

# Main Roads Standard Specification

## Open Graded Asphalt Surfacing

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**December 06**

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# Open Graded Asphalt Surfacing

## 1 INTRODUCTION

This specification applies to the construction of open graded asphalt road surfacing with superior water drainage and noise reduction characteristics.

This specification shall be read in conjunction with Standard Specifications MRS11.01 *Introduction to Standard Specifications*, MRS11.50 *Specific Quality System Requirements* and other specifications as appropriate.

This specification forms part of the Standard Specifications Roads Manual.

## 2 MEASUREMENT OF WORK

### 2.1 Standard Work Items

In accordance with the provisions of Clause 2 of MRS11.01 *Introduction to Standard Specifications*, the standard work items relevant to this specification are listed in Table 1.

Table 1 – Standard Work Items

Standard Item No.	Description	Unit
	Open Graded Asphalt Surfacing	
5542	Open graded asphalt surfacing, OG10 mix	tonne
5543	Open graded asphalt surfacing, OG14 mix	tonne

### 2.2 Work Operations

**Item 5542 Open graded asphalt surfacing, OG10 mix**

**Item 5543 Open graded asphalt surfacing, OG14 mix**

Work Operations incorporated in the above items include –

- a) Work Operations listed in Clause 2.2.5 of MRS11.01 *Introduction to Standard Specifications*;
- b) Being registered as an approved asphalt manufacturer or engaging a subcontractor who is registered as an approved asphalt manufacturer;
- c) Manufacture of the open graded asphalt in accordance with the approved mix design;

- d) Delivery of the open graded asphalt to the Works;
- e) Being registered as an approved asphalt paving organisation or engaging a registered approved asphalt paving organisation;
- f) Laying, compacting and finishing the production asphalt;
- g) Providing an allowance for production asphalt used in temporary ramps and asphalt lost from cut-offs from joints; and
- h) Provision of a laboratory and compliance testing facilities.

### 2.3 Calculation of Quantities

The quantity of asphalt shall be determined from the tally of the weighbridge dockets of delivered asphalt less the quantity of asphalt which does not remain in the Works (such as asphalt in temporary ramps, cut off joints) and that remaining on or in the Construction Plant and less any amount of asphalt placed outside tolerance but accepted to remain in the Works by the Superintendent.

## 3 DEFINITION OF TERMS

The terms used in this specification shall be as defined in Table 2. Further definitions are referenced by Clause 3 of MRS11.01 *Introduction to Standard Specifications*.

## 4 STANDARD TEST METHODS

The standard test methods listed in Table 3 shall be used in this Specification.

Further details of test numbers and test descriptions are given in Clause 4 of MRS11.01 *Introduction to Standard Specifications*.

## 5 QUALITY SYSTEM REQUIREMENTS

### 5.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5 of MRS11.01 *Introduction to Standard Specifications*.

The Hold Points, Witness Points and Milestones applicable to this specification are summarised in Table 4.

**Table 2 - Definition of Terms**

<b>Term</b>	<b>Definition</b>
added filler	A filler component which is independently added to the mix at a specified proportion. It may be an imported filler (e.g. fly ash, hydrated lime) or a reclaimed filler (e.g. baghouse dust).
approved asphalt manufacturer	An organisation which has current registration as an approved asphalt supplier for asphalt manufacture.
approved asphalt paving organisation	An organisation which has current registration as an approved asphalt supplier for asphalt paving.
approved design binder content	The binder content of the approved mix design.
approved design grading	The combined aggregate/filler particle size distribution of the approved mix design.
approved mix design	The mix design, of a particular nominal size of open graded asphalt, which has been submitted by a manufacturer and approved by Main Roads.
mix design	The design of an asphalt mix of a particular nominal size comprising the type and proportions of the constituent materials.
manufacturer	An organisation which has the necessary plant and equipment to manufacture open graded asphalt to this specification.
mix design approval	Written notification issued by Main Roads to a manufacturer approving a proposed mix design.
mix design approval certificate	A certificate issued by Main Roads to a manufacturer confirming that the manufacturer has an approved design for a particular mix.
open graded asphalt	A processed mixture of bituminous binder, mineral aggregate and filler with or without additives, which is mixed, stored, delivered, laid and compacted while hot, in accordance with this specification. The mixture contains only small amounts of fine material, providing a high percentage of air voids. Open graded asphalt may also be referred to as asphalt, bituminous mix or open graded friction course asphalt.
production asphalt	The open graded asphalt, produced at the asphalt plant by the approved asphalt manufacturer using the approved mix design, for use in work under the Contract.
proposed mix design	A mix design for open graded asphalt in a particular nominal size submitted by a manufacturer for approval.

## **5.2 Construction Procedures**

The Contractor shall prepare documented procedures for all construction processes as defined in Clause 5 of MRS11.50 *Specific Quality System Requirements*.

Procedures for those activities listed in Table 5 shall be submitted to the Superintendent in accordance with Clause 5 of MRS11.50 *Specific Quality System Requirements*.

## **5.3 Conformance Requirements**

The conformance requirements which apply to lots of open graded asphalt covered by this

specification are summarised in Clauses 9.3 and 11.

## **5.4 Testing Frequency**

The minimum testing frequencies for work covered by this specification are specified in Clauses 9.3 and 11.2.

# **6 CONDITIONS FOR MANUFACTURE AND LAYING OF ASPHALT**

## **6.1 General**

Open graded asphalt shall be manufactured and/or laid and compacted only by an approved asphalt

supplier. The criteria for registration as an asphalt supplier include the following in addition to the relevant requirements of Clauses 6.2 and 6.3:

*Table 3 – Standard Test Methods*

Property to be Tested	Test No.
<b>AGGREGATE</b>	
Sample preparation	Q101
Particle size distribution	Q103B
Flakiness index	Q201A
Polished aggregate friction value	Q203
Ten percent fines value (wet)	Q205B
Wet / dry strength variation	Q205C
Degradation factor	Q208B
Water absorption	Q214B
Crushed particles	Q215
Weak particles	Q217
<b>FILLER</b>	
Voids in dry compacted filler	AS 1141.17
<b>ASPHALT</b>	
Sampling and preparation	Q301
Marshall sample preparation	Q305
Compacted density	Q306C
Maximum density	Q307A
Binder content and aggregate grading	Q308A Q308D
Tolerance mix preparation and testing	Q309
Binder drainage	Q310
Voids calculations for compacted asphalt	Q311
Abrasion loss	Q313
Binder film thickness	Q317
Surface evenness	Q708
Three metre straightedge	Q712

- a) expertise of staff;
- b) management systems, including a quality management system that is certified against the requirements of AS 9001 : 2000 or against the requirements of a recognised construction industry based scheme;

- c) assessment of performance of the asphalt manufacturer following each project involving more than 2000 tonnes of asphalt.

