

Main Roads Technical Standard

MRTS07A

Insitu Stabilised Subgrades using Quicklime or Hydrated Lime

April 11

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Insitu Stabilised Subgrades using Quicklime or Hydrated Lime

1 INTRODUCTION

This Technical Standard applies to the stabilisation of materials insitu by the addition of quicklime (hydrated and added as a slurry) or hydrated lime.

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 MRTS01 *Introduction to Technical Standards*. Additional terms used in this standard shall be as defined in Table 2. Where indicated in Table 2, a more complete definition is contained in the referenced clause.

Table 2 – Definition of Terms

Term	Definition	Clause Reference
Actual depth	Depth achieved measured from the finished surface level of the stabilised layer.	-
Allowable Working Time	The time within which compaction and trimming of the stabilised layer is to be completed, measured from the commencement of incorporation (i.e. mixing) of stabilising agent into the unstabilised material to completion of compaction and trimming.	8.1.4
Available Lime Index	The available calcium oxide for quicklime or available calcium hydroxide for hydrated lime in accordance with AS 4489.6.1.	2.3.1 of MRS07A
Binder	Stabilising agent – see definition below.	-
Curing materials	Materials applied to the exposed surfaces of the completed stabilised layer for the purpose of curing.	-
Equivalent Calcium Oxide Content	Equivalent calcium oxide content is the amount of calcium oxide, expressed as a percentage by mass, which in quicklime produces calcium hydroxide (Ca(OH) ₂) after slaking.	-
Hydrated Lime	Hydrated lime is a granular form of lime consisting primarily of calcium hydroxide (Ca(OH) ₂).	2.3.1.1 of MRS07A
Lime Slurry	Lime Slurry is formed after the quicklime has been fully slaked and takes the form of a slurry.	-
Quicklime	Quicklime is a granular form of lime consisting primarily of calcium oxide (CaO), which can be readily slaked.	2.3.1.2 of MRS07A
Reclaimer/stabiliser	A single-rotor mix-in-place plant (i.e. plant that mixes insitu) of a type specifically designed for the dual task of reclamation and stabilisation work.	-
Slaking	The addition of water to quicklime. (The purpose is to fully hydrate the quicklime.)	8.4.7

Term	Definition	Clause Reference
Stabiliser	A single rotor mix-in-place plant (i.e. plant that mixes insitu) of a type specifically designed for stabilisation work.	-
Stabilising agent	Quicklime or Hydrated Lime.	6.2
Target depth	Depth of stabilisation measured from the design surface level of the new insitu stabilised layer.	8.1.2
Work period	The time between the start of the stabilisation process and the completion of compaction and trimming.	-

3 REFERENCED DOCUMENTS

Table 3 lists the Australian Standards referenced in this technical standard.

Table 3 – Referenced Documents

Reference	Title
AS 4489.6.1	Test methods for limes and limestones – Lime index – Available lime

4 STANDARD TEST METHODS

The Standard Test Methods listed in Table 4 shall be used in this Standard.

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

Table 4 – Standard Test Methods

Property to be Tested	Test Method No.
Determination of the relationship between standard and subsidiary test methods	Q010
Selection of sampling and test locations	Q050
Sampling of Soils, Crushed Rock and Aggregates	Q060
Spot Sampling of Soils, Crushed Rock and Aggregates	Q061
Preparation of disturbed samples	Q101
Laboratory reference density	Q141B Q142A Q142C Q143 Q144A
Relative compaction (i.e. Relative Dry Density [RDD])	Q140A Q141A Q141B
Sulfate content	Q131A
Lime demand	Q133
Stabilising Agent Content	Q134
Surface spread rate of stabilising agent	Q719
Plastic limit and plasticity index	Q105

Particle Size Distribution	Q103A
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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 Standards*.

The Hold Points, Witness Points and Milestones applicable to this standard are summarised in Table 5.1.

Table 5.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.2.2			Supply of the construction procedure(s) and construction program for the stabilisation works (42 days).
5.2.2	1. Approval of construction procedure(s) and construction program.		
7.1	2. Compliance of all materials, prior to their incorporation.		
8.1.6	3. Survey of services, utilities, buildings and drainage.		
8.3.1	4. Approval of compaction based on a process requirement.		
8.3.2		Construction of trial section (if process standard specified for compaction).	
8.4.6		Spreading stabilising agent.	
8.5.1.1			Ordered spread rate of stabilising agent (14 days)
9.7		Testing for visible deflection of pavement layers	
9.8	5. Covering a pavement layer.		
9.8	6. Construction permitted to proceed.		

