Technical Specification

Transport and Main Roads Specifications MRTS07C Insitu Stabilised Pavements using Foamed Bitumen

July 2024

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Contents

1 Introduction

This Technical Specification applies to the stabilisation of materials insitu by the addition of bitumen, as a foam, and a secondary stabilising agent.

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*. Additional terms used in this Technical Specification shall be as defined in Table 2. Where indicated in Table 2 of this Technical Specification, a more complete definition is contained in the referenced clause.

Table 2 – Definition of terms

Term	Definition
Actual stabilised layer thickness	Achieved stabilised layer thickness as measured from the bottom of stabilised layer to the top of compacted and trimmed stabilised layer.
Allowable working time	The time measured from the commencement of incorporation (i.e. mixing) of the secondary stabilising agent into the material to completion of compaction and trimming.
Available lime index	The available calcium oxide for quicklime or available calcium hydroxide for hydrated lime in accordance with AS 4489.6.1.
Binder	Stabilising agents – see definitions below.
Bulking	Increase in vertical height during incorporating stabilising agents into material using a stabiliser. The increased vertical height of the material is measured from the surface level prior to this incorporation process – refer Figure 8.6.11.
Curing materials	Materials applied to the exposed surfaces of the completed stabilised layer for curing.
Design depth	As specified in the construction drawings and contract documents – refer Figure 8.6.11.
Expansion Ratio	A term used to define the expansion properties of the bitumen. It is defined as the ratio of the maximum volume of the bitumen in its foamed state to the volume of bitumen once the foaming has completely subsided.
Finish surface level	Top level of the stabilised layer as specified in the drawings and contract documents – refer to Figure 8.6.11.
Foamed bitumen	Class 170 bitumen which is (temporarily) brought into a foamed state by the addition of water and foaming agent(s).
Foaming agent	A chemical additive added to bitumen to improve its foaming characteristics.

Term	Definition
Half-life	A term used to define the expansion properties of the bitumen. It is defined as the time taken for the foamed bitumen to settle to one half of the maximum volume of the bitumen in its foamed state. It is measured from the start of bitumen foaming.
Height of collimation	Height of collimation is the elevation of the optical axis of the telescope at the time of the setup. The line of collimation is the imaginary line at the elevation.
Hydrated lime	Hydrated lime is a granular form of lime consisting primarily of calcium hydroxide ($Ca(OH)_2$).
Lower reference level	Lower reference level is the finish surface level minus the design depth. It is the bottom of the stabilised layer as indicated in the drawings and contract documents – refer Figure 8.6.11.
Moisture ratio (uncompacted) (MR_u)	The ratio of the insitu moisture content compared to the laboratory optimum moisture content expressed as a percentage for uncompacted materials.
Primary stabilising agent	See 'foamed bitumen'.
Principal Contractor	The person or entity who is bound to execute the work under the Contract.
Quicklime	Quicklime is a granular form of lime consisting primarily of calcium oxide (CaO). Quicklime hydrates rapidly in the presence of water.
Secondary stabilising agent	Hydrated lime, slaked quicklime, or hydrated lime / fly ash blend included in the stabilisation process to improve the dispersion of the foamed bitumen and increase the early strength of the stabilised material.
Slaking	The addition of water to quicklime (the purpose is to fully hydrate the quicklime).
Spot check	Inspecting quicklime after slaking process, to identify that all quicklime is completely slaked.
Stabiliser	A single-rotor mix-in-place plant of a type (i.e. plant that mixes insitu) specifically designed for the dual task of reclamation and stabilisation work.
Stabilising agents	Primary and secondary stabilising agents – see definitions above.
Stabilising Subcontractor	Contractor or supplier (including their personnel), engaged by or on behalf of the Principal Contractor with respect to the insitu foamed bitumen stabilising works under the Contract.
Target depth	Target depth is the mixing depth required by the stabiliser to achieve the lower reference level and shall consider the bulking height – refer Figure 8.6.11.

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
AP–G41/15	Austroads' *Bituminous Materials Safety Guide*
AS 4489.6.1	*Test methods for limes and limestones – Lime index – Available lime*

Reference	Title
AS/NZS 3582.1	*Supplementary cementitious materials – fly ash*
MRTS01	*Introduction to Technical Specifications*
MRTS05	*Unbound Pavements*
MRTS07A	*Insitu Stabilised Subgrades using Quicklime and Hydrated Lime*
MRTS17	*Bitumen and Multigrade Bitumen*
MRTS23	*Supply and Delivery of Quicklime and Hydrated Lime for Road Stabilisation*
MRTS50	*Specific Quality System Requirements*
MRTS56	*Construction Surveying*
NGTM	*Nuclear Gauge Testing Manual*

4 Standard test methods

The standard test methods listed in Table 4 shall be used in this Technical Specification subject to the additional requirements given in this Technical Specification (for example, Clause 9).

