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**Technical Specification**

**Transport and Main Roads Specifications  
MRTS101 Aggregates for Asphalt**

**July 2015**

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## 1 Introduction

This Technical Specification sets out the requirements for coarse and fine aggregates that are used in asphalt.

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 Technical Specification are as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*, and Table 2 of this Technical Specification.

**Table 2 - Definition of terms**

Term	Definition
Asphalt Mix Design Register	Person(s) nominated by the Deputy Chief Engineer (Pavements, Materials and Geotechnical) to register asphalt mix designs for use on Department of Transport and Main Roads projects
QRS	Quarry Registration System as defined in MRTS50 <i>Specific Quality System Requirements</i>

## 3 Referenced documents

Table 3 lists the documents referenced in this Technical Specification.

**Table 3 - Referenced documents**

Reference	Title
<b>Australian Standards</b>	
AS 1141.3.1	Methods for sampling and testing aggregates - Sampling - Aggregates
AS 1141.5	Methods for sampling and testing aggregates - Particle density and water absorption of fine aggregate
AS 1141.6.1	Methods for sampling and testing aggregates - Particle density and water absorption of coarse aggregate - Weighing-in-water method
AS 1141.11.1	Methods for sampling and testing aggregates - Particle size distribution - Sieving method
AS 1141.12	Methods for sampling and testing aggregates - Materials finer than 75 µm in aggregates (by washing)
AS 1141.22	Methods for sampling and testing aggregates - Wet/dry strength variation
AS 1141.24	Methods for sampling and testing aggregates - Aggregate soundness - Evaluation by exposure to sodium sulphate solution
<b>Roads and Maritime Services</b>	
RMS T239	Fractured faces of coarse aggregate
<b>ASTM</b>	
ASTM C295	Standard Guide for Petrographic Examination of Aggregate for Concrete

## 4 Standard test methods

The standard test methods listed in Table 4 shall be used in this Technical Specification.

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
Sampling of aggregates	AS 1141.3.1 or Q060
Particle size distribution	AS 1141.11.1
Materials finer than 75 µm	AS 1141.12
Petrographic analysis	ASTM C295
<b>Coarse Aggregate</b>	
Flakiness index	Q201
Fractured faces	RMS T239
Wet ten percent fines value	AS 1141.22 or Q205B
Wet/dry strength variation	AS 1141.22 or Q205C
Degradation factor	Q208B
Polished aggregate friction value (PAFV)	Q203
Water absorption	AS 1141.6.1 or Q214B
Particle density (dry basis)	AS 1141.6.1 or Q214B
<b>Fine Aggregate</b>	
Water absorption	AS 1141.5 or Q214A
Particle density (dry basis)	AS 1141.5 or Q214A
Aggregate soundness (total weighted loss)	AS 1141.24

## 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 5.2 of MRTS01 *Introduction to Technical Specifications*. The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 5.1.

**Table 5.1 – Hold Points, Witness Points and Milestones**

Clause	Hold Point	Witness Point	Milestone
6	1. Use of quarry		Submit Quarry Registration Certificate, including its Testing Frequency Schedule
8.2			Submit aggregate production procedure

### 5.2 Conformance requirements

The conformance requirements that apply to this Technical Specification are summarised in Clause 7.

## 6 Quarry assessment and registration

Coarse aggregate and fine aggregate (other than natural sand) shall be supplied by a quarry registered and operated in accordance with the TMR Quarry Registration System (QRS) requirements. The current Quarry Registration Certificate, including its Testing Frequency Schedule shall be submitted to the Administrator at least seven working days before a material's supply or use.

**Milestone** For a QRS registered quarry source that does not have a testing frequency schedule nominated on the Quarry Registration Certificate, the Default Level testing frequencies stated in the QRS shall apply.