5.2 Construction Procedures

5.2.1 General

The Contractor shall prepare documented procedures for all construction processes in accordance with Clause 5 of MRTS50 *Specific Quality System Requirements*.

The construction procedure described in Clause 5.2.2 shall be submitted to the Administrator.

5.2.2 Insitu Stabilisation

A construction procedure detailing all work described in this standard shall be prepared.

The construction procedure shall include, but not be limited to –

- a) details of all plant associated with the work detailed in this Technical Standard;
- b) details of how services, utilities, buildings and drainage components shall be located and protected (refer to Clause 8.1.6);
- c) details of how services, utilities, buildings, drainage components, plant personnel shall be protected from damage, injury, etc (refer to Clause 8.1.6);
- d) calibration procedures (e.g. for the spreader);
- e) a detailed sequence of operations for all aspects of the stabilisation works, including, but not necessarily limited to –
 - i) details of joint locations;
 - ii) details of joint overlaps;
 - iii) the length of each run;
 - iv) the width of each run; and
 - v) details of procedures for working up to, or against, kerb, kerb and channel and road safety barriers, and structures such as bridges, access chambers, gullies, culverts and concrete medians and any existing pavement cutback point,
- f) the proposed program of works; and
- g) a testing program which shall include, but not be limited to, the testing methodology that shall be used to assess –
 - i) the compaction standard;
 - ii) the stabilisation depth;
 - iii) the stabilising agent spread rate;
 - iv) strength gain of the stabilised layer with time; and
 - v) geometric tolerances.

The proposed construction procedure shall be submitted to the Administrator at least 42 days prior to the commencement of stabilisation works. **Milestone**

The following shall be submitted to the Administrator with the construction procedure:

- a) details of the proposed source of the stabilising agent(s);
- b) a certificate of test results demonstrating compliance of each proposed stabilising agent to MRTS23 *Supply and Delivery of Quicklime and Hydrated Lime For Road Stabilisation* including a statement of the available lime index for each stabilising agent; and
- c) compliance test results and a representative sample of material from each proposed source to be used to replace material not suitable for stabilisation.

No stabilisation work shall be commenced until the construction procedure for stabilisation works is acceptable to, and approved by, the Administrator. **Hold Point 1**

5.3 Conformance Requirements

The conformance requirements which apply to lots of stabilised material covered by this Standard are given in the following clauses.

5.4 Testing Frequencies and Lot Sizes

Material compliance testing requirements are specified in Clause 7 and construction compliance testing requirements are specified in Clause 9.

The testing frequencies and lot sizes for any new material to replace material not suitable for stabilisation shall comply with the requirements of Clause 1.1 of Annexure MRTS07A.1.

Certification of the compliance of each stabilising agent with this standard is required for each source and for each load.

The testing frequencies and lot sizes for construction shall comply with the requirements of Clause 1.2 of Annexure MRTS07A.1. Where no maximum lot size is specified for construction in Clause 1.2 of Annexure MRTS07A.1, the maximum lot size shall be equal to the area (in m²) of production of the completed stabilised layer achieved during the specific two day work period for that layer, provided the material is, in the opinion of the Administrator, essentially uniform.

6 MATERIAL

6.1 *New Material to Replace Material not Suitable for Stabilisation*

New material which is required to replace material not suitable for stabilisation shall comply with the requirements stated in Clause 3 of Annexure MRTS07A.1.

Where not so stated in the Annexure, materials shall comply with the requirements for Class C general fill material for embankments as specified in Table 14.2.2 of MRTS04 *General Earthworks*. The lime demand of the material, determined in accordance with Test Method Q133, shall be not more than the stabilising agent content being used for the remainder of the works.

Additionally, any new material incorporated into the Works shall have a water soluble sulfate content not exceeding 1.9 grams of sulfate (expressed as SO₃) per litre.

6.2 *Stabilising Agent*

The stabilising agent shall comply with the requirements of MRTS23 *Supply and Delivery of Quicklime and Hydrated Lime for Road Stabilisation*.

The type of stabilising agent and the Specified Spread Rate of stabilising agent to be used at specific locations shall be as stated in Clause 8 of Annexure MRTS07A.1. If a Specified Spread Rate is not stated in Clause 8 of Annexure MRTS07A.1, the total Specified Spread Rate shall be 20 kg/m² for quicklime or 26 kg/m² for hydrated lime.