Further details of test method 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 No.
Available lime index	AS 4489.6.1
Calculation of characteristic value of a lot	Q020
California Bearing Ratio	Q113A
Crushed particles	AS 1141.18
Curing moulded specimens of foamed bitumen stabilised material	Q135C
Degradation factor	Q208B
Deviation from a straightedge	Q712
Fines ratio	Q103A
Flakiness index	Q201
Foreign Material (Type 2 materials containing recycled material)	Q477
Moisture Density Relationship (MDR)	Q142A, Q143, Q144A
Linear shrinkage	Q106
Liquid limit	Q104A
Moisture content	AS 1289.2.1.1, AS 1289.2.1.4, AS 1289.2.1.6
Particle size distribution	Q103A
Petrographic assessment of aggregates	Q188
pH (Type 2 materials containing recycled concrete)	AS 1289.4.3.1
Preparation and compaction of field mix foamed bitumen stabilised material	Q138B

Property to be tested	Test Method No.
Preparation and compaction of laboratory mixed foamed bitumen stabilised material	Q138A
Proof rolling test	Q723
Relative compaction	Q140A, Q141A, Q141B
Moisture ratio of uncompacted soils and crushed rock	Q250
Resilient modulus of foamed bitumen stabilised material	Q139
Road roughness (surface evenness)	Q708B, Q708C, Q708D
Sampling – aggregates	AS 1141.3.1
Selection of sampling or test sites	AS 1289.1.4.2
Spot sampling of soils, crushed rock and aggregates	Q061
Sulfate content	AS 1289.4.2.1, other published or validated classical chemistry technique or instrumentation technique[#]
Surface spread rate of stabilising agent	Q719[^]
UCS (Type 2 materials containing recycled concrete)	Q115
Water absorption	AS 1141.6.1
Wet strength	AS 1141.22
Wet / dry strength variation	AS 1141.22
Working time of foamed bitumen stabilised materials	Q136B

[#] Instrumentation techniques may include Ion Chromatography / Inductively Coupled Plasma / Discrete Analyser and so on. National Association of Testing Authorities (NATA) endorsed test results are evidence of a validated technique.

[^] For Q719, the requirement for the test to be carried out by a registered NATA and Construction Materials Testing (CMT) Supplier in accordance with MRTS50 *Specific Quality System Requirements*, shall be relaxed.

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
5.2.2	1. Approval of construction procedures and construction program		Supply of the construction procedures and construction program for the stabilisation works (42 days)
7.1	2. Compliance of all materials prior to their incorporation		
8	3. Construction permitted to proceed		
8.3	4. Survey of services, utilities, buildings and drainage		
8.5.2.1	5. Approval of compaction based on a process requirement		
8.5.2.2		1. Construction of trial section (if process standard specified for compaction)	
8.6.1		2. Removal and disposal of material not suitable for stabilisation	
8.6.2		3. Preliminary pulverisation	
8.6.4		4. Compacting and trimming surface prior to spreading of the stabilising agent	
8.6.6		5. Spreading secondary stabilising agent	
8.6.7	6. Slaking (if quicklime is used)		
8.6.9.2		6. Nominating the target depth	
8.6.11	7. Foaming properties of bitumen		
8.7.2.1			Ordered spread rate of stabilising agents (14 days)
8.7.2.2		7. Bitumen tanker dipping	
9.9.2		8. Proof rolling test	
9.10	8. Acceptance		

5.2 Construction procedures

5.2.1 General

The Contractor shall prepare documented procedures for all construction processes in accordance with Clause 6 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 Technical Specification 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 Specification.

b) Details of how services, utilities, buildings and drainage components shall be located (refer to Clause 8.3).

c) Details of how services, utilities, buildings, drainage components, plant personnel shall be protected from damage, injury, etc. (refer to Clause 8.3).

d) Calibration procedures (for example, for the spreader, for the bitumen spray bar).

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

   v. details of procedures for working up to, or against, structures, kerb, kerb and channel and road safety barriers, and such as bridges, access chambers, gullies, culverts and concrete medians and any existing pavement cutback point, and

   vi. curing methodology.

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. stabilising agent spread rate

   ii. stabilisation target depth

   iii. moisture ratio

   iv. compaction standard

   v. geometric tolerances, and

   vi. actual stabilised layer thickness.

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

a) details of the proposed source(s) of each stabilising agent(s)

b) test results demonstrating compliance of the constituents of the proposed bituminous and secondary stabilising agents to the required standards (including a statement of allowable lime index)

c) test results demonstrating compliance of each proposed water source, and

d) compliance test results and a representative sample of the unbound granular material from each proposed source to be used for shape correction and/or to replace material not suitable for stabilisation.

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

No stabilisation works shall be commenced until the construction procedure for the 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 pavement covered by this Technical Specification are given in Clauses 6 to 9.

5.4 Testing frequencies and lot sizes

The maximum lot sizes shall be as stated in Table A1 of Appendix A or otherwise stated in Clause 1.1 of Annexure MRTS07C.1.

The minimum testing frequencies shall be as stated in Table A2, A3 and A4 of Appendix A or otherwise stated in Clause 1.2 of Annexure MRTS07C.1.

Material compliance testing requirements shall be as specified in Table A2 of Appendix A.

Construction compliance testing requirements shall be as specified in Table A3 of Appendix A.

Geometric and deviation from a straightedge compliance testing requirements shall be as specified in Table A4 of Appendix A.

Certification of the compliance of each primary (bituminous) stabilising agent and each secondary stabilising agent is required for each source and for each load.

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 be unbound granular material that complies with the requirements stated in Clause 2 of Annexure MRTS07C.1.

Where not so stated in the Annexure, materials shall be either Type 2, Type 3 or Type 4 unbound granular material complying with the requirements of MRTS05 *Unbound Pavements.*

Stabilised material shall not be used as new material for replacement material.

