SECTION M

HOT MIX ASPHALT

INDEX TO CLAUSES

SECTION M

HOT MIX ASPHALT

INDEX TO CLAUSES (cont'd)

SECTION M

HOT MIX ASPHALT

M.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.

M.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 while hot to a uniform dense mass. Asphalt types are designated by the symbols T, V, H, N, L or R.

Asphalt Types

N: Normal mix with Class 170 bitumen for general use as base, intermediate or wearing course.

T: Similar to Type N but with Class 320 bitumen to provide a stiffer mix for more heavily trafficked applications. A minimum Polished Stone Value applies when used as wearing course.

H: Similar to Type T but with increased stone quality requirements for wearing course on major roads.

V: High air voids mix for wearing course at heavily trafficked intersections.

R: Bitumen rich base layer for use where included in pavement design.

L: Light traffic mix designed with lower air voids for increased durability.

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 course, which rests on the asphalt or granular base pavements.

M.2 DEFINITIONS (cont'd)

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.

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.

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 M.4.(b).

M.2 DEFINITIONS (cont'd)

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 on the basis of past test data.

M.3 COUNCIL'S STANDARD WEARING COURSE FOR SUBDIVISIONAL STREET CONSTRUCTION AND OTHER WORKS

Unless otherwise approved by the Superintendent, pavement prior to asphalting shall be treated with a cutback bitumen primer (refer Section L of this specification).

Where priming is not possible due to damp pavement, the following method of construction shall be used:-

(1) **Bitumen Emulsion Primer Seal**

Bitumen emulsion binder of Grade ARS or CRS manufactured from Class 170 bitumen complying with AS.1160 - shall be applied at the correct application rate and covered with a 7 mm basaltic aggregate. The asphalt-wearing course shall be placed within seven days of applying a bitumen emulsion primer seal.

(2) **Primer Sealing**

Where a primer seal is specified, upon completion of the road pavement and preparation of pavement surface, a primer-seal (SP1000 or equivalent) shall be applied at the correct application to retain 7 mm basaltic aggregate.

Period To Elapse Prior To Placing Asphalt Over a Primer Seal

A period of at least three (3) months of summer conditions (or such period as the Superintendent may require) shall elapse before the placing of asphalt, but primer seals shall be covered within twelve (12) months of application.

Tack Coat

Unless otherwise specified, a tack coat of rapid-breaking bituminous emulsion shall be applied at a spraying rate of 0.27 litres per square metre.

M.3 COUNCIL'S STANDARD WEARING COURSE FOR SUBDIVISIONAL STREET CONSTRUCTION AND OTHER WORKS (cont'd)

Wearing Course

The wearing course shall consist of 10 mm nominal size asphalt to provide a finished compacted surface course of 30 mm minimum thickness.

In residential private subdivisions and where directed for aesthetic reasons, the wearing course aggregate shall be granite and shall conform to the requirements of Clause M.4.

M.4 AGGREGATES

(a) General

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

When aggregates are crushed rock, they shall 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.

When aggregates are crushed gravel, not less than 75% by mass of all particles shall have two or more faces produced by crushing.

Sand aggregates shall 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 shall confirm the proposed quarry source from which the source rock will be obtained.

Unless otherwise approved by the Superintendent, only metamorphic or igneous rocks shall be used. Source rock for the production of aggregates shall comply with the requirements specified in Tables M.4.1 and M.4.2.

M.4 AGGREGATES (cont'd)

Table M.4.1.

Rock Type	Test Value			
	Sound Rock		Marginal Rock	
	Degradation Factor for Source Rock (min)	Secondary Mineral Content % (max)	Degradation Factor for Source Rock	Secondary Mineral Content %
ACID IGNEOUS				
Granite	50	-	35-49	-
Adamellite	50	-	35-49	-
Grandiorite	50	-	35-49	-
Granophyre	45	-	35 -44	-
Ryholite	45	-	35-44	-
Rhyodacite	45	-	35-44	-
INTERMEDIATE IGNEOUS				
Diorite	45	-	35-44	-
Porphyry	45	-	35-44	-
Trachyte	50	-	30-49	-
BASIC IGNEOUS				
Basaltic Rocks (Basalt, Dolerite, Limburgite)	50	25	30-49	26-30
METAMORPHIC				
Hornfels	40	-	20-39	-
Quartzite	45	-	30-44	-
Schist	45	-	30-44	-
Phyllite	45	-	30-44	-
Gneiss	45	-	30-44	-
Greenstone	45	-	30-44	-

M.4 AGGREGATES (cont'd)

Table M.4.2.

