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## 4 FLEXIBLE PAVEMENT CONSTRUCTION

### 4.01 SCOPE

The works covered by this Section of the Specification comprise the construction of flexible pavements comprising crushed rock, gravel and suitable soil pavement layers, with a bituminous surface.

This Specification does not include pavements constructed of cementitious stabilised materials or gravel surfaced pavements.

### 4.02 STANDARDS

Work carried out and testing performed under this Section of the Specification shall comply with the requirements of the following Standards to the extent that they are relevant and not overridden by the Specification.

#### **Australian Standards**

AS 1141	Methods of Sampling and Testing Aggregates
AS 1160	Bitumen Emulsions for Construction and Maintenance of Pavements
AS 1289	Methods of Testing Soils for Engineering Purposes
AS 2008	Residual Bitumen for Pavements
AS 2150	Asphalt (Hot-Mixed)
AS 2157	Cutback Bitumen
AS 2341	Methods of Testing Bitumen and Related Roadmaking Products
AS 2357	Mineral Fillers for Asphalt
AS 2734	Asphalt (Hot Mixed) Paving - Guide to Good Practice
AS 2758.2	Aggregates and Rock for Engineering Purposes – Aggregate for Sprayed Bituminous Surfacing
AS 2758.5	Aggregates and Rock for Engineering Purposes – Asphalt Aggregates

#### **RTA, NSW Test Methods**

RTA T114	Determination of Maximum Dry Compressive Strength
RTA T276	Foreign Material Content
RTA T230	Resistance to Stripping of Cover Aggregates and Binders
RTA T238	Initial Adhesion of Cover Aggregates and Binders
RTA T590	Homogeneity of Precoats and Adhesion Agents.
RTA T511	Thin Film Oven Test of Bitumen
RTA T740	Segregation Test for Bituminous Binders

**RTA, NSW Forms**

RTA 395A	Cutback bitumen (or tar) prime and primer seal design calculation sheet.
RTA 395B	Bitumen emulsion prime and primer seal design calculation sheet.
RTA 395C	Cutback bitumen seal and reseal design calculation sheet.
RTA 395D	Bitumen emulsion seal and reseal design calculation sheet.
RTA 500A	Cutback Bitumen Prime and Primerseal – Daily Record
RTA 500C	Cutback Bitumen Seal and Reseal – Daily Record

**AUSTROADS References and Test Methods**

AP – T01/00	Austrroads Provisional Specification for Multigrade Binders
AP – T04/00	Austrroads Specification Framework for Polymer Modified Binders.
AP – 41/96	Bitumen Sealing Safety Guide.
APRG Rpt 19	AUSTROADS specification framework for Polymer Modified Binders
MBT01	Sampling of Polymer Modified Binders
MBT03	Pretreatment of Polymer Modified Binders (Rolling Thin Film Oven)
MBT11	Handling Viscosity of Polymer Modified Binders ( Brookfield Thermosel)
MBT12	Flashpoint of Polymer Modified Bitumen
MBT21	Elastic Recovery Consistency and Stiffness of Polymer Modified Binders (ARRB Elastometer)
MBT22	Torsional Recovery of Polymer Modified Binder
MBT23	Force Ductility
MBT24	Toughness of Polymer Modified Binder (ARRB Extensiometer)
MBT31	Softening Point of Polymer Modified Binders
MBT32	Compression Limit of Polymer Modified Binders
NAS-70	NAASRA Performance Requirements for Mechanical Sprayers of Bituminous Materials

**VicRoads Test Methods**

RC 201.01	Binder Film Thickness
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**Australian Asphalt Pavement Association Reverences**

AAPA SBS Draft Code of Practice for the Manufacture, Making and Laying of SBS Modified Asphalt

**Definitions**

Terms used to describe the various elements of pavement structure in this Section are in accordance with the definitions prescribed in AS 1348, "Glossary of Terms Used in Road Engineering". Other definitions are included in each clause as appropriate.

**Testing**

A Testing Authority shall be employed by the Contractor to carry out all testing. The Authority shall hold a current NATA (National Association of Testing Authorities) Registration for the relevant tests, and a copy of results shall be forwarded to the Superintendent without delay.

**4.03 BASE, SUBBASE AND SELECT MATERIAL****4.03.1 General**

Pavement "base" (i.e. the highest course of the pavement below the surfacing) and pavement "subbase" (i.e. the intermediate or lower course of the pavement below the base) shall be granular material specified in terms of "Traffic Category" given in Table 4.1 for the calculated design traffic for the pavement.

Granular base and subbase material types are defined as follows:

Unbound crushed rock materials are designated:

DGB20	20mm nominal sized densely graded base
DGS20	20mm nominal sized densely graded subbase
DGS40	40mm nominal sized densely graded subbase
GMB20	20mm nominal sized graded macadam base
GMS40	40mm nominal sized graded macadam subbase

Unbound natural gravel materials are designated:

NGB20-2c	20mm nominal sized natural gravel base for Traffic Category 2c
NGB20-2d	20mm nominal sized natural gravel base for Traffic Category 2d
NGS20	20mm nominal sized natural gravel subbase
NGS40	40mm nominal sized natural gravel subbase

The acceptable material types for each "Traffic Category" are given in Table 4.2

Pavement "select material layer" (i.e. the lower course of the pavement below the subbase) shall be constructed of crushed rock, natural gravels or suitable soils meeting the requirements of this Specification. The subgrade surface shall be the surface that underlies either:

- (a) the select material layer when select material layer is present, or
- (b) the sub-base when select material layer is absent from the pavement construction, or
- (c) the base when both select material layer and sub-base are absent from the pavement construction.

**Table 4.1**

Traffic Category(i)	Description
1	Roads with design traffic equal to or exceeding $10^7$ equivalent standard axle (ESA) repetitions.
2a	Roads with design traffic exceeding $4 \times 10^6$ ESAs but less than $10^7$ ESAs.
2b	Roads with design traffic exceeding $10^6$ ESAs but less than or equal to $4 \times 10^6$ ESAs.
2c	Roads with design traffic exceeding $10^5$ ESAs but less than or equal to $10^6$ ESAs.
2d	Roads with design traffic less than or equal to $10^5$ ESAs.

*Notes on Table 4.1*

(i) *As provided in the Contract.*

**Table 4.2**

Traffic Category	Acceptable Base Material	Acceptable Subbase Material
1	DGB20, GMB20	DGS20, DGS40, GMS40
2a	DGB20, GMB20	DGS20, DGS40, GMS40
2b	DGB20, GMB20	DGS20, DGS40, GMSS40
2c	DGB20, GMB20, NGB20-2c	DGS20, DGS40, GMS40, NGS20, NGS40
2d	DGB20, GMB20, NGB20-2c, NGB20-2d	DGS20, DGS40, GMS40, NGS20, NGS40

*Notes on Table 4.2*

(i) *Conforming base material may be used as subbase material .*

**4.03.2 Materials****(i) Base Material**

Base material shall be manufactured from hard, durable stone or recycled building materials free of clay lumps, organic matter and other deleterious substances. The material may be crusher run or screened and recombined.

If materials of different type or from different sources are delivered to the site, they shall be placed in separate layers or separate lots.

All the material requirements detailed in Table 4.3 apply both prior to and after placement in the pavement.

**Table 4.3**

Test Method	Description	Base Material Requirements			
		DGB20	GMB20	NGB20-2c	NGB20-2d
AS 1289.3.6.1	Coarse Particle Size Distribution				
	% passing 75.0mm sieve	-	-	-	-
	% passing 53.0mm sieve	-	-	-	-
	% passing 37.5mm sieve	-	-	-	-
	% passing 26.5mm sieve	100	100	100	100
	% passing 19.0mm sieve	95-100	95-100	93-100	93-100
	% passing 13.2mm sieve	-	-	-	-
	% passing 9.5mm sieve	-	-	71-87	71-87
	% passing 6.7mm sieve	50-70	30-55	-	-
	% passing 4.75mm sieve	-	-	47-70	47-70
	% passing 2.36mm sieve	35-55	20-30	35-56	35-56
% passing 0.425mm sieve	-	-	14-32	14-32	
% passing 0.075mm sieve	-	-	6-20	6-20	
AS 1289.3.6.3	Fine Particle Size Distribution Ratios expressed as percentages (for that portion of the material passing 2.36mm sieve)				
	A. <u>Pass 425µm sieve</u> % Pass 2.36mm sieve	35-55	30-50	-	-
	B. <u>Pass 75µm sieve</u> % Pass 425µm sieve	35-55	30-50	-	-
	C. <u>Pass 13.5µm sieve</u> % Pass 75µm sieve	35-60	-	-	-
AS 1289.3.1.1	Liquid Limit (if non plastic)	max 20	max 20	max 20	max 20

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Test Method	Description	Base Material Requirements			
		DGB20	GMB20	NGB20-2c	NGB20-2d
AS 1289.3.3.1	Plastic Limit (if plastic)	max 20	max 20	max 20	max 20
AS 1289.3.3.1	Plasticity Index	max 6	max 6	max 6	max 8
RTA T114	Maximum Dry Compressive Strength on fraction passing 19mm sieve (Plasticity Index is less than 1)	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa
AS 1141.14	Particle Shape by Proportional Calliper  % mis-shapen (2 : 1)	max 35	max 35	-	-
AS 1141.22	Aggregate Wet Strength (ii)  (a) With surface course of asphalt of up to 50mm thickness or a bituminous seal:  For Traffic Category 1 or 2a  For Traffic Category 2b or 2c  For Traffic Category 2d  (b) with a surface course of asphalt greater than 50mm thickness:  For Traffic Category 1 or 2a  For Traffic Category 2b or 2c  For Traffic Category 2d	min 80  min 70  min 60  min 70  min 60  min 60	min 150  min 130  min 100  min 130  min 130  min 100	-  -  -  -  -	-  -  -  -  -
AS 1141.22	Wet/Dry Strength Variation (ii) <u>Dry - Wet</u> as percentage Dry  For Traffic category 1 or 2a  For Traffic category 2b or 2c  For Traffic category 2d	max 35  max 40  max 45	max 30  max 30  max 30	-  -  -	-  -  -
AS 1289.6.1.1	4 day Soaked CBR (98% Modified Compaction)	-	-	80	60
AS 1141.36	Total Sulphur Content: % S by mass	max 0.05	max 0.05	max 0.05	max 0.05
AS1289.4.2.1	Water Soluble Sulphur Content: % SO <sub>4</sub> by mass	max 0.10	max 0.10	max 0.10	max 0.10

*Notes on Table 4.3*

- (i) *The maximum value of the Liquid Limit may be increased to 23 for non-plastic material, provided that the value determined is not influenced by the presence of adverse constituents eg. mica.*
- (ii) *All fractions of the sample specified by AS 1141.22 must be within specification. The fractions 19.0mm to 13.2mm and 6.7mm to 4.75mm must be tested. The fraction with the highest wet/dry strength variation is the value for determining conformance with the specification.*

Recycled building material may be used for granular base material provided it is substantially crushed concrete and / or recycled pavement material and meets the requirements of the material type for the applicable Traffic Category. In addition contaminants shall be limited to the amounts expressed as a maximum percentage by mass in accordance with RTA T276 as follows:

- Non compressible high density materials such as mortar, metal, glass, asphalt, ceramics and slag 3.0%
- Low density or crushable materials such as plastic film, brick, plaster, clay lumps and other friable material 1.0%
- Compressible or compostable material such as rubber, lumps of plastic, wood or other vegetable matter 0.2%

**(ii) Subbase Materials**

Subbase materials shall be manufactured from hard durable stone, recycled building material or suitable natural gravels. Stone shall be hard and durable and the materials shall be free of clay lumps, organic matter and objectionable quantities of deleterious substances.

All the material requirements detailed in Table 4.4 apply both prior to and after placement in the pavement.

If materials of different type or from different sources are delivered to the site, they shall be placed in separate layers or separate lots.

**Table 4.4**

Test Method	Description	Subbase Material Requirements				
		DGS20	DGS40	GMS40	NGS20	NGS40
AS 1289.3.6.1	Coarse Particle Size Distribution					
	% passing 75.0mm sieve	-	-	-	-	-
	% passing 53.0mm sieve	-	100	100	-	100
	% passing 37.5mm sieve	-	-	-	-	95-100
	% passing 26.5mm sieve	100	-	-	100	80-97
	% passing 19.0mm sieve	95-100	50-85	50-75	96-100	-
	% passing 13.2mm sieve	70-90	-	-	-	-
	% passing 9.5mm sieve	-	-	-	65-89	48-85
	% passing 6.7mm sieve	45-70	30-55	15-35	-	-

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Test Method	Description	Subbase Material Requirements				
		DGS20	DGS40	GMS40	NGS20	NGS40
	% passing 4.75mm sieve	-	-	-	47-80	35-73
	% passing 2.36mm sieve	30-55	25-50	5-15	32-67	25-58
	% passing 0.425mm sieve	-	-	-	14-42	10-33
	% passing 0.075mm sieve	-	-	-	6-26	3-21
AS 1289.3.6.3	Fine Particle Size Distribution Ratios expressed as percentages (for that portion of the material passing 2.36mm sieve)					
	A. <u>Pass 425µm sieve</u> % Pass 2.36mm sieve	35-55	35-60	25-50	-	-
	B. <u>Pass 75µm sieve</u> % Pass 425µm sieve	35-55	35-60	25-50	-	-
	C. <u>Pass 13.5µm sieve</u> % Pass 75µm sieve	35-60	35-65	-	-	-
AS 1289.3.1.1	Liquid Limit (if non plastic) (ii)	max 23	max 23	-	max 23	max 23
AS 1289.3.3.1	Plastic Limit (if plastic)	max 20	max 20	-	max 23	max 23
AS 1289.3.3.1	Plasticity Index	max 12	max 12	max 12	max 12	max 12
RTA T114	Maximum Dry Compressive Strength on fraction passing 19mm sieve (only applies if Plasticity Index is less than 1)	min 1.0 MPa	min 1.0 MPa	-	min 1.0 MPa	min 1.0 MPa
AS 1141.14	Particle Shape by Proportional Calliper					
	% mis-shapen (2 : 1)	max 35	max 35	max 35	-	-
AS 1141.22	Aggregate Wet Strength (i)	min	min	min	-	-
	- trench backfill generally	50kN	50kN	130kN		
	- under road pavement	80kN	80kN	130kN		
AS 1141.22	Wet/Dry Strength Variation (i)					
	<u>Dry/Wet</u> as a percentage dry				-	-
	- trench backfill generally	max 60	max 60	max 30		
	- under road pavement	max 40	max 40	max 30		
AS 1289.6.1.1	4 day Soaked CBR (98% Modified Compaction)	-	-	-	30	30
AS 1141.36	Total Sulphur Content: % S by mass	max 0.05	max 0.05	max 0.05	max 0.05	max 0.05

Test Method	Description	Subbase Material Requirements				
		DGS20	DGS40	GMS40	NGS20	NGS40
AS1289.4.2.1	Water Soluble Sulphur Content: %SO <sub>4</sub> by mass	max 0.10	max 0.10	max 0.10	max 0.10	max 0.10

*Notes on Table 4.4*

(i) All fractions of the sample specified by AS 1141.22 must be within specification. The fractions 19.0mm to 13.2mm and 6.7mm to 4.75mm must be tested. The fraction with the highest wet/dry strength variation is the value for determining conformance with the specification. The other fractions may be tested at the discretion of the Superintendent.

(ii) Liquid Limit may be increased to 27 for recycled building materials

Recycled building material may be used for granular subbase material provided it is substantially crushed concrete and / or recycled pavement material and meets the requirements of the material type for the applicable Traffic Category. In addition contaminants shall be limited to the amounts expressed as a maximum percentage by mass in accordance with RTA T276 as follows:

- Non compressible high density materials such as mortar, metal, glass, asphalt, ceramics and slag 3.0%
- Low density or crushable materials such as plastic film, brick, plaster, clay lumps and other friable material 1.0%
- Compressible or compostable material such as rubber, lumps of plastic, wood or other vegetable matter 0.2%

Subbase for use as trench backfill under roads shall meet the requirements for the applicable Traffic Category of the pavement.

Natural gravel may be used only with the approval of the Superintendent and is not to be used in urban areas.

### (iii) Select Material

#### (a) General

Select material shall be crushed rock, natural gravels, recycled building material or suitable soils, and the materials shall be free of clay lumps, organic matter and deleterious substances.

Select Material is designated as defined types as follows:

CBR15 Select material with minimum CBR of 15%

CBR12 Select material with minimum CBR of 12%

CBR10 Select material with minimum CBR of 10%

CBR8 Select material with minimum CBR of 8%

CBR6 Select material with minimum CBR of 6%

Recycled building material may be used as select material provided contaminants are limited to the amounts expressed as a maximum percentage by mass to in accordance with RTA T276 as follows:

- Non compressible high density materials such as mortar, metal, glass, asphalt, ceramics and slag 25.0%

- Low density or crusherable materials such as plastic film, brick, plaster, clay lumps and other friable material 1.0%
- Compressible or compostable material such as rubber, lumps of plastic, wood or other vegetable matter 0.2%

## (b) Select material properties

The select material shall have a maximum particle size not exceeding 75mm, must not have a Unified Soil Classification of ML, MH or CH, and shall be in accordance with Table 4.5.

**Table 4.5**

Test Method	Description	Select Material Requirements(iv)				
		Type CBR15	Type CBR12	Type CBR10	Type CBR8	Type CBR6
AS1289.3.1.1	Liquid Limit	max 40	max 40	max 40	max 45	max 45
AS1289.3.4.1	Linear Shrinkage	max 7	max 8	max 8	max 9	max 10
AS 1289.3.6.1	Passing 0.075mm sieve	max 45	max 45	max 50	-	-
AS 1289.3.6.1	Plasticity Index x % Pass 0.425mm sieve	max 900	max 1000	max 1200	max 1500	max 1800
AS1289.6.1.1	% Swell in CBR test (i) (ii)	max 1.0x	max 1.3	max 1.6	max 2.0	max 2.5
AS1289.6.1.1	4 day Soaked CBR (95% Modified Compaction)(i) (ii) (iii)	min 15	min 12	min 10	min 8	min 6

*Notes on Table 4.5*(i) *Moisture content for CBR tests are to be as follows:*

- for materials with a Unified Soil Classification of GW, GP, GC, SW, SP, SC, or CL, 2.0% (+/- 0.5%) dry of the Modified optimum moisture content.
- for materials with a Unified Soil Classification of GM or SM, 2.0% (+/- 0.5%) wet of the Modified optimum moisture content.
- for materials with dual classifications consisting of soil groups from both those listed above, one test each at 2.0% (+/- 0.5) dry and 2.0% (+/- 0.5%) wet of the Modified optimum moisture content.

*The lowest CBR value of the two tests shall be taken as being representative of the material tested.*

(ii) *The surcharge mass to be applied during soaking and testing of the test specimen shall be 4.5kg, or as determined from Figure 7 of AS 1289.6.1.1 based on a wet density for the overlying materials of 2.0 t/m<sup>3</sup>.*(iii) *The period of soaking will be 4 days or until swelling movements have ceased, whichever is longer.*(iv) *Select material pretreatment*

Select material other than recycled building material shall be pretreated prior to testing. Pretreatment of samples shall be carried out in accordance with the requirements of Table 4.6 and as detailed below.

Pretreatment shall comprise cycles of Modified compaction in accordance with Test Method AS 1289.5.2.1 using the size of mould and associated compactive effort applicable to the size and grading of the sample. The sample shall be conditioned to a moisture content between 90% to 110% of the optimum moisture content for pretreatment. Fragments larger than 53mm in size shall be initially broken down to a size less than this value. Pretreatment must be carried out on all materials for use in tests prescribed in Table 4.5. Pretreatment is in addition to any compaction required for those tests. The pretreatment, if any, must be shown on all test reports.

For fine grained and medium grained soils, as defined in AS 1289.0, pretreatment shall be followed by the following:

- materials retained on the 19mm sieve shall be replaced by an equal proportion by mass of materials passing the 19 sieve and retained on the 4.75mm sieve.
- The percentage by mass of materials retained on the 19mm sieve and the fact that it was replaced should be included in all test reports.

**Table 4.6**

Sample Origin	Sampling Location	Pretreatment
Excavated Sedimentary rock	Compacted in-place materials	1 cycle of Modified compaction
	All other locations	3 cycles of Modified compaction
All other sources	Compacted in-place materials	No pretreatment required
	All other locations	1 cycle of Modified compaction

#### Hold Point 4.1

Process Held: Use of each type or source of granular pavement material.

Submission Details: At least three (3) working days before each granular pavement material is proposed for use the Contractor shall submit all test results demonstrating conformance of materials with Tables 4.1 – 4.6 as applicable.

Release of Hold Point: The Superintendent will consider the submitted documents and may carry out surveillance and audit, prior to authorising the release of the Hold Point.

#### 4.03.3 Construction

##### (i) Delivery and Spreading

Pavement base, subbase and select material shall not be placed on the subgrade or previous layers of pavement until release of the Hold Point(s) associated with those layers. Material shall not be placed over a layer with moisture content exceeding 90% of the laboratory optimum moisture content as determined by AS 1289.5.2.1 or that has become rutted or mixed with foreign matter.

Base, subbase and select materials, when delivered, shall have a moisture content within  $\pm 2\%$  of the Modified optimum moisture content.

The material shall be spread in uniform layers as near as practicable to the required thickness by direct tipping from suitable vehicles or by the use of a mechanical spreader. Segregation of material during tipping and spreading shall be minimised. If material becomes segregated it shall be remixed to produce a non-segregated material.

#### **(ii) Compaction and Finishing**

Layers of base, subbase and select material shall be not less than 100mm in compacted thickness. Maximum layer thickness shall be limited to that which will allow compaction to specified densities by the equipment in use. Where a course of a particular material is composed of several layers they shall be of approximately equal thickness within these limits.

During compaction, the moisture content of pavement materials shall be maintained in the range specified above for delivery. Water spraying equipment used for this purpose shall be capable of uniformly distributing water in controlled quantities over uniform widths.