Registration as an approved asphalt supplier is generally reviewed each 3 years, or earlier if necessitated by conditions imposed in the terms of registration, or if unsatisfactory performance is reported.

For information regarding approval status refer to –

Queensland Department of Main Roads  
Road Delivery and Performance Division  
35 Butterfield Street  
Herston Qld 4006

## 6.2 Manufacture

The criteria for registration as an approved asphalt manufacturer include the following in addition to the requirements of Clause 6.1:

- a) procedures for planning of processes and of inspection and testing activities that are acceptable to the superintendent for purposes of manufacture of asphalt in accordance with this specification;
- b) quality control arrangements, including analysis of measurement and test data and management of the variation inherent in the constituent materials and in the process for manufacture of asphalt;
- c) demonstration of capability to manufacture asphalt that consistently complies with the details of the approved asphalt mix design in accordance with Clauses 8 and 9;
- d) provision of inspection and test data that demonstrates compliance of the asphalt mix and of its various constituent materials with the requirements of all relevant specifications.

The approved asphalt manufacturer shall obtain an approved mix design in accordance with Clause 8.

The mix design approval may predate the Contract provided that it remains current at the time of supply of production asphalt under the Contract.

Alternatively, the asphalt manufacturer may elect to obtain an approved mix design for the relevant nominal size of open graded asphalt to be manufactured under the Contract, in accordance with Clause 8, before the date for supply of production asphalt.

Table 4 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
6.2	1 Asphalt mix design acceptance		Asphalt mix design approval certificate submitted
8.4.2			Approved mix design
9.3		Testing of production asphalt	
10.1	2 Acceptance of paving procedure		Submit paving procedure
10.2.2		Loading of delivery vehicles	
10.2.4.1		Surface preparation	
10.2.5		Application of tack coat	
10.2.6.1	3 Paving operations		
10.2.6.6		Temperature of asphalt discharged to hopper	
10.2.6.11		Trial of paving procedure	
10.2.10	4 Areas for corrector course		
10.3.2.3.3	5 Referring overlay design to the Principal		

Table 5 – Construction Procedures

Clause	Procedure
10.1	Asphalt Pavement Construction

At least 7 days before production asphalt is required to be produced, the Contractor shall submit to the Superintendent the identity and address of the proposed asphalt manufacturer and a copy of the mix design approval certificate of the mix proposed for the job **Milestone**.

Production asphalt shall not be delivered to the Works until written acceptance of the mix design has been obtained from the Superintendent **Hold Point 1**.

### 6.3 Laying and Compacting Mix

The criteria for registration as an approved asphalt paving organisation include the following in addition to the requirements of Clause 6.1:

- procedures for planning of processes and of inspection and testing activities that are acceptable to the superintendent for laying and compacting of asphalt in accordance with this specification;
- quality control arrangements, including analysis of measurement and test data and management of the variation inherent in the process for laying and compacting asphalt;

- demonstration of capability to lay and compact asphalt that consistently complies with the details of the approved asphalt mix design in accordance with Clauses 10 and 11;
- provision of inspection and test data that demonstrates compliance of the compacted asphalt with the requirements of all relevant specifications.

## 7 QUARRY ASSESSMENT AND CERTIFICATION

A quarry assessment shall be undertaken and Main Roads certification obtained (or current Main Roads certification held) for asphalt application for any quarry from which the coarse aggregate of an asphalt mix is to be supplied.

The quarry assessment and certification shall be conducted in accordance with Main Roads Engineering Policy number EP108 *Quarry Assessment and Certification*.

The manufacturer shall forward a Main Roads Quarry Assessment Certificate for each source of coarse aggregate with the manufacturer's submission as specified in Clause 8.4.2.



## 8 APPROVED MIX DESIGN

### 8.1 Design Responsibility

The manufacturer shall be responsible for development of the approved design to comply with the requirements of Clauses 8.2 and 8.3.

### 8.2 Constituent Material Requirements

#### 8.2.1 General

The asphalt mix shall incorporate coarse aggregate, fine aggregate, filler, added filler and binder complying with the requirements of Clauses 8.2.2 to 8.2.5 and shall be designed in accordance with the requirements specified in Clause 8.3.

#### 8.2.2 Coarse Aggregate

Coarse aggregate shall consist of crushed rock or crushed gravel particles 4.75 mm size or larger.

The aggregate shall be clean, hard, angular, durable, and free from laminated particles, clay and other aggregations of fine material, soil, organic matter and any other deleterious material.

The combined coarse aggregate shall have the properties given in Table 6.

Table 6 – Coarse Aggregate Properties

Property	Limit	Value
Flakiness Index	Maximum	30
Ten Percent Fines Value (Wet) (kN)	Minimum	150
Wet / Dry Strength Variation (%)	Maximum	35
Degradation Factor	Minimum	40
Water Absorption (%)	Maximum	2 <sup>†</sup>
Crushed Particles (%)	Minimum	80
Weak Particles (%)	Maximum	1
Polished Aggregate Friction Value	Minimum	45

† For aggregate with water absorption between 2% and 2.5%, project-specific approval may be granted provided that, in the opinion of the Superintendent, a history of satisfactory performance has been demonstrated and suitable adjustments to the mix properties have been made.

For Greenstone source material only (Metamorphic Group), if the Greenstone does not comply with the specified maximum Wet/Dry Strength Variation limit, it may be used provided that its Ten Percent Fines Value (Wet) is at least 210 kN.

