

Superseded

**Technical Specification**

**Transport and Main Roads Specifications  
MRTS05 Unbound Pavements**

**July 2015**

Superseded

## Copyright



<http://creativecommons.org/licenses/by/3.0/au/>

© State of Queensland (Department of Transport and Main Roads) 2015

**Feedback:** Please send your feedback regarding this document to: [tmr.techdocs@tmr.qld.gov.au](mailto:tmr.techdocs@tmr.qld.gov.au)

**Contents**

- 1 Introduction .....1**
- 2 Definition of terms .....1**
- 3 Referenced documents .....2**
- 4 Standard test methods .....2**
- 5 Quality system requirements .....3**
  - 5.1 Hold Points, Witness Points and Milestones ..... 3
  - 5.2 Construction procedures..... 3
  - 5.3 Lots ..... 3
  - 5.4 Conformance requirements ..... 4
  - 5.5 Testing frequencies ..... 4
- 6 Quarry registration and source material assessment .....4**
- 7 Material .....5**
  - 7.1 Type 1 unbound material ..... 5
    - 7.1.1 *General*.....5
    - 7.1.2 *Coarse component* .....5
    - 7.1.3 *Fines component*.....6
    - 7.1.4 *Particle size distribution (grading)* .....6
  - 7.2 Type 2 Unbound material ..... 7
    - 7.2.1 *General*.....7
    - 7.2.2 *Coarse component* .....8
    - 7.2.3 *Fines component*.....8
    - 7.2.4 *Particle size distribution (grading)* .....8
    - 7.2.5 *California bearing ratio* ..... 10
  - 7.3 Type 3 unbound material ..... 10
    - 7.3.1 *General*..... 10
    - 7.3.2 *Coarse component* ..... 11
    - 7.3.3 *Fines component*..... 11
    - 7.3.4 *Particle size distribution (grading)* ..... 12
    - 7.3.5 *California Bearing Ratio* ..... 13
  - 7.4 Type 4 Unbound material ..... 13
  - 7.5 All unbound materials ..... 14
  - 7.6 Stockpiling of materials ..... 14
- 8 Material compliance testing..... 14**
  - 8.1 General ..... 14
  - 8.2 Testing frequencies and number of tests ..... 14
  - 8.3 Testing ..... 15
    - 8.3.1 *General*..... 15
    - 8.3.2 *Wet Tern Percent Fines Value and Wet/Dry Strength Variation* ..... 15
    - 8.3.3 *Flakiness Index*..... 15
    - 8.3.4 *California Bearing Ratio* ..... 15
- 9 Construction..... 15**
  - 9.1 Process requirements ..... 15
    - 9.1.1 *Layer thicknesses*..... 15
    - 9.1.2 *Moisture content*..... 15

9.1.3	Surface finish.....	16
9.1.4	Construction equipment .....	16
9.2	Product standards.....	16
9.2.1	Compaction standard .....	16
9.2.2	Segregation .....	17
9.2.3	Geometrics, general .....	17
9.2.4	Geometrics, horizontal tolerances.....	17
9.2.5	Geometrics, vertical tolerances .....	17
<b>10</b>	<b>Construction compliance testing.....</b>	<b>18</b>
10.1	Process requirements.....	18
10.1.1	General.....	18
10.1.2	Pavement material.....	18
10.1.3	Moisture content of the pavement layer .....	18
10.2	Product requirements .....	19
10.2.1	General.....	19
10.2.2	Testing frequencies and number of tests .....	19
10.2.3	Geometrics .....	19
10.2.4	Compaction .....	19
10.2.5	Segregation .....	19
10.2.6	Degree of saturation.....	19
10.2.7	Surface evenness.....	20
10.2.8	Visible deflection of pavement layers.....	20
10.2.9	Acceptance.....	20
<b>11</b>	<b>Supplementary requirements .....</b>	<b>20</b>

Superseded

## 1 Introduction

This Technical Specification applies to the construction of road pavements using unbound material.

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 shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Further definitions are as defined in Table 2.

**Table 2 - Definition of terms**

Term	Definition
acid igneous rock	As defined in AS 1726. Including Rhyolite, Rhyodacite, Dacite, Tuffs (of same composition), Granite, Adamellite and Granodiorite
base course	A course or courses principally intended to directly support the traffic loads
basic igneous rock	As defined in AS 1726. Including Basalt, Dolerite and Gabbro
coarse component	The fraction of the material which does not pass the AS 0.425 mm sieve
finer component	The fraction of the material passing the AS 0.425 mm sieve
finer ratio	The ratio of the percentage of the material passing the AS 0.075 mm sieve and the percentage of the material passing the AS 0.425 mm sieve
imported material	Material that is not sourced from the quarry detailed on the Quarry Registration Certificate
intermediate igneous rock	As defined in AS 1726. Including Trachyte, Trachyandesite, Andesite, Tuffs (of same composition), Syenite and Diorite
material group	A category selected on the basis of material classification, geological processes and material properties. Materials of one group may grade into another in the one quarry site
metamorphic rock	As defined in AS 1726 including Hornfels, Quartzite, Metagreywacke, Greenstone, Slate and Amphibolite
Modified C grading	The "Modified C" grading is a type of C Grading
natural gravel	Naturally occurring granular alluvial, colluvial or residual deposits
pavement	The portion of the road placed above the subgrade for the support of and to form a running surface for, vehicular traffic
pavement verge	The edge section of the pavement as defined above, which may consist of material differing from the remainder of the pavement due to different requirements for the edge section
QRS	Quarry Registration System as defined in MRTS50 <i>Specific Quality System Requirements</i>
quarry	A site from which construction materials are won by blasting, ripping or other excavation means for use in their natural state or after processing such as by crushing, screening or combining with other materials. The term quarry also includes pits