On sections of pavement with one-way crossfall, compaction shall begin at the low side of the pavement and progress to the high side. On crowned sections, compaction shall begin at the sides of the pavement and progress towards the crown. Each coverage of the rollers shall be approximately parallel with the centreline of the roadway and uniformly overlap each preceding coverage. The outer metre of both sides of the pavement shall receive at least two more coverages by the compaction plant than the remainder of the pavement.

Surfaces of base material (i.e. surfaces to receive a bituminous surfacing) shall be constructed slightly higher than the specified levels and cut to profile by power grader or trimming machine towards the end of the compaction process. Rolling shall then continue to produce the specified density and a tight, even surface without loose stones or a slurry of fines. Cuttings from the surface may be used to a maximum depth of 50mm in the bottoms of adjoining layers of base material subject to non-contamination by other materials.

#### **(iii) Matching to Existing Pavements**

Unless specified otherwise, where the pavement is to be joined to an existing pavement, remove a strip of the existing pavement at least 300mm wide for its full depth and trim the edge to an angle of approximately  $45^\circ$  in steps of maximum height 150mm before placing new pavement material. If the existing pavement has a bituminous surface, trim the bituminous surface to a neat edge using a saw cut, pneumatic tools or other suitable means.

### **4.03.4 Conformance Criteria**

#### **(i) Compaction Conformance**

Base course material and subbase material shall be compacted to the Modified maximum dry density (AS 1289 5.2.1). Listed in Table 4.7.

**Table 4.7**

<b>Traffic Category (from Table 4.1)</b>	<b>Minimum compaction for base (MMDD)</b>	<b>Minimum compaction for sub-base (MMDD)</b>
1	100%	95%
2a	99%	95%
2b	99%	95%
2c	98%	95%
2d	98%	95%
Cycleways	97%	95%

Select material shall be compacted to at least 95% of Modified maximum dry density (AS 1289 5.2.1).

Where material is being placed which is not suitable for testing by standard laboratory methods, then compaction operations shall be carried out in a manner to satisfy conformance criteria. The Contractor may submit a method statement for compaction which may negate the requirement for testing subject to approval by the Superintendent.

Unless otherwise specified a single probe Nuclear Surface-Moisture Density Gauge may be used in direct transmission mode in accordance with AS 1289.5.8.1 to measure the insitu density and moisture content during these compaction operations.

The Superintendent may require the Contractor to perform rolling to demonstrate Compaction.

**(ii) Moisture Content**

Base, subbase and select material shall have a moisture content in the range of 60% - 90% of the laboratory optimum maximum moisture content as determined by AS 1289.5.2.1 when tested for compaction.

**(iii) Surface Tolerances**

On completion of placement, compaction and trimming, base, subbase and select material courses shall comply with the tolerances itemised in Table 4.8. Surface shape shall be such that water cannot accumulate at any point.

Each pavement layer is to be surveyed for level and thickness conformance.

Table 4.8

Item	Criteria	Tolerance
<b>Pavement layers:</b>		
Base	Surface Level:	$\pm 5\text{mm}$ If adjacent to concrete gutter $+ 10\text{mm}$ - 0mm If no gutter
	Thickness:	+ unspecified - 0 mm
	Straightness:	10mm maximum departure from 3m straightedge placed on the surface both parallel and perpendicular to the pavement centreline
Subbase & base	Thickness:	+ unspecified - 10mm
Select Material	Thickness	+ unspecified - 20mm
Total Pavement Layers over subgrade	Thickness:	+ unspecified - 10mm if select material is absent - 15mm if pavement includes select material
<b>Pavement width:</b>		
Width of pavement	Design centre line to pavement edge	- 50mm + 300mm from dimensions specified
	Average	Average width from three (3) random locations to be not less than the dimension specified

Where pavement abuts a gutter, the surface level at the edge shall be within  $\pm 5\text{mm}$  of the actual concrete level where sealing is specified or such lower level as is necessary to accommodate the specified thickness of asphalt surfacing.

#### (iv) Sampling and Testing

##### (a) Procedures

All sampling and testing of materials supplied and work carried out on base, subbase and select material shall be performed in accordance with the relevant Australian Standards or as otherwise specified by a NATA registered testing Authority registered for that test.

Sampling and testing shall be based on representative homogenous lots or discrete work areas. The Superintendent shall have the right to reject a lot which is non-homogeneous and/or non-representative.

The specified sampling and testing shall be taken at the random test locations established in each lot in accordance with the specified minimum testing frequency in Table 4.9. Prior to testing the Contractor shall work the lot to ensure uniform moisture content and compaction of all material within the lot.

The test/s then taken shall be considered to represent the total volume of material placed within the lot.

## (b) Materials

Testing of base, subbase and select materials will normally be performed on samples taken at the time of delivery to the site and after placement and compaction in the pavement. However, the properties specified and conformance are applicable to the materials in their final condition in the pavement. Conformance based on samples taken prior to placement and compaction of the pavement is dependent on no significant change in properties due to handling, compaction, segregation or contamination during subsequent pavement works.

## (c) Compaction

No lot is to be tested until adequate compactive effort has been applied. Sections with obvious defects, such as soft or loose patches or roller marks, must not be included in any lot tested for conformance.

The compaction requirements for lot conformance specified are minimum requirements.

When density tests are carried out on a lot, the number of results falling below the specified value shall not exceed the limits set out in Table 4.9.

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**Table 4.9**


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Number of Tests in the lot	Max No. of Results 0-2% below specified minimum	Max No. of Results 1-2% below specified minimum	Max No. of Results more than 2% below specified minimum
1-2	Nil	Nil	Nil
3-5	1	1	Nil
6-10	2	1	Nil
> 10	20%	10%	Nil

## (d) Frequency of Testing

The frequency of testing shall be appropriate to verify conformity and shall not be less than that stated in Table 4.10 unless otherwise approved by the Superintendent. Where no minimum frequency of inspection or testing is stated, the Contractor shall nominate appropriate frequencies in their Inspection and Test Plan(s).

The Contractor shall include in the management review of the Quality System, a review of the appropriateness of the frequency of testing nominated in the Inspection and Test Plan(s). Such review shall take into account the frequency of nonconformance detected, including nonconformance remedied by simple reworking.

Table 4.10

Clause	Characteristic Analysed	Test Method	Minimum Frequency Of Testing
<b>Materials - Base and Subbase</b>			
4.03.2(i); 4.03.2(ii); Table 4.3;Table 4.4	Coarse Particle Distribution	AS 1289.3.6.1	One (1) test per 1,000t or lot of material whichever is greater
4.03.2(i); 4.03.2(ii); Table 4.3;Table 4.4	Fine Particle Distribution	AS 1289.3.6.3	One (1) test per 1,000t or lot of material whichever is greater
4.03.2(i); 4.03.2(ii); Table 4.3;Table 4.4	Liquid Limit	AS 1289.3.1.1	One (1) test per 1,000t or lot of material whichever is greater
4.03.2(i); 4.03.2(ii); Table 4.3;Table 4.4	Plastic Limit (PI)	AS1289.3.3.1	One (1) test per 1,000t or lot of material whichever is greater
4.03.2(i); 4.03.2(ii); Table 4.3;Table 4.4	Particle Shape	AS1141.14	One (1) test per 1,000t or lot of material whichever is greater
4.03.2(i); 4.03.2(ii); Table 4.3;Table 4.4	Aggregate Wet Strength	AS1141.22	One (1) test per 5,000t or lot of material whichever is greater
4.03.2(i); 4.03.2(ii); Table 4.3;Table 4.4	Wet/Dry Variation	AS1141.22	One (1) test per 5,000t or lot of material whichever is greater
4.03.2(i); 4.03.2(ii); Table 4.3;Table 4.4	Foreign Materials Content <sup>ix</sup>	RTA T276	One (1) test per 1,000t or lot of material whichever is greater
<b>Materials - Select Material</b>			
4.03.2(iii); Table 4.5; Table 4.6	Liquid Limit	AS1289.3.1.1	Three (3) tests per source or One (1) test per 500t whichever is greater
4.03.2(iii); Table 4.5; Table 4.6	Plastic Limit (PI)	AS1289.3.3.1	Three (3) tests per source or One (1) test per 500t whichever is greater
4.03.2(iii); Table 4.5; Table 4.6	Linear shrinkage	AS1289.3.4.1	Three (3) tests per source or One (1) test per 500t whichever is greater
4.03.2(iii); Table 4.5; Table 4.6	Fine Particle Distribution	AS1289.3.6.3	Three (3) tests per source or One (1) test per 500t whichever is greater
4.03.2(iii); Table 4.5; Table 4.6	Foreign Materials Content	RTA T276	One (1) test per 1,000t
4.03.2(iii); Table 4.5; Table 4.6	4 day soaked CBR	AS1289.6.1.1	Three (3) tests per source or One (1) test per 500t whichever is greater

<b>Layer Properties</b>			
4.03.3(ii); 4.03.4(i); Table 4.8	Compaction and moisture content of base, subbase and select material	AS 1289.5.2.1; AS 1289.5.4.1	Ten (10) tests per 5,000 m <sup>2</sup> or three (3) tests per lot whichever is greater (i)
4.03.4(ii); Table 4.7	Surface Level and layer thickness	Survey	One (1) survey point per 25m <sup>2</sup>
4.03.4(ii); Table 4.7	Surface trim	Deviation from 3m straight edge	Ten (10) tests per 200m length or part thereof
4.03.4(ii); Table 4.7	Layer Width	Measure	One (1) test per 200m length or part thereof

*Notes on Table 4.10*

(i) For small lots the number of compaction tests may be reduced as approved by the Superintendent

#### **Hold Point 4.2**

Process Held: Placement of overlaying base, subbase or select material layers.

Submission Details: At least one (1) day before proposed overlay of base, subbase or select material layers the Contractor shall submit all test and survey results demonstrating conformance of the layer for material properties, compaction, level, surface trim and width.

Release of Hold Point: The Superintendent will consider the submitted documents and may carry out surveillance and audit, prior to authorising the release of the Hold Point.

#### **(v) Nonconforming work**

All nonconforming work shall be the subject of a nonconformance report. Work shall not proceed on any lot or material placed over any lot that is nonconforming. Work may only proceed subject to approval of the disposition of the nonconformance by the Superintendent.

- (a) Nonconforming Material  
Nonconforming material shall be removed and replaced
- (b) Nonconforming Compaction Results

Where a lot is nonconforming on the basis of inadequate compaction further compactive effort shall be applied to the section or nominated parts of the section until the specified standard is achieved. If the moisture content varies outside the specified limits, add water or allow to dry as necessary. Unless otherwise permitted, mix mechanically for the full depth of the layer to ensure uniform distribution of moisture before commencing rolling.

## (c) Nonconforming Moisture Content

Lots with nonconforming moisture content shall be scarified to the full layer depth and the moisture content rectified by addition of water or drying out prior to compaction as specified.

## (d) Nonconforming Levels

The disposition for nonconforming levels shall generally be as follows:

- High areas to be graded off.
- Low areas to be scarified to the full layer depth, built up with conforming material as necessary and recompact as specified.

## (e) Nonconforming layer thickness

The disposition for nonconforming layer thickness shall generally be as follows:

- Under thick layers shall be scarified to the full layer depth and additional conforming material added before compaction as specified.
- Over thick layers shall be trimmed to the specified thickness.

**Hold Point 4.3**

Process Held:	Placement of overlaying pavement layers over nonconforming work area.
Submission Details:	All test / survey results demonstrating conformance of nonconforming work repair.
Release of Hold Point:	The Superintendent will consider the submitted documents and may carry out surveillance and audit, prior to authorising the release of the Hold Point.

**4.03.5 Opening of Base, Subbase and Select Material Layers to Traffic**

Unless otherwise specified, the pavement shall not be opened to traffic other than construction traffic, until the specified bituminous surfacing has been completed. If the pavement is to be opened before completion, it shall be surfaced first with a suitable temporary seal or primerseal.

**4.04 PRIMING, PRIMERSEALING AND SEALING****4.04.1 Scope**

This Section covers the requirements for priming, primersealing and sealing with bituminous materials. The requirements relate to quality of bituminous and aggregate materials, cleaning of the surface to be treated, supply, delivery and application of bituminous materials and aggregates and conformance criteria. Types of work, materials and nominal rates of application shall be as specified in Clause 4.04.8, the drawings and/or the relevant Pay Items.

The scope of this Section of the Specification excludes priming, primersealing and sealing using polymer modified or emulsion binders.

**4.04.2 Definitions**

PRIMING:	The application of primer to a pavement.
PRIMER:	A field or refinery cutback bitumen used, without aggregate, to provide penetration of the surface (preferably from 5 mm to 10 mm) and waterproofing
PRIMERSEALING:	The application of primerbinder to a pavement and the covering of the primerbinder with aggregate.
PRIMERBINDER:	A field or refinery cutback bitumen used, with a cover of aggregate, to provide surface penetration (preferably from 2 mm to 5 mm) and a trafficable wearing surface.
SEALING:	The application of bituminous binder to a pavement and the covering of the binder with aggregate. Includes resealing
CUTTING BACK:	The addition of cutter to bitumen.
FLUXING:	The addition of flux oil to bitumen.
BINDER:	Bitumen or bitumen fluxed and/or cutback.
PMB:	Polymer Modified Binder, which is bitumen modified with a polymer.
RESIDUAL BINDER:	Binder which includes bitumen and flux oil but not cutter or other additives. In the case of bitumen emulsion, it is binder that remains after water has separated.

**4.04.3 Materials****(i) Supply**

Any offer to supply a material that is subject to approval by the Superintendent or which does not comply with the requirements of Clause 4.04.3(ii) to 4.04.3(x) inclusive shall be accompanied by a statement setting out the properties of the material.

Sampling and testing of materials shall be arranged by the Contractor and carried out by a laboratory with appropriate NATA registration in accordance with the relevant material requirements set out in this Specification. Test results shall be reported on NATA endorsed test documents.

The Supplier shall provide the following details with each delivery or lot of primer, primerbinder, bitumen, cutter, flux oil, adhesion agent and aggregate:

- Name of the manufacturer and supplier;
- Product name or trade name or number (if any);
- Batch or lot number;
- Copy of the certificate of compliance, in accordance with the requirements of this Specification;
- Documentary evidence that the delivery procedures in this Specification have been complied with for that delivery;
- If delivered in road tankers, the date of loading at refinery, any intermediate delivery site, loading temperature; and
- For bitumen or cutback bitumen delivered in road tankers, the loading and delivery temperatures.

Deliveries of bitumen and refinery produced primer and primerbinder shall be made in road tankers.

Deliveries of cutter or flux oil shall be made in either 205 litre capacity returnable steel drums of the bung type or road tankers.

As part of their Quality System, the Supplier shall implement delivery procedures to ensure that all containers and road tankers are clean and free from any deleterious material prior to filling with cutter or flux oil. In the case of bitumen, the containers and road tankers shall be free from any material (including volatile hydrocarbons and cutback bitumen) that could alter the properties of the bitumen.

The delivery procedures shall include periodic auditing at the point of delivery and periodic sampling from containers to verify compliance with the requirements of this Specification.

If adequate delivery procedures for materials are not maintained, the Supplier shall take samples, for testing, at the point of delivery to verify that each delivery complies with the requirements of this Specification.

Each container of cutter or flux oil shall be marked clearly and durably with the following information:

- Name of the manufacturer and supplier;
- Product name or trade name or number (if any);
- Refinery batch number;
- Identification of the material as Cutter, Fast Evaporating Cutter or Flux Oil.
- Batch number or date of manufacture.

The primer, primerbinder, bitumen, cutter and flux oil materials shall not contain any known component that, when handled according to approved road making practice (NAASRA Bitumen Sealing Safety Guide), will cause any person to be exposed to any injurious substance above the legal limit concentration. A "Materials Safety Data Sheet" shall be supplied with such materials.

Delivery of aggregate shall be made into designated stockpiles.

Before aggregate is used in the Works, the Contractor shall provide the Superintendent with details of each nominal size and class of aggregate proposed together with a Certificate no older than three (3) months from a laboratory, with appropriate NATA registration, stating that the aggregate meets the requirements of this Specification together with:

- Source and geological type of the rock from which the aggregate was produced;
- Relevant test results verifying material properties required by this Specification;
- Plant and methods of winning and manufacturing the materials; and
- Evidence that the source and methods proposed are adequate for the required quantity and quality of aggregate required for the Works.

#### **Hold Point 4.4**

Process Held:	Delivery of materials for priming, primersealing or sealing to be used in the works.
Submission Details:	At least three (3) working days prior to proposed priming, primersealing or sealing the Contractor shall submit all test results demonstrating conformance of the materials proposed.
Release of Hold Point:	The Superintendent will consider the submitted documents and may carry out sampling, testing and audit, prior to authorising the release of the Hold Point.

**(ii) Primer**

The primer Classification shall be as specified or designed by the Contractor in accordance with the requirements of this Specification and approved by the Superintendent and the material used shall be one corresponding to the appropriate Classification given in Tables 4.11, 4.12 or 4.13.

- (a) Medium curing cutback bitumen primer shall comply with the requirements of Australian Standard 2157 - Cutback Bitumen. The grade of cutback bitumen shall be in accordance with Table 4.11.

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**Table 4.11**


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<b>Cutback Bitumen Primer</b>	
<b>Primer Classification</b>	<b>Grade of Cutback Bitumen</b>
Light	AMC 00
Medium	AMC 0
Heavy	AMC 1

- (b) Proprietary grades of special cutback bitumen primer may be used provided that the Superintendent approves the proprietary product. The viscosity of the primer shall be in accordance with Table 4.12.

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**Table 4.12**


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<b>Proprietary Grade Primer Classification</b>	
<b>Primer Classification</b>	<b>Viscosity at 600C (Pa.s)</b>
Light	0.008 - 0.016
Medium	0.025-0.05
Heavy	0.06-0.012

- (c) Field produced cutback bitumen primer manufactured by blending Class 170 bitumen, flux oil and cutter shall be in accordance with Table 4.13.
- Field produced cut-back bitumen with flux oil shall only be used where specified or where proposed by the Contractor and approved by the Superintendent.

**Table 4.13**

<b>Field Produced Cutback</b>			
<b>Primerbinder Classification</b>	<b>Class 170 Bitumen</b>	<b>Bitumen (Parts by Volume at 15° C)</b>	
		<b>Flux Oil</b>	<b>Cutter</b>
Very Light	100	60	80
Light	100	60	50
Medium	100	45	35
Heavy	100	30	25

**(iii) Primerbinder**

The primerbinder Classification shall be as specified or designed by the Contractor in accordance with the requirements of this Specification and approved by the Superintendent and the material used shall be one corresponding to the appropriate Classification given in Tables 4.14 or 4.15 or Sub-clause 4.04.3(iii) (c).

- (a) Proprietary grades of special cutback bitumen, provided that the Superintendent approves the proprietary product, shall be in accordance with Table 4.14.

**Table 4.14**

<b>Proprietary Grades of Special Cutback Bitumen</b>		
<b>Primerbinder Classification</b>	<b>Viscosity at 60° (Pa.S)</b>	<b>Residue from Distillation to 360° C % (by volume/min)</b>
AMC4 (Light/medium)	2.0-4.0	79
AMC5 (Heavy)	5.5-11.0	88

- (b) Primerbinder may be field produced cutback bitumen manufactured by blending Class 170 bitumen and cutter shall be in accordance with Table 4.15.

**Table 4.15**

<b>Field Produced Primerbinder</b>			
<b>Primerbinder Classification</b>	<b>Class 170 Bitumen</b>	<b>Flux Oil (Parts by Volume at 15° C)</b>	<b>Cutter (Parts by Volume at 15° C)</b>
Light	100	0	25
Medium	100	0	20
Heavy	100	0	5

Adhesion agent if specified or required shall be added to field produced primerbinder in the proportion of one part by volume of adhesion agent per 100 parts of bitumen measured at 150C.

- (c) Bitumen emulsion of Grade ARS or CRS manufactured from Class 170 bitumen shall comply with the requirements of AS 1160 - Bitumen Emulsion for Construction and Maintenance of Pavements.

**(iv) Bitumen**

Bitumen shall be classified in accordance with Table 1 of AS 2008 or on the basis of viscosity at 60°C after the Rolling Thin Film procedure as shown in Table 4.16. Bitumen with a double class descriptor viz. AR600/170 and AR1000/320 may be described as "multigrade".

**Table 4.16**

Classification of Bitumen	
Class	VISCOSITY AT 60°C Pa. S
AR600/170	1400 to 2000
AR320	600 to 1000
AR1000/320	3500 to 5000

Bitumen Class 170 shall comply with the requirements of AS 2008, with the additional requirement that the minimum time to reach the specified apparent viscosity level shall be 9 days when tested in accordance with AS 2341 Section 13 - Determination of Durability of Bitumen.

Bitumen classed as AR600/170, AR320 or AR1000/320 shall comply with the requirements given in Table 4.17

Table 4.17

Properties of Bitumen for Pavements					
Test Method	Test Description	Units	Class		
			AR600/170	AR320	AR1000/320
AS 2341.2; AS 2341.10	Viscosity at 60°C after RTFO	Pa.s	1400-2000	600-1000	3500-5000
AS 2341.12; AS 2341.10	Penetration at 25°C after RTFO	10 <sup>-4</sup> m	43 min	28 min	28 min
AS 2341.3	Viscosity at 135°C	Pa.s	0.85 max	-	-
AS 2341.3; AS 2341.10	Viscosity at 135°C after RTFO	Pa.s	-	1.1 max	2.8 max
RTA T511	Mass loss 1.5 mm 163°C 5 hour	%	0.6 max	0.6 max	0.6 max
RTA T740	Segregation 72 hour 163°C		Pass	Pass	Pass
AS 2341.14	Flash Point (open cup)	°C	250 min	250 min	250 min
AS 2341.8	Matter Insoluble in toluene	%	1 max	1 max	1 max
AS 2341.11; AS 2341.10	Ductility at 15°C after RTFO	mm	Report	Report	Report
AS 2341.7	Density at 15°C	kgL <sup>-1</sup>	Report	Report	Report
AS 2341.2	Viscosity at 60°C	Pa.s	Report	Report	Report

Notes on Table 4.17:

- (i) AS 2341.4 may be used in place of AS 2341.2 or AS 2341.3. AS 2341.4 includes Thermosel only at 135°C.
- (ii) The conditions of AS 2341.12 shall be 5 seconds, 100g at 25°C.
- (iii) Instead of RTA T511 an RTFO bottle (AS 2341.10) may be weighed at ambient temperature, before and after exposure.
- (iv) AS 2341.20 may be used in place of AS 2341.8.
- (v) No compliance criteria where "Report" is specified, test and report results only.