Where aggregates are blended to achieve the minimum limit for polished aggregate friction value, the requirements set out in the Main Roads publication MGG02 *Guide for the Use of Coarse Aggregate Blends in Asphalt Mix Designs* shall apply.

#### 8.2.3 Fine Aggregate

Fine aggregate shall consist of natural sand particles and/or crushed rock or crushed gravel particles of size smaller than 4.75 mm but larger than 0.075 mm.

The aggregate shall be clean, hard, durable, and free from clay and other aggregations of fine material, soil, organic matter and any other deleterious material.

#### 8.2.4 Filler

Filler shall consist of natural sand particles and/or crushed rock or crushed gravel particles and hydrated lime and shall have particle size smaller than 0.075 mm.

The combined filler shall be free from lumps, clay, organic matter and any other deleterious material. The combined filler shall exhibit voids in the dry compacted filler of not less than 38%.

Not less than 1.0% by mass of the mix shall be hydrated lime.

#### 8.2.5 Binder

The binder to be used in open graded asphalt shall be as given in Clause 1 of Annexure MRS11.34.1. The performance requirements of this specification are not normally met with Class 170 and Class 320 bitumen.

Binder shall comply with the requirements of MRS11.17 *Bitumen* or MRS11.18 *Polymer Modified Binder* as appropriate.

#### 8.2.6 Additive

An additive may be proposed provided that full details of the type of additive are provided and the mix design standards of Clause 8.3 are attained.

## 8.3 Design Criteria

### 8.3.1 Grading

The grading of the combined mineral aggregates and added filler shall be such that it complies with the requirements shown in Table 7.

Table 7 – Grading Limits for Combined Aggregate and Filler

AS Sieve Size (mm)	Percentage Passing by Mass	
	Open Graded Asphalt Nominal Size (mm)	
	OG10	OG14
19.0		100
13.2	100	90 – 100
9.5	90 – 100	50 – 70
6.7	50 – 70	28 – 42
4.75	28 – 42	16– 26
2.36	9 – 17	8 – 14
1.18	7 – 13	6 – 11
0.30	4 – 8	3 – 7
0.075	1 – 4	1 – 4

### 8.3.2 Binder Content

The binder content of the mix shall be such as to produce the design requirements specified in Table 8.

Table 8 – Asphalt Design Requirements

Property	Unit	Limit	Value
Number of Marshall blows	–	–	50
Air voids in the compacted mix	%	Minimum	14.0
		Maximum	19.0
Abrasion loss	%	Maximum	30
Binder drainage	%	Maximum	0.3
Binder film thickness	µm	Minimum	12.0

### 8.3.3 Mix Properties

The manufacturer shall use the Marshall method of design to produce a mix design which satisfies the property requirements specified in Table 8 for the design mix and for mixes prepared with the maximum permitted variations specified in Table 9 applied to the grading and binder content.

## 8.4 Mix Design Assessment and Approval

### 8.4.1 Processes for Assessment and Approval

The requirements for submission of proposed mix design details and samples of the constituent

materials, and the processes for assessment and approval of a mix design are defined in the system for establishing and maintaining a register of approved asphalt suppliers.

### 8.4.2 Submission by the Manufacturer

The Manufacturer shall submit to Main Roads for approval the following –

- a statement detailing the combined aggregate/filler grading and binder content of the proposed mix design, the source and proportion of each constituent material in the proposed mix design, and the grading of each aggregate and filler component of the proposed mix design;
- samples of the constituent materials in the proposed mix design; and
- details of the type of additive, if any, and its proportion within the mix.

The samples shall be provided at the manufacturer's expense and shall be delivered by the manufacturer to the following address –

Queensland Department of Main Roads  
Road Delivery and Performance Division  
35 Butterfield Street  
Herston Qld 4006

At least 28 days shall be allowed by the Contractor to be advised in writing whether or not the submitted mix design is approved. An additional 14 days shall be allowed for each additional mix submitted concurrently **Milestone**.

### 8.5 Approval of Proposed Mix Design

Provided that the manufacturer's samples of constituent materials, the mix design composition and the properties of the tolerance mixes comply with the requirements specified herein, the proposed mix design will be approved and will be termed the approved mix design.

The combined aggregate/filler grading of the approved mix design will be termed the approved design grading and the binder content of the approved mix design will be termed the approved design binder content.

The manufacturer will be advised in writing of the approval of the proposed mix design and will be issued with a mix design approval certificate which will also give the maximum permitted variations for the mix in accordance with Table 9.

Table 9 – Maximum Permitted Variations from the Approved Mix Design

AS Sieve Size (mm)	Maximum Permitted Variation (% by mass)
≥ 9.5	± 6
6.7	± 5
4.75	± 4
2.36	± 3
1.18	± 3
0.30	± 2
0.075	± 1
<b>Other Properties:</b> Binder Content (%)	± 0.3

## 9 MATERIAL AND PRODUCTION ASPHALT COMPLIANCE

### 9.1 General

Notwithstanding the requirements herein specified for the production asphalt to be manufactured by an approved asphalt manufacturer, the Contractor shall take full responsibility for the mix design, manufacture, supply and laying of open graded asphalt under the Contract.

Added filler shall be introduced independently at a point in the manufacturing process which ensures thorough mixing with minimal loss of material.

The proportions of the constituent materials used in the manufacture of the mix shall comply with the requirements of Table 10.

The Contractor is responsible for carrying out sufficient testing to ensure that all production asphalt complies with the requirements of this specification.

### 9.2 Lot Sizes

A production lot shall be a portion of production asphalt of the same nominal size manufactured and supplied from the same plant to the same approved mix design, and of not greater than one day's production. Where daily production exceeds 500 tonnes, the maximum lot size shall be half of the daily production.