The Contractor shall make allowance for the variation of the Available Lime Index of the stabilising agent supplied.

At the time of spreading, the stabilising agent shall comply with the relevant Technical Standard and shall not be more than three months old, measured from its date of manufacture. The stabilising agent shall have an available lime index of not less than 80%.

6.3 *Water*

Water shall be free from oil, acids, organic matter and any other matter which could be deleterious to the mixture. It shall also be potable and contain less than 0.05% of sulfates.

7 MATERIAL COMPLIANCE TESTING

7.1 *General*

No material shall be incorporated into the work unless it has been demonstrated to the Administrator that the material complies fully with the requirements of this standard. **Hold Point 2**

The testing of individual samples shall be carried out in accordance with the Test Methods described in Table 4. Testing frequencies and lot sizes shall be as per Clause 5.4.

The costs associated with material compliance testing shall be deemed to be included in the related/relevant works.

7.2 *Stabilising Agent, Water, Curing Materials*

Sampling and testing shall be carried out in accordance with the relevant standards.

A certificate of test results demonstrating compliance of each proposed stabilising agent to MRTS23 *Supply and Delivery of Quicklime and Hydrated Lime for Road Stabilisation* shall be provided for each load, or part thereof, of each stabilising agent.

7.3 New Material to Replace Material not Suitable for Stabilisation – General (Class C) Fill Material

Compliance testing of any new material used to replace material not suitable for stabilisation shall be carried out in accordance with the requirements of Clause 1.1 of Annexure MRTS07A.1. Class C general fill material shall also comply with MRTS04 *General Earthworks*.

8 CONSTRUCTION

8.1 General

8.1.1 Extent of Stabilising Operation

Construction of the stabilised material to the target depth shall be completed in one layer.

Once stabilising agent has been spread it shall be incorporated and mixed over the entire area of spread within the same work period in which it was spread. The stabilised material shall be fully compacted and trimmed within the allowable working time.

8.1.2 Target Depth

The target depth is stated in Clause 8 of Annexure MRTS07A.1.

The datum for measurement of the target depth shall be as stated in Clause 9 of Annexure MRTS07A.1.

8.1.3 Construction Process

8.1.3.1 General

The construction process shall be based on either a process requirement or a product standard. The method for this Contract shall be as stated in Clause 8 of Annexure MRTS07A.1.

8.1.3.2 Construction Based on Process Requirements

If a process requirement is specified in Clause 8 of Annexure MRTS07A.1 construction shall –

- a) incorporate the methodology and construction of trial sections in accordance with the requirements of Clause 8.3;
- b) comply with the construction requirements stated in Clause 8.4; and
- c) comply with the product standards stated in Clause 8.5 except that compaction testing shall not be required on completed works other than trial sections, provided that the Contractor uses the same construction plant, process and methodology as that used for the trial section.

8.1.3.3 Construction Based on Product Standards

If a process requirement is specified in Clause 8 of Annexure MRTS07A.1 construction shall –

- a) comply with the construction requirements stated in Clause 8.4; and
- b) comply with the product standards stated in Clause 8.5.

8.1.4 Allowable Working Time

Compaction and trimming of the stabilised layer shall be completed within the allowable working time.

The allowable working time, measured from the commencement of incorporation (i.e. mixing) of stabilising agent into the ameliorated material on Day 2 to the completion of compaction and trimming of the stabilised material, shall be as stated in Clause 8 of Annexure MRTS07A.1. Where not so stated, the allowable working time shall be 48 hours.

8.1.5 Time Between Spreading and Mixing

The maximum time between spreading of stabilising agent and mixing of it into the insitu material shall be as stated in Clause 8 of Annexure MRTS07A.1. Where no such time is stated in the Annexure, the maximum time between spreading of the stabilising agent and mixing of the stabilising agent into the insitu shall be 30 minutes.

After each spreading run at least one mixing run, and trimming and/or compaction as required (refer to Clauses 8.4.3 and 8.4.10), shall be completed. Further mixing operations between spreading runs shall comply with Clause 8.4.8.

8.1.6 Site services, utilities, buildings and drainage

A survey of the site to determine the location and depth of services, utilities, buildings and drainage components shall be carried out prior to commencement of construction. The survey shall include details of how these and plant and personnel on site shall be protected and how the stabilisation works shall be completed without any detrimental effects to them. All such details shall be included in the proposed construction procedure (Clause 5.2.2).