**(v) Flux Oil**

Flux oil shall be diesel fuel oil, automotive distillate or similar product complying with the requirements of Table 4.18.

**Table 4.18**

Properties of Flux Oil			
Test Method	Test Description	Units	Limits
AS 2341.2 (ii)	Viscosity at 60°C	Pa.s	0.4 to 0.8
AS 2341.7	Density 15°C	kg l <sup>-1</sup>	0.975 to 1.05
AS 2341.10	Mass Loss ROTFO	%	2 max
AS 2341.10 AS 2341.2 (ii)	Viscosity Ratio after RTFO		1.5 max
AS 2341.14	Flash Point	°C	220 min

*Notes on Table 4.18*

- (i) *This material conforms to Class RA 5 of ASTM D4552.*
- (ii) *Tests AS 2341.3 and AS 2341.4 are permissible alternatives (at 60°C). A viscosity range of 35 to 65 cst at 100°C may be substituted by agreement between supplier and purchaser.*

The Supplier shall provide a certificate of compliance verifying that the flux oil complies with the requirements of this Specification, together with test results for all tests reported on NATA endorsed test documents. The certification shall relate only to the formulation on which the tests were made and must be less than five (5) years old.

**(vi) Cutter**

Cutter shall be kerosene or other similar product approved by the Superintendent with an Abel flash point of not less than 38°C and a viscosity at 40°C of not greater than 2.0 millipascal seconds and complying with the requirements for its classification given in AS 3568 Table 1 with the following qualifications:

- Either "Aniline point" or "Aromatic content" is acceptable.
- (b) There shall be no "Density" requirement.
- The presence of water, assessed visually as an immiscible phase in any sample of the material shall be grounds for its rejection. AS/NZS 2341.9 shall not be demanded as a referee test if more than 0.1% of liquid water is found by decanting in any delivery or batch.
- If the viscosity is calculated by the equation given in Table 1 Note 3 of AS 3568, "f" shall be taken to be 0.0009 per °C.
- Fast evaporating cutter oil shall have a final boiling point no greater than 185°C.

The Supplier shall provide a certificate of compliance verifying that the cutter or flux oil complies with the requirements of this Specification, together with test results for all tests reported on NATA endorsed test documents. The certification shall relate only to the formulation on which the tests were made and must be less than five (5) years old.

**(vii) Binder**

Binder for use in seal or reseal shall be the class of bitumen or grade of cutback bitumen specified or designed by the Contractor in accordance with the requirements of this Specification and approved by the Superintendent.

**(viii) Adhesion Agent**

Adhesion agent shall be subject to approval by the Superintendent.

The adhesion agent shall be homogeneous. Liquid adhesion agents after agitation and when ready for use shall remain free from skinning, precipitation or any other deterioration for 72 hours when tested in accordance with Test Method RTA T590.

When the adhesion agent is blended with the bitumen to be used in the Works at a concentration of 0.5% v/v, the amount stripped when assessed according to Test Method RTA T230 shall not be more than 10% for each aggregate type proposed for use in the Works when the aggregate is tested in the two surface conditions of dusty and saturated surface wet.

**(ix) Pre-coating Agent**

The pre-coating agent shall be bitumen, diesel fuel oil, distillate or tar based product or similar product approved by the Superintendent that is compatible with the sealing aggregate being used and enhances the adhesion between the bitumen and the aggregate. Diesoline containing 1% Megamine B.A. has proven satisfactory with ACT local aggregates.

The pre-coating agent after agitation and when ready for use shall be homogeneous and remain free from skinning precipitation or any other deterioration for 72 hours when tested in accordance with Test Method RTA T590.

When each aggregate type proposed for use in the Works is pre-coated with the pre-coating agent, the amount stripped when assessed according to Test Method RTA T230 shall not be more than 10% when the aggregate is tested in the four surface conditions of clean and dry, dusty, saturated surface dry and saturated surface wet condition.

**(x) Aggregates**

Aggregates shall conform to the requirements of AS 2758.2 for the nominal size and class as specified. They shall be crushed from hard, durable stone and be free of dust, excessive moisture and other deleterious substances.

Particle shape shall meet the requirements of AS 2758.2 Clause 8.2 (a) "Particle Shape".

Rock durability shall comply with the requirements of AS 2758.2 Clause 9.2 for Wet Strength and Wet/Dry Strength variations. Aggregate shall be Class A unless otherwise specified.

Unless otherwise specified or permitted, aggregates shall be delivered to site and stockpiled at least two weeks before commencement of primersealing or sealing operations.

Unless otherwise specified, aggregates shall have the minimum Polishing Aggregate Friction Value (PAFV) of 44. The PAFV shall be determined in accordance with the requirements of AS 1141.42.

**4.04.4 Plant**

The Contractor shall supply the necessary plant and equipment. All plant and equipment shall be in sound mechanical condition and shall be capable of constructing Works conforming to the requirements of this Specification.

The Contractor shall remove from the work any plant or equipment not fully operational or not in a satisfactory condition for carrying out work in accordance with this Specification.

The plant listed shall meet the requirements as specified.

**(i) Sprayers and Road Tankers**

A mechanical sprayer shall be used to apply primer, primerbinder and binder. Only sprayers that have been checked and calibrated by a State Road Authority and for which current spraying tables have been issued by the Authority shall be used. The spray nozzles shall be of the make and type endorsed on the Sprayer Certificate. Satisfactory nozzles of similar type shall be used in place of any nozzles that are damaged or unduly worn or defective. A sufficient number of spare nozzles for this purpose shall be available at all times.

Sprayers shall have a capacity of not less than 2000 L and shall be capable of spraying bituminous materials uniformly both transversely and longitudinally at rates of application and temperatures directed required in widths from 0.6m to 7.5m in increments of about 0.1 m.

Sprayers and road tankers shall be suitably insulated and fitted with heating equipment capable of maintaining and/or raising the temperature of the material. They shall be fitted with at least one thermometer capable of recording the temperature of the load and graduated at intervals of 2 Celsius degrees from 10°C to 230°C. The location of the element of the thermometer shall be near mid-length of the tank and such that the temperature of the load can be read when the tank is filled to one-third capacity or more. Sprayers and road tankers shall be equipped with a circulating system capable of thoroughly mixing all of the material in the tank at a rate of not less than 1000 L/min.

These requirements do not apply to road tankers used only for the cartage of materials that can be handled at ambient temperatures.

**(ii) Aggregate Loading Equipment**

Equipment for loading aggregates shall provide for screening and removal of undersize material during the loading operation except that the Superintendent may approve the use of other loading methods for aggregates to be used for primersealing and for gritting.

**4.04.5 Personnel**

Work shall not commence unless there are sufficient personnel present to carry out the work in accordance with the Specification.

**4.04.6 Preparation of Bituminous Materials****(i) Temperatures and Heating**

Except as otherwise provided in this Specification, the temperatures of bituminous materials shall not exceed the upper limits specified in Table 4.19 or 4.20 as applicable and, at the time of spraying, shall be within the range specified in that table. Higher temperatures will be permitted for freshly blended field produced cutback bitumen primer and primerbinder provided that the temperature of the bitumen prior to blending does not exceed 188°C and that the primer or primerbinder is not reheated to a temperature higher than that specified in Table 4.19.

**Table 4.19**

<b>Temperature Limits</b>		
	<b>Temperature °C</b>	
<b>Material</b>	<b>Minimum</b>	<b>Maximum</b>
Light primer	10	30
Medium primer	35	55
Heavy primer	60	80
Light medium cutback bitumen primerbinder	110	135
Heavy cutback bitumen primerbinder	120	150
Bitumen emulsion	-	60
Bitumen	172	188
Fluxed and/or cutback bitumen binder	See Table 4.19	See Table 4.19

Table 4.20

Spraying Temperatures of Fluxed and/or Cutback Bitumen Binder			
Cutter, Parts by Volume per 100 parts of Bitumen at 15°C	Flux Oil, Parts by Volume per 100 parts of Class 170 bitumen at 15°C		
	0	2	4
	Mean Temperature °C Range to be ± 80C from Mean		
0	180	177	173
2	177	173	170
4	173	170	167
6	170	167	165
8	167	165	162
10	165	162	160
12	162	160	157
14	160	157	155
16	157	155	152
18	155	152	150
20	152	150	148
22	150	148	146
24	148	146	144
26	146	144	142
28	144	142	140
30	142	140	138

Bituminous materials shall be continuously circulated at a rate of not less than 1000 l/min during heating. Circulation shall continue for at least 20 minutes after heating has stopped.

Bituminous materials shall not be heated at a rate in excess of 40°C per hour.

Bituminous materials shall not be reheated without the approval of the Superintendent.

#### (ii) Fluxing and Cutting Back of Bitumen

Fluxing and/or cutting back of binder in the field for priming, primersealing or sealing shall be done in the sprayer, located near the job site, and in the presence of the Superintendent. The proportions of flux oil and/or cutter shall be as nominated by the Contractor and agreed with the Superintendent prior to performance.

An adhesion agent may be added to the bitumen at a rate of one part by volume of adhesion agent per 200 parts of bitumen based on the volume of bitumen at 15°C.

The mixture shall be circulated in the sprayer tank at a rate of not less than 1000 L/min for a period of not less than 20 minutes after all materials have been added.

**(iii) Blending of Primer and Primerbinder**

Where primer or primerbinder is blended in a sprayer, road tanker or storage tanker the mixture shall be circulated at a rate of not less than 1000 L/min. After all materials have been added circulation shall continue for a period of at least 20 minutes per 5000 L of mixture.

**4.04.7 Preparation of Aggregates**

All sealing aggregates shall be pre-coated, with pre-coating material meeting the requirements of this Specification, in a manner and at a rate and time that will provide a complete, light, uniform, effective cover of pre-coating material on all aggregate particles at the time of spreading. Pre-coating shall occur a minimum of 2 days and no more than 4 weeks prior to spreading the aggregate. Pre-coated aggregate shall be stored to prevent contamination and reduction in effectiveness of pre-coat. Should contamination and reduction in effectiveness of the pre-coat occur, further pre-coating will be required.

Pre-coating material shall be applied thinly and evenly by means of a fine pressure spray to a moving stream of aggregate, or by other suitable means, so that all particles are fully coated but without excess material. Application rate shall be in the range 3 to 10 L/m<sup>3</sup> of aggregate.

When the pre-coating material is applied, the aggregate may be dry or damp but shall not contain sufficient moisture to cause uneven distribution of the pre-coating material on the aggregate. If the aggregate is too wet to pre-coat, the stockpile may be turned over until sufficiently dry to proceed with pre-coating. Pre-coating of aggregate shall not be carried out when rain is imminent. If aggregate has been pre-coated and rain appears imminent, the aggregate shall be adequately covered to prevent the pre-coating material being washed from the aggregate particles. The Contractor shall take precautions, such as covering stockpiles, to prevent settlement of dust, penetration of moisture or drying out of the pre-coating agent on the stockpiled aggregate. Aggregate that contains moisture at the time of pre-coating shall not be used on the work until the moisture has evaporated and the pre-coating material has adhered effectively to the aggregate.

**4.04.8 Rates of Application of Primer, Primerbinder, Binder and Aggregate**

Unless the specified otherwise, the Contractor shall design the priming, primersealing and sealing required for bituminous surfacing in accordance with the requirements of RTA Form 395, 359B, 395C or 395D as appropriate. Design application rates shall be known as "nominated application rates" and materials as "nominated materials".

At least five (5) working days before commencing sprayed bituminous surfacing work, the Contractor shall submit to the Superintendent for approval:

- (a) Details of the proposed bituminous surfacing design for the work;
- (b) Certification that the nominated materials for the work meet the requirements of the Specification;
- (c) Test results for all nominated materials;
- (d) Aggregate source, geological type, nominated grading, average least dimension (ALD);
- (e) Pre-coating agent and bitumen adhesion agent including types, proportions and manufacturer (if applicable);
- (f) Bitumen refinery source and certification of compliance with AS 2008 and/or this Specification; and
- (g) Cutback bitumen refinery source of bitumen, type of cutter, source of cutter, cutter oil fraction, certification of compliance with AS 2157 or AS 2008 as appropriate and/or this Specification.

Rates of application of primer, primerbinder, binder and aggregate will be approved by the Superintendent having regard to pavement conditions, weather conditions and measured aggregate size.

All rates of application of primer, primerbinder and binder shall be expressed in terms of volume at 15°C per unit area L/m<sup>2</sup>. In the case of binder, rates of application refer to residual binder. Where it is necessary to apply correction factors for temperatures other than 15°C, the appropriate multiplier from Table 4.22 or 4.23 shall be used. Nominated and target application rates for binder shall not include any bitumen adhesion agent and/or cutter oil. If flux oil has been added to the binder, the quantity of flux oil shall be included as part of the binder.

Where bitumen adhesion agent and/or cutter oil have been added to the binder, the application rate of the total binder at 15°C shall be adjusted to allow for the quantities of bitumen adhesion agent and/or cutter oil in the mixture.

### Hold Point 4.5

Process Held: Design of bituminous surfacing to be used in the works.

Submission Details: At least two (2) working days prior to the proposed commencement of bituminous surfacing works the Contractor shall submit all designs on the appropriate RTA Forms, test result, certificates and other documentation that demonstrate conformance with the Specification requirements.

Release of Hold Point: The Superintendent will consider the submitted documents and may carry out calculations and audit, prior to authorising the release of the Hold Point.

The Contractor shall determine the hot application rate of total primer, primerbinder or binder, including bitumen adhesion agent and/or cutter oil, using RTA Form 382.

Where refinery cutback bitumen is used as the binder, the target application rate of binder shall be increased by the Contractor to allow for the cutter oil in the mixture, in accordance with Table 4.21.

**Table 4.21**

Adjustment of Refinery Cutback Bitumen Binder				
Grade of Refinery Cutback Bitumen	Approx. Amount of Cutter Oil in Grade (%)	Increase to Target Application Rate (%)	Permissible Ranges of Pavement Temperature (°C) Aggregate Pre-coated	
			No moisture on Aggregate	Moisture on Aggregate
AMC4	16	19	-	10 - 15
AMC5	11	12	12 - 17	17 - 28
AMC6	7	8	22 - 27	27 - 38
AMC7	3	3	32 - 37	37 - 48

Table 4.22

Volume Correction - Bitumen Emulsion			
Multiplier for Converting Volume at temperature above 15°C to Volume at 15°C		Multiplier for Converting Volume at 15°C to Volume at temperature above 15°C	
Temperature °C	Multiplier	Temperature °C	Multiplier
15	1.0000	15	1.0000
20	0.9980	20	1.0020
25	0.9956	25	1.0043
30	0.9935	30	1.0065
35	0.9915	35	1.0088
40	0.9890	40	1.0111
45	0.9868	45	1.0134
50	0.9845	50	1.0157
55	0.9823	55	1.0181
60	0.9800	60	1.0204
65	0.9778	65	1.0223
70	0.9755	70	1.0251

Table 4.23

Volume Correction - Bitumen											
Multiplier for Converting Volume at Temperature above 15°C to Volume at 15°C						Multiplier for Converting Volume at 15°C to Volume at Temperature above 15°C					
Temp °C	Multiplier	Temp °C	Multiplier	Temp °C	Multiplier	Temp °C	Multiplier	Temp °C	Multiplier	Temp °C	Multiplier
15	1.0000	90	0.9536	170	0.9060	15	1.0000	90	1.0487	170	1.1038
		92	0.9524	172	0.9048			92	1.0500	172	1.1052
		94	0.9512	174	0.9037			94	1.0513	174	1.1066
16	0.9994	96	0.9500	176	0.9025	16	1.0006	96	1.0526	176	1.1080
18	0.9981	98	0.9488	178	0.9014	18	1.0019	98	1.0540	178	1.1094
20	0.9959	100	0.9476	180	0.90002	20	1.0031	100	1.0553	180	1.1109
22	0.9956	102	0.9464	182	0.8990	22	1.0044	102	1.0566	182	1.1123
24	0.9943	104	0.9452	184	0.8979	24	1.0057	104	1.0580	184	1.1137
26	0.9931	106	0.9440			26	1.0069	106	1.0593		
28	0.9918	108	0.9428			28	1.0083	108	1.0607		
30	0.9906	110	0.9416	185	0.8973	30	1.0095	110	1.0620	185	1.1144
32	0.9894	112	0.9404			32	1.0107	112	1.0634		
34	0.9881	114	0.9391			34	1.0120	114	1.0648		
36	0.9869	116	0.9379	186	0.8967	36	1.0133	116	1.0662	186	1.1152
38	0.9856	118	0.9368	188	0.8956	38	1.0146	118	1.0675	188	1.1166
40	0.9844	120	0.9356	190	0.8944	40	1.0158	120	1.0688	190	1.1181
42	0.9832	122	0.9344	192	0.8932	42	1.0171	122	1.0702	192	1.1196
44	0.9819	124	0.9332	194	0.8921	44	1.0184	124	1.0716	194	1.1210
46	0.9807	126	0.9302	196	0.8909	46	1.0197	126	1.0730	196	1.1225
48	0.9794	128	0.9308	198	0.8898	48	1.0210	128	1.0743	198	1.1238

Table 4.23 (continued)

Volume Correction - Bitumen											
Multiplier for Converting Volume at Temperature above 15°C						Multiplier for Converting Volume at 15°C					
Temp °C	Multiplier	Temp °C	Multiplier	Temp °C	Multiplier	Temp °C	Multiplier	Temp °C	Multiplier	Temp °C	Multiplier
50	0.9782	130	0.9296	200	0.8886	50	1.0223	130	1.0757	200	1.1254
52	0.9770	132	0.9284	202	0.8874	52	1.0235	132	1.0771	202	1.1269
54	0.9757	134	0.9272	204	0.8863	54	1.0249	134	1.0785	204	1.1283
56	0.9745	136	0.9260	206	0.8851	56	1.0262	136	1.0799	206	1.1298
58	0.9732	138	0.9248	208	0.8840	58	1.0275	138	1.0813	208	1.1312
60	0.9720	140	0.9236	210	0.8829	60	1.0288	140	1.0827	210	1.1326
62	0.9708	142	0.9224	212	0.8817	62	1.0301	142	1.0841	212	1.1342
64	0.9695	144	0.9213	214	0.8806	64	1.0315	144	1.0854	214	1.1356
66	0.9683	146	0.9201	216	0.8794	66	1.0327	146	1.0868	216	1.1371
68	0.9670	148	0.9189	218	0.8783	68	1.0341	148	1.0883	218	1.1386
70	0.9658	150	0.9177	220	0.8772	70	1.0354	150	1.0897	220	1.1400
72	0.9646	152	0.9165	222	0.8760	72	1.0367	152	1.0911	222	1.1416
74	0.9634	154	0.9154	224	0.8749	74	1.0380	154	1.0924	224	1.1430
76	0.9622	156	0.9142	226	0.8737	76	1.0393	156	1.0939	226	1.1446
78	0.9609	158	0.9130	228	0.8726	78	1.0407	158	1.0953	228	1.1460
80	0.9597	160	0.9118	230	0.8715	80	1.0420	160	1.0967	230	1.1474
82	0.9585	162	0.9106	232	0.8704	82	1.0433	162	1.0982	232	1.1489
84	0.9573	164	0.9095	234	0.8693	84	1.0446	164	1.0995	234	1.1504
86	0.9561	166	0.9083	236	0.8681	86	1.0459	166	1.1010	236	1.1519
88	0.9548	168	0.9072	238	0.8670	88	1.0473	168	1.1023	238	1.1534

**4.04.9 Preliminary Work**

The Contractor shall take all necessary steps to avoid or minimise delays and inconvenience to road users during the course of the work. Where adequate detours or sidetracks are included in the Contract or are otherwise available, traffic shall be temporarily diverted while the work is in progress.

If facilities for the diversion of traffic are not available, the Contractor shall spray part width of the pavement in the one operation and make available to traffic the adjacent strip of roadway, except during the actual spraying operation when all traffic movement through the work area shall cease. Traffic shall not be permitted to encroach upon any of the sprayed bituminous material until such time as it is covered with aggregate.

The surface to be sprayed shall be swept clean and free of dust, dirt, clay and deleterious materials. Sweeping shall be done using a rotary road broom, hand broom or other means approved by the Superintendent. The Superintendent may require that concrete shall be cleaned using compressed air or high pressure water jets.

**4.04.10 Conditions For Spraying****(i) Pavement**

The surface on which primer or binder is to be applied shall be dry. The surface on which primerbinder is to be applied shall be damp.

**(ii) Ambient Temperature**

Unless otherwise approved by the Superintendent, spraying shall not be carried out when the road temperature is less than that specified in Table 4.24.

**Table 4.24**

<b>Road Temperature for Priming, Primersealing or Sealing</b>	
<b>Type of Work</b>	<b>Road Temperature °C (minimum)</b>
Priming	10
Primersealing	10 (i)
Sealing	15

*Notes on Table 4.24*

- (i) *Primersealing may be carried out when the road temperature is between 10 °C and 15 °C only if the work is so arranged that the aggregate is applied to the primerbinder within ten (10) minutes of spraying.*

**4.04.11 Spraying and Covering****(i) Review of Nominated Application Rates and Prepared Surface**

For primersealing and sealing, the Contractor shall select the locations where each lot of aggregate is to be incorporated in the Works.

The Contractor shall review the bituminous surfacing design at each location, in the case of sealing this shall be based on the actual ALD test result for the actual aggregate to be used instead of the ALD value of the nominated aggregate, using the appropriate RTA 395 design form. The revised application rates shall be known as “target application rates”.

Where nominated in the Contract the Contractor shall inspect the prepared surface to accept the sprayed bituminous surfacing together with the Superintendent. The works shall not proceed until the Contractor and Superintendent agree that the prepared surface is suitable for spraying to commence.