Table 10 - Constituent Proportion Limits for Production Mix

Constituent	Limit
Coarse aggregate	For each constituent: ±20% of the approved proportion up to a maximum of ± 5% absolute For the total coarse aggregate proportion (>5 mm nominal size): ± 5% absolute
Fine aggregate	For each constituent: ±20% of the approved proportion up to a maximum of ± 5% absolute
Added filler	For each constituent filler proportion and for the total added filler proportion: ±15% of the approved proportion or ± 0.5% absolute, whichever is the greater

Note: Where any of the above values are exceeded, the mix design approval may remain current, subject to the approval of the Superintendent, provided that the constituent proportions are reviewed and the production mix confirms design property compliance (Marshall). Where such compliance is not confirmed, the mix design shall be resubmitted for approval.

### 9.3 Sampling and Testing

Compliance testing of the production asphalt shall be undertaken for each lot.

Samples for compliance testing shall be taken from fresh production asphalt at the asphalt plant. Two samples shall be taken from each production lot in accordance with Test Method Q301. The first sample shall be taken from within the first 40% of asphalt produced for the lot, and the second from within the last 40% of asphalt produced for the lot. These samples shall be deemed to be representative of the asphalt in the lot.

Each sample shall be tested in accordance with Test Methods Q307A and Q308A for compliance with the approved design grading, approved design binder content and the maximum density of the approved mix design **Witness Point**.

The Superintendent may select samples from trucks on Site for audit testing. Sampling shall be undertaken in the presence of the Contractor and in accordance with all relevant Workplace Health and Safety requirements.

Testing shall be performed in a laboratory which is NATA registered for these tests.

## 9.4 Conformance Requirements

Each sample of production asphalt shall be assessed for compliance with the approved design grading, approved design binder content and the maximum density of the approved mix design.

The grading and binder content of the production asphalt shall lie within the limits given in Table 9 of the approved design grading and approved design binder content respectively.

The average maximum density of a production lot shall be the arithmetic mean of the individual maximum densities of each sample from the lot. The average maximum density of a production lot shall generally remain within the maximum density range of the tolerance mixes and each individual result shall remain within that range  $\pm 0.020 \text{ t/m}^3$ .

The manufacturer shall not substitute other materials for any of the constituent materials in the approved mix design. Additives shall not be used in the production asphalt unless they were present in the approved mix design.

## 10 CONSTRUCTION

### 10.1 Construction Procedure

At least 7 days prior to commencement of paving, the Contractor shall submit the identity and address of the approved asphalt paving organisation (where not the Contractor) and the procedure for paving operations detailing at least the following **Milestone** –

- a) all equipment to be used in spreading and compacting the asphalt;
- b) laying program and rolling pattern;
- c) details of any required preliminary trial; and
- d) inspection and test plan.

Paving operations shall not commence until the procedure is accepted by the Superintendent **Hold Point 2**.

### 10.2 Process Requirements

#### 10.2.1 Storage of Asphalt

The production asphalt shall be loaded directly from the plant to the delivery vehicles. No storage of the asphalt will be permitted.

#### 10.2.2 Loading of Delivery Vehicles

The loading of asphalt into the delivery vehicles shall be carried out in a manner which effectively prevents segregation of the asphalt occurring **Witness Point**.

The loaded asphalt shall, on visual inspection, appear uniform in texture, with all particles completely covered with binder.

The temperature of the loaded asphalt shall not exceed  $150^\circ\text{C}$  and there shall be no foaming or other evidence of a moisture content of the asphalt greater than 1.5% by mass. Where a binder other than Class 320 bitumen is a constituent material in the approved mix design, the maximum temperature of the loaded asphalt may be varied subject to the approval of the Superintendent.

Loaded asphalt which does not comply with the above requirements shall not be delivered to the Works.

#### 10.2.3 Delivery of Asphalt to the Works

The asphalt shall be delivered to the Works in vehicles equipped with leak proof, spillproof, metal tipping trays.

Prior to loading, the inside surfaces of the tipping tray shall be cleaned to remove all foreign matter and then coated with a thin film of an approved release agent to prevent adhesion of the asphalt to the tray surfaces.

The load shall be covered with a heavy cover, made from canvas or similar material, to minimise heat loss and to provide protection against wetting by rain or other contamination.

Delivery shall be undertaken as expeditiously as possible. If the asphalt is transported over long distances or if the ambient air temperature is low, the tipping tray shall be suitably insulated to further minimise heat loss.

The load-carrying capacity of delivery vehicles shall be not less than 6 tonnes. All loads of asphalt shall be in accordance with the legal load limit of the vehicle.

The asphalt shall be delivered at a rate which, as far as is practicable, permits continuous operation of the paver.

Delivery vehicles shall be fitted with an adjustable tail-gate or conveyor which allows adequate control of the discharge of the asphalt into the receiving hopper of the paver. Alternatively, a material transfer vehicle may be used.

The alignment of the paver shall not be adversely affected by the delivery operation.

All deliveries of asphalt shall be accompanied by the following documentation –

- a) a docket from a certified weighbridge, stating the mass of asphalt in the delivery vehicle; and
- b) a docket from the asphalt plant identifying the delivery vehicle, and stating the time of loading of the asphalt and the temperature of the asphalt at the time of loading.

A copy of all dockets shall be provided to the Superintendent.

## 10.2.4 Preparation of the Existing Surface

### 10.2.4.1 General

The Contractor shall carry out the preparation work detailed in Clauses 10.2.4.2 to 10.2.4.5 on existing surfaces on or against which the asphalt is to be placed **Witness Point**.

### 10.2.4.2 Preparation

The surface of the existing substrate shall be dry, and shall be thoroughly swept using a rotary broom to remove any loose material or other deleterious material which may be present. Any deleterious material which still adheres to the surface after sweeping shall be removed by other means.

Any cracks, joints or holes in the pavement/bridge deck shall be rectified as specified in Clause 10.2.4.3.

Frames for manhole covers, gully gratings, kerbs and other structures shall have the joint surfaces cleaned free of any extraneous material.

### 10.2.4.3 Crack Filling

Cracks in the substrate shall be treated as specified in Clause 10.2.4.3 of MRS11.30 *Dense Graded Asphalt Pavements*.

### 10.2.4.4 Stress Absorbing Fabric Strips

Stress absorbing fabric shall be applied as specified in Clause 10.2.4.4 of MRS11.30 *Dense Graded Asphalt Pavements*.

