

Main Roads Technical Standard

MRTS31

Heavy Duty Asphalt

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Heavy Duty Asphalt

1 INTRODUCTION

This Technical Standard applies to the construction of dense graded asphalt layers for high load intensity low intervention (HILI) pavements. Additionally, the requirements of MRTS30 *Dense Graded and Open Graded Asphalt* shall apply to the construction of such pavements unless they are specifically amended or amplified by this standard.

This Technical Standard shall be read in conjunction with MRTS01 *Introduction to Technical Standards*, MRTS50 *Specific Quality System Requirements* and other technical standards as appropriate.

This Technical Standard forms part of the Main Roads Specifications and Technical Standards Manual.

2 DEFINITION OF TERMS

The terms used in this standard shall be as defined in Clause 2 of MRTS30 *Dense Graded and Open Graded Asphalt*.

3 REFERENCED DOCUMENTS

Table 3 lists documents referenced in this technical standard.

Table 3 – Referenced Documents

Reference	Title
AS 1672.1	Limes and limestones - Limes for building
AS 2891.12.1	Methods of sampling and testing asphalt - Determination of the permanent compressive strain characteristics of asphalt - Dynamic creep test

4 STANDARD TEST METHODS

The standard test methods given in Table 4 shall apply to this Technical Standard, as well as the test methods listed in Clause 4 of MRTS30 *Dense Graded and Open Graded Asphalt*.

Further details of test numbers and test descriptions are given in Clause 4 of MRTS01 *Introduction to Technical Standards*.

Table 4 – Standard Test Methods

Property to be Tested	Method Number
Sensitivity to water	Q315
Dynamic creep	AS 2891.12.1

5 QUALITY SYSTEM REQUIREMENTS

The quality system requirements stated in Clause 5 of MRTS30 *Dense Graded and Open Graded Asphalt* shall apply to this standard.

6 INTENTION OF THIS STANDARD

6.1 General

This standard is intended for dense graded asphalt pavements which will be placed on heavily trafficked roads in accordance with the Queensland Department of Main Roads Pavement Design Manual. The intention of this standard varies according to nominal mix size and type as described in Clauses 6.2, 6.3 and 6.4.

It is possible that an asphalt mix can meet the requirements of this standard but not satisfy its intentions. Where an asphalt mix does not perform in the intended manner, the mix shall still be accepted provided the mix specification requirements stated in Clauses 10, 11 and 12 have been met. However, in such cases, the

mix design registration status may be reviewed by the Department of Transport and Main Roads in accordance with the Queensland Department of Transport and Main Roads *Asphalt Supplier Registration System*.

6.2 DG14HS Mix

DG14HS mix is intended to be used as a binder layer under the final surfacing or as a surfacing in a heavy duty asphalt pavement. DG14HS is intended to have –

- a) A high level of rut resistance;
- b) Life greater than 12 years when placed on a sound pavement;
- c) A texture depth above 0.4 mm when placed; and
- d) An average permeability of less than 15 $\mu\text{m/s}$ when initially placed to minimise moisture damage and oxidation of the binder during service.

6.3 DG14HP Mix

DG14HP mix is intended to be used in free flowing traffic conditions as a binder layer under the final surfacing or as a surfacing in a heavy duty asphalt pavement. DG14HP is intended to have –

- a) A high level of rut resistance;
- b) Life greater than 12 years when placed on a sound pavement;
- c) A texture depth above 0.4 mm when placed; and
- d) An average permeability of less than 15 $\mu\text{m/s}$ when initially placed to minimise moisture damage to the layer and oxidation of the binder during service.

6.4 DG20HM Mix

DG20HM mix is intended to be used as a structural layer in a heavy duty asphalt pavement. DG20HM is intended to have –

- a) A relatively high level of rut resistance; and
- b) An average permeability of less than 15 $\mu\text{m/s}$ when initially placed to minimise moisture damage to the layer and oxidation of the binder during service.