Term	Definition
relative compaction	The ratio, expressed as a percentage, of the in situ dry density of the material presented for compliance testing and the maximum dry density of a reference sample compacted in accordance with a specified procedure
sedimentary and duricrust rocks	As defined in AS 1726 including Limestone, Mudstone, Arenite, Chert, Silcrete and Dolomite
subbase course	A course or courses principally intended to distribute to the subgrade the loads from overlying courses
wearing course	A course which has no structural function but protects the underlying course from wear and the ingress of water. A hot-mixed asphalt course less than 50 mm thick and an open graded hot-mixed asphalt course are classed as wearing courses

### 3 Referenced documents

Table 3 lists additional documents referenced in this Technical Specification

**Table 3 – Referenced documents**

Reference	Title
AS 1726	Geotechnical site investigations

### 4 Standard test methods

The standard test methods given in Table 4 will 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
Relationship between test methods	Q010
Characteristic Value	Q020
Selection of Sampling and Testing Location	Q050
Representative Sampling of Soils, Crushed Rock and Aggregates	Q060
Moisture content	Q102A Q102B Q102D Q141A
Particle size distribution, Fines ratio	Q103A
Liquid limit	Q104A
Plastic limit, Plasticity index, Weighted Plasticity Index	Q105
Linear shrinkage, Weighted Linear Shrinkage	Q106
Relative compaction	Q140A Q141A Q141B Q142A Q144A

Property to be Tested	Test Method Number
Degree of saturation	Q146
California bearing ratio	Q113A Q113C
Flakiness index	Q201
Wet ten percent fines value	Q205B
Wet/dry strength variation	Q205C
Degradation factor	Q208B
Crushed particles	Q215
Surface evenness	Q708B Q708C Q708D
Petrographic analysis	ASTM C295

## 5 Quality system requirements

### 5.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are stated 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	Milestone
6	1. Use of quarry or source	Submit Quarry Registration Certificate (seven days). Submit Construction Procedure for aggregate production (seven days). Submit Source Material Report (seven days).
7.2.4	2. Approval of grading envelope – Type 2	
7.3.4	3. Approval of grading envelope – Type 3	
8.2	4. Demonstration of material compliance prior to incorporation into pavement	
10.2.9	5. Covering a pavement layer	

### 5.2 Construction procedures

The Contractor shall prepare documented procedures for all construction processes as defined in Clause 6 of MRTS50 *Specific Quality System Requirements*.

### 5.3 Lots

In addition to any other requirements of the Contract, the maximum size of a lot shall be within the limits given in Clause 1.1 of Annexure MRTS05.1.

#### 5.4 Conformance requirements

The conformance requirements which apply to lots of unbound pavement covered by this Technical Specification are summarised in Clauses 8 and 10.

#### 5.5 Testing frequencies

The following minimum testing frequency requirements apply to material standards:

- a) For Type 1, Type 2 (excluding Subtype 2.5) and Type 3 (excluding Subtype 3.5) materials:
  - i. unless otherwise stated in Clause 1.2.1 of Annexure MRTS05.1, testing frequencies for the following source rock test properties shall be in accordance with Clause 8.1.1 of MRTS50 *Specific Quality System Requirements*:
    - Petrographic analysis
    - Wet Ten Percent Fines Value
    - Wet/ Dry strength variation, and
    - Degradation factor

Guide Note – A testing frequency for a source rock property may be nominated in Clause 1.2.1 of Annexure MRTS05.1 when the project-specific risk assessment identifies that this is warranted based on recent performance.

- ii. testing frequencies for other than source rock tests shall be as stated in Clause 1.2.1 of Annexure MRTS05.1.
- b) For Subtype 2.5, Subtype 3.5 and Type 4 materials, testing frequencies shall be as stated in Clause 1.2.1 of Annexure MRTS05.1.

For construction activities' standards, the requirements of Clause 1.2.2 of Annexure MRTS05.1 apply.

### 6 Quarry registration and source material assessment

The following applies to the Works:

- a) The coarse component of Type 1, Type 2 (excluding Subtype 2.5) and Type 3 (excluding Subtype 3.5) materials shall each be supplied by a quarry registered and operated in accordance with the TMR *Quarry Registration System* requirements. The current *Quarry Registration Certificate* shall be submitted to the Administrator at least 7 days before a material's supply or use. **Milestone**
- b) Where a Subtype 2.5, Subtype 3.5 or Type 4 material is not sourced from a quarry registered under the Quarry Registration System, for Contractor supplied material a source material assessment in accordance with TN140 *Source Material Assessment for Subtype 2.5, Subtype 3.5 and Type 4 Unbound Pavement Materials* shall be undertaken for the material source from which Subtype 2.5, Subtype 3.5 or Type 4 unbound pavement material is to be supplied. A copy of the Source Material Assessment Report shall be submitted to the Administrator at least seven days before supply or use. **Milestone**
- c) The written permission of the Administrator to use the quarry or source is required prior to material being supplied to or used in the Works. **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*. Hold Point 1 shall be reapplied.