### 10.2.4.5 Joining New Work to Existing Work

Existing asphalt pavements shall be cut back to provide the following –

- a) a vertical surface at the joint line against which the new asphalt is to be placed; and

- b) a longitudinal taper such that the minimum layer thickness is as specified in Clause 10.2.6.4.

## 10.2.5 Tack Coating

Tack coating of existing surfaces on or against which the asphalt is to be laid shall be carried out as specified in Clause 10.2.5 of MRS11.30 *Dense Graded Asphalt Pavements* **Witness Point**.

## 10.2.6 Laying of Asphalt

### 10.2.6.1 General

With the exception of those operations defined in Clause 10.2.6.8, self-propelled mechanical pavers shall be employed to lay the asphalt.

Paving operations shall not commence until the preparation of the existing surface is acceptable to the Superintendent **Hold Point 3**.

### 10.2.6.2 Use of a Material Transfer Vehicle

Where stated in Clause 2 of Annexure MRS11.34.1, a material transfer vehicle shall be used for placing asphalt in conjunction with the asphalt paving machine. The material transfer vehicle shall be used for placing all asphalt except for areas to be paved at ramps, tapers, turning lanes, roundabouts of radius less than 50 metres and other areas approved to be excluded by the Superintendent.

The material transfer vehicle shall be a self-propelled, self-steering machine which will receive hot asphalt materials from delivery vehicles, remix and deliver those materials to an asphalt paving machine without touching or bumping the asphalt paving machine.

The material transfer vehicle shall be equipped with –

- a) a receiving hopper compatible with normal delivery vehicles;
- b) conveyor mechanisms and anti-segregation devices for remixing hot asphalt materials;
- c) conveyor mechanisms capable of delivering re-mixed asphalt materials to a paving machine at a minimum rate to suit the paver capacity and asphalt work being carried out;
- d) a minimum storage capacity of 15 tonnes;
- e) sufficient motor horsepower to operate with full load on grades up to 6% and to travel in tandem with an asphalt paving machine,

whether directly in front or at an offset position.

### 10.2.6.3 Paver Capability

Mechanical pavers shall be capable of laying at least 30 tonnes of asphalt per hour, unless approved otherwise by the Superintendent [Refer to Hold Point 2].

### 10.2.6.4 Layer Thickness Limits

The target thickness of the compacted asphalt layer will be stated in the Contract within the limits given in Table 11.

Table 11 – Layer Thickness Limit

Asphalt Mix Nominal Size (mm)	Compacted Layer Thickness (mm)	
	Minimum	Maximum
OG10	25	35
OG14	35	45

### 10.2.6.5 Weather Restrictions

The surface on which the asphalt is to be placed shall be essentially dry and free of any surface water. Asphalt shall not be placed during periods of heavy or continuous rain or when rain is likely to fall during the laying and compaction of asphalt.

Compaction of thin layers of asphalt is adversely affected by low pavement temperatures and high wind speed. If the pavement temperature is less than 25°C and is exceeded by the wind speed in km/h (i.e. 20°C and greater than 20 km/h, or 15°C and greater than 15 km/h etc), the Contractor shall supply at least one additional roller and/or increase the asphalt discharge temperature (not exceeding the maximum discharge temperature specified in Clause 10.2.6.6). If, under these conditions, laying operations do not produce an acceptable compacted surfacing, no further asphalt shall be placed **Nonconformance**.

### 10.2.6.6 Discharge Temperatures

The maximum temperature of the asphalt at the time of discharge from the delivery vehicle into the receiving hopper of the paver shall be 150°C. The minimum temperature of the asphalt at the time of discharge into the receiving hopper shall be 110°C **Witness Point**.

Where a binder other than Class 320 bitumen is a constituent material in the approved mix design,

the discharge temperatures may be varied, subject to the approval of the Superintendent.

Reheating of the delivered asphalt shall not be permitted.

### 10.2.6.7 Paver Operation

Laying of the asphalt shall commence immediately following discharge of the asphalt into the receiving hopper. The operating speed of the paver shall be so adjusted that, as far as is practicable, continuous laying of the asphalt is achieved.

The spreader box shall not be left in contact with the previously laid asphalt for prolonged periods whilst the paver awaits delivery of asphalt.

The asphalt shall not be allowed to segregate or to accumulate along the sides of the receiving hopper.

The finished mat shall have a uniform appearance with no evidence of segregation.

The method of paver level control shall be as given in Clause 3 of Annexure MRS11.34.1. If no method is given in Clause 3 of Annexure MRS11.34.1, the Contractor shall provide an adequate method of level control for the work. A matching shoe attachment shall be employed when the asphalt is being laid to match the level of previously constructed work.

If any irregularity in the laying of the asphalt occurs, operation of the paver shall cease until the cause of the irregularity is identified and corrective procedures applied. If, however, the irregularity is of a minor nature and is confined to the surface of the laid asphalt, then, provided that the surface has not cooled below 105°C, operation of the paver may continue and the affected areas shall be corrected by hand-spreading methods.

### 10.2.6.8 Hand Spreading

Hand spreading of the asphalt shall be confined to the correction of minor surface irregularities, to work on or very close to drainage channels, to work in tapers, and to work in other areas normally inaccessible to pavers.

In the correction of minor surface irregularities, a thin layer of fresh asphalt shall be placed over the affected areas, spread evenly using board rakes, and rolled immediately.

In areas where hand-spreading operations are required, the asphalt shall be taken directly from the receiving hopper (or other approved location),

immediately distributed into place using shovels, and spread to the required loose depth using metal rakes or board rakes (lutes).

Loose stones shall be removed from the surface prior to rolling.

General broadcasting of the asphalt from shovels shall not occur.

#### 10.2.6.9 Removal Prior to Rolling

Any asphalt which, prior to rolling, has cooled to a temperature lower than that specified in Clause 10.2.7.3, or which, when laid, exhibits an irregularity which cannot be satisfactorily corrected, shall be removed from the Works and replaced with fresh asphalt.