Additionally, any new material incorporated into the works shall have a water-soluble sulfate content not less than 0.19%.

Sulfate content is typically not an issue for materials sourced from approved quarries. Therefore, for quarried materials, the Administrator may elect to waive the requirement for sulfate testing.

For existing pavement materials that have been reclaimed for reuse, the original source may be unknown. Therefore, where reclaimed materials are used, sulfate testing is typically required.

6.2 Additional material for shape correction

Where specified in the Drawings or Contract, shape correction material shall be imported and spread after preliminary pulverisation as per the requirements of Clause 8.6.3.

Additional material that is required for shape correction shall be unbound granular material that complies with the requirements stated in Clause 3 of Annexure MRTS07C.1.

Where not so stated in the Annexure, materials shall be either Type 2, Type 3 or Type 4 unbound granular pavement material complying with the requirements of MRTS05 *Unbound Pavements.*

Stabilised material shall not be used as additional material for shape correction.

Additionally, any new material incorporated into the Works shall have a water-soluble sulfate content less than 0.19%.

Sulfate content is typically not an issue for materials sourced from approved quarries. Therefore, for quarried materials, the Administrator may elect to waive the requirement for sulfate testing.

For existing pavement materials that have been reclaimed for reuse, the original source may be unknown. Therefore, where reclaimed materials are used, sulfate testing is typically required.

6.3 Stabilising agents

The primary (bituminous) and secondary stabilising agents shall comply with the relevant Technical Specification in Table 6.3.

Table 6.3 – Stabilising agent requirements

Agent	Relevant Technical Specification or Australian Standard
Primary stabilising agent (bitumen)	Class 170 Bitumen complying with MRTS17 *Bitumen and Multigrade Bitumen*
Secondary stabilising agent (hydrated lime or slaked quicklime)	Hydrated lime or slaked quicklime complying with MRTS23 *Supply and Delivery of Quicklime and Hydrated Lime for Road Stabilisation*
Secondary stabilising agent (hydrated lime / fly ash blend)	Hydrated lime blended with Special Grade or Grade 1 fly ash that complies with AS/NZS 3582.1. In all cases, the blend proportion shall be 50/50.

The estimated content and specified spread rate for the bituminous stabilising agent shall be given in Clause 10 of Annexure MRTS07C.1. Where not so stated in Clause 10 of Annexure MRTS07C.1, the total specified application rate shall be 21 kg/m².

The bituminous stabilising agent shall exhibit an expansion ratio greater than 10 and a half-life greater than 20 seconds following incorporation of any foaming agents required to meet these minimum bitumen foaming requirements. The foaming agent content shall not be less than 0.4% nor greater than 2% of the bitumen by mass.

Calculation for determining the foaming agent content as a percentage of the bitumen by mass.

$$Foaming\ agent\ content\ (\%) = \frac{V_F \times \rho_F}{M_B} \times 100$$

where: V_F = total volume of foaming agent used (L)

ρ_F = density of the foaming agent (kg/L)

M_B = total mass of bitumen at 15°C (kg) (refer to Clause 9.5 for calculation details)

The total time at which the Class 170 bitumen shall be held in the bitumen tanker at foaming temperature (170ºC to 190ºC refer to Clause 8.6.11) shall be no greater than 72 hours.

The estimated content and specified spread rate for the secondary stabilising agent shall be given in Clause 10 of Annexure MRTS07C.1. Where not so stated in Clause 10 of Annexure MRTS07C.1, the specified spread rate shall be 10 kg/m² (hydrated lime). The secondary stabilising agent content shall not be less than 1.25% of the dry mass density of the material to be stabilised.

Where a blended secondary stabilising agent is supplied to the Works, all of the stabilising agent components shall be completely, homogeneously and accurately blended / mixed by a dedicated blending plant, prior to delivery to the works.

At the time of spreading, the secondary stabilising agent shall not be more than six months old, measured from its date of manufacture.

The lime shall have an available lime index of not less than 80% from the time of manufacture up to the time of spreading. The secondary stabilising agent shall be sampled and tested to demonstrate the available lime index does not fall below 80% at the following times:

- at the time of manufacture, and
- monthly between three to six months from its date of manufacture.

The Contractor shall make allowance for the type of secondary stabilising agent used and the variation of the available lime index of the secondary stabilising agent supplied. The calculation to convert the hydrated lime content used in the laboratory, to the quicklime or hydrated lime content used in construction is shown below.

Converted quicklime content (%) from laboratory hydrated lime content (%)

$$\text{Rate Q} = 0.76 \times (\text{Rate H}) \times \frac{AL_x}{AL_y}$$

where: Rate Q is the content of quicklime to be targeted in the field (% by mass)

Rate H is the content of hydrated lime nominated in the design (% by mass)

AL_x is available lime index of hydrated lime (%) used in the laboratory mix design testing

AL_y is available lime index of quicklime (%), used in construction

Converted hydrated lime content (%) from laboratory hydrated lime content (%)

$$\text{Rate Q} = (\text{Rate H}) \times \frac{AL_x}{AL_y}$$

where: Rate Q is the content of hydrated lime to be targeted in the field (% by mass)

Rate H is the content of hydrated lime nominated in the design (% by mass)