Rock Type	Assigned Los Angeles Abrasion Loss (max)
ACID IGNEOUS	
Granite Adamellite Granodiorite Granophyre Rhyolite Rhyodacite	30 30 30 20 20 20
INTERMEDIATE IGNEOUS	
Diorite Porphyry Tachyte	20 20 25
BASIC IGNEOUS	
Basaltic Rocks (Basalt, Dolerite, Limburgite)	25
METAMORPHIC	
Hornfels Quartzite Schist Phyllite Gneiss Greenstone	20 25 25 25 25 25

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.

If the Contractor proposes to use a source rock type other than those listed in Tables M.4.1. and M.4.2. the Superintendent will determine whether the rock type is acceptable and will set appropriate test values.

M.4 AGGREGATES (cont'd)

(c) Crushed Aggregate Products

(ii) The Flakiness Index of each separate sized coarse aggregate, with a nominal size of 10 mm or larger, shall comply with Table M.4.3.

(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 M.4.3. 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 M.4.3.

Table M.4.3.

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
N and R	35	10	5
L	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 M.4.(b) appropriate to the asphalt type being produced;

(ii) be free from lumps and aggregations;

(iii) comply with the grading limits specified in Table M.4.4.

M.4 AGGREGATES (Cont'd)

Table M.4.4

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 M.4.5.

Table M.4.5

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.

M.4 AGGREGATES (cont'd)

(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 job 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.

M.5 FILLER

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

The added filler required by Clause M.8. to be included in wearing course mixes shall be hydrated lime, Portland cement or cement works flue dust.

M.6 BITUMINOUS MATERIALS

Bituminous Class

(a) Unless otherwise specified, the class of bitumen for each asphalt type shall be as specified in Table M.6.1.

Table M.6.1.

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

Bitumen shall comply with Australian Standard 2008, Residual Bitumen for Pavements and with the additional requirement specified in Table M.6.2.

M.6 BITUMINOUS MATERIALS (cont'd)

Table M.6.2

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**

Bitumen recovered from mixed asphalt sampled either at the plant or at the roadbed shall comply with the requirement specified in Table M.6.3.

Class of Bitumen	Viscosity at 25^{o}C kPa.s
170	100 - 600
320	500 - 1600

(c) **Bitumen Emulsion**

Bitumen emulsion shall 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 water shall contain a minimum bitumen content of 30%.

(d) Where requested by the Superintendent, the Contractor shall provide test certificates as to the quality of bitumen used. Such certificates shall be issued by a laboratory registered by the National Association of Testing Authorities for the performance of such tests.

M.7 MIX DESIGN

The mix to be used shall 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.

Where a current approved mix is available for the size and type of asphalt the Contractor shall forward the approved mix design number with the tender.

New mix designs shall 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.

For every approved mix design, the Superintendent will allocate and advise the Contractor of a mix design number which shall be used to identify the particular mix.

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

The following information shall 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;

(f) 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 M.8.2.:-

  (i) stability (kN)

  (ii) flow (mm)

  (iii) air voids (%)

  (iv) voids in mineral aggregates (%)

M.7 MIX DESIGN (cont'd)

(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.

M.8 MIX DESIGN REQUIREMENTS

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 M.8.1. and M.8.2. for each size of asphalt unless otherwise approved by the Superintendent.

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

Table M.8.1. - 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.

M.8 MIX DESIGN REQUIREMENTS (cont'd)

Table M.8.2. - Proportions of Mineral Matter 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
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 shall comply with Tables M.8.3. and M.8.4.

Table M.8.3. - Asphalt Type T, V, H and N

Min Size	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 shall be established from the relevant Size 20 Type N mix with an increase in bitumen content of 1.0% by max of the total mix.

M.8 MIX DESIGN REQUIREMENTS (cont'd)

Table M.8.4. - Asphalt Tyle 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 10	4.5 5.5	1.5 1.5	3.5 3.5	3.8 3.8	4.2 4.2	16 16	8.0 8.0

Asphalt used for wearing course and asphalt containing aggregates of coarse or medium grained acidic rocks (e.g. granite, adamellite, granodiorite, quartz porphyry) shall contain not less than 1% hydrated lime added filler.