#### **Hold Point 4.6**

Process Held:	Sprayed bituminous surfacing work for each work location.
Submission Details:	At least one (1) working day prior to proposed sprayed bituminous surfacing works the Contractor shall submit primer, primerbinder, binder, aggregate lot details and target application rates and notification that the prepared surface to accept the sprayed bituminous surfacing is ready for inspection.
Release of Hold Point:	The Superintendent will consider the submitted documents, inspect the prepared surface and may carry out calculations and audit, prior to authorising the release of the Hold Point.

#### **(ii) Operation of sprayer**

Each sprayer shall, when spraying, be operated by a crew as endorsed on the spraying table issued by a State Road Authority.

The forward speed of the sprayer shall be in accordance with the current spraying table for the sprayer issued by the State Road Authority. Such table allows for the expansion of primer, primerbinder and binder when heated to spraying temperatures. The table does not allow for added cutter and the forward speed shall be adjusted in accordance with the procedures described on the spraying table to allow for any added cutter.

The appropriate number of nozzles for the width to be sprayed shall be determined from the spraying table. The correct type of end nozzles shall be fitted and all nozzles shall be correctly set.

Setting out of edges and/or centreline shall be undertaken by the Contractor. Where additional marks are required for the guidance of the sprayer they shall be provided by the Contractor using water-based paint or, on untreated surfaces, primer. Stones or other objects shall not be used as markers. Guideline marks shall be placed at about 10m intervals.

#### **(iii) Application of Primer, Primerbinder and Binder**

The Contractor shall carry out sprayed bituminous surfacing so as to:

- (a) provide a uniform application of primer, primerbinder or binder with adequate adhesion to the underlying surface;
- (b) provide a complete cover of interlocking aggregate particles (except for primes), and
- (c) achieve effective bond between binder and aggregate (except for primes).

The work shall be so planned as to minimise spraying by hand.

Each sprayer run shall overlap any adjacent run by 50mm.

Primed areas shall not be trafficked until the primer is sufficiently dry to avoid damage.

Except where the surface to be primed abuts an existing edging, structure or bituminous surface, the primer shall be applied at least 100 mm. wider than the width of the proposed sealing or asphalt to be placed thereon.

Spraying of any load of primerbinder or binder shall not commence unless sufficient aggregate to cover the area to be sprayed is at the work site in trucks ready for spreading and sufficient rollers are ready on site to roll the aggregate in accordance with the requirements of this Specification.

**(iv) Papering and Other Protection**

The Contractor shall lay sufficient paper at the start and finish of each sprayer run to ensure clean cut-on and cut-off. The paper shall be a minimum of Kraft 67 g/M<sup>2</sup> or an equivalent approved by the Superintendent.

Edgings and adjoining structures shall be protected by papering or by a method approved by the Superintendent and all necessary precautions shall be taken to protect traffic and parked vehicles. Raised pavement markers shall be protected by covers.

For primersealing and sealing, paper for cut-ons, cut-offs and protection of edgings and structures shall be held in place by weighting down with small quantities of aggregate from the same stockpile as used for the work.

For priming, paper for cut-ons, cut-offs and protection of edgings and structures shall be firmly secured so it remains in place during spraying.

Adjacent bituminous surfaces shall be protected by means of an effective end-shield or by covering at least 0.3m. of the surface with paper or grit.

After each day's work the Contractor shall remove from the site all paper and other protective materials.

**(v) Loading of Aggregates**

Aggregates shall be loaded into trucks by means of a loader complying with the requirements of Clause 4.04.4 (ii).

**(vi) Spreading and Incorporation of Aggregates**

Spreading of aggregates shall commence immediately after the start of spraying of the primerbinder or binder and shall continue without delay until all the primerbinder or binder has been covered. The surface shall be inspected and any bare areas shall be covered by hand brooming and/or spreading and any spillage or overlapping of aggregate shall be removed.

Spreading rates for aggregates shall be as specified or as set out in the Contractor's design approved by the Superintendent.

Only aggregate meeting the requirements of this Specification shall be used. For sealing the aggregate shall be pre-coated. Wet aggregate shall not be used.

The application of aggregate where required shall proceed after spraying of the binder has commenced and shall be completed within fifteen minutes of spraying bitumen or cutback bitumen.

The Contractor shall apply the aggregate of the specified nominal size and at the target aggregate application rate. Sufficient loaded and measured trucks of dry aggregate shall be at the site to provide full cover for the area to be sprayed prior to any spraying commencing.

The aggregate shall be spread uniformly over the sprayed surface by means of suitable mechanical spreading equipment.

Any areas bare or insufficiently covered with aggregate shall be covered by aggregate spread by a re-run of the mechanical spreader or spread by hand as necessary to give a uniform and complete coverage. Any aggregate spread in excess of the target aggregate application rate shall be removed before rolling is commenced.

**(vii) Gritting**

Where excess primer is applied and when directed by the Superintendent primed surfaces shall be gritted by the Contractor with clean sand or quarry dust and unless otherwise directed by the Superintendent at least two hours shall elapse between application of primer and grit.

**(viii) Rolling**

Rolling to incorporate the aggregate into primerbinder or binder shall commence as soon as practicable after the aggregates have been spread onto each section of the work .

The number of rollers to be used shall be at least one for each 10,000 m<sup>2</sup> or part thereof of primersealing or sealing to be done in one day.

Initial rolling shall be carried out with two or more dual axle smooth pneumatic tyred multi-wheel rollers of minimum load of one tonne per tyre and minimum tyre pressure of 550 kPa. Initial rolling shall continue until the aggregate is firmly embedded in the primerbinder or binder.

If the aggregate is not evenly distributed over the surface of the pavement, the surface shall be traversed with a light drag broom after the initial rolling. If the broom has any tendency to dislodge aggregate particles bedded in the primerbinder or binder, the Contractor shall defer or eliminate the drag brooming. Where drag brooming is eliminated, the Contractor shall substitute light hand brooming.

After initial rolling, the Contractor shall back-roll with the pneumatic tyred multi-wheel rollers for a minimum period of one hour per 1,000 square metres of primerseal or seal for roads having a traffic volume of less than 500 vehicles per lane per day and one hour per 1,500 square metres sprayed for other roads, up to a maximum of twenty-four hours after the aggregate has been applied.

**(ix) Drag Brooming**

When size 10 mm. or smaller aggregates are used, drag brooming shall be done in conjunction with rolling to ensure that a uniform distribution of aggregates is achieved. The operation of the drag broom and the duration of brooming shall be sufficient to ensure even distribution of aggregate.

**(x) Protection of Work**

The Contractor shall take all necessary precautions to protect the work from damage until such time as the new primerseal or seal coat has developed sufficient strength to carry normal traffic without disturbance of the aggregate. Where early use of the new primerseal or seal is needed to facilitate the movement of traffic, vehicles may be allowed to run on the work after initial rolling has taken place provided that vehicles are controlled to such slow speeds that no displacement of aggregate occurs. Where necessary, the Contractor shall use patrol vehicles to ensure that traffic travels at an acceptable speed.

**(xi) Work Records**

Particulars of the work performed shall be recorded by the Contractor on RTA Form 500A or 500C (as appropriate) or a similar bituminous surfacing daily record form. Details of primer, primerbinder, binder and aggregate applied and the application rates shall be recorded immediately after every sprayer run. Each form shall be signed by the Contractor's representative as a true record of the work performed. The Contractor shall supply to the Superintendent a copy of each completed form. Details of primer, primerbinder, binder and aggregate applied shall be recorded immediately after every sprayer run. Each form shall be signed by the Contractor's representative as a true record of the work performed. The Contractor shall supply to the Superintendent a copy of each completed form.

**4.04.12 Supervision**

The Contractor shall afford the Superintendent every facility to check rates of application, temperatures and quantities and to take samples.

**4.04.13 Conformance Criteria****(i) Sampling and Testing**

All sampling and testing of materials supplied and work carried out under this Clause of the Specification shall be performed in accordance with the relevant Australian Standards or as otherwise specified.

Work under this Clause of the Specification shall be subdivided into homogeneous lots of discrete material or discrete work areas. The Superintendent shall have the right to reject a lot that is considered non-homogeneous and/or non-representative.

The specified testing shall be taken at the random samples or test locations established in each lot in accordance with the specified minimum testing frequency in Table 4.24.

The samples and tests then taken shall be considered to represent the total volume of material or work within the lot.

When requested by the Superintendent the Contractor shall prepare and make available to the Superintendent three one litre samples of each prime, primerbinder, binder, cutter, flux oil, pre-coating material, adhesion agent or three 30kg samples of aggregate supplied under the Contract.

The Contractor shall not proceed or continue until tests on the samples requested have been performed and/or the Superintendent has given consent to proceed or continue, such consent not being unreasonably withheld.

Test results provided by the Contractor of refinery compliance testing may be accepted in lieu of the above subject to performance of testing to Australian Standards and/or other Test Methods given in this Specification..

Routine sampling and testing shall be performed in accordance with the procedures laid down in Australian Standards referred to in this Specification.

**(ii) Materials**

Testing of primer, primerbinder, binder, cutter, flux oil, adhesion agent, pre-coating material and related materials will normally be performed on samples taken at the point of manufacture. However, the properties specified and conformance is applicable to the materials in their final condition in the pavement. Samples for possible check and conformance testing should be taken at time of delivery to the site. Conformance based on testing at the point of manufacture is dependent on no significant change in properties due to heating, handling, segregation or contamination during subsequent pavement works.

Representative samples of aggregate for testing shall be taken from stockpiles at the quarry or work site in accordance with the requirement of AS 1141.3.1.

**(iii) Frequency of Testing**

The frequency of testing shall be appropriate to verify conformity and shall not be less than that stated in Table 4.24 unless approved otherwise by the Superintendent. Where no minimum frequency of inspection or testing is stated, the Contractor shall nominate appropriate frequencies in their Inspection and Test Plan(s).

The Contractor shall include in the management review of the Quality System, a review of the appropriateness of the frequency of testing nominated in the Inspection and Test Plan(s). Such review shall take into account the frequency of nonconformance detected, including nonconformance remedied by simple reworking.

Table 4.25

Clause	Characteristic Analysed	Test Method	Minimum Frequency Of Testing
<b>Binder</b>			
4.04.3 (iv)	Properties of bitumen	AS 2341	One set of tests test per 1,000t
4.04.3 (ii); 4.04.3 (iii)	Properties of cutback bitumen	AS 2341	One set of tests test per 1,000t
4.04.3 (ix); 4.04.3 (vii)	Liquid bituminous additive	RTA T590	One (1) test per 1,000t
4.04.3 (v); Table 4.17	Properties of flux oil	AS 2341.2; AS 2341.7; AS 2341.10 AS 2341.14	One set of tests test per 1,000t
4.04.3 (vi)	Properties of cutter	AS 3568	One set of tests test per 1,000t
<b>Aggregate properties</b>			
4.04.3 (x)	Particle size distribution	AS 1289.3.6.1	One (1) test per 250m <sup>3</sup> of aggregate
	Material finer than 0.075mm	AS 1289.3.6.3	One (1) test per 250m <sup>3</sup> of aggregate
	Particle shape	AS 2758.2	One (1) test per 250m <sup>3</sup> of aggregate
	Wet/dry strength variation	AS 1142.22	One (1) test per 250m <sup>3</sup> of aggregate
	Resistance to stripping of aggregate with the binder proposed	RTA T230	One (1) test per 250m <sup>3</sup> of aggregate
	Average least dimension	RTA T233	One (1) test per 250m <sup>3</sup> of aggregate
	Polishing Aggregate Friction Value (when specified as a requirement)	AS 1142.42	One (1) test per 250m <sup>3</sup> of aggregate
	Fractured faces	RTA T239	One (1) test per 250m <sup>3</sup> of aggregate
4.04.3	Resistance to stripping of cover aggregates and binders		One (1) set for each combination of binder and aggregate and when any change occur in the binder or aggregate source or type with at least one set per 1,000m <sup>3</sup> of aggregate

**(iv) Nonconforming Work**

If any materials supplied fail to conform to the requirements of the Contract or if any section of priming, primersealing or sealing work fails to conform to the requirements of this Contract, whether failure of the work is due to bad workmanship, defective materials supplied by the Contractor or materials made defective by the method of operation adopted or any other cause, then such failure or failures shall constitute a nonconformanc' under the Contract.

Departures from the design target application rates for primer, primerbinder and binder, after allowing for adjustments due to adhesion agent, cutting oil, flux oil and temperature, will be determined from the bituminous

surfacing daily record. Adjustments made on site due to surface condition and stockpile ALD dimension will be allowed for, subject to a record of their prior approval by the Superintendent. Departures up to  $\pm 5$  per cent of the adjusted design target application rate shall be deemed as conforming. Departure outside this range is a nonconformance.

If the nonconformance is not acceptable to the Superintendent, the nonconforming material shall be replaced or the nonconforming section of work shall be either replaced or corrected as proposed by the Contractor, subject to the approval of the Superintendent being attained.

The cost of rectifying nonconforming work, including any restoration work to any underlying or adjacent surface or structure, that becomes necessary as a result of such replacement or correction, shall be borne by the Contractor. Materials removed from the site by the Contractor shall be replaced with materials that conform to this Specification.

#### (v) Deductions

Nonconforming material may be, but need not be, accepted by the Superintendent subject to deductions, as specified hereunder, to the pay item applied to the quantity of material represented by the failed sample.

##### (a) Bitumen

In the case of bitumen having a viscosity at  $60^{\circ}\text{C}$  within the specified limits, but having any other property outside the limits specified, a deduction of 2 per cent of the schedule rate for the supply and spraying of bitumen shall apply.

In the case of Class 170 bitumen or Class 320 bitumen having a viscosity at  $60^{\circ}\text{C}$  outside the limits specified, the deductions shown in Table 4.26 shall apply. For this purpose, viscosity shall be calculated to the nearest whole number.

**Table 4.26**

Deduction for Bitumen Actual Viscosity at $60^{\circ}\text{C}$ (Pa.s)		
Viscosity at $60^{\circ}\text{C}$ (Pa.s)		Deduction (percent of Pay Item)
Class 170	Class 320	
Under 120	Under 220	50
120 - 124	220 – 229	25
125 - 129	230 – 239	10
130 - 134	240 – 249	5
135 - 139	250 – 259	2
140 - 200	260 – 380	Nil
201 - 210	381 – 400	2
211 - 220	401 – 420	5
221 - 230	421 - 440	10
231 - 240	441 - 460	25
Over 240	Over 460	50

## (b) Refinery Cutback Bitumen

In the case of a cutback bitumen having a viscosity at 60°C within the specified range but having any property (other than viscosity at 60°C) outside the range specified, a deduction of 2 percent of the schedule rate for the supply and spraying of cutback bitumen shall apply.

In the case of cutback bitumen having a viscosity at 60°C outside the range specified, the deductions shall be as shown in Table 4.27.

**Table 4.27**

Deduction for Bitumen actual Viscosity at 60°C (Pa.s)	
Viscosity	Deduction
Viscosity in range of next adjoining grade	- deduction 10% of schedule rate
Viscosity in range of next but one adjoining	- deduction 25% of schedule rate
Viscosity beyond next but one adjoining grade	- deduction 50% of schedule rate

*Notes on Table 4.27*

- (i) *The viscosity as determined by any method allowed shall be rounded to two significant figures in the direction favouring the Contractor.*

**4.05 ASPHALT SURFACING****4.05.1 Scope**

This section covers the requirements of asphalt surfacing. The requirements relate to all aspects of supply of materials, manufacturing and placement of asphalt.

**4.05.2 General**

Asphalt for surface courses shall consist of coarse and fine aggregates and mineral filler plant-mixed with bitumen binder. Mix design, manufacture, placing and compaction shall be the responsibility of the Contractor.

**4.05.3 Materials****(i) Definition of Terms**

Material retained on the 4.75mm sieve shall be known as coarse aggregate.

Material passing the 4.75mm sieve and retained on the 0.075mm sieve shall be known as fine aggregate.

Material passing the 0.075mm sieve shall be known as mineral filler.

**(ii) Aggregates**

Aggregates shall be of uniform quality and grading. Aggregates complying with the requirements of this Specification, when combined with the mineral filler shall be capable of achieving the asphalt properties required by this Specification.

Aggregates of different type or quality from the same face or quarry shall be regarded as coming from a different source

**(iii) Coarse Aggregate**

Coarse aggregate shall comply with AS 2758.5 and comprise all mineral matter retained on a AS 4.75 mm sieve. Coarse aggregate shall consist of clean, dry, hard, tough and sound crushed rock, metallurgical slag or gravel, be of uniform quality and be free from dust, clay, dirt or other matter deleterious to asphalt.

The particle size distribution of the coarse aggregate used in the work shall be determined in accordance with AS 1141.11.

If the Contractor proposes to blend two or more coarse aggregates from different sources to provide the Nominated Mix then Test Reports for each constituent material shall be submitted separately. The coarse aggregate from each source shall comply with the following requirements:

(a) Wet Strength - AS 1141.22.

Shall be not less than 100 kN for any fraction except the wet strength required for any fraction of open graded asphalt shall not be less than 150 kN.

(b) Wet/Dry Strength Variation - AS 1141.22

Shall not exceed 35 per cent for any fraction or constituent.

(c) Particle Shape - AS 1141.14

The proportion of misshapen particles retained on the 9.50mm AS sieve shall not exceed 25 percent for Stone Mastic Asphalt or 35 per cent for all other asphalt using a calliper ratio of 2:1 and shall not exceed 10 per cent using a calliper ratio of 3:1 for all asphalt.

(d) Fractured (Crushed) Faces of Coarse Aggregate - AS 1141.18

Aggregate that is from a gravel or river deposit and which is retained on a 6.70 mm AS sieve shall consist of at least 75 per cent by mass of particles with at least two fractured faces and when used in the wearing course shall have at least 90 per cent by mass of particles with at least one fractured face. The area of each fractured face shall be a significant proportion of the total surface area of the particle.

For Stone Mastic Asphalt the aggregate shall have:

- at least 85 per cent by mass of particles with at least two fractured faces where the combined fractured surface area is judged to be about one half or more of the total surface area of the particle, and
- not less than 100 per cent by mass of particles with at least one fractured face where the area of the fractured face on those particles with only one fractured face is one quarter or more of the total surface area of the particle.

(e) Resistance to Stripping – AS 1141.50

Resistance to stripping shall be determined and reported in accordance with AS 1141.50 for aggregate in the 'as received' condition (without precoat) but dried to constant mass except that in

lieu of the requirement of clause 4 (b) of AS 1141.50 the test must be conducted using Class 170 binder conforming to AS 2008 from the same source as the binder proposed for use in the works.

- (f) Polishing Aggregate Friction Value (PAFV) - AS 1141.42  
Aggregate to be used in Asphalt Wearing Course, shall have a Polishing Aggregate Friction Value (PAFV) of at least 44 or other value specified.

- (g) Water Absorption - AS 1141.6.1  
The water absorption of coarse aggregate of any nominal size shall not exceed 2.5%.

**(iv) Fine Aggregate**

Fine aggregate comprises all mineral matter (other than filler) passing the 4.75 mm AS sieve. It shall consist of clean, hard, tough and sound grains, free of coatings or loose particles of clay, silt or other matter deleterious to asphalt. The fine aggregate shall consist of natural sand or a mixture of natural sand and material derived from the crushing of sound stone or gravel conforming to the requirement in this Specification. The fine aggregate shall generally consist of material derived from the crushing of sound stone or gravel conforming to the of coarse aggregates conforming to the requirements of this Specification or natural sand.

The water absorption of fine aggregate of any nominal size determined in accordance with the requirements of AS 1141.5, shall not exceed 3.5%.

For Stone Mastic Asphalt, the fine aggregate shall only be quarry stone aggregate and/or secondary and/or tertiary crusher dusts (such crusher dusts may be washed and/or classified prior to use), resulting from the manufacture of coarse aggregates conforming to the requirements of this Specification or natural sand.

For Stone Mastic Asphalt, the uncompacted void content of the combined fine aggregate, when determined in accordance with AASHTO T 304-96 Method 'A' must not be less than 43.

For Stone Mastic Asphalt the weighted percent loss from a fine aggregate, when determined in accordance with AS 1141.24, must not exceed 12% of the test portion.

If the Contractor proposes to blend two or more fine aggregates from different sources to provide the Nominated Mix, then Test Reports for each constituent material shall be submitted separately.

**(v) Mineral Filler**

All material passing the 0.075mm sieve is mineral filler for the purposes of this Specification.

Mineral filler shall be stone dust, fine sand, hydrated lime, fly ash, Portland cement, flue dust from the manufacture of Portland cement or plant bag-house dust or other suitable material and shall be non-plastic and comply with the requirements of AS 2357. The nature and proportion of filler shall conform to the requirements of this Specification and the Nominated Mix design.

The combined filler from all sources shall conform to the following requirements:

- (a) For asphalt other than that designated "for Heavy Duty Application", not less than 50% of the filler shall consist of flyash, hydrated lime or other similar material approved by the Superintendent. If hydrated lime is approved for use in this application, proportions shall be as specified for heavy duty application.
- (b) Asphalt for heavy duty application shall contain, by mass of the combined particle size distribution, the following proportions of powdered hydrated lime:
- for Dense Graded Asphalt (AC): not less than 1.5%;
  - for Open Graded Asphalt (OG): not less than 1%.
- (c) The dry compacted voids (percent) of the combined filler shall not be less than 40% in accordance with AS 1141.17.

**(vi) Fibre Additive**

Fibre additive for Stone Mastic Asphalt must be cellulose fibre. The Contractor shall provide the Superintendent the technical specification for the fibre additive and manufacturer's recommendations on the application, handling and incorporation of the fibre additive into asphalt.

The Contractor may propose and use, subject to the Superintendent's approval, an alternative fibre additive provided that the Contractor submits documented evidence of successful use or trial of such fibre additive under circumstances similar to those that exist under the contract.

**(vii) Binder**

The binder to be used in asphalt shall be bitumen complying with AS 2008.

The Contractor shall provide documentary evidence of the binder conformity for each delivery used in the work.

Binder shall be sampled from the recirculation line or taken from near and below the middle of the tank contents.