#### 10.2.6.10 Laying Program and Rolling Pattern

Prior to commencement of the work, the Contractor shall submit to the Superintendent a laying program and rolling pattern which will achieve the requirements of this specification [Refer to Hold Point 2]. The laying pattern shall ensure that –

- a) the main paving runs are laid first;
- b) the longitudinal joints are parallel to the pavement centreline;
- c) the longitudinal joints are located away from the traffic wheel paths; and
- d) where practical, longitudinal joints are located under proposed line marking.

#### 10.2.6.11 Preliminary Trial

The Contractor shall carry out a trial of the procedure for the laying operations for the Works **Witness Point**.

The trial section shall be located within the site and shall be not less than 1000 m<sup>2</sup>. The trial shall determine –

- a) the adequacy or otherwise of the construction plant for the work; and
- b) the rolling pattern and the number of passes of the roller(s) required to produce an acceptable compacted surfacing. The minimum number of roller passes shall be as specified in Clause 10.2.7.4.

Once the rolling pattern and number of passes of the rollers have been established, they shall be maintained for the whole of the laying operation, or until such time as a subsequent trial run establishes an alternative pattern. The rolling

pattern including the number of passes of the rollers shall not be varied without advising the Superintendent.

### 10.2.7 Compaction

#### 10.2.7.1 Intent

Clause 10.2.7 sets out the recommended compaction procedure for open graded asphalt. These requirements are intended to provide sufficient compactive effort to ensure interlocking of the material without fracturing the aggregate.

#### 10.2.7.2 Rollers

Compaction of the asphalt shall be achieved using approved steel-wheeled rollers of minimum static weight of 6 tonne. However, pneumatic-tyred rollers may be used for two complete passes only in the final rolling. Vibratory rolling shall not be used.

#### 10.2.7.3 Rolling Temperatures

The minimum temperature of the asphalt at the time of commencement of rolling shall be 100°C.

If the temperature of the asphalt is such that ridges or other irregularities form due to horizontal displacement of the asphalt under the action of the roller, the rolling operation shall cease until such time as the asphalt has cooled sufficiently to allow rolling to proceed without these deficiencies forming.

#### 10.2.7.4 Rolling Technique

Rolling shall commence as soon as practicable after the laying of the asphalt is under way, consistent with the temperature limitations detailed in Clause 10.2.7.3. A minimum of five passes of the steel-wheeled roller shall be completed within 20 minutes of discharge of the asphalt into the paver receiving hopper.

Tyre pressures on pneumatic-tyred rollers shall be maintained within the roller manufacturer's recommended limits.

Transverse joints, longitudinal joints and edges shall be rolled first, in sequential order. Rolling shall then proceed longitudinally using the approved pattern, as specified in Clauses 10.2.6.10 and 10.2.6.11.

Care shall be taken to ensure that the rolling is delayed sufficiently to minimise displacement of the asphalt, but not sufficiently to allow the asphalt to cool below the minimum rolling temperature specified in Clause 10.2.7.3.

Steel-wheeled rollers shall be operated at a steady speed not exceeding 5 km/h. Pneumatic-tired rollers shall operate at a maximum speed of 15 km/h. Care shall be taken to avoid abrupt stops and starts, which might displace partially compacted asphalt.

Rollers shall not remain stationary on the newly compacted asphalt.

#### **10.2.7.5 Tamping of Asphalt**

Mechanical tamping (other than that provided by the operation of the paver) and hand tamping of the asphalt shall be employed only in those locations which are either inaccessible to or prohibited to rollers.

#### **10.2.8 Joints**

The laying program specified in Clause 10.2.6.10 shall be such as to keep the number of joints, transverse and longitudinal, to a minimum.

Joints shall be provided as follows –

- a) transversely, after the completion of a day's paving operations or where a delay in the laying operation allows the previously laid asphalt to cool below the minimum rolling temperature specified in Clause 10.2.7.3; and
- b) longitudinally, if the width of the pavement is such that more than one paving run is necessary.

Except where asphalt has been placed over a strain alleviating membrane interlayer, joints shall be formed by cutting back broken material or other deformities to the extent that the previously laid asphalt complies with the specified requirements for compaction and geometric tolerances as specified in Clause 10.3.

Machine-cutting or hand-cutting methods may be employed to effect the joint. All joints shall be finished clean and straight, and normal to the finished surface of the pavement.

In multiple layer work, the joints in the open graded asphalt shall be offset from those in the dense graded asphalt by at least 100 mm, except for longitudinal joints on a crowned pavement.

The cut face shall be tack-coated with bituminous emulsion, as specified in Clause 10.2.5, prior to laying the adjoining run.

The adjoining run shall be laid with the uncompacted asphalt overlapping the previously laid run by between 25 mm and 75 mm. Prior to

rolling, the overlapping material shall be pushed back to the line of the joint to form a ridge along the edge of the newly laid asphalt. Care shall be taken to remove and discard from the Works excessive amounts of the overlapping material and any segregated material before rolling commences.

Excess asphalt shall not be spread across the mat.

If adjoining lanes are laid simultaneously using two pavers operating in echelon, the loose depths of the laid asphalt shall match exactly along the joint.

#### **10.2.9 Temporary Ramps**

If, at the end of a day's laying operations, traffic is required to run on the new asphalt work, the Contractor shall provide temporary asphalt ramps down to the level of the adjacent road surface.

Ramps shall be constructed so as to provide safe passage for traffic at the allowable speed limit.

Prior to laying the adjoining run, the asphalt ramp shall be cut back to form a transverse joint as detailed in Clause 10.2.8.

#### **10.2.10 Surface Correction**

A corrector course shall be used to correct irregularities in an existing surface and/or modify the shape of an existing surface.

Surface correction shall be carried out using dense graded asphalt in accordance with the requirements of MRS11.30 *Dense Graded Asphalt Pavements* with the additional requirement that the tolerance on the surface of the corrector course shall be  $\pm 10$  mm **Hold Point 4**.

Corrector course will be scheduled separately under Work Item 5405 in MRS11.30.

#### **10.2.11 Surface Finish**

The surface of any asphalt layer shall have a uniform appearance and shall contain no cracked, segregated, corrugated, bony or fatty sections.