M.9 PRODUCTION TOLERANCES

The production tolerances on the grading aim of the mix before compaction shall be as specified in Table M.9.1.

Table M.9.1.

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
2.35 - 0.600	±5	±5	±5	±5
0.300 - 0.150	±3	±3	±3	±3
0.075	±1.0	±1.0	±1.0	±1.0

SECTION M

HOT MIX ASPHALT

M.9 PRODUCTION TOLERANCES (cont'd)

The production tolerances on the grading aim of the mix after compaction shall be as specified in Table M.9.1. 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.

M.10 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 M.10.1.

Table M.10.1.

Material	Temperature ^{o}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 M.10.1 that has been stored in an insulated bin for more than 18 hours shall 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% by mass of the total aggregates.

M.11 FREQUENCY OF INSPECTION AND TESTING AT THE MIXING PLANT

The Contractor shall test asphalt production at a frequency which is sufficient to ensure that all material supplied under the Contract complies with specified requirements but which is not less than shown in Table M.11.1.

Table M.11.1.

Checks Required	Minimum Frequency
Scrutiny for segregation, uncoated particles, separate 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 dispatched in 15 minutes
Unsound rock content	On 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 10 mm 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 shall make available for inspection at the plant all work sheets and results of checks carried out.

SECTION M

HOT MIX ASPHALT

M 12 RATE OF DELIVERY

On the date or dates of commencement as notified by the Contractor in writing, 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, continuously from the time of commencement of laying each day until the completion of the days work, with only one break and that of not more than an hour, apart from breaks directed by the Superintendent due to unsatisfactory weather conditions. Should it be necessary to change the specified rates of delivery, the Contractor will be notified in writing by the Superintendent of the changed requirements.

Minimum daily rate:	300 tonnes
Minimum hourly rate:	30 tonnes

Asphalt which does not to 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 Contractors expense.

M.13 AMBIENT CONDITIONS FOR PLACING

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

Asphalt shall not be placed when the ambient temperature is less than 5^{o}C.

Wearing course asphalt shall not be placed when the ambient temperature is less than 10^{o}C.

M.14 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 all rich fatty areas before applying the tack coat. No asphalt shall be placed on any areas which contains an excess of binder in such a 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.

SECTION M

HOT MIX ASPHALT

M.15 TACK COAT

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

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 .3 litres/m^2 (60% Bitumen content) or 0.3 to 0.6 litres/m^2 (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 shall 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 50 mm, the Superintendent may direct the Contractor to omit the tack coat.

M.16 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 separate bitumen or uncoated particles which does not comply with the Specification shall be removed from the site at the Contractor's expense.

M.16 DELIVERY (cont'd)

(b) **Delivery Dockets**

Delivery dockets shall show:-

(i) empty and loaded mass of the vehicle;

(ii) date and time of loading;

(iii) supplier and location of mixing plant;

(iv) registration or fleet number of vehicle;

(v) size and type of asphalt;

(vi) class of bitumen;

(vii) temperature of load at mixing plant when measured.

The Contractor shall make delivery dockets available for inspection on request by the Superintendent.

M.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 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 M.23.(b).

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

Where asphalt is placed adjacent to or at junctions with existing asphalt or a sprayed seal coat, the joint shall be sealed with emulsion and 5 mm grit. The colour of the grit chosen shall be such as to match the colour of the existing aggregate. The width of the emulsion sealed joint shall not exceed 30 mm.

M.17 JOINTS AND JUNCTIONS (cont'd)

(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 150 mm.

(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 lane line positions or the centre of a traffic lane unless otherwise specified.

Subject to review by the Superintendent, a longitudinal joint 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 kph or less - 2m
- through carriageways with a speed limit of more than 75 kph - 4 m.

M.17 JOINTS AND JUNCTIONS (cont'd)

(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 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 situation 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 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.

SECTION M

HOT MIX ASPHALT

M.18 COMMENCEMENT OF PLACING

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

M.19 REGULATING COURSE

Preparatory to re-surfacing those areas in which there are departures or more than 10 mm from a 3.0 metre straight edge, a separate regulating course shall be placed for correction of both longitudinal and transverse pavement shape.