AL_x is available lime index of hydrated lime (%), used in the laboratory mix design testing

AL_y is available lime index of hydrated lime (%), used in construction

For secondary stabilising agent which is a hydrated lime / fly ash blend, the corrected content (%)

$$\text{Rate Q} = (\text{Rate H}) \left[\left(\frac{P_{FA}}{100} \right) + \left(\frac{P_{HL}}{100} \times \frac{AL_x}{AL_y} \right) \right]$$

where: Rate Q is the content of secondary stabilising agent to be targeted in the field (% by mass)

Rate H is the content of secondary stabilising agent nominated in the design (% by mass)

P_{FA} is the proportion of the secondary stabilising agent blend in percent (%) that is fly ash (50%)

P_{HL} is the proportion of the secondary stabilising agent blend in percent (%) that is hydrated lime (50%)

AL_x is available lime index of hydrated lime (%), used in the laboratory mix design testing

$AL_y$is available lime index of hydrated lime (%), used in construction

6.4 Water

Where possible, water used for insitu stabilisation works shall be ‘potable water’.

Water sources classified by the relevant water authority as ‘potable water’, shall be exempt from any testing requirement

Where 'potable water' is not available, the Administrator may consider water from other sources.

Unless otherwise accepted by the Administrator, any ‘non-potable water’ sources shall be tested.

In all cases, the water used shall contain less than 0.05% sulfates and be free from oil, acids, organic matter and any other matter that could be deleterious to the mixture.

Marine water and recycled water shall not be used for foamed bitumen stabilisation.

The sources(s) of water shall not be changed without the written approval of the Administrator.

7 Material compliance testing

7.1 General

No material shall be incorporated into the work unless it has been demonstrated to the Administrator’s satisfaction that the material to be used in this Contract comply fully with the requirements of this Technical Specification. **Hold Point 2**

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 the testing frequencies and number of tests are not less than those given in Clause 5.4.

The testing of individual samples shall be carried out in accordance with the Test Methods described in Clause 4.

The material / sources used in the Contract shall be the same as those for material supplied as samples or for which certificates of compliance with this Technical Specification are provided.

The costs associated with material compliance testing shall be deemed to be incorporated in the relevant work items.

7.2 Stabilising agents

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

A certificate of test results demonstrating compliance of each of the bituminous and secondary stabilising agents to the relevant Specification shall be provided for each load, or part thereof, of each stabilising agent.

7.3 Water

A certificate of test results demonstrating the compliance of each proposed water source shall be provided.

7.4 Unbound granular material

Compliance testing of any new unbound granular material used to replace material not suitable for stabilisation shall be carried out in accordance with the requirements of Clause 5.4.

Compliance testing of any additional unbound granular material used for shape correction shall be carried out in accordance with the requirements of Clause 5.4.

In all cases Type 2, Type 3 and Type 4 material shall also comply with MRTS05 *Unbound Pavements.*

8 Construction

Prior to acceptance (Clause 9.10), construction shall not proceed until the Administrator is satisfied that the requirements covered from Clause 8.1 to Clause 8.7.5.5.3 have been adhered to by the Contractor. **Hold Point 3**

8.1 General

Construction of the stabilised layer shown in the Drawings or otherwise specified in the Contract shall be completed as one layer.

Once the secondary stabilising agent has been spread (and fully hydrated via slaking if quicklime is used), and incorporated into pavement, the foamed bitumen incorporation shall follow. The foamed bitumen shall be incorporated over the entire area of stabilisation within the same work period in which the secondary stabilising agent was applied. The stabilised material shall be fully compacted and trimmed within the allowable working time as per Clause 8.4.

The required design depth shall be stated in Clause 10 of Annexure MRTS07C.1.

The datum for measurement of the design depth (refer to Figure 8.6.11) shall be as stated in Clause 11 of Annexure MRTS07C.1.

Details of measuring the actual thickness of stabilised layer is described in Clause 8.7.5.3.2.

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 has been approved by the Administrator (refer to Clause 5.2.2 and Hold Point 1).

8.3 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 in the proposed construction procedure (refer to Clause 5.2.2).

Stabilising operation shall not commence until the survey has been completed and a copy of the report provided to the Administrator. **Hold Point 4**

8.4 Allowable working time

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

The allowable working time is measured from the commencement of the incorporation (i.e. mixing) of the first application of secondary agent into the insitu materials, to the completion of compaction and trimming (excluding static multi-tyre rolling).

The maximum allowable working time shall be 6.5 hours, and the construction process shall not extend overnight.

Instances where stabilisation cannot be completed within the 6.5-hour period, due to unforeseeable circumstances, the Administrator may consider the following:

- If lime or lime / fly ash blend is the secondary stabilising agent and the construction can recommence within 24 hours, the process may continue, provided the material prior to foam bitumen stabilisation meets the requirements in Clause 8.7.3.
- If the construction delay exceeds 24 hours, treatment with an additional 0.5% lime or lime / fly ash blend should be considered. Any additional secondary stabilising (over 0.5%) should be only considered after extensive investigation and testing.
- If cement is the secondary stabilising agent, the material shall be considered unsuitable for foamed bitumen stabilising.
- In all cases, any rework shall be performed to the full depth of the stabilised layer.
- In all cases, any rework shall have full compliance testing in accordance with this Technical Specification.