The Superintendent may arrange testing to evaluate areas of suspected segregation using Test Methods Q302A/Q302B, Q303A, Q303B and Q308A, however, the test limits for production mix contained in this specification do not apply to cores taken from the road.

#### **10.2.12 Clean Up**

Upon completion of the asphalt works, all excess materials, including cut-offs from temporary ramps and joints, shall be removed from the Site



and disposed of in a manner which complies with environmental requirements in force at the time of such disposal.

### 10.3 Product Standards

#### 10.3.1 Compaction Standard

Compaction shall be deemed to have been achieved upon verification of compliance with Clause 10.2.7.4.

#### 10.3.2 Geometrics

##### 10.3.2.1 General

There are two alternative primary vertical tolerance controls for asphalt pavements; thickness and reduced level. Vertical tolerance controls for both thickness and reduced level shall apply unless stated otherwise in Clause 4 of Annexure MRS11.34.1.

The surfacing shall be constructed so as not to depart from the relevant widths, lengths, shapes and reduced levels or thicknesses specified in the documents by more than the tolerances listed in Clauses 10.3.2.2 and 10.3.2.3.

##### 10.3.2.2 Geometrics, Horizontal Tolerances

The horizontal location of any point on the surfacing shall not differ by more than  $\pm 50$  mm from the corresponding point shown in the Contract, except for the following situation. Where alignment of the surfacing with an existing road or other existing road structure is necessary, the new work shall be joined to the existing work in a smooth manner as shown on the Drawings.

##### 10.3.2.3 Geometrics, Vertical Tolerances

###### 10.3.2.3.1 Primary Tolerance

###### a) Thickness

The thickness of the open graded asphalt surfacing layer at any point, excluding any corrector course, shall lie within + 10 mm and - 5 mm of the specified thickness.

###### b) Deviation from a straightedge

The deviation from a 3 metre long straightedge placed anywhere on the surface of a layer in accordance with Test Method Q712 shall not exceed 5 mm, due allowance being made for design shape, where relevant.

###### 10.3.2.3.2 Additional Tolerance – New Work and Overlays with Specified Correction or Profiling

The additional tolerance, as stated below, shall apply to the asphalt pavement lots in the open graded asphalt surfacing layer of work other than single layer asphalt pavement overlays. The Contractor may have to carry out additional work to achieve this tolerance.

The surface evenness of the open graded asphalt surfacing layer shall be such as to provide a road roughness count rate not exceeding the specified road roughness  $R_s$  stated in Clause 5.1 of Annexure MRS11.34.1 or where not so stated, not exceeding 50 counts per kilometre.

###### 10.3.2.3.3 Additional Tolerance – Single Layer Overlays

The additional tolerance, as stated below, shall only apply to the asphalt pavement lots in open graded asphalt pavement overlays without a nominal full length corrector course. The Contractor may have to carry out additional work to achieve this tolerance.

The surface evenness of the surface of the open graded asphalt pavement layer shall be such as to provide a road roughness count rate not exceeding the specified counts per kilometre as calculated by the following formula –

$$R_s = R_p \times 0.6 + 5 \text{ counts per kilometre}$$

where –

$$R_s = \text{specified road roughness count rate; and}$$

$$R_p = \text{road roughness count rate prior to overlay.}$$

Unless nominated otherwise in Clause 5.2 of Annexure MRS11.34.1,  $R_p$  shall be taken as the value obtained by the Principal prior to and within 30 days of the Contractor commencing work on the asphalt overlay. Where  $R_p$  is greater than 85, single layer overlays should not be used without correction or profiling and the design is to be referred to the Principal **Hold Point 5**.

Where the value of  $R_s$  is calculated to be less than 50,  $R_s$  shall be taken as 50 counts per kilometre.

Costs associated with the measurement of surface evenness prior to the asphalt overlay will be borne by the Principal. No separate payment will be made for the measurement of surface evenness after the completion of the asphalt overlay and the

Contractor shall be deemed to have made allowance for the costs of this operation in the Contractor's unit rates and lump sum amounts for the various Work Items in the Schedule of Rates.

## **11 CONSTRUCTION COMPLIANCE TESTING**

### **11.1 General**

The Contractor is responsible for carrying out sufficient testing to ensure that all asphalt surfacing constructed under the Contract complies with the requirements of this specification.

The process requirements shall be checked for compliance with the specified requirements during and after the construction operation, as relevant.

Compliance testing of the pavement shall be undertaken for each lot. A pavement lot shall be a section of completed asphalt pavement of the same mix design which, in the opinion of the Superintendent, is essentially homogeneous and has been constructed under essentially uniform conditions. Pavement lot size shall be no greater than one day's construction in a single layer.

If, in the opinion of the Superintendent, part of a lot is segregated, the lot shall be subdivided and the segregated sub-lot shall be rejected and the remainder shall be assessed as a new lot. If, in the opinion of the Superintendent, the whole lot is segregated, it shall be rejected.

### **11.2 Testing Frequency**

The minimum testing frequency for work covered by this specification shall be as listed in Table 12.

### **11.3 Geometrics**

The geometric tolerances, except for surface evenness shall be checked at regular intervals not greater than those specified in Table 12.

### **11.4 Surface Evenness**

The surface evenness of compacted asphalt surfacing constructed under the Contract shall be measured by road roughness (Test Method Q708).

*Table 12 – Minimum Testing Frequency*

<b>Conformance Requirement</b>	<b>Minimum Test Frequency</b>
Horizontal geometry	1 test per 50 m
Vertical geometry and deviations from a straightedge	1 test per 20 m
Layer thickness at 3 points on the cross section	1 test per 20 m

The minimum length of a lot for this test shall be 100 metres and the maximum length of a lot shall be 500 metres.

## **12 UTILISATION OF A REJECTED LOT FOR A REDUCED LEVEL OF SERVICE**

### **12.1 Production Asphalt**

#### **12.1.1 Assessment of a Production Lot**

The assessment of a rejected production lot for utilisation for a reduced level of service will be based on the number of defects associated with non-compliance with the requirements for grading and binder content only, as determined from Clause 12.1.2.