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 product:

- a) area of the quarry from which the material will be won
- b) production process including methods 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 Construction Procedures shall be submitted to the Administrator at least seven days prior to the commencement of material production for the Works. **Milestone**

## 7 Material

### 7.1 Type 1 unbound material

#### 7.1.1 General

Imported material shall not be added to the source material without the prior approval of the Administrator [Refer to Hold Point 1].

The material subtypes to be used for various locations under the Contract are given in Clause 9 of Annexure MRTS05.1.

#### 7.1.2 Coarse component

The coarse component properties for Type 1 materials are given in Table 7.1.2.

**Table 7.1.2 – Coarse component properties – Type 1**

Property	Subtype	Material Group †				
		Acid Igneous	Intermediate Igneous	Basic Igneous	Metamorphic	Sedimentary Duricrust
Wet Ten Percent Fines Value (kN) minimum	1.1	130	140	150	140	130
	1.2	95	105	110	105	95
Wet/Dry Strength Variation (%) maximum	1.1	40	35	30	35	40
	1.2	45	40	35	40	45
Degradation factor minimum	1.1	40	45	50	45	-
	1.2	30	35	40	35	-
Crushed particles (%) minimum	1.1	70	70	70	70	70
	1.2	70	70	70	70	70
Flakiness Index General (%) maximum	1.1	35	35	35	35	35
	1.2	35	35	35	35	35

† Naturally occurring gravels are to be classified into a material group on the basis of the lithology of the major granular component.

The following additional requirements shall also apply to the coarse component properties given in Table 7.1.2:

- a) for Adamellite source material only (Acid Igneous Group), the minimum Wet Ten Percent Fines Value for Subtype 1.1 shall be 115 kN, and
- b) for Greenstone source material only (Metamorphic Group), if the Greenstone does not comply with the specified maximum Wet/Dry Strength Variation limits, it may be used provided that its Wet Ten Percent Fines Value is at least 60 kN greater than the specified minimum value for the relevant subtype.

### 7.1.3 Fines component

The fines component of Type 1 material shall comply with the properties as given in Table 7.1.3.

Requirements for both plasticity index and linear shrinkage are given in Table 7.1.3. Only one of these properties shall apply to each particular subtype. The property for this Contract is given in Clause 10 of Annexure MRTS05.1.

**Table 7.1.3 – Fines component properties – Type 1**

Property	Subtype	
	1.1	1.2
Liquid Limit maximum	25	28
Plasticity Index maximum	4	6
Linear Shrinkage maximum	2.5	3

### 7.1.4 Particle size distribution (grading)

The particle size distribution requirement is given in Table 7.1.4. The Contractor shall aim at producing material conforming to the target grading. The maximum and minimum limits define an acceptable zone of departure from this target grading for any single sample.

**Table 7.1.4 – Particle size distribution – Type 1**

AS Sieve Size (mm)	Percentage by Mass Passing (%)		
	Target	Minimum	Maximum
37.5	100	100	100
26.5	100	85	100
19.0	87	75	100
9.5	69	58	80
4.75	54	45	62
2.36	39	33	45
0.425	18	14	22
0.075	7	5	10

The following additional requirements shall apply to the particle size distribution given in Table 7.1.4:

- a) fines ratio, the ratio of the percentage of the material passing the AS 0.075 mm sieve and the percentage of the material passing the AS 0.425 mm sieve, shall lie between 0.30 and 0.55, and

- b) the grading curve of the material shall be smooth and shall not vary from one outer third of the total limits range between the minimum and maximum limits for one sieve to the opposite outer third of the total limits range for the next lower sieve.

## 7.2 Type 2 Unbound material

### 7.2.1 General

Type 2 material, excluding Subtype 2.5, shall comply where applicable with the following requirements:

- a) any component retained on the AS 2.36 mm sieve shall be manufactured only from source material from a quarry which has a current *Quarry Registration Certificate* and will produce the coarse component of the final product which complies with the relevant properties given in Table 7.2.1, and
- b) any component passing the AS 2.36 mm sieve and retained on the AS 0.425 mm sieve (ie sand size) shall be obtained from either a natural deposit in which the individual grains are hard and durable or a crushed rock source which has current certification and from which the coarse component complies with the properties given in Table 7.2.1.

**Table 7.2.1 – Coarse component properties – Type 2**

Property	Subtype	Material Group †				
		Acid Igneous	Intermediate Igneous	Basic Igneous	Metamorphic	Sedimentary Duricrust
Wet Ten Percent Fines Value (kN) minimum	2.1	115	125	135	125	115
	2.2	100	105	115	105	100
	2.3	85	90	100	90	85
	2.4	70	80	85	80	70
	2.5	-	-	-	-	-
Wet/Dry Strength Variation (%) maximum	2.1	40	35	30	35	40
	2.2	40	35	30	35	40
	2.3	45	40	35	40	45
	2.4	45	40	35	40	45
	2.5	-	-	-	-	-
Degradation factor minimum	2.1, 2.2	40	45	50	45	40
	2.3, 2.4	30	35	40	35	30
	2.5	-	-	-	-	-
Flakiness Index General (%) maximum	2.1, 2.2	35	35	35	35	35
	2.3, 2.4	40	40	40	40	40
	2.5	-	-	-	-	-

† Naturally occurring gravels are to be classified into a material group on the basis of the lithology of the major granular component.