8.5 Construction process

8.5.1 General

The construction process shall be based either on a process requirement or a product standard. The method for this Contract shall be as stated in Clause 10 of Annexure MRTS07C.1. Where not so stated in the Annexure, product standard shall apply.

8.5.2 Construction based on process requirements

If a process requirement is specified in Clause 10 of Annexure MRTS07C.1, construction shall:

a) incorporate the methodology and construction of trial sections in accordance with the requirements of Clause 8.5.2.1 and 8.5.2.2

b) comply with the construction requirements stated in Clause 8.6, and

c) comply with the product standards stated in Clause 8.7 except that compaction testing shall not be required on completed works other than trial section, provided that the Contractor uses the same construction plant, process and methodology as that used for the trial section.

8.5.2.1 Methodology

Each section of the Works with a specific combination of stabilising agent type(s), stabilising agent content(s), 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 8.5.2.2.

The compaction of each trial section shall be tested in accordance with Clause 5.4 and checked for compliance with Clause 8.7.4.

If the minimum characteristic value of the relative compaction results for the trial section is not less than the value specified in Clause 8.7.4, no further compaction testing shall 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 minimum characteristic value of the relative compaction results for the trial section is less than the value specified in Clause 8.7.4, the trial section shall be rectified so that it complies with this Technical Specification, and an additional trial section shall be constructed and assessed in accordance with this Clause 8.5.

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 5**

8.5.2.2 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 1

A trial section shall be at least 200 m long, 3 m wide and include a longitudinal joint.

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

8.5.3 Construction based on product standards

If a product requirement is specified in Clause 10 of Annexure MRTS07C.1, construction shall:

a) comply with the construction requirements stated in Clause 8.6, and

b) comply with the product standards stated in Clause 8.7.

8.6 Construction requirements

8.6.1 Removal and disposal of material not suitable for stabilisation (if required)

Material not suitable for stabilisation shall include:

a) Any particle or conglomeration, that exists after preliminary pulverisation, with a dimension greater than 75 mm along any axis.

b) Any material(s) deemed unsuitable by the Administrator, which may include:

   i. concrete

   ii. cement treated patches

iii. asphalt patches where the total asphalt thickness is greater than 50 mm unless other methods are approved by the Administrator, and

c) Any additional requirements stated in Clause 4 of Annexure MRTS07C.1.

At least seven days prior to the date shown in the Contractor's program of works for the removal of material not suitable for stabilisation, the Administrator will mark out patches and/or identify unsuitable materials that are to be replaced.

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. **Witness Point 2**

Existing material that is unsuitable for stabilisation shall be removed and disposed of in accordance with Clause 10 of MRTS01 *Introduction to Technical Specifications* unless other methods are approved by the Administrator.

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.

Compaction of the new material shall be administrated through either product requirement (Clause 9.3) and/or process requirement (Clause 9.2). This shall be approved by the Administrator. The minimum characteristic value of the relative compaction results shall not be less than 100%. This compaction testing requirement is not applicable if the layer thickness is less than 100 mm.

8.6.2 Preliminary pulverisation

The material to be stabilised shall be pulverised in accordance with this clause. One pass of a stabiliser hooked-up to a fully laden water truck shall be used to pulverise the material to be stabilised.

The pulverisation pass shall be undertaken to a depth that is 50 mm less than the design depth (50 mm above the lower reference level). **Witness Point 3**

Preliminary pulverisation shall occur:

a) after the removal and replacement of material identified as material not suitable for stabilisation

b) prior to the addition of shape correction material, and

c) prior to the application or addition of either the bituminous or secondary stabilising agents.

The pulverisation pass shall be undertaken with the incorporation of moisture from the water truck hooked-up to the stabiliser.

The incorporation of moisture during the pulverisation pass allows the insitu materials to be pre-conditioned (in particular, those insitu materials with higher water absorptions).

Typically, 0.2-0.5% moisture rate through the stabiliser for the pulverisation pass.

Where the insitu materials has a relatively higher moisture content at the time of insitu stabilising, the addition of moisture during the pulverisation pass may not be required to pre-condition the materials.

Any additional patches identified during preliminary pulverisation as material not suitable for stabilisation and accepted by the Administrator as being material not suitable for stabilisation shall be removed and replaced as specified in Clause 8.6.1.

Any particle or conglomeration with a dimension greater than 75 mm along any axis shall be removed from the pulverised material and the voids made good prior to stabilisation. Voids shall be made good either by using new material in accordance with Clause 6.1 or excess pulverised material that is both adjacent to the void and suitable for stabilisation.

8.6.3 Additional material for shape correction (if required)

The shape of the pavement shall be corrected after the preliminary pulverisation and prior to the importation of any shape correction (or overlay) material, unless otherwise agreed to by the Administrator.

Additional material required for shape correction shall be as specified in Clause 6.2 and shall be added after preliminary pulverisation has been completed. It shall be spread onto the surface of the pavement to a shape suitable for stabilisation, compaction and trimming to the alignment, heights and shapes specified in the Contract.

Compaction of the additional material required for shape correction shall be administrated through either product requirement (Clause 9.3) and/or process requirement (Clause 9.2). This shall be approved by the Administrator. The minimum characteristic value of the relative compaction results shall not be less than 100%. This compaction testing requirement is not applicable if the layer thickness is less than 75 mm.