**(a) Bitumen**

If no binder is specified, the binder shall be Class 320 bitumen complying with the requirements of AS 2008 except for Fine Gap Graded asphalt (FGG) where the binder shall be Class 170 bitumen.

**(b) Multigrade Bitumen**

Multigrade bitumen shall conform with the requirements of Clause 4.04.3(iv) and Tables 4.15 and 4.16

**(c) Polymer Modified Bitumen**

Polymer modified bitumen shall comply with the requirements given in Table 4.27 as appropriate and the requirements set out below. The polymer modified bitumen shall be supplied in the grades specified.

Polymer modified bitumen shall be pumped and stored at the manufacturer's recommended temperatures.

For polymer modified bitumen, all blending of materials (with the exception of bitumen adhesion agent) shall be carried out in the manufacturer's premises before dispatch. Materials shall not be blended in a road tanker or sprayer. The polymer modifiers shall be compatible in mixing with bitumen complying with AS 2008.

For production control properties, the numbers that appear in Table 4.27 under status D are advisory values only. Suppliers may nominate other tests or different values in their Quality Plan and when agreed by the Principal shall be the basis for the production testing Quality System. The Supplier defined test(s) may include any of the already specified tests, another MBT test, or any other test which the Supplier's Quality System can demonstrate ensures compliance with one or more of the status A, B and C test requirements. The control limits or target value of this test shall be nominated in advance of tendering.

Where a production control property does not comply with the specified limit, the material represented by the test may be accepted if the Supplier can verify that it meets the other requirements

Table 4.28

Physical Properties of Polymer Modified Bitumen (Asphalt Grade)											
CLASS:					A10E	A15E	A20E	A25E	A30P	A35P	A40R
Test method	Minimum Frequency	Property	Limit	Status							
MBT21	Quarterly	Consistency at 60°C Pa.s	min	A	8500	5000	600	800	1800	2000	4500
MBT32	Quarterly	Compression limit mm	min	A	NS	NS	NS	NS	NS	NS	0.2
MBT21	Quarterly	Elastic Recovery 60°C 100s %	min	B	93	85	80	10	45	40	35
MBT11	Each Batch	Viscosity at 165°C Pa.s	max	C	1.5	1.5	1.5	0.8	1.5	1.5	1.5
MBT12	Annually	Flash Point °C	min	C	250	250	250	250	250	250	250
MBT03	Annually	Loss of mass on heating %	max	C	0.6	0.6	0.6	0.6	0.6	0.6	0.6
MBT22	Each Batch at the point of delivery	Torsional Recovery %	min	D	60	50	35	10	12	8	35
MBT31	Each Batch	Softening Point °C	min	D	90	80	60	50	62	60	68

Notes on Table 4.28

Abbreviations:

MBT = Modified Binder Test, see reference max = maximum

NS = Not Specified min = minimum

Status codes:

A = Performance Related Properties

B = Index properties (performance related but with shifts between different generic types)

C = Handling properties

D = Production Control Properties

MBT11= The shear rate and the gap size used in performing this test shall be recorded. Minimum rotation speed shall be 12 rpm.

MBT21 = The shear rate shall be  $0.1 \text{ s}^{-1}$  and the shear rate shall be 1.

**(viii) Bitumen Adhesion Agent**

A bitumen adhesion agent may be added to the binder. Prior to use, details of the proposed bitumen adhesion agent shall be submitted for the Superintendent's approval.

Any added bitumen adhesion agent shall be used strictly in accordance with the manufacturer's recommendations. The bitumen adhesion agent shall be added at a concentration within the range 0.5 per cent to 1.0 per cent by mass of the binder

**(ix) Bituminous Emulsion Tack Coat**

Unless otherwise specified, bituminous emulsion for tack coat shall be Designation CRS/170-60 complying with the requirements of AS 1160.

**(x) Particle Size Distribution**

The particle size distribution of the combined aggregates and mineral filler shall comply with the limits prescribed in this Specification for the specified asphalt type and nominal maximum size.

**(xi) Asphalt**

This Specification covers four types of asphalt as follows:

- (a) Dense Graded Asphalt (AC)
- (b) Stone Mastic Asphalt (SMA)
- (c) Open Graded Asphalt (OG)
- (d) Fine Gap Graded Asphalt (FGG)

**(xii) Asphalt Base Course (Binder course)**

Asphalt base course is the part of an asphalt pavement supporting the intermediate and wearing courses.

**(xiii) Asphalt Intermediate Course**

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

**(xiv) Asphalt Wearing Course**

Asphalt wearing course is that part of the pavement upon which the traffic travels.

**(xv) Asphalt Regulating Course (Corrective Course)**

Asphalt regulating course is an asphalt course or variable thickness applied to the road surface to adjust the shape preparatory to surfacing or resurfacing.

**4.05.4 Properties of Asphalt****(i) Nominated Mixes**

The Contractor shall design each asphalt mix required for the works, designated the "Nominated Mix", using materials meeting the requirements of Clause 4.05.3 and meeting the requirements specified in this Clause 4.05.4 as appropriate for each type of asphalt.

The Contractor shall submit to the Superintendent at least one nominated mix for each type of asphalt required in the Works. Details of the Nominated Mix shall be submitted to the Superintendent at least twenty-one days before placing of asphalt. Each submission must include a Certificate, signed by the Contractor stating that the asphalt mix and its constituents meet the specified requirements. The Certificate must include NATA endorsed test results for all specified tests and a copy of the Contractor's completed verification checklist for the mix design and testing. All phases of any particular test must be performed at one laboratory. The Certificate shall confirm that the required testing has been performed at one laboratory within the three-month period prior to the date of submission to the Superintendent. All tests for each nominated mix must be from one trial batch and tests of the constituent materials must represent the materials used in the trial batch.

The Certificate shall be accompanied by a statement covering the following details:

- (a) The constituent materials including:
- Aggregates – source(s), geological type(s)
  - Filler – type(s) and source(s)
  - Binder - source, class or grade
  - Bitumen Adhesion Agent - name, type, source of supply
  - Fibre Additive (if applicable) - type and source
  - Bitumen emulsion tack coat - class of bitumen, any bitumen modification, source
  - Relevant test results verifying the material properties specified for the materials
- (b) The Asphalt design including:
- Proportion of each constituent material by percentage of mass of total asphalt mix;
  - Combined aggregate and filler particle size distribution;
  - Binder content, by mass of total mix;
  - Type and identification number of asphalt mixing plant;
  - Voids in the laboratory compacted mix and voids in mineral aggregate; and
  - Dry compacted voids in the fraction of mineral aggregate passing 0.075 AS sieve
  - Propensity for stripping for Dense Graded Asphalt for Heavy Duty Application only.

#### **Hold Point 4.7**

Process Held:	Use of each asphalt nominated mix in the works.
Submission Details:	At least ten (10) working days prior to proposed commencement of asphalt works the Contractor shall submit all designs, test result, certificates and other documentation that demonstrate conformance of the asphalt with the Specification requirements for each asphalt mix proposed to be used.
Release of Hold Point:	The Superintendent will consider the submitted documents and may carry out testing, calculations and audit, prior to authorising the release of the Hold Point.

**(ii) Variations to Nominated Mix**

The Contractor must submit to the Superintendent a new Nominated Mix in compliance with the requirements of this Specification for approval prior to the variation, if the Contractor proposes to vary:

- (a) The proportions of the constituents in a Nominated Mix, with the exception of added filler, by 10% or more of the value nominated; or
- (b) The proportion of added filler by 15% or more of the value nominated; or
- (c) Any values of the nominated mix; or
- (d) Any constituent source or material, including binder.

If any revision to the Nominated Mix is necessary, then the costs associated with the revision and testing of the revised nominated mix in accordance with the requirements of the Specification shall be borne by the Contractor.

**(iii) Requirements of Production Mix**

Asphalt produced in the plant and delivered to the site shall be known as the "Production Mix".

The Production Mix shall comply with the materials, mix and other requirements given in this Specification, unless otherwise approved by the Superintendent. Additionally, at delivery and during laying:

- (a) Mix that shows evidence of segregation of aggregate after mixing, transport or paving shall be excluded from the work at the Contractor's expense.
- (b) Mix that is not homogeneous and is observed to be "fatty" (bitumen rich) or "bony" (coarse and porous) shall be excluded from the work at the Contractor's expense.
- (c) The mix workability and compactability shall be consistent and compatible with the capacity of paving and compaction equipment on site.

The Contractor shall assure the Superintendent that all asphalt produced during the course of the Contract, complies with the requirements of this Specification by a suitable quality processes covering materials, production and laying.

**(iv) Dense Graded Asphalt**

- (a) Proportions of Constituents for AC

Dense graded asphalt shall meet the requirements given in this Subclause and Table 4.28 for "Moderate Duty" AC or Table 4.29 for "Heavy Duty" AC..

Typically, Moderate Duty AC is used on collector and arterial roads and in industrial estates and Heavy Duty AC is used in other roads carrying more heavily vehicles such as highways.

Dense graded asphalt that does not incorporate polymer modified binder or scrap rubber may include reclaimed asphalt pavement material (RAP) subject to the following requirements:

- The proportion of RAP shall not exceed 15 percent by mass of the dense graded asphalt.
- The dense graded asphalt shall conform to the requirements of Table 4.28 or Table 4.29 as appropriate.
- The RAP aggregate shall conform to the requirements for aggregates given in Clause 4.05.3.

The nominated mix and production mix properties shall be based on incorporated RAP.

Table 4.29

Requirements for Dense Graded Asphalt (AC) – Moderate Duty Designation					
Test Method	Property	Limits for nominal size of asphalt			
		5mm (AC5-MD)	10mm (AC10-MD)	14mm (AC14-MD)	20mm (AC20-MD)
AS 2891.3.1	Combined Particle size distribution (% by mass)				
	26.5mm	-	-	-	100
	19.0mm	-	-	100	90-100
	13.2mm	-	100	85-100	70-90
	9.50mm	-	90-100	-	-
	6.70mm	100	70-90	55-75	40-70
	4.75mm	80-100	-	-	-
	2.36mm	45-70	40-60	35--52	25-50
	1.18mm	-	-	-	-
	0.600mm	20-43	20-38	15-30	10-27
	0.300mm	-	-	-	-
	0.150mm	-	-	-	-
	0.075mm	4.5-11	4.5-10	3-7	3-7
	Binder	Class 320 bitumen or multigrade bitumen unless specified otherwise			
AS 2891.3.1	Binder content (% by mass of total asphalt mix) (i)	5.6-6.8	5.1-6.4	4.8-6.2	4.6-6.1
AS 2891.3.1	Ratio Filler/Binder content (by mass)	0.6-1.2 (iii)	0.6-1.2 (iii)	0.6-1.2	0.6-1.2
AS 2891.5	Stability of the compacted asphalt mix (kN) - as per Marshall Method (at 50 blows)	5.5 min	5.5 min	6.5 min	6.5 min
AS 2891.8	Voids in compacted asphalt mix (% of voids in volume of mix) - as per Marshall Method (at 50 blows)	4-6	4-6	4-6	4-6
AS 2891.8	Voids filled by binder (% voids in the total mineral aggregate to be filled by binder) - as per Marshall Method (at 50 blows)	65-80	65-80	65-80	65-80
AS 2891.5	Flow (mm) of compacted mix as per Marshall Method (at 50 blows) (iii)	1.5-4.0	1.5-4.0	1.5-4.0	1.5-4.0

Notes on Table 4.29:

- (i) Some increase beyond these ranges of binder content may be permitted for aggregates having unusually high absorption characteristics. Superintendent's approval is required for such adjustments.
- (ii) This requirement only where Marshall Method of Testing is used.
- (ii) The Superintendent may approve higher filler/binder ratios provided convincing evidence of local usage and satisfactory performance is submitted with the nominated mix design.

**Table 4.30**

Requirements for Dense Graded Asphalt (AC) – Heavy Duty Designation					
Test Method	Property	Limits for nominal size of asphalt			
		5mm (AC5-HD)	10mm (AC10-HD)	14mm (AC14-HD)	20mm (AC20-HD)
AS 2891.3.1	Combined Particle size distribution (% by mass)				
	37.5 mm				100
	26.5 mm			100	80-98
	19.0 mm		100	80-98	(ii)
	13.2 mm	100	80-98	65-93	50-80
	9.50 mm	80-98	(ii)	(ii)	(ii)
	6.70 mm	65-90	55-80	45-70	35-60
	4.75 mm	(ii)	(ii)	(ii)	(ii)
	2.36 mm	35-65	25-45	20-40	15-40
	1.18 mm	(ii)	(ii)	(ii)	(ii)
	0.600 mm	15-35	10-30	5-25	5-25
	0.300 mm	(ii)	(ii)	(ii)	(ii)
	0.150 mm	(ii)	(ii)	(ii)	(ii)
	0.075 mm	3-11	2-8	2-8	2-7
AS 2891.3.1	Ratio Filler/Binder content (by mass)	0.6-1.2	0.6-1.2	0.6-1.2	0.6-1.2
AS 1141.17	Dry compacted voids (percent) of the combined filler	40% min	40% min	40% min	40% min
AS 2891.3.1	Powdered hydrated lime by mass of the combined particle size distribution	1.5% min	1.5% min	1.5% min	1.5% min
	Binder	Class 320 bitumen or multigrade bitumen unless specified otherwise			
AS 2891.3.1	Binder content (% by mass of total asphalt mix) (i)	5.1-6.4	4.8-6.2	4.6-6.1	4.0-5.8

Requirements for Dense Graded Asphalt (AC) – Heavy Duty Designation					
Test Method	Property	Limits for nominal size of asphalt			
		5mm (AC5-HD)	10mm (AC10-HD)	14mm (AC14-HD)	20mm (AC20-HD)
RC 201.01	Binder Film Thickness( $\mu\text{m}$ )(iv)	>7.5	>7.5	>7.5	>7.5
RTA T640	Minimum tensile strength ratio (%)	80	80	80	80
AS 2891.2.2; RTA T605; AS 2891.8; AS 2891.9.2	: (a) Voids in laboratory compacted asphalt mix (% voids of the volume of the asphalt mix)  - After 120 cycles of compaction  - After 350 cycles of compaction (iii)  (b) Minimum Voids in Mineral Aggregate (% VMA) after 120 cycles of compaction	3-6  >2.5  16	3-6  >2.5  15	3-6  >2.5  14	3-6  >2.5  13
RTA T613	Moisture Content of Asphalt (% by mass of total asphalt mix)	< 0.5	< 0.5	< 0.5	< 0.5

Notes on Table 4.30:

- (i) Some increase beyond these ranges of binder content may be permitted for aggregates having unusually high absorption characteristics.
- (ii) For each sieve given on the left hand side of the table, even when no particle size distribution range is specified on the right hand side of the table, a particle size distribution shall be given in the submission of the nominated mix and in the reporting of trial and production mixes.
- (iii) The use of additional spacer discs in the gyratory compactor mould should be considered.
- (b) (iv) This specification requirement applies to the nominated mix and production trial(s) only. The factor for 0.075 mm material in Table 1 of the test method shall be amended to read 32.77. Tolerances for AC Nominated Mixes

For the dense graded asphalt (AC) Production Mixes, tolerances from the nominated aggregate particle size distribution for the actual combined aggregate particle size distribution and actual binder content from the nominated binder content will be permitted, within the limits shown in Table 4.30 provided the values do not fall outside the limits for design of nominal mix as shown in Tables 4.28 and 4.29 as appropriate.



Table 4.32

Requirements for Stone Mastic Asphalt (SMA)			
Test Method	Property	Limits for nominal size of asphalt	
		10 mm SMA (SMA10)	14 mm SMA (SMA14)
AS 2891.3.1	Aggregate passing AS Sieve Size (% by mass) determined in accordance with		
	19.0 mm	100	100
	13.2 mm	100	84-100
	9.50 mm	84-100	35-60
	6.70 mm	35-60	20-40
	4.75 mm	20-40	19-31
	2.36 mm	16-28	16-28
	1.18 mm	14-24	14-24
	0.600 mm	11-21	11-21
	0.300 mm	10-18	10-18
	0.150 mm	9.0-15.0	9.0-15.0
0.075 mm	8.0-12.0	8.0-12.0	
AS 2891.3.1	Percentage of fine aggregate constituent(s) derived from crushed hard rock quarry material	50% min	50% min
AS 2891.3.1	Powdered hydrated lime by mass of the combined particle size distribution	1.5% min	1.5% min
AS 1141.11; AS 1141.17	Dry compacted voids of the fraction of mineral matter passing a 0.075 mm AS sieve	40% min	40% min
	Fibre additive (% by mass of total SMA mix)	0.3% min	0.3% min
	Binder	Polymer modified or multigrade bitumen as specified,	
AS 2891.3.1	Binder content (% by mass of total SMA mix)	≥6.2% to ≤7.2%	≥6.0% to ≤7.0%
	Bitumen adhesion agent	May be incorporated in the binder	
AS 2891.7; AS 2891.8; AS 2891.9.2	Voids when compacted in accordance with AS 2891.2.2 (% voids of the volume of the mix)	Refer to Table 4.32 and loading category specified.	

**Table 4.33**

Voids in Laboratory Compacted SMA			
Loading Category (i)	Cycles of Compaction	10 mm SMA	14 mm SMA
Medium	80	5.0% ± 1.5%	5.0% ± 1.5%
	350	> 2.0%	> 2.0%
Heavy	120	5.0% ± 1.5%	5.0% ± 1.5%
	350	> 2.5%	> 2.5%

Notes on Table 4.33

- (i) *Heavy loading category is applicable to approaches to intersections and/or junctions (minimum 50m length) and turning bays and areas of speed restriction such as curves and/or grades that cause commercial vehicles to travel at less than 80 kph.*

*Medium loading category applies where there is only light traffic at locations other than approaches to intersections and/or junctions and where commercial vehicles travel over 80 kph in locations not covered in the heavy loading category*

- (b) Tolerances for SMA Nominated Mixes

For SMA Production Mixes, tolerances from the nominated aggregate particle size distribution for the actual combined aggregate particle size distribution and actual binder content from the nominated binder content will be permitted, within the limits shown in Table 4.30.

**(vi) Open Graded Asphalt (OGA)**

- (a) Proportions of Constituents for OGA

Open graded asphalt shall meet the requirements given in this Sub-clause and Table 4.33.

Table 4.34

Requirements for Open Graded Asphalt (OG)			
Test Method	Property	Limits for nominal size of asphalt	
		10 mm OG (OG10)	14 mm OG (OG14)
AS 2891.3.1	Aggregate passing AS Sieve Size (% by mass) determined in accordance with		
	19.0mm		100
	13.2mm	100	85-100
	9.50mm	85-100	65-95
	6.70mm	50-80	35-75
	4.75mm	25-55	15-45
	2.36mm	10-35	3-25
	1.18mm	0-19	0-20
	0.600mm	(ii)	(ii)
	0.300mm	(ii)	(ii)
	0.150mm	(ii)	(ii)
	0.075mm	(ii)	(ii)
	Binder	Polymer modified or multigrade bitumen as specified,	
AS 2891.3.1	Binder Content (% by mass of total asphalt mix) (i)	3.8-5.7	3.4-5.2
AS 2891.5; AS 2891.6; AS 2891.9.3	Voids in laboratory compacted asphalt mix (% voids of the volume of the asphalt mix)	18-23	18-23

Notes on Table 4.34:

- (i) Some increase beyond these ranges of bitumen content may be permitted for aggregates having unusually high absorption characteristics. The Superintendent's approval is required for such adjustments.
- (b) (ii) For each sieve given on the left hand side of the table, even when no value is given for the particle size distribution, the percentage passing shall be included in the nominated mix submission and in the reporting of trial and production mixes. Tolerances for OG Nominated Mixes

Open graded asphalt (OG) Production Mixes, tolerances from the nominated aggregate particle size distribution for the actual combined aggregate particle size distribution and actual binder content from the nominated binder content will be permitted, within the limits shown in Table 4.35 provided the values do not fall outside the limits for design of nominal mix as shown in Table 4.34.

**Table 4.35**

Tolerances for Open Graded Asphalt (OG)		
Test Method	Production Mix Properties	Allowable Variations from Approved Mix
AS 2891.3.1	Particle size (% by mass of total aggregate) :	
	Passing 13.2mm AS sieve and larger	±7%
	Passing 4.75mm and larger to 13.2mm	±7%
	Passing 1.18mm and 2.36mm	±5%
	Passing 0.075mm	±1.5%
AS 2891.3.1	Production tolerance for the actual binder content from the nominated binder content during production (% by mass of total asphalt mix)	±0.3%

**(vii) Fine Gap Graded Asphalt (FGG)****(a) Proportions of Constituents for FGG**

Fine gap graded asphalt (FGG) shall meet the requirements given in Table 4.36.

**Table 4.36**

Requirements for Fine Gap Graded Asphalt (FGG)				
Test Method	Property	Limits for nominal size of asphalt		
		Type A (FGG-A)	Type B (FGG-B)	Type R (FGG-R)
AS 2891.3.1	Aggregate passing AS Sieve Size (% by mass) determined in accordance with			
	13.2mm	100	100	-
	9.50mm	95-100	90-100	-
	6.70mm	80-95	65-85	100
	4.75mm	65-80	60-80	85-100
	2.36mm	45-60	55-75	55-80
	1.18mm	35-50	45-65	38-60
	0.600mm	25-40	30-50	25-43
	0.300mm	15-25	20-30	15-30
	0.150mm	7-15	10-18	8-20
	0.075mm	3-10	5-11	5-12
	Binder	Bitumen Class 170 unless specified otherwise		
RTA T607	Binder Content (% by mass of total asphalt mix) (i)	6.0-7.0	5.8-6.8	6.5-7.5

# SECTION 4

# FLEXIBLE PAVEMENT CONSTRUCTION

AS 2891.5	Stability of the compacted asphalt mix (kN)Min as per Marshall Method (at 35 blows)	4.0 min (35 blows)	4.0 min (35 blows)	3.5 min (35 blows)
AS 2891.8	Voids in compacted asphalt mix (% of voids in volume of mix) as per Marshall Method (at 35 blows)	3-5 (35 blows)	3-5 (35 blows)	3-5 (35 blows)
AS 2891.5	Flow (mm) of compacted mix (35 blow Marshall)	2-5	2-5	2-5

Notes on Table 4.36

- (i) Some increase beyond these ranges of binder content may be permitted for aggregates having unusually high absorption characteristics. Superintendent's approval is required for such adjustments.
- (ii) Unless specified otherwise Type A and B are for residential streets, car parks and commercial driveways carrying light traffic and Type R is for footpaths, cycleways and recreation areas.
- (b) (iii) The Superintendent may approve higher filler/binder ratios when evidence of local usage and satisfactory performance is submitted with the mix design. Tolerances for FGGA Nominated Mixes

For FGGA Production Mixes, tolerances from the nominated aggregate particle size distribution for the actual combined aggregate particle size distribution and actual binder content from the nominated binder content will be permitted, within the limits shown in Table 4.37 provided the values do not fall outside the limits for design of nominal mix as shown in Table 4.36.

