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Technical Specification

**Transport and Main Roads Specifications
MRTS31 Heavy Duty Asphalt**

June 2013

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1 Introduction

This Technical Specification applies to the construction of dense graded asphalt layers for high load intensity low intervention (HLI) 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 specification.

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

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of terms

The terms used in this specification 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 specification.

Table 3 – Referenced documents

Reference	Title
AS 1672.1	Limes and limestones – Limes for building

4 Standard test methods

The standard test methods given in Table 4 shall apply to this Technical Specification, 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 Specifications*.

Table 4 – Standard test methods

Property to be Tested	Test Method Number
Sensitivity to water	Q315
Gyratory compaction curve – air voids at 250 cycles	Q322

5 Quality system requirements

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

6 Intention of this specification

6.1 General

This specification is intended for dense graded asphalt pavements which will be placed on heavily trafficked roads in accordance with the Department of Transport and Main Roads *Pavement Design Manual*. The intention of this specification 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 specification but not satisfy its intentions. Where an asphalt mix does not perform in the intended manner, the mix shall still be accepted provided the 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 *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 not more than 15 $\mu\text{m/s}$ when initially placed, to minimise moisture damage to the layer 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 not more 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 not more 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 specification.

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 specification except that the asphalt supplier shall:

- a) use a production verified mix design or
- b) use a laboratory verified mix design and conduct a production trial in accordance with the requirements of Clause 10.4.3 of MRTS30 *Dense Graded and Open Graded Asphalt*. The

production trial shall be undertaken in conjunction with the first asphalt production lot incorporated into the Works.

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 specification.

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. It may also contain an additive complying with the requirements of Clause 10.2.6 and/or RAP material in accordance with Clause 10.2.7. The mix 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* except that the minimum PAFV shall be 48 for DG14HS and DG14HP mixes used in surfacing layers.

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 (for example fibre, wax, anti-stripping agent, water from a mechanical foaming system) 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 or multigrade bitumen 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 Graded Asphalt*.

10.3 Design criteria

10.3.1 General

The design criteria for the asphalt mix shall be as defined in Clauses 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 Specification, 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 applied to grading and binder content as stated in Table 10.4.2 of MRTS30 *Dense Graded and Open Graded Asphalt*.

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 ^{t2}
Air voids in the compacted mix (tolerance mixes)†1		Minimum	3.0	2.5	tbr
		Maximum	7.0	6.5	tbr

Property	Unit	Limit	Value		
			Asphalt Mix Type		
			DG14HS	DG14HP	DG20HM
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 up to 80 for DG20HM mix, provided the air voids of the tolerance mixes is 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.

Tbr To be recorded

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	tbr
Gyratory compaction curve – Air voids at 250 cycles	%	Minimum	2.0	tbr	tbr
Wheel tracking ^{†2 †3} rut rate final rut depth	Mm/kcycle mm	Maximum	0.3 4.0	0.3 4.0	0.3 4.0

†1 Test specimens to be prepared in accordance with AS 2891.2.2 using 120 cycles of gyratory compaction.

†2 Test specimens to be prepared in accordance with Q319 to achieve air voids of $5 \pm 1.0\%$.

†3 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* for DG20 mix 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 Advisor (Materials Testing) 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 not more than 15 $\mu\text{m/s}$ at 7.0% air voids or not more than 10 $\mu\text{m/s}$ 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 Constituent materials and production asphalt compliance

The compliance requirements for constituent materials 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 Advisor (Materials Testing) in accordance with the procedure defined in Clause 11.5 of MRTS30 *Dense Graded 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 15000 tonnes, and at least once for each type of asphalt on the project where the total amount of asphalt is less than 15000 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) Wheel tracking
- l) Gyrotory compaction curve – voids at 250 cycles, and
- m) Sensitivity to water.

Test results are for reporting only and not for assessment of compliance. A copy of the test results shall be forwarded to the Administrator and Principal Advisor (Materials Testing).

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 shall be within the limits given in Table 12, and
- b) the minimum characteristic value of relative compaction shall be;
 - i. 92.5% for DG14HS
 - ii. 93.0% for DG14HP and
 - iii. 93.0% for DG20HM.

Table 12 – Layer thickness limits

Asphalt Mix Type	Compacted Layer Thickness (mm)	
	Minimum	Maximum† ¹
DG14HS & DG14HP	50	60
DG20HM	50	80

†¹ The layer thickness may be increased to 5 times the nominal size, subject to the approval of the Administrator

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.

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