlays

Where a minimum average or nominal thickness of overlay is specified, and no existing pavement or finished levels are available, the average thickness of the overlay shall be calculated by:

$$T = \frac{M}{D \times A} \times 1000$$

Where:

T is the thickness of overlay in millimetres

A is the area of the job in square metres

D is the mean field density of placed asphalt in tonnes/m³.

M is the mass of asphalt used in tonnes

The average thickness of the overlay shall not be less than the specified thickness.

407.24 SCHEDULES OF DETAILS – REFER TO CONSTRUCTION DRAWINGS

(a) Asphalt Requirements (Clause 407.06)

Course	Layer	Nominal Size of Asphalt (mm)	Type of Asphalt	Thickness of Layer (mm)
Wearing and Regulation	Open Graded (Section 417)	##:	##:	##:
	Wearing	##:	##:	##:
	Regulation	##:	##:	##:
Intermediate	Intermediate 1	##:	##:	##:
	Intermediate 2	##:	##:	##:
	Intermediate 3	##:	##:	##:
Base		##:	##:	##:
Combined Thickness of Asphalt Pavement (less the Open Graded Asphalt Wearing Course Layer)				##:

(b) Scales Compaction and Level/Thickness Control (Clause 407.23) – REFER TO TENDER DOCUMENT PART 4, SECTION 1.2

Road Name	Location	Scale for Level / Thickness Control
##:	##:	##:

(c) Basis for Determining the Value of the Lot to be used for Price Deduction for Departure from Specified Surface Level and Density Requirements (Clauses 407.22 and 407.23).

Location	Layer	Unit Price \$/m ²
##:	##:	##:

(d) Schedule of Manhole and Valve Covers to be Raised or Lowered to the New Finished Level Prior to Asphalt Overlay – REFER TO CONSTRUCTION DRAWAINGS.

Location or Chainage	Direction of Carriageway	Lane	Cover Type (Manhole or Valve)
##:			

(e) Polymer Modified Binder if different to Class A10E (Clauses 407.05(a) and (b)) ~~##[strikethrough if 'default' Class A10E is to be used]~~ – REFER TO CONSTRUCTION DRAWAINGS.

The class of PMB required in the ##: course shall be Grade ##:.

(f) Maximum Size of Test Lots if different to 4,000 m² (Clause 407.23(c)) ~~##[strikethrough if the maximum lot size is to be 4,000 m²]~~ – REFER TO SECTION 172.

The maximum size of test lot for assessment of compaction under Clause 407.22 and if applicable, compliance drawings under Clause 407.23 shall be ##: m².

(g) Paving in Echelon (Clause 407.20(e))

Two pavers in echelon shall be used on the through carriageways from ##: to ##:.