Stabilisation related operations shall not commence until the survey has been completed and a copy of the report provided to the Administrator. **Hold Point 3**

8.2 Program of works

The Contractor shall submit the proposed program of the stabilisation works to the Administrator at least 42 days prior to the commencement of stabilisation works, unless otherwise agreed by the Administrator.

Stabilisation works shall not be commenced until the program have been approved by the Administrator. (Refer to Clause 5.2.2 and Hold Point 1.)

8.3 Process Requirements

8.3.1 Methodology

Each section of the Works with a specific combination of stabilising agent type, stabilising agent spread rate, material(s) to be stabilised and target depth shall be identified as a separate area for construction.

A trial section shall be constructed for each separate area for construction in accordance with the requirements of Clause 8.3.2.

If the characteristic value of the RDDs for the trial section is not less than the value specified in Clause 8.5.2, further compaction testing need not be carried out for the balance of the area for construction that is represented by that trial section, provided that the same construction plant, processes and methodology is used to construct the remaining area as that used for the construction of the trial section.

If the characteristic value of the RDDs for the trial section is less than the value specified in Clause 8.5.2, the trial section shall be rectified so that it complies with this standard and an additional trial section shall be constructed and assessed in accordance with this Clause 8.3.

Construction based on a process requirement and a trial shall not be used for the balance of the works without approval of the Administrator. **Hold Point 4**

8.3.2 Trial Section

A trial section shall be constructed using the same construction plant, processes and methodology that is proposed to be used for the remainder of the works represented by the trial section. **Witness Point**

A trial section shall be at least 200 metres long and 3 metres wide (so that a longitudinal joint is included).

All operations, testing, etc required by this standard, including compaction testing, shall be used in the construction and testing of a trial section.

8.4 Construction Requirements

8.4.1 Removal and Disposal of overlying material (if required)

Material shall be excavated to the shapes, lines, dimensions and other requirements shown on the drawings or as otherwise specified in Clause 2 of Annexure MRTS07A.1.

Overlying material that is to be disposed of shall be disposed of in accordance with Clause 11 of MRTS01 *Introduction to Technical Standards*.

8.4.2 Removal and Disposal of Material not Suitable for Stabilisation (if required)

Material not suitable for stabilisation shall include –

- a) Unbound material with –
 - i) a plasticity index less than 10%; and
 - ii) less than 25% passing the 0.425 mm sieve,
- b) any patch which may include –
 - iii) concrete;
 - iv) cement treated material; and
 - v) asphalt,
- c) any additional requirements stated in Clause 4 of Annexure MRTS07A.1.

Where material not suitable for stabilisation is encountered, the volume to be removed shall be agreed with the Administrator prior to removal and replacement operations commencing.

Existing material that is unsuitable for stabilisation shall be removed and disposed of in accordance with Clause 11 of MRTS01 *Introduction to Technical Standards*.

New material conforming to the requirements stated in Clause 6.1 shall be used to replace the material removed as not suitable for stabilisation. It shall be spread, compacted and trimmed to a shape suitable for stabilisation, compaction and trimming to the alignment, heights and shapes specified in the Contract for the completed work.

8.4.3 Compacting and Trimming of the surface Prior to Spreading of the Stabilising Agent

Prior to spreading of the stabilising agent, the existing surface shall be shaped, compacted and trimmed to shape to a degree that is sufficient to facilitate stabilisation, compaction and trimming to the alignment, heights and shapes specified in the Contract.

8.4.4 Stabilising Agent Equipment

Stabilising agent shall be transported, stored and spread using equipment that is both waterproof and watertight. Equipment used to transfer the stabilising agent shall also be waterproof during the transfer process. All such equipment shall be emptied, cleaned and dried prior to the introduction of each type of stabilising agent to be used in the stabilisation works.

8.4.5 Stabilisation Process

8.4.5.1 General

Lime stabilisation of subgrade material shall be carried out as a two day operation.

The stabilising agent shall be spread using a purpose-built spreader and the stabilising agent and water shall be incorporated into the material using a reclaimer/stabiliser or stabiliser.

Alternatively, a reclaimer/stabiliser with a calibrated integrated spreader/applicator may be used to incorporate the stabilising agent and water directly into the material to be stabilised.

Where a reclaimer/stabiliser with calibrated integrated spreader/applicator is used, quicklime shall not be used as the stabilising agent.