Fine material can be imported to overcome grading and plastic property deficiencies provided it is durable and complies with the above requirements.

The strength of Type 2 material is principally assessed by the soaked California Bearing Ratio (CBR) test (Test Method Q113A). To comply with the relevant CBR requirement, it may be necessary for the Contractor to develop a set of secondary requirements which comply with the list of primary

requirements given in Clauses 7.2.2, 7.2.3 and 7.2.4 but, where necessary, are more stringent so that the specified CBR is achieved.

The material subtypes to be used for various locations under the Contract are given in Clause 9 of Annexure MRTS05.1.

### 7.2.2 Coarse component

The coarse component properties for Type 2 material are given in Table 7.2.1.

In addition to the coarse component properties given in Table 7.2.1, for Greenstone source material only (Metamorphic Group), if the Greenstone does not comply with the specified maximum Wet/Dry Strength Variation limits, it may be used provided that its Wet Ten Percent Fines Value is at least 60 kN greater than the specified minimum value for the relevant subtype.

### 7.2.3 Fines component

The fines component properties for Type 2 material are given in Table 7.2.3.

Requirements for both plasticity index and linear shrinkage are given in Table 7.2.3. Only one of these requirements shall apply to each particular subtype and the requirement for this Contract is given in Clause 10 of Annexure MRTS05.1.

**Table 7.2.3 – Fines component properties – Type 2**

Property	Subtype				
	2.1	2.2	2.3	2.4	2.5
Liquid Limit maximum	25	25	28	35	40
Plasticity Index maximum	6	6	8	12	14
Weighted Plasticity Index (WPI) maximum	150	150	200	360	–
Linear Shrinkage maximum	3.5	3.5	4.5	6.5	7.5
Weighted Linear Shrinkage (WLS) maximum	85	85	110	195	–

Requirements for both Weighted Plasticity Index and Weighted Linear Shrinkage are also given in Table 7.2.3. Only one of these shall apply to each particular subtype. The former shall apply if the requirement given in Clause 10 of Annexure MRTS05.1 is for Plasticity Index and the latter if the requirement is for Linear Shrinkage.

Minimum limits for plasticity index or linear shrinkage shall also apply if given in Clause 11 of Annexure MRTS05.1.

### 7.2.4 Particle size distribution (grading)

The particle size distribution envelopes are specified in Table 7.2.4-A.

The grading envelopes to be used for various locations under the Contract are given in Clause 9 of Annexure MRTS05.1 as a selection from Table 7.2.4-A.

**Table 7.2.4-A – Particle size distribution envelopes – Type 2**

AS Sieve Size (mm)	Percent Passing by Mass				
	Grading B	Grading C	Grading “Modified C”	Grading D	Grading E
75.0	100	100	100	100	100
53.0	100	100	100	100	-
37.5	85-100	100	100	100	85-100
19.0	55-90	80-100	87-100	100	-
9.5	40-70	55-90	67-88	80-100	40-100
4.75	28-55	40-70	50-65	55-90	-
2.36	20-45	30-55	38-50	40-70	20-100
0.425	10-25	12-30	16-26	20-40	10-80
0.075	4-15	5-20	8-16	8-25	4-30

**Guide Note**

The “Modified C” grading option has been introduced into this version with the intent of standardising project-specific local practices. Before nominating the “Modified C” grading, if it has not been used previously, it is recommended that the TMR District investigate the feasibility of obtaining this tighter grading with their locally available quarries. Depending on rock type and crusher capability, mix adjustment/s to assure compliance with both this tighter grading and all other requirements may require allowance/s for additional time and/or cost. Prior to nomination of “Modified C” grading in Departmental projects, the TMR District should consult with the Director (Pavements Rehabilitation) or their nominee.

The required grading envelope shall also be in accordance with the following requirements:

- a) only grading envelopes B or C may be used for material Subtype 2.1
- b) only grading envelopes B, C or D may be used for material Subtypes 2.2 and 2.3, and
- c) only grading envelopes B, C or D may be used for material Subtypes 2.4 and 2.5 if used in a base or subbase 1 (upper subbase) layer in the pavement.

If more than one grading envelope is given in Clause 9 of Annexure MRTS05.1 for an entry, the Contractor shall notify the Administrator in writing, at least two working days before the commencement of the delivery of the materials to the pavement, which of the alternative grading envelopes will be used **[Refer to Hold Point 1]**

The envelope chosen shall be the only envelope to be used for the particular location until prior approval is obtained from the Administrator for the use of one of the other alternatives in lieu of the original envelope chosen. Such approval shall be obtained at least two working days before the use of the alternative envelope. **Hold Point 2**

The following additional requirements shall apply to the grading envelopes given in Table 7.2.4-A:

- a) fines ratio, the ratio of the percentage of the material passing the AS 0.075 mm sieve to the percentage of the material passing the AS 0.425 mm sieve, shall lie between the limits given in Table 7.2.4-B, and

**Table 7.2.4-B – Ratio 0.075 mm material to 0.425 mm material – Type 2**

Subtype	Fines Ratio	
	Minimum	Maximum
2.1	0.30	0.55
2.2, 2.3	0.30	0.65
2.4, 2.5	-	-

- b) for all grading envelopes B, C, Modified 'C' and D the grading curve for the material shall be smooth and shall except for Modify 'C' not vary from one outer third of the total limits range between the minimum and maximum limits for one sieve to the opposite outer third of the total limits range for the next lower sieve.