8.6.4 Compacting and trimming the surface prior to spreading of the secondary stabilising agent

Prior to spreading of the stabilising agent, the surface shall be shaped, compacted and trimmed to a degree that is sufficient to facilitate stabilisation specified in the Contract. **Witness Point 4**

8.6.5 Secondary stabilising agent equipment

Secondary stabilising agent shall be transported, stored and spread using equipment that is both waterproof and watertight. Equipment used to transfer the secondary 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 secondary stabilising agent to be used in the stabilisation works.

Where a stabiliser with a calibrated integrated spreader is nominated (refer to Clause 5 of Annexure MRTS07C.1), the secondary stabilising agent shall be incorporated into the pavement directly using this device. In this case, quicklime shall not be used as the secondary stabilising agent.

Where a stabiliser with a calibrated integrated spreader is not nominated (refer to Clause 5 of Annexure MRTS07C.1), the secondary stabilising agent shall be uniformly spread over the insitu material using a purpose-built calibrated spreader at a controlled rate (mass per unit area, kg/m²).

8.6.6 Spreading of secondary stabilising agent

The stabilising agent shall be uniformly spread over the insitu material at a controlled rate (mass per unit area, kg/m²).

The maximum amount of secondary stabilising agent to be spread in one pass shall be 10 kg/m² to avoid wastage. Spread rates greater than 10 kg/m² are generally not recommended. However, a maximum spread rate of 12 kg/m may be considered by the Administrator provided a successful field trial is carried out. If excessive wastage is seen, a maximum spread rate of 10 kg/m² shall be adopted. The number of passes shall be calculated to comply with this requirement.

Traffic shall be stopped during spreading of secondary stabilising agent. If wind direction is such that airborne secondary agent impeding through traffic.

At the start of each individual spreading run, the surface spread rate of the secondary stabilising agent shall be determined using the surface spread rate test method Q719. The surface spread rate test shall be carried out within a distance of 35 m from the start of each individual spreading run. After the purpose-built calibrated spreader / integrated spreader has spread over the mat or tray(s), the spreader shall be halted, the actual spread rate measured, and this result compared with allowable tolerances specified in Clause 8.7.2.3. If the spread rate result is within the allowable tolerance, the spreader shall be allowed to complete the run. If the spread rate result is outside the allowable tolerance, additional surface spread rate tests shall be repeated in 35 m intervals until the measured surface spread rate result is within the tolerance stated in Clause 8.7.2.3. The Contractor shall undertake corrective action in the area which has non-conforming surface spread rates.

Witness Point 5

Additional surface spread rate tests at other locations (for example middle and/or end of a run) shall be conducted upon the request of the Administrator.

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

The results of all surface spread rate tests shall be recorded and included in the quality records and reported to the Administrator (refer to Clause 9.7).

Secondary stabilising agent shall be incorporated as specified in Clauses 8.6.7, 8.6.8, 8.6.9, 8.6.10 and 8.6.11. Further shaping, trimming and/or compaction as required (refer to Clauses 8.6.4, 8.6.12, 8.6.13 and 8.6.14) shall be completed before each spreading run.

8.6.7 Quicklime as the secondary stabilising agent

The Principal Contractor shall ensure the slaking of quicklime is completed by a Stabilising Subcontractor. The Stabilising Subcontractor shall be responsible for the provision of water / water carts / operators and associated plant / operators for the purpose of slacking quicklime. This is to ensure the slaking procedures, plant and water is adequate for the purpose of slaking quicklime in accordance with this clause.

The equivalent calcium oxide content of quicklime (available lime index) shall not be less than 80%.

Where quicklime is used as the secondary stabilising agent, it shall be spread (refer to Clause 8.6.6) and fully slaked prior to incorporation into the material(s) to be stabilised. There shall be no residual quicklime after 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 additional water is added to the lime.

All through traffic shall be stopped during slaking operations.

Quicklime and/or lime slurry formed from the slaking process, shall be evenly placed and contained within the stabilising area at the required spread rate. Where displacement of quicklime and/or lime slurry outside the stabilising area has occurred, corrective action shall be undertaken by the Contractor prior to commencement of the incorporation. The Contractor shall ensure that no quicklime and/or lime slurry runs into the adjacent table drain or watercourse during the spreading and slaking operations.

The slaked quicklime shall be spot checked with a temperature probe and a shovel, to ensure that no pockets of unslaked quicklime remain (refer to Figure 8.6.7). Where excessive amounts of quicklime is present (for example, due to poor distribution), additional slaking shall be carried out to ensure complete hydration prior to the incorporation. Where an impervious thin layer (or crust) forms on the top of the quicklime making it difficult for additional water to penetrate for the slaking process, the Contractor shall open up the crust in a safe manner (with proper personal protective equipment) so further water can access the unslaked quicklime beneath.

The results of the spot checks performed on the slaked quicklime, shall be included in the Contractor's quality records (refer to Clause 9.6). The frequency of the spot check testing shall be as per Clause 5.4. **Hold Point 6**

Figure 8.6.7 – Checking completion of slaking with temperature probe

Process of spot check for slaking:

1. remove the 'crust' formed on the top of quicklime after the initial slaking
2. insert temperature probe to cover the full depth of quicklime being slaked
3. add water to the area surrounding the temperature probe (water bottle suggested), and
4. note for any rise in temperature and steam.