8.4.5.2 Day 1

A single lime pass at a rate of up to half the required rate shall be applied in accordance with Clause 8.4.6. Where quicklime is spread over the subgrade, it shall be slaked in accordance with Clause 8.4.7. In situations where hydrated lime is used, slaking is not required before mixing the stabilising agent into the soil. The hydrated lime or lime slurry formed from the slaking of quicklime shall then be mixed into the material in accordance with Clause 8.4.8. The depth of mixing shall not exceed 90% of the specified stabilisation thickness. The material shall be lightly rolled to seal the surface prior to the completion of work on that particular day.

8.4.5.3 Day 2

After the overnight amelioration period, the balance of the required lime shall be spread in accordance with Clause 8.4.6. Where quicklime is spread over the subgrade, it shall be slaked in accordance with Clause 8.4.7. Insituations where hydrated lime is used, slaking is not required before mixing the stabilising agent into the soil. The hydrated lime or lime slurry formed from the slaking of quicklime shall then be mixed into the material in accordance with Clause 8.4.8. Notwithstanding this a minimum of two mixing passes shall be completed.

8.4.6 Spreading of Stabilising Agent

Lime shall be spread at a maximum spread rate of 12 kg/m². The number of passes shall be calculated to comply with this requirement. The stabilising agent shall be uniformly spread over the insitu material at a controlled rate (mass per unit area, kg/m²). **Witness Point**

The total rate of spread shall be such that the stabilising agent spread rate for the compacted material is within the specified tolerances.

Once the stabilising agent has been spread, no traffic, other than the construction plant employed for the stabilisation work, shall travel over it.

After each spreading run at least one mixing run, and trimming and/or compaction as required (refer to Clauses 8.4.3 and 8.4.10), shall be completed. Further mixing operations between spreading runs shall comply with Clause 8.4.8.

8.4.7 Slaking

Quicklime shall be slaked with sufficient water to allow complete hydration such that the material remains friable after slaking and no further exothermic reaction occurs when further water is added to the lime.

All through traffic shall be stopped during any slaking operation.

8.4.8 Mixing

Mixing shall be achieved using a reclaimer/stabiliser or stabiliser. Where quicklime is used as the stabilising agent mixing shall not commence until slaking is complete.

On day two, all lime spread shall be mixed into the soil within 6 hours of each application.

The depth of each mixing pass, except the final mixing pass, shall not exceed 90% of the full depth of stabilisation specified. The final mixing pass shall be to the full depth of stabilisation specified. Mixing shall proceed until all material other than stones can pass a 19 mm AS sieve, at least 60% of such material can pass a 9.5 mm AS sieve and the lime is uniformly mixed through the soil. Notwithstanding this the minimum number of mixing passes shall be two.

The distribution of the stabilising agent and water shall be uniform throughout the full depth, and over the entire area, of the material to be stabilised. The moisture content shall be adjusted as necessary during the mixing process to maintain a moisture content of between 97% and 101% of OMC (optimum moisture content) of the stabilised soil as determined by tests using standard compactive effort.

Unless otherwise approved by the Administrator, water shall be added by means of a controlled pressure feed distribution system located inside the mixing chamber of the reclaimer/stabiliser or stabiliser. This system shall be capable of spraying varying rates across its width.

Where test results or visual inspection by the Administrator indicates that any of the requirements stated in this Clause have not been met, additional mixing passes shall be carried out to improve the uniformity of the –

- a) Materials to be stabilised;
- b) Distribution of the stabilising agent; and
- c) Distribution of water.

After each spreading run mixing, and trimming and/or compaction as required (refer to Clauses 8.4.3 and 8.4.10), shall be completed,

8.4.9 Trimming Before Compaction

After completion of stabilisation and before compaction commences, the surface shall be trimmed to approximately the alignment, heights and shapes specified for the completed work, and any depressions shall be filled with additional stabilised material that is mixed and placed within its allowable working time.

8.4.10 Compaction

Light compaction of the stabilised material shall be completed after each application of lime has been incorporated into the material. This shall be carried out using an appropriate roller that is capable of achieving relatively uniform compaction over the depth of the stabilised layer.

Final compaction shall be completed within the allowable working time (refer to Clause 8.1.4). The stabilised layer shall be compacted to the standard stated in Clause 8.5.2.

8.4.11 Trimming After Compaction

No marks caused by a pad foot or other roller shall remain on the surface after final trimming.