### 7.2.5 California bearing ratio

The California Bearing Ratio requirements for Type 2 material are given in Table 7.2.5.

**Table 7.2.5 – California bearing ratio requirements – Type 2**

Property	Subtype				
	2.1	2.2	2.3	2.4	2.5
CBR (soaked) minimum	80	60	45	35	15

## 7.3 Type 3 unbound material

### 7.3.1 General

Type 3 material, excluding Subtype 3.5, shall comply where applicable with the following requirements:

- a) any component retained on the AS 2.36 mm sieve shall be manufactured only from source material from a quarry which has a current *Quarry Registration Certificate* and will produce the coarse component of the final product which complies with the relevant properties given in Table 7.3.1, and
- b) any component passing the AS 2.36 mm sieve and retained on the AS 0.425 mm sieve (ie sand size) shall be obtained from either a natural deposit in which the individual grains are hard and durable or a crushed rock source which has a current *Quarry Registration Certificate* and from which the coarse component complies with the properties given in Table 7.3.1.

**Table 7.3.1 – Coarse component properties – Type 3**

Property	Subtype	Material Group †				
		Acid Igneous	Intermediate Igneous	Basic Igneous	Metamorphic	Sedimentary Duricrust
Wet Ten Percent Fines Value (kN) minimum	3.1	100	105	115	105	100
	3.2	80	90	95	90	80
	3.3	70	80	85	80	70
	3.4	60	65	70	65	60
	3.5	-	-	-	-	-
Flakiness Index General (%) maximum	3.1, 3.2	35	35	35	35	35
	3.3, 3.4	40	40	40	40	40
	3.5	-	-	-	-	-

† Naturally occurring gravels are to be classified into a material group on the basis of the lithology of the major granular component.

The strength of Type 3 material is principally assessed by the unsoaked California Bearing Ratio (CBR) test (Test Method Q113A). To comply with the relevant CBR requirement, it may be necessary for the Contractor to develop a set of secondary requirements which comply with the list of primary requirements given in Clauses 7.3.2, 7.3.3 and 7.3.4 but, where necessary, are more stringent so that the specified CBR is achieved.

Material can be imported to overcome grading and plastic property deficiencies provided it complies with the above requirements.

The material subtypes to be used for various locations under the Contract are given in Clause 9 of Annexure MRTS05.1.

### 7.3.2 Coarse component

The coarse component properties for Type 3 material are given in Table 7.3.1.

### 7.3.3 Fines component

The fines component properties for Type 3 material are given in Table 7.3.3.

Requirements for both plasticity index and linear shrinkage are given in Table 7.3.3. Only one of these requirements shall apply to each particular subtype and the requirement for this Contract is given in Clause 10 of Annexure MRTS05.1.

Requirements for both Weighted Plasticity Index and Weighted Linear Shrinkage are also given in Table 7.3.3. Only one of these shall apply to each particular subtype. The former shall apply if the requirement given in Clause 10 of Annexure MRTS05.1 is for Plasticity Index and the latter if the requirement is for Linear Shrinkage.

**Table 7.3.3 – Fines component properties – Type 3**

Property	Subtype				
	3.1	3.2	3.3	3.4	3.5
Liquid Limit maximum	25	28	35	35	40
Plasticity Index maximum	6	8	12	12	14
Weighted Plasticity Index maximum	150	200	360	–	–
Linear Shrinkage maximum	3.5	4.5	6.5	6.5	7.5
Weighted Linear Shrinkage maximum	85	110	195	–	–

Minimum limits for plasticity index or linear shrinkage shall also apply if given in Clause 11 of Annexure MRTS05.1.

### 7.3.4 Particle size distribution (grading)

The particle size distribution envelopes are given in Table 7.3.4-A.

The grading envelopes to be used for various locations under the Contract are given in Clause 9 of Annexure MRTS05.1 as a selection from Table 7.3.4-A.

**Table 7.3.4-A – Particle size distribution envelopes – Type 3**

AS Sieve Size (mm)	Percent Passing by Mass (%)				
	Grading B	Grading C	Grading “Modified C”	Grading D	Grading E
75.0	100	100	100	100	100
53.0	100	100	100	100	-
37.5	85 - 100	100	100	100	85 - 100
19.0	55 - 90	80 - 100	87-100	100	-
9.5	40 - 70	55 - 90	67-88	80 - 100	40 - 100
4.75	28 - 55	40 - 70	50-65	55 - 90	-
2.36	20 - 45	30 - 55	38-50	40 - 70	20 - 100
0.425	10 - 25	12 - 30	16-26	20 - 40	10 - 80
0.075	4 - 15	5 - 20	8-16	8 – 25	4 - 30

#### Guide Note

The “Modified C” grading option has been introduced into this version with the intent of standardising project-specific local practices. Before nominating the “Modified C” grading, if it has not been used previously, it is recommended that the TMR District investigate the feasibility of obtaining this tighter grading with their locally available quarries. Depending on rock type and crusher capability, mix adjustment/s to assure compliance with both this tighter grading and all other requirements may require allowance/s for additional time and/or cost. Prior to nomination of “Modified C” grading in Departmental projects, the TMR District should consult with the Director (Pavements Rehabilitation) or their nominee.



The grading envelope shall also be in accordance with the following requirements:

- a) only grading envelopes B or C may be used for material Subtype 3.1
- b) only grading envelopes B, C or D may be used for material Subtypes 3.2 or 3.3, and
- c) only grading envelopes B, C or D may be used for material Subtypes 3.4 or 3.5 if these are used in a base or subbase 1 (upper subbase) layer in the pavement.