7 CONTRACTOR RESPONSIBILITIES

The Contractor's responsibilities as stated in Clause 7 of MRTS30 *Dense Graded and Open Graded Asphalt* shall apply to this standard.

8 CONDITIONS FOR MANUFACTURE AND LAYING OF ASPHALT

The conditions for manufacture and laying of asphalt as stated in Clause 8 of MRTS30 *Dense Graded and Open Graded Asphalt* shall apply to this standard.

9 QUARRY ASSESSMENT AND CERTIFICATION

The quarry assessment and certification requirements as stated in Clause 9 of MRTS30 *Dense Graded and Open Graded Asphalt* shall apply to this standard.

10 REGISTERED MIX DESIGN

10.1 Design Responsibility

The manufacturer shall be responsible for development of a mix design to comply with the requirements of Clauses 10.2 and 10.3.

10.2 Constituent Material Requirements

10.2.1 General

The asphalt mix shall incorporate coarse aggregate, fine aggregate, filler, and binder complying with the requirements of Clauses 10.2.2 to 10.2.5 and shall be designed in accordance with the requirements stated in Clause 10.3.

10.2.2 Coarse Aggregate

Coarse aggregate shall comply with the requirements stated in Clause 10.2.2 of MRTS30 *Dense Graded and Open Graded Asphalt*.

10.2.3 Fine Aggregate

Fine aggregate shall comply with the requirements stated in Clause 10.2.3 of MRTS30 *Dense Graded and Open Graded Asphalt*.

10.2.4 Filler

Filler shall comply with the requirements stated in Clause 10.2.4 of MRTS30 *Dense Graded and Open Graded Asphalt*, except that hydrated lime complying with AS 1672.1 shall comprise not less than 1.0% by mass of the mix for DG14HS, DG14HP and DG20HM mixes.

10.2.5 Binder

Unless otherwise stated in Clause 1 of Annexure MRTS31.1, the binder shall comply with the requirements stated in Table 10.2.5.

Table 10.2.5 – Asphalt Binders

Asphalt Mix Type	Binder	Nominal size (mm)
DG14HS	A5S	14
DG14HP	A5S	14
DG20HM	Class 600	20

Binder shall comply with the requirements of MRTS17 *Bitumen* and MRTS18 *Polymer Modified Binder* as appropriate.

10.2.6 Additive

An additive may be proposed provided that full details of the type of additive are provided and the mix design standards of Clause 10.3 are attained.

10.2.7 Reclaimed Asphalt Pavement (RAP) Material

RAP may be used in heavy duty asphalt non-surface layers which have bitumen binders or multigrade binders. A maximum RAP content of 15% by mass of mix shall apply. RAP shall comply with the requirements stated in Clause 10.2.7 of MRTS30 *Dense Graded and Open Grade Asphalt*.

10.3 Design Criteria

10.3.1 General

The design criteria for the asphalt mix shall be as defined in Clause 10.3.1 and 10.3.2 of MRTS30 *Dense Graded and Open Graded Asphalt* and Clauses 10.3.2 and 10.3.3 of this Technical Standard, except that the design mix for DG14HS and DG14HP mixes shall have an effective binder volume not less than 10.0% and not more than 11.5%, and the minimum free binder volume shall be not less than 5.5%.

10.3.2 Mix Properties

The manufacturer shall use the Marshall method of design (50 blow) to produce a mix design which satisfies the property requirements stated in Table 10.3.2 for the design mix and for mixes prepared with the maximum permitted variations state in Table 10.4.2. of MRTS30 *Dense Graded and Open Graded Asphalt* applied to the grading and binder content.