A production lot which has a number of defects greater than six shall not be utilised for a reduced level of service.

A production lot which has a number of defects up to and including two may be utilised for a reduced level of service provided that the Contractor takes the necessary action to prevent recurrence of the non-compliance and states, on the nonconformance report, what action is to be taken.

A production lot which has a number of defects greater than two but not greater than six may be utilised for a reduced level of service provided that –

- a) The Contractor takes the necessary action to prevent recurrence of the non-compliance and states, on the nonconformance report, what action is to be taken; and
- b) The Contractor accepts payment for the lot at the reduced value given in Clause 12.1.3.

### 12.1.2 Calculation of Defects for a Production Lot

Calculation of defects for a production lot shall be based on variations from the approved design grading and approved design binder content with the tolerances of Table 9 applied, as shown in Table 13.

*Table 13 – Schedule for Calculating Defects in a Production Lot*

Measurement	Variations	No. of Defects
% passing – 6.7 mm sieve	Tolerances exceeded	1
% passing – 4.75 mm sieve 2.36 mm sieve 1.18 mm sieve	Tolerances exceeded on 1 or 2 sieves	1
	Tolerances exceeded on all 3 sieves	2
% passing – 0.30 mm sieve	Tolerances exceeded	1
% passing – 0.075 mm sieve	Up to 0.5% outside the limits	0
	Each additional 0.5% (or part thereof) beyond 0.5% outside the limits	1
Binder Content (%)	Each 0.1% (or part thereof) outside the limits	1

The number of defects in a production lot shall be calculated as the total number of defects in the two samples representing that production lot.

In the case of a terminated production lot, where only one sample has been obtained, the number of defects in the production lot shall be calculated by doubling the number of defects in the sample.

### 12.1.3 Determination of the Reduced Value

The reduced value for defects in a production lot shall be determined from Table 14.

*Table 14 – Reduction in Value for Defects in a Production Lot*

Number of Defects in a Lot	% Reduction in Value
3	5
4	10
5	15
6	20

## 12.2 Placement

### 12.2.1 Assessment of a Pavement Lot

The assessment of a rejected pavement lot for utilisation for a reduced level of service shall be based on the compaction standard and surface evenness.

### 12.2.2 Compaction Standard

A pavement lot which has not received the minimum number of roller passes as required by Clause 10.2.7.4 shall not be utilised for a reduced level of service.

### 12.2.3 Surface Evenness

#### 12.2.3.1 New Work and Overlays with Specified Correction or Profiling

In the case of works other than for asphalt overlays, a lot which has a road roughness count rate greater than 70 shall not be utilised for a reduced level of service.

A lot which has a road roughness count rate greater than  $R_s$  but not greater than 70 may be utilised for a reduced level of service at a reduced rate provided that –

- the Contractor takes the necessary action to prevent recurrence of the non-compliance; and
- the Contractor accepts payment for the lot at the reduced value given in Clause 12.2.4.

#### 12.2.3.2 Single Layer Overlays

In the case of lots for single layer asphalt pavement overlays without a nominal full length corrector course, a lot which has a road roughness count rate greater than  $R_s + 20$  counts per kilometre (where  $R_s$  is as defined in Clause 10.3.2.3.3) shall not be utilised for a reduced level of service.

A lot which has a road roughness count rate up to  $R_s + 20$  counts per kilometre may be utilised for a reduced level of service at a reduced value provided that –

- the Contractor takes the necessary action to prevent recurrence of the non-compliance; and
- the Contractor accepts payment for the lot at the reduced value given in Clause 12.2.4.

### 12.2.4 Determination of the Reduced Value

The reduced value for an increased road roughness count rate of a lot of asphalt pavement shall be determined from Table 15 for single layer asphalt pavement overlays and from the following formula for other than single layer asphalt overlays –

$$\text{Percentage Reduction} = 0.5 \times (R_a - R_s)$$

where –

$R_a$  = the actual road roughness count rate, and

$R_s$  = the specified road roughness count rate.

*Table 15 – Reduction in Value, Surface Evenness – Overlays*

Road Roughness Count Rate (counts/km)	% Reduction in Value
> $R_s$ to ( $R_s + 5$ )	1
> ( $R_s + 5$ ) to ( $R_s + 10$ )	2
> ( $R_s + 10$ ) to ( $R_s + 15$ )	4
> ( $R_s + 15$ ) to ( $R_s + 20$ )	8

Note:  $R_s$  is as defined in Clause 10.3.2.3.3.

### 12.3 Application of the Reduced Payments

The percentage reductions in value calculated in accordance with Clauses 12.1.3 and 12.2.4 shall be summed for each lot and shall be applied to the unit rate for the relevant “Open graded asphalt surfacing” Work Item in the Schedule of Rates. Where the reduction applies to different lots, each percentage reduction shall be applied to the relevant Work Item.

## 13 ADDITIONAL PAYMENT FOR A HIGHER STANDARD OF SURFACE EVENNESS

### 13.1 General

Unless indicated otherwise in Clause 6 of Annexure MRS11.34.1, an additional payment above the scheduled rate will be made for the additional benefit of an improved standard of rideability as represented by the road roughness count rate.

### 13.2 Payment

Any such additional payment will be made for each lot of asphalt which has been determined to have an improved standard of road roughness compared with the specified count rate calculated in accordance with the following –

- a) A percentage increase in the scheduled rate shall be determined from the formula –

$$\text{Percentage increase} = 0.4 \times (R_s - R_a - 5)$$

where –

$R_s$  = the specified road roughness count rate as defined in Clause 10.3.2.3.2 or Clause 10.3.2.3.3 as relevant, and

$R_a$  = the road roughness count rate measured after placement and compaction of the asphalt;

- b) The additional payment shall apply only to the top layer of asphalt placed over the relevant pavement lots or sections thereof, and shall be determined from the product of the scheduled rate for the work per tonne, and the quantity in the lot in tonnes (up to but not exceeding the specified quantity for the relevant lots or sections of the works), and the percentage increase determined from a) above; and
- c) The maximum percentage increase shall be 4%.