**Table 4.37**

Tolerances for Fine Gap Graded Asphalt (FGG)		
Test Method	Production Mix Properties	Allowable Variations from Approved Mix
AS 2891.3.1	Particle size (% by mass of total aggregate) :  Passing 4.75mm AS sieve and larger Passing 2.36mm and 1.18mm Passing 0.600mm and 0.300mm Passing 0.150mm Passing 0.075mm	  ±7% ±5% ±4% ±2.5% ±1.5%
AS 2891.3.1	Production tolerance for the actual binder content from the nominated binder content during production (% by mass of total asphalt mix)	±0.3%

## 4.05.5 Manufacture of Asphalt

### (i) Methods of Production

The Contractor's methods of production must be such as to:

- (a) control the process and to target the nominated mix; and

- (b) supply a homogeneous product.

**(ii) Mixing Plant**

- (a) General

The production plant must have, and the Contractor must allocate, sufficient capacity to supply asphalt for continuous operation of the paver.

Equipment for the storage, heating and mixing of materials for asphalt shall comply with the requirements of Section 7 of AS 2150 as supplemented or modified in this Specification.

The mixing plant shall comply with the following basic requirements, together with the additional requirements specified for the particular type of plant.

- (b) Basic Requirements for all Plants

Mixing shall be undertaken in an approved batch pugmill, continuous pugmill or drum mixing plant, capable of uniformly mixing coarse and fine aggregate, filler and binder to meet the specified requirements at all times. The plant shall include a rotary drum dryer for the continuous heating and drying of the coarse and fine aggregate. Each size of mineral material comprising the coarse and fine aggregate shall be fed into the dryer by a mechanical feeder at a uniform rate. The dryer shall maintain a uniform flow of aggregate at correct temperature, sufficient to operate the mixing unit at its rated output. Added filler shall be stored and handled in a separate system from that which handles aggregate and be capable of accurately measuring and adding the quantity required. The bitumen storage and handling shall be arranged so that contamination of the bitumen by flushing liquids or other materials cannot occur.

Specifically:

- The plant shall produce a uniform mixture meeting the requirements of this Specification and the Nominated Mix within the tolerances specified.
- The bitumen storage tanks shall be capable of holding at least sufficient bitumen for one day's production. All tanks used for storage and preparation of bitumen shall be fitted with thermometers and circulating and heating equipment.

Heating of bitumen shall be accomplished by steam coils, electricity or other means that will not allow any direct flame to come into contact with the heating tank. Tanks shall have a circulating system capable of providing continuous circulation of binder between the storage tanks and the mixer. Pipelines shall be insulated to prevent heat loss.

- The means for controlling the addition of bitumen shall at least have sufficient capacity to deliver bitumen in quantities not less than 10% of the mass of the combined aggregate.

The bitumen shall be introduced into the mixer in such a way as to produce a uniform distribution.

The binder feed unit shall be capable of supplying the specified amount of binder to the mix within  $\pm 1\%$  of the total binder either by weighting, metering, or volumetric measurement.

Suitable means shall be provided either by steam or oil jacketing or by insulation, for maintaining the specified temperature of the binder in all pipe lines, meters, weigh buckets or spray bars and other containers.

- The binder feed unit shall be such that the heated binder is delivered in a thin, uniform sheet or in multiple streams the full width of the mixer except in the case of a mixer where the bituminous material is sprayed.

An armoured thermometer with a range of 900C to 2000C shall be fixed in the bituminous feed and near the discharge valve to the mixing device.

When a bucket is used for weighing it shall have a capacity of not less than 15% of the rated capacity of the mixer. The bucket shall be steam-jacketed or equipped with electric heating units. Weighing equipment shall be accurate to  $\pm 1\%$ .

- Screens shall be capable of screening hot aggregate into not less than four separate fractions (for batch plants).
- The plant shall include not less than four bins for the storage of the separate fractions of the aggregate (for batch and continuous plants).
- Each bin for the storage of the separate fractions of the hot aggregate shall be equipped with a mercury thermometer or electric pyrometer to register the temperature of the hot aggregate in the bin (for batch and continuous plants).
- Where a bin for storage of hot asphalt is provided it shall be constructed and operated in such a way that segregation is minimised, negligible heat is lost, localised heating is avoided and the asphalt within the bin does not compact and so block the outlet. The bin shall be fitted with an indicator to show when the bin is filled to at least half capacity.

Asphalt that has been stored for more than twenty-four hours or produced at temperatures not in accordance with those specified shall not be used.

Inspection and testing procedures in accordance with Clause 4.05.6 shall apply to asphalt that has been stored in hot storage bins.

- Discharge from the plant shall be arranged so as to minimise segregation.
- The feeders on the cold storage bins for fine aggregates and added filler shall be equipped with warning devices to indicate any interruption to material flow.

(c) Additional Requirements for Particular Types of Plant

- Additional requirements applicable to batch pugmill and continuous pugmill mixing plant:

The mixing plant shall be provided with accurate mechanical means for uniformly feeding into the dryer each of the several sizes of aggregates.

Vibratory type feeders may be used on coarse aggregate bins but variable speed belt feeders shall be used on all bins dispensing material of maximum size 4.75mm or less.

The dryer shall be capable of uniformly drying and heating the aggregates and shall be fitted with temperature reading equipment.

Plant screens shall be capable of uniformly drying and heating the aggregates and shall be fitted with temperature reading equipment.

The pugmill shall be equipped with a dust hood.

- Further requirements for batch pugmill mixing plant:

The mass of each size of dried and heated aggregate shall be determined by a weighting hopper of sufficient size to hold a full batch without overflowing.

Discharge gates, bins and hoppers shall be so constructed as to prevent leakage when they are closed.

The plant shall include a batch mixer of an approved twin shaft pugmill type with a batch capacity of not less than 450 kg. The mixer shall be so constructed as to prevent leakage of contents until the batch is to be discharged. The discharging equipment shall be so arranged that the whole batch of asphalt is discharged with minimal segregation on each occasion.

Where an automatic timing device is incorporated, it shall be capable of controlling both wet and dry mixing periods up to a total mixing period of at least three minutes, with increments not greater than five seconds.

- Further requirements for continuous pugmill mixing plant:

The plant shall be capable of accurately proportioning each size of dried and heated aggregate by means of hot bin gate openings that have been calibrated by measurements of the mass per unit time passing each opening at different settings. Each hot bin gate opening shall be adjustable by positive mechanical means.

The flow from each hot aggregate storage bin, the filler bin and the binder supply shall be fully synchronised.

The plant shall include a continuous twin shaft pugmill having paddles that can be adjusted for angular position and clearance.

- Additional requirements for drum mixing plant:

Aggregates shall be proportioned and measured by accurately calibrated variable speed continuous belt feeders from each cold storage bin. Each feeder shall maintain a constant and uniform flow throughout the range of its calibration and shall be equipped with a warning device to indicate any interruption to material flow. The plant shall have positive interlocking between the flows of aggregates, filler and bitumen.

Either individual belt scales shall be incorporated in the feeders from each bin or a single belt scale shall be incorporated in the feed to the mixing drum to indicate the mass of aggregates being fed to the drum per unit time.

The mixing drum shall be so constructed as to produce complete mixing of aggregates, filler and bitumen and to prevent contact between the burner flame and the bitumen.

The burner unit shall be of sufficient capacity to dry the aggregates and to heat the asphalt to the specified temperature. Temperature sensing equipment shall be located at the discharge point and linked to the burner to automatically prevent overheating of the asphalt.

### **(iii) Temperatures of Bitumen, Aggregates and Asphalt**

Temperatures of constituent materials must be controlled by suitable thermometer elements placed in the flow of materials from the drier and in the binder storage system or binder supply line. The difference in temperature between binder and aggregate must not exceed 30°C at the point of mixing.

Thermometer registrations must be readable and accurate to within plus or minus 2°C.

The asphalt temperatures must be measured as the material leaves the pug mill or drum and the hot storage bin(s) or on the trucks prior to leaving the plant.

The temperature of bitumen and aggregates at the mixing plant and the temperature of the asphalt as it is discharged from the mixing plant be within the limits specified in Table 4.38.

Table 4.38

Temperature Requirements for Asphalt					
Type of Binder	Dense Graded Asphalt (AC), Stone Mastic Asphalt (SMA) and Fine Gap Graded Asphalt (FGG)			Open Graded Asphalt (OG)	
	Class 170	Class 320	Polymer Modified	Class 170	Class 320
Minimum Binder Temperature (°C)	140	140	180 (i)	115	115
Maximum Binder Temperature (°C)	165	170	190(i)	165	170
Minimum Asphalt Temperature (°C)	140	140	150 (i)	125	125
Maximum Asphalt Temperature (°C)	165	170	165 (i)	140	140

*Notes on Table 4.38*

(i) *Temperatures for Polymer Modified Binders are for guidance only. Temperature requirements shall be to the Manufacturer's recommendations for the particular product used.*

The temperature of the asphalt at the paving site shall be suitable for placing the asphalt in accordance with the Specification. The Contractor must, in accordance with a documented procedure, nominate the range of temperatures within which the paving of the asphalt will be completed.

In special cases the Superintendent may permit a lower temperature, but in no circumstances shall the temperature of the mix at the time of placing be less than the value specified in Clause 4.0511 for the appropriate road surface temperature and layer thickness.

#### (iv) Proportioning and Mixing

The hot aggregate and filler (unheated) shall be mixed dry in the pugmill for a period of not less than 15 seconds. The approved proportion of binder shall then be introduced into the pugmill.

Mixing time after addition of binder shall be not less than 45 seconds.

#### (v) Storage and Handling of Binder and Asphalt

The Contractor must implement procedures for storage and handling of binder that ensure prevention of segregation and contamination of the binder by flushing liquids or other materials.

At the asphalt manufacturing plant, polymer modified binder must be recirculated in delivery and/or storage tanks to a uniform consistency prior to use in the asphalt and the Contractor must clearly demonstrate adherence to the binder manufacturer's written recommendations in regard to storage times and storage temperatures.

SMA shall not be retained in hot storage silos prior to use except for that period of time necessary to minimise segregation during loading of trucks.

**4.05.6 Construction Equipment****(i) Sprayers**

Sprayers shall be capable of spraying the tack coat uniformly through jets in a spray bar at the desired rate of application. Spray bars shall be fitted with end shields. Each sprayer shall be fitted with a hand lance.

**(ii) Spreaders**

Spreaders shall be self-propelled. They shall be equipped with hoppers and distributing screws of the counter-rotating type to place the asphalt evenly in front of the screed. Means shall be provided to heat the screed uniformly over its full width.

Spreaders shall be equipped to enable automatic control of levels and thicknesses using a fixed stringline or a mobile level averaging beam on one side of the machine concurrently with:

- a fixed stringline on the other side, r
- a mobile level averaging beam on the other side, or
- a joint-matching shoe on the other side.

according to the requirements of the job.

**(iii) Compaction Equipment**

Rollers shall comply with the following requirements:

- All rollers.

Rollers shall be self propelled and capable of reversing without backlash.

Rollers shall be fitted with brushes or similar devices to enable the contact surface of each roll or tyre to be kept uniformly damp with a minimum amount of water and free from foreign material. The taps controlling the rate of flow shall be readily accessible to the driver. Water shall not be allowed to run directly from taps on the asphalt being compacted.

A wetting agent shall be incorporated into the water applied to pneumatic tyred rollers at all times, and in the water applied to steel wheeled rollers when directed.

- Steel Wheeled Rollers

Steel wheeled non-vibrating rollers shall have a mass of not less than 6 t. and shall have a static load intensity of not less than 35 kN per metre width of drive roll.

Rollers of less than 6t and generally in the range of 2 t to 3 t will be permitted for use on footpaths, cycleways and areas where access is limited, subject to the Contractor demonstrating specified compaction is attained.

Steel wheeled vibrating rollers shall have a total mass of not less than 6 t. and shall have a static load intensity of not less than 20 kN per metre width of vibrating roll. Rollers shall not operate in the vibrating mode while stationary and shall be fitted with a device that will automatically stop vibration when rolling stops.

- Pneumatic tyred multi-wheeled rollers.

Pneumatic tyred multi-wheeled rollers shall have smooth tyres of equal size. Rear wheels shall be offset relative to the front wheels to give overlapping tyre paths and complete coverage for the effective width of the roller. The tyre pressures shall be at least 500 kPa and adjustable up to at least 700 kPa. They shall have an all up mass of not less than 10 t. and wheel loads of not less than 10 kN.

Pneumatic tyred multi-wheeled rollers used for initial rolling on layers of compacted thickness 100 mm or more shall have tyres of width not less than 220 mm on rims of diameter not less than 500mm.

#### 4.05.7 Preparation of Surface

The primed or sealed area to be surfaced with asphalt shall be cleared of all foreign or loose material with power blowers, power brooms or hand brooms. Preparation of the pavement prior to placing asphalt shall comply with AS 2734 Section 4 and shall include removal of extruded thermoplastic road markings and raised pavement markers.

Areas of pavement exhibiting excessive bitumen on the surface, bleeding of fatty areas, and areas of unstable asphalt shall be prepared by burning, chipping, planing or excavation to the satisfaction of, utilising methods approved by, the Superintendent.

#### 4.05.8 Delivery

Asphalt shall be delivered as specified in Section 8 of AS 2150. Trucks shall be fitted with canvas covers to protect the asphalt from rain and loss of heat.

A delivery docket record shall be generated showing:

- empty and loaded mass of the vehicle date and time of loading
- supplier and location of mixing plant
- registration number of the vehicle
- size and type of asphalt class of binder
- temperature of load at mixing plant

Any loads that are outside the allowable range of temperature or which become wet shall be rejected.

#### 4.05.9 Tack Coat

Tack Coat shall be applied generally, not less than thirty (30) minutes nor more than two (2) hours before asphalt is placed.

The tack coat shall consist of a mixture of three parts of bituminous emulsion to two parts of water. The mixture shall cover the surface uniformly at an application rate of between 0.15 and 0.30 L/m<sup>2</sup> of residual bitumen generally and approximately double that rate on joints and chases. The tack coat must be evenly spread over the surface to be tack coated and shall be applied at the nominated application rate  $\pm 0.2$  L/m<sup>2</sup>.

The tack coat must not be damaged prior to placing of the asphalt layer.

The interior of tanks, pipe work, spray bars and jets of tack coat sprayers shall be kept clear of foreign materials at all times. Pipe work, spray bars and jets shall be empty of tack coat materials before spraying commences.

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

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

Any pools of tack coat that form on the surface shall be brushed out over the adjacent area with brooms or rubber squeegees before the emulsion breaks.

In dusty conditions, every precaution shall be taken to prevent freshly coated surfaces from being contaminated by dust or other foreign material.

The Contractor must endorse and provide to the Superintendent, a record of the average tack coat application rate in each lot.

#### 4.05.10 Placing and Finishing of Asphalt

##### (i) General

The asphalt shall be placed with a minimum delay after delivery. On no account shall asphalt be reheated.

Asphalt shall not be placed during rain or while the surface is wet or when the pavement temperature does not comply with the Table below.

##### (ii) Weather Conditions and Pavement Surface Temperature

The Contractor must measure and record pavement surface temperature and wind velocity at the point of asphalt laying. Measurements shall be recorded in a suitable Asphalt Work Record Sheet.

Asphalt layers less than 45 mm nominated or specified thickness shall not be placed when:

- (a) the pavement surface temperature is below 10° C for dense graded asphalt or below 15° C for open graded asphalt; or
- (b) the pavement surface temperature is below 25° C and the velocity of the wind across the pavement exceeds 15 kilometres per hour.

Asphalt layers less than 30 mm nominated or specified thickness shall not be placed when the pavement surface temperature is below 25° C and the velocity of the wind across the pavement exceeds 5 km/hr.

Asphalt paving will not be permitted when the surface of the road is wet or when cold winds chill the mix to such an extent that, in the opinion of the Superintendent, spreading and compaction are adversely affected

##### (iii) Asphalt Paving Temperature

The temperatures of asphalt at the time of paving shall be as shown in Table.4.39. Any asphalt outside the appropriate temperature range shall be rejected.

**Table 4.39**

Requirements for Asphalt Paving Temperatures				
Binder Type	Road Surface Temperature in Shade (°C)	Minimum Asphalt Temperatures (°C) for Laying		
		Layer Thickness Less than 30mm	Layer Thickness 30mm to 45mm	Layer Thickness 45mm to 100mm
Class 170 & Class 320 Bitumen	5-10	(ii) Not permitted	Not permitted	145 (iv)
	10-15	150	145 (iii)	140
	15-25	145	140 (iii)	135
	over 25	140	135	130
SBS polymer modified bitumen (i)	15-25	Not applicable	160	155
	over 25	Not applicable	150	150

*Notes on Table 4.39:*

- (i) For other polymers the minimum temperatures shall be as per the Manufacturer's recommendation or as directed by the Superintendent.*
- (ii) Laying not permitted if wind velocity across the pavement exceeds 5 km/hr.*
- (iii) Laying not permitted if wind velocity across the pavement exceeds 15 km/h.*
- (iv) The laying temperature of open graded asphalt shall not exceed 140°C*

The Superintendent may reject that part of any truck load which contains lumps of cooled asphalt which are liable to affect the quality of the finished surface.

The temperature of the mix shall be measured in the paver hopper. A suitable stem type thermometer readable and accurate to within  $\pm 2^{\circ}\text{C}$  with a range from at least  $0^{\circ}\text{C}$  to  $200^{\circ}\text{C}$  shall be used. The stem shall be inserted into the mix to a depth of approximately 200mm at a location at least 300mm from the side of the paver. An average of at least two readings shall be adopted as the temperature of the mix.

#### **(iv) Spreading**

No layer of asphalt shall be spread until the Superintendent gives approval to proceed (refer Hold Point 4.9).

A course of Open Graded Asphalt or Stone Mastic Asphalt must comprise one layer only.

The Contractor shall place and finish asphalt so as to:

- (a) Produce a homogeneous product with a tightly bound surface;
- (b) Achieve the specified in situ air voids for dense graded asphalt or the specified compactive effort for open graded asphalt;
- (c) Provide the specified thickness of asphalt; and
- (d) Achieve the finished pavement properties, specified in Clause 4.05.13, to the specified tolerances.

Unless otherwise permitted, asphalt shall be placed by a self-propelled mechanical spreader using automatic level control. Hand placement of asphalt shall be used only for minor correction of the existing surface and in areas where placement with a mechanical spreader is impracticable.

The mechanical spreader shall be operated at a uniform rate consistent with the production of the mixing plant and delivery of asphalt to the site such that stopping of the machine due to lack of asphalt is minimised..

Unless otherwise specified or approved, the day's work shall be organised so that each layer spread covers the full width of the carriageway.

Each layer shall be completed to a surface parallel to the finished surface of the pavement and at a depth below it equal to the compacted thickness of the subsequent layer or layers specified.

Where a levelling beam automatic level control device is used, it shall provide an average profile from a minimum of 8 separate contact points evenly spaced over a length of at least 9m.

Adjoining the edge of a lane which has been spread, tamped and rolled, the asphalt shall be spread to a height such that after compaction the finished surface will match the adjoining levels.

Adjoining a lane which has been spread and tamped but the outer edge of which has not been compacted (See 4.05. 11 below), the asphalt shall be spread to the height of the unrolled material at that edge.

When any asphalt is to be laid by hand it shall be dumped outside the area on which it is to be spread and then distributed into place in a loose layer of uniform density and to the correct levels. Material shall be spread and levelled by means of suitable wooden lutes, care being taken to avoid segregation.

**(v) Placement Trials**

When specified, the Contractor's plant, materials and personnel proposed for use on the job shall be subjected to placement trial(s). The trial section, which shall be at least 300 m in length, one lane in width and a maximum of one day's production. Each nominated mix shall be subject to a separate placement trial and the location of each trial shall be subject to the agreement of the Superintendent

In the event of nonconformances in the placement trial in respect of in situ characteristics, including air voids, thickness, levels, joint quality or riding quality or when the Superintendent deems that a previous trial does not represent the changes in the equipment, materials, asphalt mix proportions, temperature, plant or rate of output, the Superintendent may direct a new trial.

**Hold Point 4.8**

Process Held:	Commencement of asphalt placement trial for each combination of materials, mix proportions, equipment, rate of paving and methods for placement, compaction and finishing when a placement trial is required.
Submission Details:	At least five (5) working days prior to proposed use of the nominated mix the Contractor shall submit verification checklist(s) and all relevant test results for the asphalt for the trial section and details of the proposed location of the trial.
Release of Hold Point:	The Superintendent will consider the submitted documents and agree the trial location, prior to authorising the release of the Hold Point.

**4.05.11 Course and Layer Thicknesses**

**(i) Dense Graded Asphalt and Fine Gap Graded Asphalt**

A course of dense graded asphalt or fine gap graded asphalt may comprise one or more layers.

Where a course comprises more than one layer, the layer thickness(es) shall conform to the limits specified in Table 4.40.

