

SECTION NINE

HOT MIX ASPHALT

9.01 GENERAL

This section covers the requirements for the manufacture and placing of asphalt of Types T, V, H, N, L and R and Sizes 7, 10, 14 and 20. The requirements relate to quality of materials, mix design, supply and placing of the asphalt.

9.02 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 while hot to a uniform dense mass. 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 when used as wearing course in very lightly trafficked areas (eg. 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 Type N mix 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 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 175mm deep.

Asphalt Base Course

Asphalt base course is that part of an asphalt pavement supporting the intermediate and wearing courses which 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 courses which rests on the asphalt or granular base pavements.

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 that part of the pavement upon which the traffic travels.

Binder

Binder is the bituminous or synthetic 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 including the total air voids.

Course Aggregates

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

Fine Aggregates

Fine aggregates are aggregates passing a 4.75mm 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.

Unsound Rock

Unsound rock is material, whether in the source or as spalls or as crushed particles, which is soft, friable, or composed of clay or weathered rock, or which contains matter which breaks up when alternately wetted and dried or which fails to meet one or more of the relevant requirements for marginal rock specified in Clause 9.03(b).

Assigned Los Angeles Abrasion Loss

The assigned Los Angeles Abrasion Loss is a hardness rating derived from Los Angeles Abrasion Loss test results.

Assigned Polished Stone Value

The assigned Polished Stone Value is a friction rating derived from Polished Stone Value test results.

9.03 AGGREGATES

(a) General

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

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

Aggregates produced from source rock which does not comply with the specified requirements but which has been proven to have satisfactory performance may be accepted for use subject to the written approval of the Superintendent.

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

(b) Source Rock

Prior to the commencement of work, the Contractor is to confirm the proposed quarry source from which the source rock will be obtained.

Unless otherwise approved by the Superintendent, only those rock types listed in Table 9.031 are to be used.

Source rock is to be considered sound or marginal in accordance with the provisions of Table 9.031.

Table 9.031

Rock Type	Test Value			
	Sound Rock		Marginal Rock	
	Degradation Factor for Source Rock (min)	Secondary Mineral Content % (max)	Degradation Factor for Source Rock (range)	Secondary Mineral Content % (range)
BASIC IGNEOUS				
Basaltic Rocks (includes Basalt, Dolerite, Limburgite)	50	25	30-49	26-30

The hardness of the source rock is to be measured by a Los Angeles Abrasion Loss test on the product and must comply with the test values shown in Table 9.032.

Table 9.032

Rock Type	Assigned Los Angeles Abrasion Loss (Max)
BASIC IGNEOUS	
Basaltic Rocks (Basalt, Dolerite, Limburgite)	25

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

If the Contractor proposes to use a source rock type other than those listed in Table 9.031 the Superintendent will determine whether the rock type is acceptable and will set appropriate test values.

(c) Crushed Aggregate Products

- (i) The Flakiness Index of each separate sized coarse aggregate, with a nominal size of 10mm or larger, must comply with Table 9.033.
- (ii) Unsound rock and marginal rock in that fraction of the combined mixture retained on a 4.75mm AS sieve must not exceed the relevant percentages specified in Table 9.033. 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 4.75mm AS sieve must not exceed the relevant percentages specified in Table 9.033.

Table 9.033

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 are to:

- (i) consist of a uniformly graded product of separate particles from the crushing of rock which complies with the requirements of Clause 9.03(b) appropriate to the asphalt type being produced;
- (ii) be free from lumps and aggregations;
- (iii) comply with the grading limits specified in Table 9.034.

Table 9.034

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 9.035.

Table 9.035

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

(e) Aggregates for Asphalt Used as Wearing Course

- (i) Coarse aggregates are to be a mixture of separate one-sized aggregates.
- (ii) Coarse aggregates for Type T, H or V asphalt must have a minimum assigned polished stone value of 48.
- (iii) Fine aggregates are to be a mixture of one or more natural sands and crusher fines such that the fraction of the job mix passing a 4.75mm AS sieve will 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 are to consist either wholly of crushed material or of a mixture of crushed material and natural sands provided that the fraction of the job mix passing the 4.75mm AS sieve contains not more than 50% by mass of natural sands unless otherwise approved by the Superintendent.

9.04 FILLER

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

The added filler required by Clause 9.07 to be included in wearing course mixes is to be hydrated lime, Portland cement or cement works flue dust.

9.05 BITUMINOUS MATERIALS

(a) Bitumen Class

Unless otherwise specified, the class of bitumen for each asphalt type is to be as specified in Table 9.051.