Material from a quarry shall be neither supplied nor used in the Works without written permission of the Administrator. **Hold Point 1**

The Contractor shall notify the Administrator within three days of any change to the Quarry Registration Certificate, including its Testing Frequency Schedule. In this event, Hold Point 1 shall be reapplied.

## 7 Materials

Each type and source of aggregate shall be tested separately.

All materials must maintain conformity and have a homogeneous appearance for the duration of the work.

Measures shall be taken to ensure that materials supplied to the work do not exhibit any expansive reactions resulting from the presence of free calcium oxide, magnesium oxide or other expansive materials.

### 7.1 Coarse aggregate

Coarse aggregates are materials having a nominal size greater than 5 mm and consisting of crushed rock gravel that is clean, dry, hard, tough, sound and free from dust, clay, dirt or other deleterious matter.

Coarse aggregates must not break or disintegrate under compaction equipment or deteriorate rapidly in stockpiles or at the quarry face.

Coarse aggregates must conform to the requirements of Table 7.1.

**Table 7.1 - Coarse aggregate requirements**

Coarse Aggregate Properties	Acceptance Criteria	Test Method
<b>Source Rock Tests</b>		
Petrographic analysis	Interpretative report	ASTM C295
Strength and durability: Wet ten percent fines value	≥ 150 kN	AS 1141.22 or Q205B
Wet/dry strength variation	≤ 35% <sup>2</sup>	AS 1141.22 or Q205C
Degradation factor	≥ 40%	Q208B

Coarse Aggregate Properties	Acceptance Criteria	Test Method
Polished aggregate friction value (PAFV)	Wearing course $\geq 48$ (unless otherwise specified in Clause 1 of Annexure MRTS101.1) All other courses $\geq 44$	Q203
Water absorption	$\leq 2.5\%$	AS 1141.6.1 or Q214B
Particle density (dry basis)	Report	AS 1141.6.1 or Q214B
Product Tests		
Particle size distribution	Contractor's nominated grading envelope	AS 1141.11.1
Materials finer than 75 $\mu\text{m}$	Report	AS 1141.12
Flakiness index (for coarse aggregate combined in the asphalt mix proportions):		
• Dense graded asphalt	$\leq 30\%$	Q201
• Open graded asphalt	$\leq 25\%$	Q201
• Stone mastic asphalt.	$\leq 20\%$	Q201
Fractured face(s) for aggregates derived from gravels and meta-sediments <sup>1</sup> :		
• at least two fractured faces	$\geq 85\%$	RMS T239
• at least one fractured face.	100%	RMS T239

1 Testing only required where aggregate is obtained from other than a blasted face in a quarry.

2 For Greenstone material only, nonconformance with the stated maximum wet/dry strength variation limit may be accepted, provided the wet ten percent fines value is at least 210 kN.

## 7.2 Fine aggregate

Fine aggregates are materials having a nominal size of 5 mm or less and consisting of one or a combination of the following:

- a) aggregate, including crusher dust generated from tertiary crushers (such crusher dusts may be washed and/or classified prior to use), resulting from the manufacture of the coarse aggregate
- b) the fine aggregate source material must also meet the strength and durability requirements specified in Table 7.1
- c) clean natural quartz sands.

Fine aggregates must conform to the requirements of Table 7.2.

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

**Table 7.2 - Fine aggregate requirements**

Fine Aggregate Properties	Acceptance Criteria	Test Method
<b>Source Rock Tests</b>		
Petrographic analysis	Interpretative report	ASTM C295
Aggregate soundness (total weighted loss)	≤ 12%	AS 1141.24
Water absorption <sup>1</sup> : • quartz sands • all other types of aggregates	≤ 1.5% ≤ 3.0%	AS 1141.5 or Q214A
Particle density (dry basis) <sup>1</sup> :	Report	AS 1141.5
<b>Product Tests</b>		
Particle size distribution	Contractor's nominated grading envelope	AS 1141.11.1
Materials finer than 75 µm	Report	AS 1141.12

1 Testing shall be completed on material passing the 4.75 mm sieve and retained on the 0.075 mm sieve.

### 7.3 Particle size distribution

The nominated particle size distribution and associated nominated grading envelope for each material must form part of the Contractor's aggregate production procedure. The actual particle size distribution of each coarse and fine aggregate material may vary from the nominated value within the tolerances shown in Table 7.3. The Contractor may adopt wider tolerances where they can demonstrate to the satisfaction of the Administrator that the proposed tolerances will not impact on the quality of the asphalt.