All trimming shall involve cutting to waste. All material cut to waste shall be disposed of in accordance with Clause 11 of MRTS01 *Introduction to Technical Standards*.

No separate payment shall be made for the disposal of material cut to waste. The cost of all activities associated with the disposal of material cut to waste shall be deemed to be incorporated into the relevant works.

8.4.12 Period for Compaction and Trimming

Compaction and trimming shall be completed within the allowable working time (refer to Clause 8.1.4).

8.4.13 Construction Joints

8.4.13.1 General

Joints shall be constructed such that the material at the joints complies with the requirements of this standard.

A construction joint (longitudinal or transverse) shall be deemed fresh when the material on each side of the joint has been stabilised, placed and compacted within the allowable working time of the stabilised material constructed first.

8.4.13.2 Longitudinal Joints

Longitudinal joints shall not be located in the through traffic wheel paths.

Where a fresh longitudinal joint between adjacent runs is to be compacted, the outside 300 mm of material from the first run shall be left uncompacted until the adjacent material is ready for compaction. The joint shall be water cured during this period. When the fresh joint is compacted the roller shall be partially supported on the portion of the first run that has been previously compacted.

The minimum distance for cutting back into previously compacted material shall be the greater of 75 mm or the distance to a point where the stabilised material complies with this standard. The cutback material shall be removed, disposed of and replaced in accordance with this standard.

No separate payment shall be made for the disposal of material cut to waste. The cost of all activities associated with the disposal of material cut to waste shall be deemed to be incorporated into the relevant works.

8.4.13.3 Transverse Joints

For transverse joints that are not made during the allowable working time of the material stabilised first, the adjoining section previously stabilised shall be cut back by the greater of 1.5 m and the distance to a point where the stabilised material complies with this standard. The cutback material shall be removed, disposed of and replaced in accordance with this standard. After this material has been replaced with material that complies with the requirements of Clause 6.1. This material shall then be included in the stabilisation process of the adjoining section to be stabilised.

No separate payment shall be made for the disposal of material cut to waste. The cost of all activities associated with the disposal of material cut to waste shall be deemed to be incorporated into the relevant works.

8.4.14 Curing

A curing operation shall commence immediately after the completion of compaction.

The stabilised layer shall be cured using water by maintaining the layer surface and edges in a continuously damp condition, using a uniformly applied fine mist, until the stabilised layer is covered by an overlying pavement layer or a sprayed bituminous surfacing with cover aggregate. Water shall be applied in a manner such that slurring of the surface, pavement instability and erosion and/or leaching of the stabilising agent are all avoided.

8.4.15 Protection

The surface of the compacted layer shall be kept moist, in good order, in good condition and free from contamination until an overlying pavement layer or a sprayed bituminous surfacing with cover aggregate is placed, or until the Administrator accepts and takes responsibility for that area. Construction or other traffic shall not use a compacted layer where damage to the surface may occur. Placement and compaction of any subsequent layer shall be carried out within 48 hours of density testing subject to the stabilised later complying with all specified requirements or where the area has been accepted by the Administrator.

8.4.16 Minimum Requirements and Numbers of Particular Plant

The minimum requirements and numbers of particular plant that shall be on Site at all times during the stabilisation works shall be as stated in Clause 5 of Annexure MRTS07A.1.

Where not so stated in the Annexure, the minimum requirements and numbers of particular plant that shall be on Site at all times during the stabilisation works shall be as stated in Table 8.4.16.

Table 8.4.16 – Minimum Requirements and Numbers of Particular Plant

Description	Minimum requirement for each piece of plant	Minimum number of Units
Reclaimer / stabiliser or Integrated spreader/applicator / reclaimer / stabiliser	375 kilowatts. Calibrated and capable of uniformly spreading stabilising agent to varying widths (if integrated spreader / reclaimer / stabiliser).	1
Purpose built spreader	Calibrated with load cells and capable of uniformly spreading stabilising agent to varying widths.	1
Vibrating pad foot roller	18 tonnes for compacted thicknesses up to 200mm. 21 tonnes for compacted thicknesses up to 300 mm.	1
Vibrating smooth drum roller	18 tonnes for compacted thicknesses up to 200 mm. 21 tonnes for compacted thickness up to 300 mm	1
Multi-tyre roller	Minimum 12 tonnes.	1
Water truck	Capacity of 6,000 litres.	2
Grader	Manned by Final Trim Operator	1

8.4.17 Conditions under which stabilisation shall not proceed

The entire stabilisation process shall not proceed in any of the following situations –

- a) during rainfall;
- b) when rainfall appears to be imminent;
- c) during periods when the wind is strong enough to cause particles of the stabilising agent to become airborne;

- d) during conditions that may result in the work causing nuisance or danger to people, property, the environment, or live stock;
- e) when the pavement temperature, measured 50 mm below the surface, drops below 10°C; or
- f) when the air temperature, measured in the shade, exceeds 40°C.