Table 10.3.2 – Heavy Duty Asphalt Design Requirements

Property	Unit	Limit	Value		
			Asphalt Mix Type		
			DG14HS	DG14HP	DG20HM
Air voids in the compacted mix (design mix) ^{†1}	%	Minimum	4.5	4.0	4.1
		Maximum	5.5	5.0	5.1
Stability	kN	Minimum	7.5	7.5	7.5
Flow	mm	Minimum	2.0	2.0	2.0
Stiffness	kN/mm	Minimum	2.0	2.0	2.0
Voids in the mineral aggregate (VMA)	%	Minimum	13.5	13.0	12.5
		Maximum	17.5	17.0	16.5
Voids filled with binder (VFB)	%	Minimum	tbr	tbr	58
		Maximum	tbr	tbr	78 ^{†2}
Air voids in the compacted mix (tolerance mixes) ^{†1}		Minimum	3.0	2.5	tbr
		Maximum	7.0	6.5	tbr
Maximum density	t/m ³	-	tbr	tbr	tbr

†1 Preparation of test specimens for determining air voids to be carried out using Test method Q305 and standard Marshall moulds.

†2 The maximum VFB limit may be increased to 80 maximum for DG20HM mix provided the air voids of the tolerance mixes are not less than 2.7% and the VFB range (which is the difference between the VFB results of the fine grading / high binder content and coarse grading / low binder content tolerance mixes) does not exceed 20. A reduced binder content range may apply where compliance with the VFB range cannot be achieved.

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10.3.3 Performance Properties

10.3.3.1 Mix Design Performance Requirements

Heavy duty asphalt mix designs shall also comply with the performance requirements stated in Table 10.3.3.1.

Table 10.3.3.1 – Asphalt Performance Requirements

Property	Unit	Limit	Value		
			DG14HS	DG14HP	DG20HM
Sensitivity to water	%	Minimum	80	80	80
Indirect tensile resilient modulus ¹	MPa	Minimum	tbr	tbr	5 000
Dynamic creep ^{1,2} (2% strain)	Pulses	Minimum	tbr	tbr	tbr
Gyratory compaction curve – Air voids at 250 cycles	%	Minimum	2.0	tbr	tbr
Wheel tracking ² rut rate final rut depth	Mm/kcycle mm	Maximum	0.3	0.3	0.3
			4.0	4.0	4.0

1 Samples compacted in accordance with AS 2891.2.2 to achieve air voids 5 ± 0.5%

2 Class 320 bitumen shall be used as the binder for the test. For DG20HM mix, where the specified wheel tracking requirement cannot be achieved using Class 320 bitumen as the binder, the mix design will be accepted provided the rut rate is not greater than 0.2 mm/kC when using the mix design binder in the test. For DG14HS and DG14HP mixes, where the specified wheel tracking requirements cannot be achieved using Class 320 bitumen as the binder, the mix design will be accepted provided the rut rate is not greater than 0.1 mm/kC and the final rut depth is not greater than 2.0 mm when using the mix design binder in the test..

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10.3.3.2 Permeability Performance Requirements

10.3.3.2.1 General

DG14HS and DG14HP mix designs shall be tested for permeability in accordance with Test Methods Q304A and Q304B.

DG20HM mix designs which have any point of the target grading that falls on or within the grading envelope limits stated in Table 10.3.4.2 of MRTS30 *Dense Graded and Open Graded Asphalt* shall be tested for permeability in accordance with Test Methods Q304A and Q304B

Other DG20HM mix designs may also be tested for permeability in accordance with Test Methods Q304A and Q304B at the discretion of the Principal Chemist where field observations indicate the mix may not comply with the permeability characteristics listed in Clause 6.

10.3.3.2.2 Permeability Requirements

DG14HS, DG14HP and DG20HM mixes shall have a permeability less than 15 µm/s at 7.0% air voids or less than 10 µm/s at 6.0% air voids. An increased minimum compaction standard may apply to mixes where compliance with these permeability requirements cannot be achieved.

10.4 Mix Design Registration

The requirements for mix design registration shall be in accordance with those stated in Clause 10.4 of MRTS30 *Dense Graded and Open Graded Asphalt*, except that the air voids of production mix for the production trial shall comply with the requirements of Table 10.4

Table 10.4 – Minimum Air Voids of Production Mix

Asphalt Mix Type	Minimum Voids (%)
DG14HS	3.0
DG14HP	2.5
DG20HM	2.6

11 MATERIAL AND PRODUCTION ASPHALT COMPLIANCE

The compliance requirements for material and production asphalt shall be in accordance with those stated in Clause 11 of MRTS30 *Dense Graded and Open Graded Asphalt*, except that the average five most recent production mix air voids characterisation test results (rolling average) shall be not less than that stated in Table 10.4.