**Table 7.3 - Permissible variation to nominated particle size distribution of coarse and fine aggregates (% by mass of aggregate)**

Description	Tolerance
Passing 26.5 mm and larger	± 10
Passing 4.75 mm to 19.0 mm	± 8
Passing 1.18 mm and 2.36 mm	± 6
Passing 0.300 mm and 0.600 mm	± 5
Passing 0.150 mm	± 3
Passing 0.075 mm	± 2

## 8 Nominated aggregates

The nominated aggregate and aggregate production procedure submission is the Contractor's statement of the quality of the aggregates that they:

- a) consider will satisfy the requirements of this Technical Specification, and
- b) will target during production and supply.

### 8.1 Submission of details of nominated aggregates to the Asphalt Mix Design Register

The Contractor shall submit the following to the Asphalt Mix Design Register as part of the asphalt mix design submission:



- a) Quarry registration certificate and registered testing frequencies for each aggregate source.
- b) Aggregate test results from a production trial for the quarry which will supply the aggregates. Test results must be provided for each nominated aggregate and for each aggregate requirement in Clause 7. All test results for each nominated aggregate must be from the same production trial.

All tests relating to the submission must be carried out within twelve months prior to the date of submission to the Asphalt Mix Design Register.

All phases of any particular test must be performed at the same laboratory.

## **8.2 Aggregate production procedure**

For each quarry that will supply material(s) to be used in the Works, the Contractor shall prepare a construction procedure for aggregate production in accordance with Clause 6 of MRTS50 *Specific Quality System Requirements* and detail the following for each nominated material:

- a) area (e.g. face number, bench number and reduced level) of the quarry from which the material in the lot will be won
- b) production process and method of winning the material
- c) procedures for stockpile management and traceability as part of lot control and, as applicable, stockpile subplot control, and
- d) quality control procedures.

The aggregate production procedure shall be submitted to the Administrator at least seven days prior to the commencement of aggregate production for the Works. **Milestone**

## **9 Material conformance**

For all aggregates the conformance with this Technical Specification shall be verified by sampling and testing, and providing records of process control.

### **9.1 Homogeneity**

Aggregate of segregated appearance shall be divided into sub-lots such that each sub-lot contains only that quantity of aggregate which is visually homogeneous. Each sub-lot must separately comply with the requirements of this Technical Specification.

### **9.2 Sampling**

The Contractor shall nominate all sampling locations, frequencies and test methods in their inspection and test plan (ITP). Samples must be representative of materials used in asphalt production.

In addition to the requirements of AS 1141.3.1 or Q060, and unless otherwise specified or agreed with the Administrator, defined boundaries of sub-lots represented by individual tested samples are deemed to be the midpoints in production between the samples.

When the Administrator requests samples, the Contractor shall riffle and/or quarter the samples taken for testing, and deliver the samples in sealed and labelled containers identifying the following:

- a) lot number
- b) sample description
- c) sampler

- d) date produced and/or supplied
- e) date sampled, and
- f) any other quality system references, as appropriate.

### 9.3 Testing

#### 9.3.1 Minimum frequency of testing

##### 9.3.1.1 General

The Contractor shall nominate in their inspection and test plan(s) (ITP) the frequency of testing for coarse and fine aggregates.