If more than one grading envelope is given in Clause 9 of Annexure MRTS05.1 for an entry, the Contractor shall notify the Administrator in writing, at least two working days before the commencement of the delivery of the materials to the pavement, which one of the alternative grading envelopes will be used [**Refer to Hold Point 1**].

The envelope chosen shall be the only envelope to be used for the particular location until prior approval is obtained from the Administrator for the use of one of the other alternatives in lieu of the original envelope chosen. Such approval shall be obtained at least two working days before the use of the alternative envelope. **Hold Point 3**

The following additional requirements shall apply to the grading envelopes given in Table 7.3.4-A:

- a) fines ratio, the ratio of the percentage of the material passing the AS 0.075 mm sieve and the percentage of the material passing the AS 0.425 mm sieve, shall lie between the limits given in Table 7.3.4-B, and

**Table 7.3.4-B – Ratio 0.075 mm material to 0.425 mm material – Type 3**

Subtype	Fines Ratio	
	Minimum	Maximum
3.1	0.35	0.55
3.2, 3.3	0.35	0.65
3.4, 3.5	–	–

- b) for all grading envelopes B, C, Modified 'C' and D the grading curve for the material shall be smooth and shall except for Modify 'C' not vary from one outer third of the total limits range between the minimum and maximum limits for one sieve to the opposite outer third of the total limits range for the next lower sieve.

### 7.3.5 California Bearing Ratio

The California Bearing Ratio requirements for Type 3 material are given in Table 7.3.5.

**Table 7.3.5 – California bearing ratio requirements – Type 3**

Property	Subtype				
	3.1	3.2	3.3	3.4	3.5
CBR (unsoaked) minimum	80	60	45	35	15

### 7.4 Type 4 Unbound material

Type 4 material is specified by its unsoaked California Bearing Ratio and any additional requirements given in Clause 12 of Annexure MRTS05.1.

The California Bearing Ratio requirements are given in Table 7.4.

**Table 7.4 – California bearing ratio requirements – Type 4**

Property	Subtype				
	4.1	4.2	4.3	4.4	4.5
CBR (unsoaked) minimum	80	60	45	35	15

The moisture content at which the CBR result is to be reported may vary from OMC for Type 4 materials. The relative moisture content for this Contract is given in Clause 12.2 of Annexure MRTS05.1. If no indication is given for a particular material subtype, the CBR shall be reported at the Optimum Moisture Content.

### **7.5 All unbound materials**

All pavement material incorporated into the finished pavement shall be free from sticks, organic matter, clay lumps and other deleterious material. Visual inspection of the material during and after placement shall be used to ensure compliance with this clause.

### **7.6 Stockpiling of materials**

If a position is given in Clause 2 of Annexure MRTS05.1, the stockpile shall be so positioned. If a position is not given in Clause 2 of Annexure MRTS05.1, the stockpile shall be located on clear, even, firm, well-drained ground in a location where it can be clearly identified.

There shall be a separate stockpile for each material with different requirements.

All stockpiles shall be separated from other stockpiles by at least 2 metres.

For the purpose of testing, each individual stockpile lot shall be clearly delineated by one of the following methods:

- a) a separate stockpile shall be formed for each lot, or
- b) material of the same requirements shall be added to a single stockpile incrementally such that a portion representing a lot is added, tested and found to be conforming before the next portion, representing the next lot, is added. Nonconforming lots shall be removed from the stockpile prior to the addition of further portions.

## **8 Material compliance testing**

### **8.1 General**

Compliance testing of materials shall be undertaken for each lot. A lot shall include only material of the same subtype.

Unless indicated otherwise in Clause 3 of Annexure MRTS05.1, samples for material compliance testing shall be taken from the stockpile.

Locations for compliance testing shall be selected by random sampling as given in Test Method Q050. Sampling shall be undertaken as detailed in Test Method Q060.

### **8.2 Testing frequencies and number of tests**

The Contractor is responsible for carrying out sufficient testing to ensure that the material complies with the standards and requirements of this Technical Specification. However, the Contractor's testing program shall be such that lot sizes are not greater than those stated in Clause 5.3 and testing frequencies and number of tests are not less than those stated in Clause 5.5.

The Contractor shall not incorporate materials into the work unless it has demonstrated that the material complies fully with the requirements of this Technical Specification. **Hold Point 4**

### **8.3 Testing**

#### **8.3.1 General**

The testing of individual samples shall be carried out in accordance with the test methods set out in Table 4.

#### **8.3.2 Wet Tern Percent Fines Value and Wet/Dry Strength Variation**

The Wet Ten Percent Fines Value and the Wet/Dry Strength Variation tests shall both be carried out on the fraction of the coarse component passing the AS 13.2 mm sieve but retained on the AS 9.5 mm sieve.

However, for material which complies with grading envelopes D or E, if sufficient material for the test cannot be obtained from this sieve range, the tests may be carried out on an alternative fraction approved by the Administrator. This will normally be the next most coarse fraction which comprises 10% or more of the material and conforms with one of the component sizes listed in Test Method Q205B.

#### **8.3.3 Flakiness Index**

The Flakiness Index Test results (Test Method Q201) shall be reported for the total sample.