If increase in the temperature (and steam), additional slaking is required and steps 1 to 4 above should be repeated, until no temperature rise and further steaming occurs (exothermic reaction).

8.6.8 Incorporation of the secondary stabilising agent

8.6.8.1 General

The maximum allowable time between spreading the secondary stabilising agent and incorporation into the insitu material shall be as stated in Clause 10 of Annexure MRTS07C.1. Where no such time is stated in the Annexure, the maximum time between spreading and mixing shall be 60 minutes.

Incorporation of the secondary stabilising agent shall be achieved using a stabiliser hooked-up to a fully laden water truck and shall occur before the incorporation of the bituminous stabilising agent. The exact location at the start and end of each of the stabilisation runs shall be marked out.

Single pass secondary stabilising agent incorporation (refer to Clause 8.4):

1. Spread and mix the maximum allowable secondary stabilising agent for a single pass as per Clause 8.6.6 with the addition of water by means of stabiliser to achieve 55% – 75% MR_u. The secondary stabilising agent incorporation depth shall be 50 mm less than design depth (50 mm above the lower reference level) and compacted with a smooth drum roller with vibration (refer to Figure 8.6.11 and Table 8.6.19) and shaped prior to foamed bitumen pass by using a grader (refer to Clause 8.6.9.2).
2. Where the secondary stabilising agent is lime, not more than four hours after the secondary stabilising agent is incorporated into the pavement material, the bituminous stabilising agent shall be mixed into the pavement material with one pass of the stabiliser to the full target depth of stabilisation to achieve lower reference level (refer to Figure 8.6.11 and Clause 8.6.9.2).

Two pass secondary stabilising agent incorporation (refer to Clause 8.4):

1. Both incorporation passes of the secondary stabilising agent shall be undertaken with the incorporation of moisture from the water truck hooked-up to the stabiliser. Spread and mix the first pass at a rate of up to half the required rate of the secondary stabilising agent with the addition of water. The first incorporation pass shall be to a depth of 50 mm less than design depth (50 mm above the lower reference level) and compacted with smooth drum roller with vibration (refer to Figure 8.6.11 and Table 8.6.19).
2. Spread and mix remaining balance of the required secondary stabilising agent with the addition of water by means of stabiliser to achieve 55–75% MR_u. Through all incorporation passes, the Contractor shall not exceed 55-75% MR_u. The secondary stabilising agent incorporation depth shall again be 50 mm less than design depth (50 mm above the lower reference level) and compacted with a smooth drum roller with vibration (refer to Figure 8.6.11 and Table 8.6.19) and shaped prior to final foamed bitumen pass using a grader (refer Clause 8.6.9.2).

The incorporation of moisture together with the secondary stabilising agent allows the insitu materials to be pre-conditioned (in particular, those insitu materials with higher water absorptions).

3. Where the secondary stabilising agent is lime, not more than four hours after the secondary stabilising agent is incorporated into the pavement material, the bituminous stabilising agent shall be mixed into the pavement material with one pass of the stabiliser to the full target depth of stabilisation to achieve the lower reference level (refer Figure 8.6.11 and Clause 8.6.9.2).

After each spreading run, and before any other spreading run, secondary stabilising agent shall be incorporated as specified in Clauses 8.6.7, 8.6.8, 8.6.9, 8.6.10 and 8.6.11. Further shaping, trimming and/or compaction as required (refer to Clauses 8.6.4, 8.6.12, 8.6.13, and 8.6.14) shall be completed before each spreading run.

The Contractor shall ensure that no excess secondary stabilising agent is spilt into the adjoining section during the spreading and incorporation pass(es). This shall be achieved by:

a) ensuring the stabiliser slows down as it approaches the limit of the section, and

b) any excess secondary stabilising agent which is spilt into the adjoining section is spread by the grader back into the section which is currently being stabilised.

8.6.8.2 Compaction after incorporation of the secondary stabilising agent

Adequate compaction shall be completed after each application of secondary stabilising agent 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.

8.6.9 Incorporation of moisture

8.6.9.1 General

Moisture may be incorporated into the stabilised pavement material using a stabiliser to correct for moisture variations in the existing pavement material at the following stages during the stabilisation process to assist with bitumen dispersion:

a) during the initial pulverisation of the pavement material

b) during the incorporation of the secondary stabilising agent into the pavement material, and

c) during a separate pass of the stabiliser prior to, or during, the incorporation of the bituminous stabilising agent.

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 stabiliser. This system shall be capable of spraying varying rates across its width. The moisture content of the material being stabilised shall be uniform and within the specified moisture ratio range indicated in Clause 8.7.3.

Moisture may also be incorporated into the stabilised pavement material following incorporation of the bituminous stabilising agent for the purposes of achieving compaction.

The stabiliser shall control the moisture content to be incorporated into the stabilised pavement material following incorporation of the bituminous stabilising agent for the purposes of achieving compaction.

8.6.9.2 Trimming prior to the incorporation of the bituminous stabilising agent

Prior to the final bituminous incorporation pass, the surface level shall be compacted and shaped to the specified crossfall. Surface level heights higher than specified in the Drawings or Contract after compaction and shaping due to the effects of 'bulking' shall be uniform and shall be identified. In this case, the difference in height between specified in the Drawings or Contract and attained (bulking) shall be added to the design depth to determine the stabilising target depth for the final bituminous incorporation pass (refer to Figure 8.6.11). **Witness Point 6**

Alternatively, prior to the incorporation pass of the bituminous stabilising agent, the surface shall be shaped, compacted and trimmed to the alignment, heights and shapes specified in the Contract.