Where the rolling average is less than the value stated in Table 10.4, the Contractor shall submit a nonconformance report to the Administrator and Principal Chemist in accordance with the procedure defined in Clause 3.1.2 of MRS30 *Dense Grade and Open Graded Asphalt*. If this nonconformance persists, the registration status of the mix design may be reviewed under the requirements of the *Asphalt Supplier Registration System*.

In addition, complete characterisation testing of the production asphalt shall be undertaken for each 15 000 tonnes, and at least once for each type of asphalt on the project where the total amount of asphalt is less than 15 000 tonnes. The production asphalt shall be tested for the following properties –

- a) Binder content;
- b) Grading;
- c) Maximum density;
- d) Free binder volume;
- e) Fixed binder fraction;
- f) Stability, flow and stiffness (Marshall);
- g) Air voids (Marshall);
- h) Voids in mineral aggregate;

- i) Voids filled with binder;
- j) Resilient modulus;
- k) Dynamic creep;
- l) Wheel tracking; and
- m) Sensitivity to water.

Test results are for reporting only and not for compliance. A copy of the test results shall be forwarded to the Administrator.

12 CONSTRUCTION

The requirements for construction of asphalt pavement shall be in accordance with those stated in Clause 12 of MRTS30 *Dense Graded and Open Graded Asphalt* except that the following shall apply –

- a) the target layer thickness of DG14HS and DG14HP surfacing/binder layers shall be within the limits given in Table 12-A;
- b) the minimum characteristics value of relative compaction shall be 92.5% for DG14HS and 93.0% for DG 14HP layers with a layer thickness not less than 50 mm.
- c) unless indicated otherwise in Clause 13 of Annexure MRTS30.1, DG14HS, DG14HP and DG20HM lots used in surfacing, binder or base layers that do not comply with the minimum characteristic value of relative compaction shall be accepted for utilisation at a reduced level of service, provided that the minimum characteristic value of relative compaction is not less than 92.0%. Where the lot does not comply with these requirements, the assessment for acceptance of a rejected lot for utilisation at a reduced level of serviced shall be undertaken in accordance with the Contract; and
- d) the additional payment for achieving a higher and more uniform standard of compaction does not apply for DG14HS and DG14HP layers.

Table 12A – Layer Thickness Limits

Asphalt Mix Type	Compacted Layer Thickness	
	Surfacing or Binder Layer	
	Minimum	Maximum
DG14HS & DG14HP	50 ¹	60

1 The thickness of DG14HP may be reduced to 40 mm when used as binder layer over a concrete pavement. The minimum characteristic value of relative compaction of DG14HP laid less than 50 mm thick shall be 92%.

The percentage reduction in value of a pavement lot accepted under this clause for utilisation at a reduced level of service shall be determined from Table 12-B.

Table 12B – Reduction in Value for Reduced Compaction

Asphalt Mix Type	Percentage Reduction in Value
DG14HS	3.33 x (92.5% – CV)
DG14HP ≥ 50 mm layer thickness	3 x (93.0% – CV)
DG20HM	3 x (93.0% – CV)

CV = characteristic value of relative compaction (%)

13 CONSTRUCTION COMPLIANCE TESTING

The requirements for construction compliance testing shall be in accordance with those stated in Clause 13 of MRTS30 *Dense Graded and Open Graded Asphalt*. All asphalt joints shall be tested in accordance with

Clause 13.4.4 and at the frequency stated in Table 13.2 of MRTS30 *Dense Graded and Open Graded Asphalt*.

14 SUPPLEMENTARY REQUIREMENTS

The requirements of MRTS31 *Heavy Duty Asphalt* are varied by the supplementary requirements given in Clause 2 of Annexure MRTS31.1.