8.5 Product Standards

8.5.1 Stabilising Agent Spread Rate

8.5.1.1 Ordered Spread Rate

At least 14 days prior to the commencement of stabilisation works, the estimated stabilising agent spread rate stated in Clause 8 of Annexure MRTS07A.1 will be confirmed or adjusted by the Administrator.

The confirmed or adjusted stabilising agent spread rate shall be the ordered spread rate of lime. **Milestone**

8.5.1.2 Actual Spread Rate

The actual spread rate shall be represented by the average of the actual surface spread rates of the stabilising agent for each lot.

The actual stabilising agent spread rate shall be within $\pm 10\%$ of the ordered spread rate as defined in Clause 8.5.1.1.

8.5.2 Compaction Standard

The characteristic value of the RDDs shall not be less than 97% (standard compaction).

8.5.3 Geometrics, General

The stabilised layer shall be constructed so as not to depart from the alignment, widths, thicknesses, lengths, heights and shapes specified in the Contract by more than the tolerances stated in Clauses 8.5.4 and 8.5.5.

8.5.4 Geometrics, Horizontal Tolerances

The horizontal position of any point on the pavement shall not differ from the corresponding point shown on the Drawings or otherwise specified in the Contract, calculated as described in Clause 8.5.3, by more than ± 50 mm.

8.5.5 Geometrics, Vertical Tolerances

8.5.5.1 Primary Tolerance

A primary tolerance shall apply to the height of any point on the surface of the stabilised layer. This shall be as specified in Clause 6.1 of Annexure MRTS07A.1 and be one of the alternatives given in Table 8.5.5.1.

Table 8.5.5.1 – Primary tolerance for the height of any point on the surface of the stabilised layer

Alternative	Primary tolerance
A	± 15 mm
B	± 25 mm

In all cases the primary tolerance shall also apply for the thickness of the completed stabilised layer. At any point the thickness of the stabilised layer shall be within - 5 mm and + 10 mm of the specified thickness.

8.5.5.2 Additional Tolerances

8.5.5.2.1 General

Where required by Clauses 8.5.5.2.2 and 8.5.5.2.3, additional tolerances shall apply to the stabilised layer.

Additional work shall be carried out where necessary to achieve these additional tolerances.

8.5.5.2.2 Deviation from a Straight-Edge

Clause 6.2.1 of Annexure MRTS07A.1 specifies whether a deviation from a straight edge tolerance is to be applied. Where it does apply the deviation from a 3 metres long straight-edge placed anywhere on the surface of a layer shall not exceed the limits stated in Clause 6.2.2 of Annexure MRTS07A.1, due allowance being made for design shape, where relevant.

8.5.5.2.3 Crossfall

Clause 6.3 of Annexure MRTS07A.1 specifies whether a crossfall tolerance is to apply. Where it does apply, 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 of the carriageway; and
- c) within the boundaries of a cross-section element which has a constant crossfall.

9 CONSTRUCTION COMPLIANCE TESTING

9.1 General

Unless otherwise stated in this standard, the selection of sampling or test locations shall be carried out using random stratified sampling. Exceptions include testing of –

- a) geometrics (Clause 9.4);
- b) the stabilising agent spread rate (Clause 9.6); and
- c) visible deflection of pavement layers (Clause 9.7).

The Contractor is responsible for performing sufficient tests to ensure that the pavement complies with the standards and requirements of this standard. 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 5.4.

9.2 Process Requirements

Where construction has been carried out using process requirements, checking for compliance with the specified requirements shall be carried out during and after the construction operation, as relevant. Except for compaction, compliance checking shall be carried out in accordance with Clause 5.4. If a process requirement is specified for compaction the minimum testing frequencies and minimum number of tests for compaction specified in Clause 5.4 do not apply. Notwithstanding this the requirements of Clause 8.4 apply.