**Table 4.40**

<b>Limits on Nominated Compacted Layer Thickness Dense Graded Asphalt and Fine Gap Graded Asphalt</b>		
<b>Nominal Size of Asphalt (mm)</b>	<b>Type of Work</b>	<b>Nominated Compacted Layer Thickness (mm)</b>
5	Wearing course	15 to 25
10	Wearing course	25 to 40
14	Wearing course	35 to 55
10	Intermediate and Base course	25 to 40
14	Intermediate and Base course	35 to 55
20	Intermediate and Base course	50 to 80
28	Intermediate and Base course	70 to 110
5	Corrective course	10 to 25
10	Corrective course	20 to 40
14	Corrective course	30 to 55
20	Corrective course	40 to 80

**(ii) Corrective Courses**

Notwithstanding the requirements of Table 4.40, the Contractor may propose to vary the specification limits for nominated layer thickness for corrective courses. The proposal shall include:

- (a) Details of work methods proposed to ensure that a dense homogeneous layer will be provided;
- (b) Proposed nominated layer thicknesses; and
- (c) Evidence that affected areas are the absolute minimum necessary to conform to the drawings and that as far as possible, the nominated layer thickness of corrective courses complies with Table 4.40.

The Superintendent will, subject to all requirements of this Specification being met, approve such proposal.

**(iii) Open Graded Asphalt and Stone Mastic Asphalt**

A course of open graded asphalt or stone mastic asphalt shall comprise one layer only.

**(iv) Compaction**

- (a) General

Asphalt shall be compacted uniformly to the standard specified as soon as it will support rollers without undue displacement. All rolling shall be completed while the mix is at a temperature above 80°C.

Rolling shall be performed in a definite sequence and pattern previously determined by the Contractor.

The driving roll or wheels shall be nearer the spreader except on steep grades or sharp curves where the steering roll or wheels shall be nearer the spreader.

The speed of rollers at all times shall be slow enough to avoid displacement of the mix and shall not be greater than 5 km/h. Vibratory mechanisms shall be disengaged before stopping or reversing direction. Steel wheel rollers shall be operated with minimum wetting of rollers. Pneumatic tyred rollers shall be operated without wetting the tyres except during the initial stages of rolling, when only sufficient water shall be applied to the tyres to prevent adhesion of the mix until the tyres have gained heat.

- (b) Initial rolling of layers of compacted thickness less than 100mm

Where asphalt is being placed in layers of compacted thickness less than 100mm, initial rolling shall be performed with a steel wheeled roller. Transverse and/or longitudinal joints shall be rolled first. Rolling shall continue longitudinally, commencing on the lower side and proceeding to the higher side of the spreader run. The roller shall overhang the unsupported edges of the run by about 0.1m. Each longitudinal pass shall overlap the previous pass by about 0.1 m. and adjacent passes of the roller shall be of different lengths.

- (c) Initial rolling of layers of compacted thickness 100mm or more

Where asphalt is being placed in layers of compacted thickness of 100mm or more, the initial rolling of transverse and longitudinal joints and of unsupported edges shall be performed using a steel wheeled roller. Elsewhere, the initial rolling shall be performed using either a self-propelled pneumatic tyred multi-wheeled roller or a steel wheeled roller. Transverse and/or longitudinal joints shall be rolled first. Rolling shall proceed from the lower side of the spreader run to the higher side, but rolling within 0.2m of an unsupported edge shall be delayed to minimise possible displacement of the asphalt.

Initial rolling of the 0.2m strip adjacent to the unsupported edge shall be performed with the steel wheeled roller. The first pass shall cover about half the width of the unrolled strip; the second pass shall cover the remainder of the width and may overhang the edge of the material by not more than 0.1m.

Where a steel wheeled roller is used, each longitudinal pass shall overlap the edge of the previous pass by about 0.1m. If a self propelled pneumatic tyred multi-wheeled roller is used, each longitudinal pass shall overlap the previous run by a minimum of about 1 m. Adjacent passes of the roller shall be of different lengths.

- (d) Secondary Rolling

Secondary rolling shall be performed as soon as possible after initial rolling and shall be performed with a self-propelled pneumatic tyred roller. Rolling shall be carried out longitudinally commencing on the lower side and proceeding to the higher side of the spreader run. Each roller pass shall overlap the previous pass and adjacent passes shall be of different lengths.

- (e) Final Rolling

Final rolling to eliminate all roller marks shall be performed with a steel wheeled non-vibrating roller.

- (f) Echelon Paving

When paving in echelon, the edge of the run common to adjacent spreaders shall be left unrolled for a width of 0.2m until the longitudinal joint has been constructed. This strip shall be rolled together

with the edge of the adjacent spreader run. Rolling shall commence before the temperature of the material along the edge of the first spreader run has fallen below 95°C.

(g) Avoidance of Surface Defects

Rollers shall not remain stationary on asphalt while it is still warm. Roller wheels shall be kept free from any build-up.

Surface defects occurring as a result of rolling shall be corrected immediately.

(h) Areas Inaccessible to Rollers

Asphalt placed in areas inaccessible to the specified rollers shall be compacted using small vibrating rollers or hand-operated mechanical compactors of size and mass acceptable to the Superintendent.

(i) Compaction of Joints

A positive bond shall be provided between adjacent paving runs and loose or cracked material at the edge of a paved mat shall be removed prior to placing the adjacent mat

All joints shall be fully compacted and finished with a smooth, planar surface coinciding with the surface of the rest of the mat and meet all requirements for asphalt given in this Specification.

#### 4.05.12 Joints

(i) Longitudinal and Transverse Joints

Longitudinal and transverse joints shall be well bonded and sealed and shall provide a smooth riding surface across the joint.

Unless otherwise specified or approved, the layout of joints shall conform to the following requirements:

(a) Asphalt shall be spread in such a manner as to minimise the number of joints in the carriageway;

(b) Transverse joints shall be constructed at right angles to the direction of spreading and be cut to a straight vertical face for the full depth of the layer;

(c) Transverse joints in adjoining spreader runs shall be offset by not less than 2m.;

(d) Transverse joints shall be offset from layer to layer by not less than 2m. except that the Superintendent may direct that the minimum offset shall be up to 7m.;

(e) A transverse joint shall be formed at the commencement of each paving run and when the asphalt being paved has cooled below binder manufacturer's recommendations for compaction temperatures.

(f) Longitudinal joints shall be offset from layer to layer by not less than 150mm.

(g) Longitudinal joints shall be parallel to the centre line of the carriageway.

(h) Longitudinal joints shall be located out of the wheel paths.

(i) Longitudinal joints in wearing surface layers shall be coincident with final traffic markings unless otherwise approved by the Superintendent and the position of joints in lower courses shall be planned accordingly.

(j) Longitudinal joints at ramp connections and intersections shall be so positioned so as to avoid joint layouts which may mis-direct traffic away from designed travel paths.

The exposed edges of each spreader run shall be formed while hot to a straight line with a dense face that shall lie between vertical and 45° to the vertical for the full depth of the layer. The unsupported longitudinal edges of spread material shall be side tamped to raise the level of the asphalt slightly to secure maximum edge compaction from subsequent rolling. Rollers shall not be permitted to damage the unsupported longitudinal edge, except that, on 10 mm courses, the Superintendent may permit such edge to be rolled over.

Longitudinal edges that contain segregated or open textured material or which have been damaged by traffic or rolling shall be made good by cutting back in a straight line to expose fresh, dense material and 45° to the vertical. Cutting with a diamond saw will not be permitted.

The screed of the asphalt spreader shall overlap the adjacent run by 25mm to 50mm. At joints constructed against cold edges, the overlapping asphalt shall be removed to waste or crowded back at the joint but shall not be thrown on to the layer being spread.

Unless otherwise approved, transverse joints shall be constructed where the spreading operation is stopped for longer than 20 minutes.

Before placing asphalt to construct transverse joints, all cold contact surfaces shall be tack coated uniformly and thinly. Where directed, cold longitudinal edges and other contact surfaces shall be treated in the same manner. Longitudinal joints shall be treated as "cold" when the temperature of the first run has fallen below 60°C.

#### **(ii) Abutting Structures**

The placing of asphalt against abutting structures such as kerb, gutter manhole or adjoining pavement shall be carried out in the same manner as for longitudinal and transverse joints. Any spaces left unfilled between the spreader run and abutting edges shall be filled with sufficient material to the proper height prior to compaction so that the asphalt meets the requirements of this Specification.

#### **(iii) Junctions**

Where asphalt is required to match an existing pavement, bridge deck, rail or other fixture, the Contractor shall place the asphalt so as to provide a smooth riding surface across the junction. Where specified or required, the Contractor shall remove sufficient of the existing pavement to enable a smooth riding surface to be constructed across the junction.

Where it is necessary to taper the thickness of an asphalt layer to provide a smooth riding connection with an existing surface, the layer shall end at a chase cut or cold planed into the existing pavement surface. The chase shall be of a depth not less than twice the nominal aggregate size of the mix being placed and not less than 400mm wide. Where necessary, removal of coarse particles from a layer of tapering thickness asphalt will be allowed using hand raking.

Where the thickness of the asphalt layer tapers to less than twice the nominal size of the mix, the area upon which material of such thickness is to be placed shall be tack coated uniformly at an application rate between 0.50 and 0.75 litre per square metre.

### **4.05.13 Conformance Criteria**

#### **(i) Compaction Requirements**

##### **(a) General**

Conformance for compaction will be based on insitu air voids testing of the work in homogeneous lots. A lot will usually consist of that part of a particular layer of asphalt that is placed and compacted in one day using homogeneous asphalt. A lot shall contain only areas of work that are essentially homogeneous and any defective areas or work that is cracked or contains bony or fatty material or is otherwise nonconforming shall be excluded from the lot before testing commences. Excluded areas shall be rectified using methods approved by the Superintendent through disposition of a nonconformance report and be tested as a separate lot.

The surfaces of each core taken for the purpose of determining insitu voids and compacted course thickness shall be visually assessed for segregation of constituents and findings reported to the Superintendent before work is covered up. Where directed by the Superintendent, the cores shall also be presented to the Superintendent before work is covered up.

For each lot, insitu voids tests shall be performed on core samples taken from the layer except that, for a layer of nominal thickness 60 mm. or greater, a nuclear gauge may be used to measure insitu voids. The Contractor must establish a correlation between compaction results and insitu voids from cores, approved by the Superintendent, before use of nuclear gauge results to prove conformance is accepted.

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.

(b) **Compaction Standard for Dense Graded Asphalt (AC) and Fine Gap Graded Asphalt (FGG)**

Each layer of dense graded asphalt and fine gap graded asphalt shall be uniformly compacted to achieve the characteristic in situ air voids specified in Table 4.38, before the next layer is commenced.

Compaction control shall be carried on a homogeneous lot-by-lot basis using statistical techniques to randomly select test locations. Conformance of a lot shall be achieved if the characteristic values of in situ air voids, determined in accordance with the following Sub-clause 4.05.13 (e) for that lot, are within the limits of Table 4.41.

**Table 4.41**

<b>Limits for Characteristic Values of In situ Air Voids for Dense Graded Asphalt (AC) and Fine Gap Graded Asphalt (FGG)</b>	
Heavy Duty Application excluding courses of specified thickness less than 50 mm.	All other asphalt including Heavy Duty Application courses of specified thickness less than 50 mm
$V_L = 3\%$ and $V_U = 7\%$	$V_L = 3\%$ and $V_U = 8\%$

*Notes on Table 4.41*

(i) *In situ air voids shall be reported to the nearest 0.1% and shall be assessed for conformance after rounding to the nearest 1%.*

(ii) *Layers less than 30 mm nominated thickness shall not be tested for in situ air voids.*

(c) **Compaction Standard for Stone Mastic Asphalt (SMA)**

The compaction standard for SMA is as follows:

- Compaction control shall be carried out on a homogeneous lot by lot basis using statistical techniques to randomly select test locations.
- In situ air voids shall be reported to the nearest 0.1% and shall be assessed for conformance after rounding to the nearest 1%.
- Conformance of the lot is achieved if, when determined in accordance with Subclause 4.05.13 (e), the lower characteristic value of in situ air voids ( $V_L$ ) for that lot is not less than 4% and the upper characteristic value of in situ air voids ( $V_U$ ) for the lot is not more than 9%.

SMA placed to a specified layer thickness less than 30 mm shall not be subject to the compaction standard.

(d) Compaction of Open Graded Asphalt (OG)

Compaction methods for OG shall be in accordance with AS 2734 Section 8.

(e) Determination of Insitu Air Voids

The Contractor must determine characteristic values of insitu air voids of the lot on the basis of cores.

The calculation of the upper and lower Characteristic Values of Insitu Air Voids (V) of a lot shall be determined as follows:

$$V_U = \bar{a} + ks \quad V_L = \bar{a} - ks$$

where:  $\bar{a}$  is the arithmetic mean of insitu air voids test results for the lot.

s is the standard deviation of air voids test results for the lot

k is the acceptance constant from Table 4.42

**Table 4.42**

Sample Size	3	4	5	6	7	8	9	10	15	20 +
k	0.52	0.62	0.67	0.72	0.75	0.78	0.81	0.83	0.90	0.95

The values of V must be rounded and reported to the nearest 0.1% and both  $\bar{a}$  and s are expressed in percentage. Relative compaction of a core is the ratio of the bulk density of the core and the mean maximum density of the lot determined by AS 2891.9.2 and AS 2891.7.3 respectively and reported as a percentage of mean maximum density.

**(ii) Tolerances**

(a) Job Mixture

Each batch of asphalt shall conform to the proportions of the approved job mix within the tolerances itemised in Table 1 of AS 2150.

Binder content shall not vary by more than  $\pm 0.3\%$ .

(b) Course Thickness for Dense Graded Asphalt (AC) and Fine Gap Graded Asphalt (FGG) where Finished Surface Levels are not specified

When asphalt is placed over an existing pavement in one or more courses and no corrective course is applied, the average compacted course thickness of each lot shall not be less than the specified course thickness.

When asphalt is placed over an existing pavement on which a corrective course has been applied, the compacted course Characteristic Thickness (T) as defined in Subclause 4.05.13(ii) (e) of each lot excluding the corrective course(s) shall be neither less than the specified course thickness nor greater than the specified course thickness plus the tolerance shown in Table 4.43 for the nominal size of asphalt.

**Table 4.43**

<b>Tolerance for Specified Course Thickness for Dense Graded Asphalt (AC) and Fine Gap Graded Asphalt (FGG)</b>	
<b>Nominal Size of Asphalt (mm)</b>	<b>Tolerance (mm)</b>
5	-0 and + 5
10	-0 and + 6
14	-0 and + 8
20	-0 and + 10
28	-0 and + 12

- (c) Course Thickness for Dense Graded Asphalt (AC) and Fine Gap Graded Asphalt (FGG) where Finished Surface Levels are specified

Where finished surface levels are specified, the course levels and straight edge tolerance requirements shall primarily control the course thickness. The average compacted course thickness of each lot shall be determined from the cores.

Where level surveys are required of the course and the underlying surface, the average compacted course thickness of each lot calculated from the surveys shall be checked for consistency with the average compacted course thickness of the respective lot determined from the cores sampled and measured in accordance with Subclause 4.05.13(ii) (e).

When asphalt is placed in more than one course (excluding a corrective course) to specified levels over a pavement constructed by others, the average compacted course thickness of each lot of the wearing course shall also be within 10 per cent of the specified course thickness.

- (d) Course Thickness for Stone Mastic Asphalt (SMA) and Open Graded Asphalt (OG) where finished levels are not specified.

When SMA or OG is placed over an existing pavement constructed by others, the average compacted course thickness of each lot must not be less than the specified course thickness.

When SMA or OG is placed over an existing pavement on which at least one other intermediate or corrective course has been applied by the Contractor, a lot will be deemed to have achieved conformance if the lower characteristic value of thickness ( $T_L$ ) for the lot is not less than the specified course thickness and the upper characteristic value of thickness ( $T_U$ ) for the lot is not more than the specified course thickness plus the tolerance specified in Table 4.44.

**Table 4.44**

<b>Tolerance for Specified Course Thickness for Stone Mastic Asphalt (SMA) and Open Graded Asphalt (OG)</b>	
<b>Nominal Size of Asphalt (mm)</b>	<b>Tolerance (mm)</b>
10	-0 and + 6
14	-0 and + 8

## (e) Thickness Determination

The Contractor shall determine characteristic values and average value of thickness of the homogeneous lot on the basis of cores and statistical techniques.

The calculation of the upper and lower Characteristic Values of Thickness (T) for the lot shall be as follows:

$$T_U = \bar{x} + ks \quad T_L = \bar{x} - ks$$

where:  $x$  is the arithmetic mean height of a core based on measurements taken at four equidistant points at the circumference of the core

$\bar{x}$  is the arithmetic mean of  $x$  for the lot

$s$  is the standard deviation of test results for the lot

$k$  is the acceptance constant from Table 4.42

Note  $\bar{x}$ ,  $x$  and  $s$  are in mm and  $T$  is rounded to the nearest whole millimetre.

## (f) Finished Surface Level where Specified

Where the finished surface level is specified, the top surface of any course after final compaction shall be parallel with the final wearing surface and the levels of the surface of the nominated course shall not vary from the levels determined from the Drawings or as determined by the Superintendent by more than the limits shown in Table 4.45.

When asphalt is placed in more than one course (excluding a corrective course) to specified surface levels over a pavement built by others, each course shall be placed in accordance with this Specification provided that the thickness of the wearing course shall be not less than 90 per cent of that specified and the level of the surface of the wearing course shall comply with the limits shown in Table 4.45.

When the Contractor also constructs the underlying pavement, the level and thickness of the asphalt shall comply with the requirements of Tables 4.43 and 4.44 as applicable and the level of the surface of the wearing course shall comply with the limits shown in Table 4.44.

Surface irregularities exceeding the tolerances given in this Clause shall be corrected to the satisfaction of the Superintendent at the Contractor's cost before a subsequent course is placed.

**Table 4.45**

Tolerance for Asphalt Course Surface Levels		
Nominated Course	Below Nominated Course Level (mm)	Above Nominated Course Level (mm)
Wearing Course	0	10
Top of Intermediate Course	5	10
Other Intermediate Course	10	10
Corrective Course	15	10

## (g) Completed Surfacing

Where a finished surface level is not specified, the top surface of any course after final compaction shall be parallel with the final wearing surface shape determined from the Drawings or as otherwise specified.

On completion of placement and compaction, the asphalt surface shall not deviate from the bottom of a 3 m long straightedge laid in any direction and at any point on the surface by more than the tolerances shown in Table 4.46 (except where required to meet the required surface shape) and shall be such that water cannot accumulate at any point.

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**Table 4.46**


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Surface Deviations from 3 m Straight-edge	
<b>Highways and Major Arterial Roads</b>	<b>Other Roads</b>
3 mm	5 mm

Where the Contractor is required to provide a new wearing course in a single layer operation over a pavement constructed by others and the deviations of the existing surface from a 3 m straight-edge exceed the tolerance specified in Table 4.41, the requirements of Table 4.41 do not apply at those locations. However, the measured deviation of the new surface must be less than that of the existing surface

Where pavement abuts a gutter, the asphalt surface level at the edge shall be within  $\pm 5$ mm, -0mm of the actual concrete level.

**(iii) Riding Quality**

The finished surface must have a smooth longitudinal profile and, on roads with a designated or proposed speed limit in excess of 60 km/hour, except within roundabouts, the riding quality of the finished surface must be measured in terms of NAASRA Roughness with a Profilometer, (RTA T187 (Draft)) or a calibrated NAASRA (AUSTROADS) roughness meter vehicle (RTA T182).

On roads with a designated or proposed speed limit in excess of 60 km/hour, the contractor shall determine and report the roughness of the asphalt surface, and where require, the existing surface prior to overlaying with asphalt, based on the average of three replica runs as follows. For this purpose, each lane shall be divided into sections 100m long. Any length less than 100m shall be included with the section immediately preceding it and an average roughness determined for the section. The start and finish joints of the entire work shall not be included in any section.

A lot will be deemed to have achieved conformance for ride quality if the NAASRA roughness count of each 100m section does not exceed:

- (a) a value of 40 counts per kilometre where construction of the underlying pavement forms part of the contract; or
- (b) a value of 40 counts per kilometre where, excluding any corrective course, asphalt is placed in more than one layer, over a pavement constructed by others; or
- (c) the value (S) as specified below where the Contractor provides only one course, excluding any corrective course, in a single layer operation over a pavement constructed by others:

$S = 40 \text{ counts/km or } (A \times 0.6) + 5 \text{ counts/km, whichever is the greater}$

Where: A = count prior to overlay

and S and A are reported to the nearest 1 count/km

For sections having riding quality outside that specified, deductions in accordance with Table 4.47 shall apply.

**Table 4.47**

Roughness Count Rate above specified count (counts per kilometre)	Deduction per cent for the value of the section
1-5	2
6-10	4
11-15	8
16-20	16
>20	Top 30 mm to be removed and replaced provided remaining thickness of layer is at least twice the nominal mix size otherwise remove and replace whole depth of layer

*Notes on Table 4.47*

*Each section, for the purpose of calculating deductions, shall consist of a 30 mm compacted thickness of asphalt along a single traffic lane. When the Pay Item is measured in tonnes, the following conversion factors shall apply:*

- (i) 2.4 tonnes per cubic metre for dense graded asphalt with normal aggregates.
- (ii) 2.0 tonnes per cubic metre for open graded asphalt.
- (iii) As determined by the Superintendent for asphalt containing special aggregates

#### **(iv) Sampling**

Asphalt shall be sampled at either the point of loading or the point of delivery to the work.

Sampling of each nominal size of asphalt supplied must be undertaken by the Contractor in accordance with AS 2891.1 and at the minimum frequencies nominated in this Specification.

Unless otherwise specified or agreed with the Superintendent, boundaries of lots represented by a single tested sample must be defined by the midpoints in production between the sample points.

When the Contractor is obtaining samples and when requested by the Superintendent, the Contractor must provide samples to the Superintendent, from the same lot by riffing or quartering the Contractor's own samples.

#### **(v) Testing**

Asphalt supplied for the work must be tested for the purpose of verifying conformance to specification.

Tests for binder content, combined particle size distribution, voids in laboratory compacted mix, moisture content, filler/binder ratio, binder film thickness and VMA shall be completed and reported to the Superintendent

within one (1) working day of mixing. Tests for in situ air voids, shape and compacted course thickness shall be completed and reported to the Superintendent within three (3) working days of placing the asphalt.