Table 9.051

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

Bitumen must comply with Australian Standard 2008, Residual Bitumen for Pavements and with the additional requirement specified in Table 9.052.

Table 9.052

Class of Bitumen	Durability * Minimum time to reach the specified apparent viscosity level (SAVL) days
170	9
320	7
600	5

* AS 2341.13 Determination of Durability of Bitumen

(b) Bitumen Recovered

Bitumen recovered from mixed asphalt sampled either at the plant or at the roadbed must comply with the requirement specified in Table 9.053.

Table 9.053

Class of Bitumen	Viscosity at 25°C kPas
170	100 - 350
320	300 - 1000
600	500 - 2000

(c) Bitumen Emulsion

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

(d) Polymer Modified Binder

Where polymer modified binder is specified the Contractor must comply with the following requirements:

- (i) the material is to be handled in accordance with the manufacturer's specification;
- (ii) a certificate of quality from the manufacturer must be submitted for each load of modified binder received;

- (iii) the modified binder is to be transported and stored in dedicated vehicles and/or storage facilities. Transport tankers and storage tanks must be properly flushed and cleaned before being used to avoid possible contamination.
- (e) Where requested by the Superintendent, the Contractor must provide test certificates as to the quality of bitumen used. Such certificates are to be issued by a laboratory registered by the National Association of Testing Authorities for the performance of such tests.

9.06 MIX DESIGN

The mix to be used must be approved by the Superintendent. The approval of the Superintendent is also required before any changes are made to the components or proportions of components used in the approved mix.

New mix designs are to be carried out where it is proposed to change the source grading or nature of the components, or where current approved mix designs are more than two years old.

Where a new mix design is required or proposed the Contractor must submit the mix design details to the Superintendent for approval.

The following information must be submitted 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;
- (g) Washington 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 within the range specified in Table 9.072:
 - (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) 4 No., 8 kg sample batches of the combined aggregates for each mix size; and
- (j) 1 No., 20 kg sample of each component of sand and aggregates.

A minimum period of two weeks will be required from the date of submission of mix design details for checking by the Superintendent

9.07 MIX DESIGN REQUIREMENTS

The grading of mineral matter and the proportions of mineral matter and bitumen in the mix after mixing but before compaction, must lie within the limits specified in Table 9.071 and 9.072 for each size of asphalt unless otherwise approved by the Superintendent.

The bitumen content is to be expressed as a percentage by mass of the total mix.

Table 9.071 - Grading 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 9.072 - Proportions of Mineral and Bitumen

Material	Percentage Passing (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

The Marshall cylinder test properties of the mix for asphalt Types T, V, H, N and L must comply with Tables 9.073 and 9.074.

Table 9.073 - Asphalt Type T, V, H and N

Mix Size (mm)	Stability (kN) min	Flow (mm)		Air Voids (%)				Voids in Mineral Aggregates 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 must 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 9.074 - 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

9.08 PRODUCTION TOLERANCES

The production tolerances on the grading aim of the mix before compaction are to be as specified in Table 9.081.

Table 9.081

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 are to be as specified in Table 9.081 except that the positive tolerance is to be increased by one percentage point.

The tolerance on the bitumen content in the mix must be $\pm 0.3\%$ of the total mix by mass.

9.09 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 must not exceed the limits specified in Table 9.091.

Table 9.091

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

The mixing period is to 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 must not exceed 0.5%.

Asphalt which has been manufactured at temperatures in excess of limits specified in Table 9.091 or which has been stored in an insulated bin for more than 32 hours will be rejected.

Material recycled from within the plant which is partially coated, fully coated or remaining in hot bins may be used in the mix at a proportion not greater than 5% mass of total aggregates.

9.10 FREQUENCY OF INSPECTION AND TESTING AT THE MIXING PLANT

The Contractor is to test asphalt production at a frequency which is sufficient to ensure that all material supplied under the Contract complies with specified requirements. The frequency must not be less than that shown in Table 9.101, 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 9.101