##### 9.3.1.2 Coarse aggregate

Testing frequencies for the following coarse aggregate source rock test properties shall comply with the requirements of Clause 8.1.1 of MRTS50 *Specific Quality System Requirements* and Clause 6 of this Technical Specification:

- a) petrographic analysis
- b) wet ten percent fines value
- c) wet/dry strength variation
- d) degradation factor
- e) water absorption
- f) particle density, and
- g) polished aggregate friction value.

Testing frequencies for coarse aggregate product test properties shall comply with the requirements of Table 9.3.1-A.

**Table 9.3.1-A - Minimum testing frequencies for coarse aggregate product tests**

Property	Test Method	Minimum Frequency of Testing	
		Normal Testing Level	Reduced Testing Level
Particle size distribution	AS 1141.11.1	1 per 1,000 tonnes	1 per 1,000 tonnes
Materials finer than 75 µm	AS 1141.12	1 per 1,000 tonnes	1 per 1,000 tonnes
Flakiness index	Q201	1 per 2,500 tonnes	1 per 5,000 tonnes
Fractured faces(s) <sup>1</sup>	RMS T239	1 per 10,000 tonnes	1 per 20,000 tonnes

<sup>1</sup> Testing only required where aggregate is obtained from other than a blasted face in a quarry.

##### 9.3.1.3 Fine aggregate

Testing frequencies for fine aggregate source rock test properties shall comply with the following requirements:

- a) for quarries registered and operated in accordance with the TMR Quarry Registration System requirements, testing frequencies for the following fine aggregate source rock test properties shall comply with the requirements of Clause 8.1.1 of MRTS50 *Specific Quality System Requirements* and Clause 6 of this Technical Specification:

- i. petrographic analysis
- ii. water absorption
- iii. particle density, and
- iv. aggregate soundness.

Testing for wet ten percent fines value, wet/dry strength variation and degradation factor is also required for the source material used to produce the fine aggregate. This requirement does not apply to natural sands or fine aggregates produced from the same source material as the coarse aggregate.

For natural sand sources that are not registered and operated in accordance with the TMR Quarry Registration System requirements, testing frequencies shall comply with the requirements of Table 9.3.1-B.

Testing frequencies for fine aggregate product tests shall comply with the requirements of Table 9.3.1-C.

**Table 9.3.1-B - Minimum testing frequencies for source rock test properties of natural sand sources that are not TMR registered sources**

Property	Test Method	Minimum Frequency of Testing	
		Normal Testing Level	Reduced Testing Level
Petrographic analysis	ASTM C295	1 per 6 months	1 per 6 months
Water absorption	AS 1141.5 or Q214A	1 per 6 months	1 per 6 months
Particle density	AS 1141.5 or Q214A	1 per 6 months	1 per 6 months
Aggregate soundness (total weighted loss)	AS 1141.24	1 per 5,000 tonnes	1 per 5,000 tonnes

**Table 9.3.1-C - Minimum testing frequencies for fine aggregate product tests**

Property	Test Method	Minimum Frequency of Testing	
		Normal Testing Level	Reduced Testing Level
Particle size distribution	AS 1141.11.1	1 per 1,000 tonnes	1 per 1,000 tonnes
Materials finer than 75 µm	AS 1141.12	1 per 1,000 tonnes	1 per 1,000 tonnes

### 9.3.2 Maximum lot size

The maximum lot size must be nominated by the Contractor in accordance with the requirements of Clause 8.1.1 of MRTS50 *Specific Quality System Requirements*.

### 9.4 Nonconformances

If a lot fails to conform to this Technical Specification, such failure will constitute a nonconformance under the Contract.

Where it is deemed by the Administrator that a nonconformance in the aggregate supply will adversely affect asphalt performance, the aggregate must not be used in asphalt production.

Grading nonconformances are typically acceptable provided the contractor takes corrective action to address the nonconformance and the properties of the asphalt mix (such as combined grading and air voids) are not compromised by the nonconformance.

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