**(vi) Frequency of Testing**

The frequency of testing shall be appropriate to verify conformity and shall not be less than that stated in Table 4.48. Where no minimum frequency of inspection or testing is stated, the Contractor shall nominate appropriate frequencies in their Inspection and Test Plan(s).

The Contractor shall include in the management review of the Quality System, a review of the appropriateness of the frequency of testing nominated in the Inspection and Test Plan(s). Such review shall take into account the frequency of nonconformance detected, including nonconformance remedied by simple reworking.

The Superintendent may conditionally agree to a Contractor's proposal to reduce the specified minimum frequency of testing. The proposal shall be supported by a statistical analysis verifying consistent process capability and product characteristics. The Superintendent may vary or restore the specified minimum frequency of testing, either selectively or permanently, at any time.

**Table 4.48**

Minimum Frequency of Testing of Asphalt	
Quantity of Asphalt Supplied each Shift	Minimum Frequency of Testing
Less than 100 tonnes	One per 50 tonnes or part thereof
101 to 300 tonnes	One per 100 tonnes or part thereof
301 to 600 tonnes	One per 150 tonnes or part thereof
Over 600 tonnes	One per 200 tonnes or part thereof

*Notes on Table 4.48:*

- (i) For the purpose of this clause, a "shift" must be continuous work not exceeding a period of 12 hours

**Table 4.49**

Clause	Characteristic Analysed	Test Method	Minimum Frequency Of Testing
<b>Materials – Coarse Aggregate (per lot)</b>			
4.05.3(iii) (a)	Wet Strength	AS 1141.22	One (1) test per 1,000t (i)
4.05.3(iii) (b)	Wet / Dry Strength Variation	AS 1141.22	One (1) test per 1,000t (i)
4.05.3(iii) (c)	Particle shape	AS 1141.14	One (1) test per 1,000t
4.05.3(iii) (d)	Fractured faces	AS 1141.14	One (1) test per 1,000t

## SECTION 4

FLEXIBLE PAVEMENT  
CONSTRUCTION

Clause	Characteristic Analysed	Test Method	Minimum Frequency Of Testing
4.05.3(iii) (e)	Resistance to stripping	AS 1141.50	One (1) test per six (6) months or change in quarry face
4.05.3(iii) (f)	Polished Aggregate Friction Value (PAFV)	AS 1141.42	One (1) test per six (6) months or change in quarry face
4.05.3(iii) (g)	Water Absorption	AS 1141.6.1	One (1) test per six (6) months or change in quarry face
<b>Materials – Fine Aggregate (per lot)</b>			
4.05.3(iv)	Water Absorption	AS 1141.5	One (1) test per three (3) months or change in quarry face
<b>Materials – Mineral Filler</b>			
4.05.3(iv)	Voids in dry compacted filler	AS 1141.17	One (1) test per 1,000t or part thereof or change in source of mineral matter
<b>Materials – Hydrated Lime</b>			
4.05.3(v) (b)	Available Lime	AS 4489.6.1	One (1) test per 500t of hydrated lime production
4.05.3(v) (b)	Sieve residue	AS 4489.2.1	One (1) test per 500t of hydrated lime production
<b>Materials - Binder</b>			
4.05.3(v) (a)	Bitumen Class 170, 320	AS 2008	Certificate of Compliance per batch
4.05.3(v) (c)	Multigrade Bitumen	Table 4.15	Certificate of Compliance per batch
4.05.3(v) (c)	Polymer Modified Binder	Table 4.27	Frequency prescribed in Table 4.27
<b>Asphalt Production</b>			
4.05.4; Tables 4.28; 4.29; 4.31; 4.33; 4.35	Particle size distribution of combined aggregate	AS 2891.3.1	Frequency prescribed in Table 4.47
4.05.4; Tables 4.28; 4.29; 4.31; 4.33; 4.35	Binder content	AS 2891.3.1	Frequency prescribed in Table 4.47
4.05.4 (iv); Table 4.29 AC-HD	Binder film thickness	RC 201.01	One (1) test per nominated mix and One (1) test per trial mix
4.05.4; Tables 4.28; 4.29; 4.31; 4.33; 4.35	Filler / Binder Ratio	AS 2891.3.1	Frequency prescribed in Table 4.47
4.05.4 (iv); Table 4.28 AC-MD	Voids in laboratory compacted asphalt and VMA		
	- Marshall Stability and flow (50 blow)	AS 2891.5	Frequency prescribed in Table 4.47
	- Voids in mix (50 blow)	AS 2891.8	One (1) test per production lot

## SECTION 4

FLEXIBLE PAVEMENT  
CONSTRUCTION

Clause	Characteristic Analysed	Test Method	Minimum Frequency Of Testing
4.05.4 (iv); Table 4.29 AC-HD	- gyropac 120 cycles - gyropac 350 cycles	AS 2891.2.2; T605; AS 2891.8; AS 2891.9.2	Frequency prescribed in Table 4.47 One (1) test per production lot
4.05.4 (v); Table 4.31; Table 4.32 SMA	- gyropac 80 or 120 cycles - gyropac 350 cycles	AS 2891.7; AS 2891.8; AS 2891.9.2	Frequency prescribed in Table 4.47 One (1) test per production lot
4.05.4 (vi); Table 4.33 OG	- gyropac 80 cycles	AS 2891.5; AS 2891.6; AS 2891.9.3	Frequency prescribed in Table 4.47
4.05.4 (vii); Table 4.35 FGG	- Marshall Stability and flow (35 blow) - Voids in mix (35 blow)	AS 2891.5 AS 2891.8	Frequency prescribed in Table 4.47 One (1) test per production lot
4.05.4 (iv); Table 4.29 AC-HD	Minimum tensile strength ratio	RTA T640	One (1) test per 1000 t (ii)
4.05.4 (iv); Table 4.29 AC-HD	Moisture Content	RTA T613	One (1) test per production lot
4.05.4 (v); Table 4.31 SMA	Voids in mineral matter passing 0.075 mm AS sieve	AS 1141.11; AS 1141.17	One (1) test per 10,000 t or part thereof or change in source of mineral matter
<b>Asphalt Paving</b>			
4.05.9	Tack Coat Application Rate	Measure	One (1) per lot
4.05.10 (ii)	Pavement Temperature	Measure	One (1) test every two (2) hours
4.05.10 (ii)	Wind Velocity	Measure	One (1) test every two (2) hours
4.05.10 (iii)	Asphalt Temperature	Measure	One (1) test every delivered load
<b>Asphalt Insitu</b>			
	Insitu Air voids		
4.05.13 (ii) (b)	AC-MD; AC-HD; FGG	RTA T605; AS 2891.8; AS 2891.9.2	One (1) core per 500 m <sup>2</sup> with minimum five (5) per lot (iii)
4.05.13 (ii) (c)	SMA	RTA T605; AS 2891.8; AS 2891.9.2	One (1) core per 500 m <sup>2</sup> with minimum five (5) per lot (iii)
4.05.13 (ii) (b); 4.05.13 (ii) (c); 4.05.13 (ii) (d); Table 4.43	Compacted course thickness	4.05.13 (i) (e)	One (1) core per 500 m <sup>2</sup> with minimum five (5) per lot (iii)
4.05.13 (ii) (f); Table 4.44	Course position	Survey	One (1) survey point per 25 m <sup>2</sup>

Clause	Characteristic Analysed	Test Method	Minimum Frequency Of Testing
4.05.13 (ii) (g); Table 4.45	Shape	Deviation from 3m straight edge	Ten (10) tests per 200m length or part thereof
4.05.13 (iii); Table 4.44	Riding Quality	RTA T182 or RTA T187	One (1) per Contract

*Notes on Table 4.49*

- (i) *Provided that for the six previous lots actually tested, all tests have met specification requirements for both wet strength and wet/dry strength variation then the following reduced frequency shall apply; where all wet/dry variation results are < 25% : 1 per 10,000 tonnes  
where all wet/dry variation results are < 30% : 1 per 4,000 tonnes  
where all wet/dry variation results are < 35% : 1 per 2,000 tonnes*
- (ii) *If the nominated mix is in use on other Contracts and more than 5,00t of conforming mix has been supplied the frequency may be reduced to one (1) test per 5,000 t. To allow the reduction in test frequency the Contractor must supply all supporting documentation to the Superintendent for approval.*
- (iii) *For lots less than 1,000m<sup>2</sup> this may be relaxed to minimum three (3) cores. For wearing surfaces of FGG, a method statement for compaction with suitable records, together with correlated core results for the particular mix may be accepted by the Superintendent in lieu of cores results for subsequent lots.*

#### **Hold Point 4.9**

Process Held:	Placement of overlaying asphalt layers.
Submission Details:	At least one (1) working day before proposed overlay of asphalt layers the Contractor shall submit all test and survey results demonstrating conformance of the layer for material properties, insitu voids, level and width.
Release of Hold Point:	The Superintendent will consider the submitted documents and may carry out surveillance and audit, prior to authorising the release of the Hold Point.

## **4.06 MEASUREMENT AND PAYMENT**

Payment shall be made for all activities associated with completing the work detailed in this Specification in accordance with Pay Items 403P1-P4; 404P1-P7; and 405P1-P13 inclusive.

A lump sum price for any of these items will not be accepted.

The Contractor shall allow in the pay items generally for the costs associated with all testing required to prove conformance of the works as specified.

If any pay item for which a quantity of work is listed in the Contract has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other pay items for the cost of the activity which has not been priced.

**Pay Item 403P1            Base material**

The unit of measurement shall be cubic metre in place.

This pay item shall include supply, spreading, compaction and trimming of base material at the specified moisture content.

A separate pay item shall be included in the Contract for each Traffic Category type.

403P1.1	Traffic Category 1
403P1.2	Traffic Category 2a
403P1.3	Traffic Category 2b
403P1.4	Traffic Category 2c
403P1.5	Traffic Category 2d
403P1.6	Cycleways

**Pay Item 403P2            Subbase material**

The unit of measurement shall be cubic metre in place.

This pay item shall include supply, spreading, compaction and trimming of subbase material at the specified moisture content.

A separate pay item shall be included in the Contract for each Traffic Category type.

403P2.1	Traffic Category 1
403P2.2	Traffic Category 2a
403P2.3	Traffic Category 2b
403P2.4	Traffic Category 2c
403P2.5	Traffic Category 2d
403P2.6	Cycleways

**Pay Item 403P3            Select Material**

The unit of measurement shall be cubic metre in place.

This pay item shall include supply, spreading and compaction of select material at the specified moisture content. Material may be from on site or imported. If the Contractor assesses that the specified select material type can not be sourced from on site then due allowance shall be made in the pay item for importation of select material of the specified type.

A separate pay item shall be included in the Contract for each select material type.

403P3.1	CBR15
403P3.2	CBR12
403P3.3	CBR10
403P3.4	CBR8
403P3.5	CBR6

**Pay Item 403P4            Match to Existing Pavement**

The unit of measurement shall be linear metre constructed

This pay item shall include all works associated with matching granular pavement layers to the existing pavement as described in Clause 4.03.3 (iii) or as shown on the drawings. This includes excavation and removal of the existing pavement, compaction, and trimming.

**Pay Item 404P1                      Supply and Spray Primer, Primerbinder**

The unit of measurement shall be the litre measured at 15°C.

The quantities (in litres) shall be determined by multiplying the target application rate of the combined mixture of all materials (including any field or refinery incorporated cutter or flux) at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres).

This pay item shall include preparation of the surface to be sprayed including brooming where required, and supply, heating and spraying of primer and primerbinder.

A separate pay item shall be included in the Contract for each type of primer and primerbinder.

404P1.1	AMC00
404P1.1	AMC0
404P1.1	AMC1
404P1.1	AMC2
404P1.1	AMC3
404P1.1	AMC4
404P1.1	Field Cutback Primer / Primerbinder

**Pay Item 404P2                      Supply and Spray Binder - Class 170 Bitumen**

The unit of measurement shall be the litre of Class 170 bitumen at 15°C.

The quantities (in litres) shall be determined by multiplying the target application rate of Class 170 bitumen at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres).

This pay item shall include preparation of the surface to be sprayed including brooming where required, adhesion agent where specified and supply, heating and spraying of Class 170 bitumen.

Measurement shall include bitumen used for tack coat under specified geotextile.

**Pay Item 404P3                      Supply and Spray Binder - Class 320 Bitumen**

The unit of measurement shall be the litre of Class 320 bitumen at 15°C.

The quantities (in litres) shall be determined by multiplying the target application rate of Class 320 bitumen at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres).

This pay item shall include preparation of the surface to be sprayed including brooming where required, adhesion agent where specified and supply, heating and spraying of Class 320 bitumen.

**Pay Item 404P4                      Supply, Incorporate and Spray Cutter Oil in Binder**

The unit of measurement shall be the cold litre.

The quantities (in cold litres) shall be determined from the target percentage of cutter oil added in the field to produce the binder for each sprayer run of Seal and Reseal.

This pay item shall include all work required to supply, heat and incorporate cutter oil to the binder in the field, and spray of the mixture.

**Pay Item 404P5                      Supply, Incorporate and Spray Flux Oil in Binder**

The unit of measurement shall be the cold litre.

The quantities (in cold litres) shall be determined from the target percentage of flux oil added in the field to the binder of Seal and Reseal.

This pay item shall include all work required to supply, heat and incorporate flux oil to the binder in the field, and spray of the mixture.

**Pay Item 404P6                      Supply, Precoat, Apply and Incorporate Aggregate**

The unit of measurement shall be the cubic metre.

The quantity of aggregate required (in cubic metres) shall be determined by dividing the area of road surface to be covered for each sprayer run (in square metres) by the target application rate (in square metres per cubic metre).

This pay item shall include the supply, stockpiling as appropriate, precoating, spreading, rolling into the binder of precoated aggregate and removal of excess aggregate where appropriate.

A separate shall be included in the Contract for each nominal size of aggregate precoated as specified.

404P6.1	5mm aggregate (precoated)
404P6.2	7mm aggregate (precoated)
404P6.3	10mm aggregate (precoated)
404P6.4	14mm aggregate (precoated)
404P6.5	20mm aggregate (precoated)

**Pay Item 404P7                      Deductions in Accordance with Clause 4.04.13 (v)**

Deductions shall be made on the actual application rate and shall not be subject to adjustment for rise and fall in costs.

404P6.1	Bitumen
404P6.2	Refinery Cutback Bitumen

**Pay Item 405P1                      Supply and Application of Tack Coat**

The unit of measurement shall be the litre of residual bitumen

The volume shall be determined by multiplying the nominated application rate of residual bitumen by the specified area of the road surface to be tack coated.

The pay item shall include surface preparation including sweeping and brooming as required, supply and spray of tack coat. No account shall be taken of tack coat necessarily applied to faces of joints, kerbs and other structures by hand is also included in the pay item.

**Pay Item 405P2                    Dense Graded Asphalt (AC) Asphalt in Corrective Courses**

The unit of measurement shall be tonnes confirmed by weighbridge docketts.

This pay item shall include all operations involved in the supply, spreading and compaction of the asphalt.

A separate pay item shall be included in the Contract for each type of binder, nominal size of aggregate and application designation.

405P2.1	AC-MD	5 mm Nominal Size
405P2.2	AC-MD	10 mm Nominal Size
405P2.3	AC-MD	14 mm Nominal Size
405P2.4	AC-MD	20 mm Nominal Size
405P2.11	AC-HD	5 mm Nominal Size
405P2.12	AC-HD	10 mm Nominal Size
405P2.13	AC-HD	14 mm Nominal Size
405P2.14	AC-HD	20 mm Nominal Size

**Pay Item 405P3                    Dense Graded Asphalt (AC) in Intermediate Courses**

The unit of measurement shall be tonnes confirmed by weighbridge docketts.

This pay item shall include all operations involved in the supply, spreading and compaction of the asphalt.

A separate pay item shall be included in the Contract for each type of binder, nominal size of aggregate and application designation.

405P3.1	AC-MD	10 mm Nominal Size
405P3.2	AC-MD	14 mm Nominal Size
405P3.3	AC-MD	20 mm Nominal Size
405P3.11	AC-HD	10 mm Nominal Size
405P3.12	AC-HD	14 mm Nominal Size
405P3.13	AC-HD	20 mm Nominal Size

**Pay Item 405P4                    Dense Graded Asphalt (AC) in Wearing Course**

The unit of measurement shall be tonnes confirmed by weighbridge docketts.

This pay item shall include all operations involved in the supply, spreading and compaction of the asphalt.

A separate pay item shall be included in the Contract for each type of binder, nominal size of aggregate and application designation.

405P4.1	AC-MD	10 mm Nominal Size
405P4.2	AC-MD	14 mm Nominal Size
405P4.3	AC-MD	20 mm Nominal Size
405P4.11	AC-HD	10 mm Nominal Size
405P4.12	AC-HD	14 mm Nominal Size
405P4.13	AC-HD	20 mm Nominal Size

**Pay Item 405P5                    Dense Graded Asphalt (AC) over an Existing Pavement  
(No Levels Specified)**

The unit of measurement shall be tonnes confirmed by weighbridge docketts.

This pay item shall include all operations involved in the supply, spreading and compaction of the asphalt.

A separate pay item shall be included in the Contract for each type of binder, nominal size of aggregate and application designation.

405P5.1	AC-MD	10 mm Nominal Size
405P5.2	AC-MD	14 mm Nominal Size
405P5.3	AC-MD	20 mm Nominal Size
405P5.11	AC-HD	10 mm Nominal Size
405P5.12	AC-HD	14 mm Nominal Size
405P5.13	AC-HD	20 mm Nominal Size

**Pay Item 405P6                    Dense Graded Asphalt (AC) over an Existing Pavement  
(Levels Specified)**

The unit of measurement shall be tonnes confirmed by weighbridge docketts.

This pay item shall include all operations involved in the supply, spreading and compaction of the asphalt.

A separate pay item shall be included in the Contract for each type of binder, nominal size of aggregate and application designation.

405P6.1	AC-MD	10 mm Nominal Size
405P6.2	AC-MD	14 mm Nominal Size
405P6.3	AC-MD	20 mm Nominal Size
405P6.11	AC-HD	10 mm Nominal Size
405P6.12	AC-HD	14 mm Nominal Size
405P6.13	AC-HD	20 mm Nominal Size

**Pay Item 405P7                    Stone Mastic Asphalt (SMA) in Wearing Course**

The unit of measurement shall be tonnes confirmed by weighbridge docketts.

This pay item shall include all operations involved in the supply, spreading and compaction of the asphalt and incorporation of fibres as specified.

A separate pay item shall be included in the Contract for each binder type, nominal size of aggregate and loading category.

405P7.1	SMA-M	10 mm Nominal Size
405P7.2	SMA-M	14 mm Nominal Size
405P7.11	SMA-H	10 mm Nominal Size
405P7.12	SMA-H	14 mm Nominal Size

**Pay Item 405P8 Stone Mastic Asphalt (SMA) over an Existing Pavement  
(No Levels Specified)**

The unit of measurement shall be tonnes confirmed by weighbridge docketts.

This pay item shall include all operations involved in the supply, spreading and compaction of the asphalt and incorporation of fibres as specified.

A separate pay item shall be included in the Contract for each binder type, nominal size of aggregate and loading category.

405P8.1	SMA-M	10 mm Nominal Size
405P8.2	SMA-M	14 mm Nominal Size
405P8.11	SMA-H	10 mm Nominal Size
405P8.12	SMA-H	14 mm Nominal Size

**Pay Item 405P9 Open Graded (OG) Asphalt in Wearing Course**

The unit of measurement shall be tonnes confirmed by weighbridge docketts.

This pay item shall include all operations involved in the supply, spreading and compaction of the asphalt.

A separate pay item shall be included in the Contract for each binder type and nominal size of aggregate.

405P9.1	OG	10 mm Nominal Size
405P9.2	OG	14 mm Nominal Size

**Pay Item 405P10 Open Graded Asphalt (OG) over an Existing Pavement  
(No Levels Specified)**

The unit of measurement shall be tonnes confirmed by weighbridge docketts.

This pay item shall include all operations involved in the supply, spreading and compaction of the asphalt.

A separate pay item shall be included in the Contract for each binder type and nominal size of aggregate.

405P10.1	OG	10 mm Nominal Size
405P10.2	OG	14 mm Nominal Size

**Pay Item 405P11 Fine Gap Graded Asphalt (FGG) in Wearing Course**

The unit of measurement shall be tonnes confirmed by weighbridge docketts.

This pay item shall include all operations involved in the supply, spreading and compaction of the asphalt.

A separate pay item shall be included in the Contract for each binder and FGG type.

405P11.1	FGG-A
405P11.2	FGG-B
405P11.3	FGG-R

**Pay Item 405P12          Fine Gap Graded Asphalt (FGG) over an Existing Pavement (No Levels Specified)**

The unit of measurement shall be tonnes confirmed by weighbridge docketts.

This pay item shall include all operations involved in the supply, spreading and compaction of the asphalt.

A separate pay item shall be included in the Contract for each binder and FGG type.

405P11.1	FGG-A
405P11.2	FGG-B
405P11.3	FGG-R

**Pay Item 405P13          Deductions in Accordance with Clause 4.05.13 (iii)**

Deductions for Ride Quality made under this pay item shall not be subject to rise and fall adjustments.

**4.07          SCHEDULE OF HOLD POINTS**

<b>Hold Points</b>	<b>Clause</b>	<b>Description</b>
4.1	4.03.2	Use of each type or source of granular pavement material
4.2	4.03.4(iv)(d)	Placement of overlaying granular pavement layers
4.3	4.03.4(v)	<i>Placement of overlaying granular pavement layers over nonconforming works area</i>
4.4	4.04.3(i)	Delivery of materials for sprayed bituminous surfacing
4.5	4.04.8	Design of sprayed bituminous surfacing to be used in the works
4.6	4.04.11(i)	Sprayed bituminous surfacing work for each work area
4.7	4.05.4(i)	Use of each asphalt nominated mix
4.8	4.05.10(v)	Commencement of asphalt placement trial if required
4.9	4.05.13(vi)	Placement of overlaying asphalt layers