#### **8.3.4 California Bearing Ratio**

California Bearing Ratio tests shall be undertaken in accordance with Test Method Q113A, for material Type 2 and Type 3 and any Type 4 material for which the result is to be reported at optimum moisture content (refer to Clause 7.4).

For Type 2 and Type 3 materials and Type 4 materials as described in the previous paragraph, the test result shall be reported at the maximum dry density and optimum moisture content as defined by Test Method Q113A.

For other Type 4 materials, the California Bearing Ratio may be determined from one single-point test, in accordance with Test Method Q113C, carried out at the maximum dry density, and the relative moisture content given in Clause 12.2 of Annexure MRTS05.1. The result reported shall be that at the relative moisture content given in Clause 12.2 of Annexure MRTS05.1.

## **9 Construction**

### **9.1 Process requirements**

#### **9.1.1 Layer thicknesses**

Individual compacted layer thicknesses shall be chosen to suit the construction process and the requirements of the Contract. Compacted layer thicknesses shall not be greater than 250 mm nor less than 75 mm.

#### **9.1.2 Moisture content**

##### **9.1.2.1 Limits**

The pavement layer shall have a moisture content such that the degree of saturation is less than the relevant limit given in Table 9.1.2.1.

**Table 9.1.2.1 – Maximum degree of saturation**

Material Type	Maximum Degree of Saturation (%)
1	65
2	65
3	70
4	70

### 9.1.2.2 Construction

A section of a pavement may have a moisture content greater than that represented by the relevant degree of saturation limit given in Clause 9.1.2 for the purpose of construction only, provided that the section of pavement is dried back to the requirements of Clause 9.1.2.1 prior to covering with the next layer of pavement or surfacing.

### 9.1.3 Surface finish

The final unbound material layer shall have a uniform surface free from loose, segregated and contaminated areas and the coarse particles shall be slightly exposed. If necessary, the surface shall be trimmed, lightly watered, drag-broomed and rolled with an approved roller to achieve the above finish to the approval of the Administrator.

### 9.1.4 Construction equipment

Pavements incorporating Type 1 materials shall be constructed using self-propelled spreading machines purpose-built for this work.

Such machines shall have the capacity to either:

- a) place and spread the material directly on the prepared surface to the necessary uncompacted layer depth, width and shape in one pass, or
- b) spread previously placed windrows of material to the necessary uncompacted layer depth, width and shape in one pass.

Other methods of construction may be used in areas where the pavement width is such that the use of such purpose-built machines is impracticable, subject to the approval of the Administrator.

Self-propelled spreading machines shall have the capacity to spread the material in one pass to the necessary uncompacted layer depth over at least half of the pavement or to at least 3 metres, whichever is the lesser.

If specific equipment is stated in Clause 4 of Annexure MRTS05.1, it shall be used in the construction of pavements with Type 2, 3 or 4 materials.

## 9.2 Product standards

### 9.2.1 Compaction standard

The characteristic value of the Relative Compaction shall not be less than 102% for all Type 1 materials unless specified otherwise in Clause 5 of Annexure MRTS05.1.

The characteristic value of the Relative Compaction shall not be less than 100% for all Type 2, 3 and 4 materials, unless specified otherwise in Clause 5 of Annexure MRTS05.1.

### 9.2.2 Segregation

Segregation is the uneven distribution of particle sizes. The construction process shall minimise segregation so that the particle size distribution of the material in the pavement shall comply with the particle size distribution requirements in Clause 7 for the relevant subtype.

### 9.2.3 Geometrics, general

The pavement shall be constructed so as not to depart from the widths, lengths, heights and shapes specified in the Contract by more than the tolerances stated in Clauses 9.2.4 and 9.2.5. The widths and heights for the surface of layers other than the final layer shall be calculated using the widths, heights and shapes for the completed pavement as described in the Contract and the depth to the surface of the particular layer within the pavement.

### 9.2.4 Geometrics, horizontal tolerances

The horizontal location of any point on the pavement shall not differ from the corresponding point shown in the Contract, or as calculated as specified in Clause 9.2.3, by more than  $\pm 50$  mm except for the following situations:

- a) for pavement edges not adjacent to any other section of pavement and not adjacent to any structure or adjoining road, the transverse tolerance shall be  $-50$  mm,  $+250$  mm (where the  $+$  tolerance is in the direction which increases the width of the pavement)
- b) where alignment of the pavement with an existing pavement or structure is necessary, the new work shall be joined neatly to the existing work in a smooth manner as shown on the Drawings or, if this is not shown, in an approved manner.

### 9.2.5 Geometrics, vertical tolerances

#### 9.2.5.1 Primary tolerance

A primary tolerance shall apply to the height of any point on the surface of any layer.

The primary tolerance for Type 1 materials shall be  $\pm 15$  mm. The primary tolerance for Type 2, 3 and 4 materials is given in Clause 6.1 of Annexure MRTS05.1 as one of the alternatives set out in Table 9.2.5.1.

**Table 9.2.5.1 – Primary tolerance – Types 2, 3 and 4**

Alternative	Primary Tolerance (mm)
A	$\pm 15$
B	$\pm 25$

#### 9.2.5.2 Additional tolerances

##### 9.2.5.2.1 General

Additional tolerances, as stated in Clauses 9.2.5.2.2 and 9.2.5.2.3, shall apply to lots in the final unbound layer. These tolerances shall also apply to such other layers as stated in Clause 6.2 of Annexure MRTS05.1. Surface evenness as stated in Clause 9.2.5.2.4 shall apply to lots in the final unbound layer.