The maximum compacted thickness of any one layer of the regulating course shall in no circumstances exceed five times the size of asphalt used.

M.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

(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.

M.20 SPREADING (cont'd)

(iii) **Automatic Control**

Fixed Level

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

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 minimized.

If the paver is required to stop and asphalt in front of the screed cools to below 120^{o}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 M.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 awkward areas where it is not practical to use a paver.

M.21 COMPACTION

Asphalt shall be uniformly compacted to the standards specified in Clause M.22 as soon as the asphalt has cooled sufficiently to support the roller without undue displacement.

M.22 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF COMPACTION

(a) General

Work shall be tested and accepted for compaction on a lot basis as provided in Clause M.22 (b).

(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 on 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 nominal thickness 50 mm 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 200 mm of a joint constructed against a cold edge.

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

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 M.22.1.

M.22 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF COMPACTION (cont'd)

Table M.22.1.

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
93.0% or more	Accept lot	95.0 % or more	Accept lot
90.0% to 92.9%	Lot will be accepted at a reduced rate calculated by P= 10 Rc-840	90.0% to 94.9%	Lot will be accepted at a reduced rate calculated by P = 6 Rc – 470
Less than 90.0%	Remove and replace or alternatively the lot may be accepted at a rate fixed by the Superintendent (not more than 70% of the scheduled rate)	Less than 90.0%	Remove and replace or alternatively the lot may be accepted at a rate fixed by the Superintendent (not more than 70% of the scheduled rate)

(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 'Bill of Quantities' accompanying the lump sum tender for assessment of variations. If no such rate is provided a variation will be considered in accordance with Clause 40.5 of the General Conditions of Contract - Valuation of Variations.

Individual core thicknesses shall not be less than the relevant values shown in Table M.22.2.

Where less than six cores are used, assessment modified in accordance with Table M.22.3.is permitted provided that there are at least four test values.

M.22 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF COMPACTION (cont'd)

Table M.22.2.

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

Table M.22.3.

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
94.5%or more	Accept lot	96.0% or more	Accept lot
91.5% to 94.4%	Lot will be accepted at a reduced rate calculated by P=10 Rm–845	92.0% to 95.9%	Lot will be accepted at a reduced rate calculated by P=6 Rm–476
Less than 91.5%	Remove and replace or alternatively the lot may be accepted at a rate fixed by the Superintendent (not more than 70% of the scheduled rate)	Less than 91.0%	Remove and replace or alternatively the lot may be accepted at a rate fixed by the Superintendent (not more than 70% of the scheduled rate)

(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%.

M.23 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 of each Asphalt Course**

The level of the top of each layer 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 4mm 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**

The average compacted thickness of asphalt pavement based on the core samples referred to in Clause M.22 shall be not less than the thickness specified or shown on the Drawings. No core sample shall be less than the individual core thickness shown in Table M.22.2. For the purpose of this clause a lot shall be defined as asphalt which is placed on one day under uniform conditions and is essentially homogeneous in respect to material and appearance. Asphalt, which fails to comply with this clause, shall be treated in accordance with General Conditions of Contract Clause 30.3 - Defective Materials or Work.

(d) **Alignment**

Where asphalt layers are 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.

M.23 SURFACE FINISH, AND CONFORMITY WITH DRAWINGS AND SPECIFICATION (cont'd)

(f) **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 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.

M.24 STRAIGHT EDGE

A suitable 3.0 metre straight edge, approved spirit level, a depth gauge graduated in millimetres, a thermometer, a set of boning rods and string lines shall be kept at the work and continually used to check the surface of the respective courses as specified.

M.25 OCCUPATION OF CARRIAGEWAY

For the purpose of laying the asphalt the Contractor will be given occupancy of either:-

(1) One half the width of the carriage way plus 1200 mm and one shoulder or channel, in which case the balance of the carriageway shall remain clear of all obstruction for the uninterrupted use of the traffic.

(2) Full width of the carriageway from which traffic will be excluded and diverted. All detours and traffic control shall be in accordance with AS 1742.3.

M.26 CLEANING UP

Following the completion of works, all paper and sand and surplus paving mixture shall be completely removed from all kerbs and channels and shall be disposed of in an approved location.

M.27 DAMAGE

Any damage caused by the Contractor to kerbs, channels, structures or private property shall be made good by the Contractor before final payment is made.