9.3 Product Standards

Where construction has been carried out using product standards, compliance testing of the stabilised layer shall be undertaken for each lot. If a product standard is specified, the minimum testing frequencies and minimum number of tests for compaction specified in Clause 5.4 apply.

9.4 Geometrics

9.4.1 General

All geometric tolerances shall be checked at regular intervals not greater than those specified in Clause 5.4.

9.5 Compaction

Where a product standard is specified, the compaction standard for each lot shall be represented by the characteristic value of RDD.

The characteristic value shall be calculated as stated in Clause 13 of MRTS01 *Introduction to Technical Standards* using the individual RDD determined from testing of each lot.

The locations of all samples taken for the determination of reference density, insitu dry density and relative compaction shall be at the same offset and positioned one metre longitudinally in a direction opposite to the travel of the stabiliser from the earlier sampling position.

Sampling of stabilised materials to determine the laboratory reference density as detailed in Test Method Q142A shall take place after the final mixing run, but prior to the commencement of compaction of the stabilised material. Following sampling, reference density testing shall be completed to a stage where laboratory compaction has been completed within the Allowable Working Time of the corresponding lot. Additionally, following sampling, oven drying of any specimens used to determine the moisture content shall commence within the Allowable Working Time of the corresponding lot.

The relative compaction of the stabilised material as detailed in Test Method Q140A shall be determined using the ratio of either –

- a) the compacted dry density to the maximum dry density;
- b) the compacted dry density to the maximum converted dry density; or
- c) the compacted wet density to the maximum converted wet density.

For Test Method Q140A the use of the ratio of compacted wet density to the maximum converted wet density shall only be used where the insitu moisture content is within the range of - 4% to + 2% of the moisture content corresponding to the maximum converted wet density. The relative compaction shall be determined for the entire thickness of the stabilised layer.

For calibration for Test Method Q141A, compacted density testing as detailed in Test Methods Q141B and Q143, shall be completed to a stage where the mass of wet sample has been determined and any moisture sub-sample is being oven dried within the following time constraints –

- a) where rolling is completed before 4pm – same day; or
- b) where rolling is completed 4pm or later – same day or before 10am on the following day.

9.6 Stabilising Agent Spread Rate

The stabilising agent spread rate shall be determined by Test Method Q719.

The results of all surface spread rate tests shall be recorded, included in the quality records and reported to the Administrator. The record and report for each surface spread rate test shall include –

- a) the position, date and time;
- b) all values and calculations, including assumptions, used to calculate the surface spread rate; and
- c) the calculated surface spread rate.

The testing program shall be discussed and agreed with the Administrator prior to commencement of stabilising operations (refer Hold Point 2).

In addition, the tonnage of stabilising agent placed during each spreading run shall be recorded and reported. The record and report for each spreading run shall include –

- a) the start position, date and time;
- b) the end position, date and time;
- c) the length of the run;
- d) the width of the run;
- e) the tonnage of stabilising agent in the spreader at the start of the run;
- f) the tonnage of stabilising agent at 500 m intervals (if the length of the run exceeds 500 m);
- g) the tonnage of stabilising agent in the spreader at the end of the run;
- h) the tonnage of stabilising agent spread for each 500 m interval (if the length of the run exceeds 500 m); and
- i) the tonnage of stabilising agent spread for the entire run.

9.7 Visible Deflection of Pavement Layers

The objective visible deflection test specified in this Clause shall apply to a stabilised layer, unless stated otherwise in Clause 7 of Annexure MRTS07A.1.

Where the surface of any section of a stabilised layer displays visible deflection, as a result of the movement of a vehicle with an 8 tonne gross axle load on a single axle with dual tyres, **Witness Point** the Administrator may require the Contractor to undertake additional compliance testing shall be carried out to ensure that the affected section of the pavement layer complies with Clauses 9.5 and 9.6. This shall be at the Contractor's expense unless the Administrator agrees otherwise.

9.8 Acceptance

No stabilised layer shall be covered by a subsequent layer until all testing has been completed and the layer has been presented to the Administrator for approval and the Administrator has given approval. **Hold Point 5**. The Contractor shall allow at least one day for a response from the Administrator.

Construction shall not proceed until the Administrator has been issued the results of compliance testing for all lots constructed in the preceding four work periods, except where less than four work periods have passed since the commencement of stabilisation works. **Hold Point 6**

10 SUPPLEMENTARY REQUIREMENTS

The supplementary requirements given in Clause 10 of Annexure MRTS07A.1 shall apply.