The Contractor may have to carry out additional work to achieve these additional tolerances. No additional payment will be made by the Principal for such additional work.

### 9.2.5.2.2 Deviation from a straight-edge

The deviation from a 3 metre long straight-edge placed anywhere on the surface of a layer shall not exceed 5 mm for all Type 1 materials, due allowance being made for design shape, where relevant.

For other material types, the deviation from a 3 metre long straight-edge placed anywhere on the surface of a layer shall not exceed the limit stated in Clause 6.3 of Annexure MRTS05.1, which limit shall be one of the alternatives set out in Table 9.2.5.2.2, due allowance being made for design shape where relevant.

**Table 9.2.5.2.2 – Deviation from a straight-edge**

Alternative	Deviation Limit (mm)
C	5
D	8

### 9.2.5.2.3 Crossfall

The crossfall shall not depart from the corresponding crossfall shown in the Contract by more than 0.5% absolute.

The crossfall shall be measured:

- a) between any two points more than 2 metres apart except where a pavement verge is less than 2 metres wide. For pavement verges less than 2 metres wide, the measurement shall be made between the extreme edges of the pavement verge on each side of the pavement
- b) transverse to the centre line, and
- c) within the boundaries of a cross-section element which has a constant crossfall.

### 9.2.5.2.4 Surface evenness

The surface evenness of the final pavement layer shall be such as to provide a road roughness count rate not exceeding the specified road roughness ( $R_s$ ) stated in Clause 7 of Annexure MRTS05.1 or where not so stated, not exceeding 60 counts per kilometre.

## 10 Construction compliance testing

### 10.1 Process requirements

#### 10.1.1 General

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

Compliance checking shall be carried out in accordance with any minimum testing frequencies and minimum test numbers specified in Clause 5.5

#### 10.1.2 Pavement material

Each lot of constructed pavement shall be cross-referenced to the accepted lot in the stockpile from which the pavement material was obtained.

#### 10.1.3 Moisture content of the pavement layer

The in situ moisture content shall represent the full depth of the layer and shall be measured in accordance with Test Method Q141A, Test Method Q102A, or one of the subsidiary Test Methods

Q102B or Q102D for which a relationship with Test Method Q102A has been established and used in accordance with Test Method Q010.

## **10.2 Product requirements**

### **10.2.1 General**

Compliance testing of the pavement shall be undertaken for each lot.

### **10.2.2 Testing frequencies and number of tests**

The Contractor is responsible for performing sufficient tests to ensure that the pavement complies with the standards and requirements of this Technical Specification. However, the Contractor's testing program shall be such that the testing frequencies and number of tests are not less than those specified in Clause 5.5.

### **10.2.3 Geometrics**

The geometric tolerances, except for surface evenness, shall be checked at regular intervals not greater than those specified in Clause 5.4.

### **10.2.4 Compaction**

The compaction standard for each lot shall be represented by the characteristic value of the Relative Compaction. The characteristic value of the Relative Compaction for each lot shall be calculated as stated in Q020 using:

- a) the individual Relative Compaction results measured within the lot, and
- b) the acceptance constant "k" value as nominated in Clause 12 of MRTS01 *Introduction to Technical Specifications*.

The location of each in situ dry density test shall be chosen by a method of random stratified sampling as given in Test Method Q050.

The in situ dry density shall be determined by Test Method Q141A or Q141B and the maximum dry density of a reference sample shall be determined by Test Method Q142A or Q144A.

### **10.2.5 Segregation**

There shall be no visible signs of segregation on each lot.

Samples shall be taken from each lot to check that segregation of the material in the lot has not occurred. Additional samples shall be taken from any areas which show visible signs of segregation. Each sample shall be tested in accordance with Test Method Q103A.

### **10.2.6 Degree of saturation**

The degree of saturation for each lot shall be represented by the characteristic value of the degree of saturation of the individual samples taken from the lot. The characteristic value shall be calculated as stated in Clause 12 of MRTS01 *Introduction to Technical Specifications*.

The degree of saturation test shall be performed within a period of 6 hours prior to the placement of the next pavement layer or the surfacing.

The degree of saturation shall be determined in accordance with Test Method Q146.

### 10.2.7 Surface evenness

The surface evenness of the final unbound pavement layer shall be measured by road roughness (Test Methods Q708B, Q708C, and Q708D).

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

### 10.2.8 Visible deflection of pavement layers

The objective visible deflection test specified in this Clause shall apply to lots in the final pavement layer only, unless stated otherwise in Clause 8 of Annexure MRTS05.1.

Where the surface of any section of the pavement layer displays visible deflection as a result of the movement across the surface of a vehicle with a gross vehicle mass of 20 tonnes, the Administrator may require the Contractor to carry out additional compliance testing to ensure that the affected section of the pavement layer complies with Clauses 10.2.4, 10.2.5 and 10.2.6. No additional payment will be made by the Principal for such additional testing.

### 10.2.9 Acceptance

No layer of a pavement shall be covered by a subsequent layer of pavement or by surfacing until all testing has been completed and the layer has been presented to the Administrator for permission to proceed. **Hold Point 5**

## 11 Supplementary requirements

The requirements of MRTS05 *Unbound Pavements* are varied by the supplementary requirements given in Clause 13 of Annexure MRTS05.1.



Superseded