Checks Required	Minimum Frequency
Scrutiny for segregation, uncoated particles, separated bitumen, excess bitumen 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 despatched in 15 minutes
Unsound rock content	One each day: one test on each component
Degradation Factor of crusher fines	At monthly intervals
Plasticity Index of crusher fines	At monthly intervals
Flakiness Index of coarse aggregate 10mm and larger	At monthly intervals
Bitumen Content and Full Sieve Analysis of Asphalt (full extraction test)	On each day: One test per 500 tonnes or part thereof of the asphalt plant production
Sieve analysis of the coarser fraction of asphalt (quick extraction test)	On each day: one test per 100 tonnes or part thereof for each size of asphalt
Viscosity of Bitumen	Certification of specification compliance for each delivery of bitumen supplied to the mixing plant. In addition, the Contractor shall implement an inspection and test plan to ensure that bitumen in storage tanks is not contaminated or damaged and that the correct class is incorporated in the works

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

9.11 RATE OF DELIVERY

Asphalt is to be placed at the highest practicable rate in order to minimise the time traffic is disrupted and to avoid intermittent paving.

9.12 AMBIENT CONDITIONS FOR PLACING

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

Asphalt must not be placed when the ambient temperature is less than 5°C.

Wearing course asphalt must not be placed when the ambient temperature is less than 10°C for Class 170/320 bitumen or less than 15°C for Class 600 bitumen and mixes containing polymer modified binders.

9.13 SURFACE PREPARATION

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

9.14 TACK COAT

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

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

Unless otherwise directed, the application rate for bitumen emulsion tack coat will 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.

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 are to be taken to protect kerbs, channels, adjoining structures, traffic and parked vehicles.

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 50mm, the Superintendent may direct the Contractor to omit the tack coat.

9.15 DELIVERY

(a) General

Delivery shall be made during the hours of possession of site. Asphalt 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 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 bitumen, or proprietary name of modified binder;
- (x) temperature of load at mixing plant when measured.

Plant asphalt is scheduled for measurement by loose volume or 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.

9.16 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 work shall proceed in such a way to minimise the number of joints.

All joints shall be well bonded and sealed and the surface across the joint shall meet the requirements of Clause 9.22(b).

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

(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 shall be offset from layer to layer by not less than 150mm.
- (ii) Longitudinal joints shall be parallel to the centre line of the carriageway as applicable.
- (iii) Longitudinal joints in the wearing course shall coincide with the lane line positions or the centre of a traffic lane unless otherwise specified.

Subject to approval by the Superintendent, a longitudinal joint may be located up to 300mm 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 2.8metres.

(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 - 600mm
 - through carriageways with a speed limit of 75kph or less - 2m
 - through carriageways with a speed limit of more than 75kph - 4m
- (ii) If cold planing is not specified, a 40mm wide by 20mm 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 is to 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 one 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 one vertical for traffic speeds of more than 75 km/h or 10 horizontal to one 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.

9.17 COMMENCEMENT OF PLACING

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

9.18 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.

9.19 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

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

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

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 9.16(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

Where the width of the mat to be placed in a single run exceeds 6 metres, two or more pavers shall be used in echelon.

9.20 COMPACTION

Asphalt shall be uniformly compacted to the standards specified in Clause 9.21 as soon as the asphalt has cooled sufficiently to support the roller without undue displacement.

9.21 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF COMPACTION

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 plan shall provide for additional testing to demonstrate correction of a non conformance. Placing procedures shall be in accordance with Australian Standard AS 2734 Asphalt (Hot Mixed) Paving - Guide to Good Practice.

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.

For each lot, density tests shall be performed on core samples taken from the layer except that for a layer of normal thickness 50mm or greater a nuclear gauge may be used to measure density in situ. Sites for density testing shall be selected on an essentially random basis provided that no site shall be selected within 150mm 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 $x - 0.92S$ for six tests per lot where x and S are respectively the mean and standard deviation of the individual density ratio test values for the lot.

Asphalt shall be compacted to a density not less than the characteristic value of the density ratio shown on Table 9.211.

Table 9.211

	For Layers Less Than 50mm Thickness	For Layers Thickness or Greater
Characteristic Value of the Density Ratio	93.0%	95.0%

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

(a) Level

The level of the top of each layer shall not differ from the specified level by more than 10mm, 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 5mm 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 4mm below a 3m straight edge laid either parallel to the centre line of the pavement or, except on crowned sections, at right angles to the centre line. For intermediate and base course layers, the distance below the straight edge shall not exceed 6mm and 10mm respectively.

(c) Thickness

Where pavement has been scheduled at a rate per square metre, the average compacted thickness of asphalt pavement shall be not less than the thickness specified in Schedule 1 or shown on the drawings.

(d) Alignment

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

(e) Width

Where asphalt layers are 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 50mm or greater than the design or specified width by more than 100mm and the average width over any 300m shall not be less than the design or specified width.