8.6.10 Bituminous stabilising agent equipment

The bituminous stabilising agent shall be transported, stored and transferred using the recommended equipment and procedures described in *Austroads' Bituminous Materials Safety Guide*. Notwithstanding this the bituminous stabilising agent shall also be transported, stored and transferred as specified in MRTS17 *Bitumen and Multigrade Bitumen*. Further bituminous stabilising agent equipment shall also comply with the requirements given in Clause 8.6.20.

8.6.11 Incorporation of bituminous stabilising agent and mixing

Incorporation of the bituminous stabilising agent and mixing of the stabilised pavement material shall be carried out using a stabiliser with at least the attributes stated in Clause 8.6.20.

The exact location at the start and end of each of the stabilisation runs shall be marked out.

To assist with the ordering of bitumen quantities (L) and calculation of lot sizes (m²), the following formulas can be used.

$$V_B = \frac{M_B}{1.04}$$

$$V_{BH} = \frac{V_B}{F_T}$$

where: V_B = volume of bitumen at 15ºC (L)

M_B = mass of bitumen at 15ºC (kg)

V_{BH} = volume of bitumen at high temperature (L), and

F_T = factor in high temperature from Table 9.5.

Foaming agent shall be added to bitumen tanker at least 30 minutes prior to incorporation to enable foaming properties to be achieved as per Clause 6.3.

The bituminous stabilising agent shall be incorporated and mixed into the pavement material during one pass of the stabiliser. Mixing shall be to the full depth of stabilisation to ensure mixing to the lower reference level whereby meeting the requirements of Clause 8.7.5.3. In addition, the distribution of the bituminous stabilising agent, secondary stabilising agent and water shall be uniform throughout the full depth, and over the entire area of the material to be stabilised. The resultant layer shall have no lenses, pockets, lumps or granules of either incompletely mixed material, or incompletely mixed bituminous and secondary stabilising agents. It shall also not be segregated. Mixing uniformity shall be continuously inspected visually and work shall stop if bitumen streaks, blotches or bitumen rich agglomerations form in the mixed material. Corrective action shall immediately be implemented to limit the extent of the defective area.

Where test results or visual inspection by the Administrator indicate that the mixing 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 bituminous and secondary stabilising agents, and

c) distribution of water.

No additional or separate payment shall be made for any additional passes ordered by the Administrator.

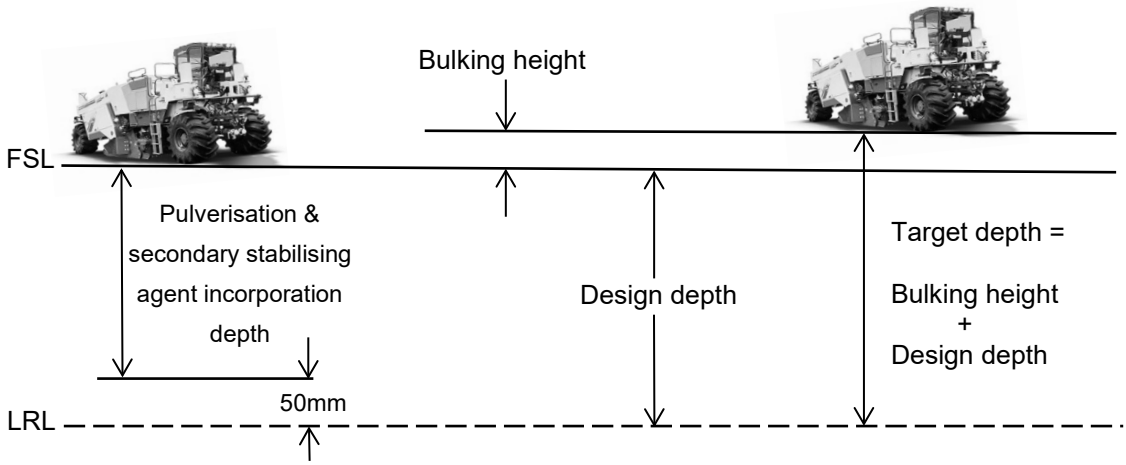
The bitumen incorporation shall commence at a temperature between 180ºC and 190ºC. Bitumen temperature shall not fall below 170ºC throughout the bitumen incorporation process.

The foamed bitumen shall exhibit a minimum expansion ratio of 10 and a minimum half-life of 20 seconds at the time of incorporation. The expansion ratio and half-life of every tanker load of bitumen shall be checked using the inspection nozzle on board the stabiliser.

Foaming properties shall be determined within the first 35 m of incorporation of bitumen stabilisation agent while the machine is in motion. Incorporation shall halt until expansion ratio and half-life requirements stated in the clause are satisfied. **Hold Point 7**

The bituminous stabilising agent shall not continue to be incorporated into the pavement material when the foaming properties of the tanker load of bitumen are not in accordance with the requirements stated in this clause.

Figure 8.6.11 – Target depth sketch



Design depth – as specified in the construction drawings and contract documents.
FSL : Finish Surface Level
LRL : Lower Reference Level

Pulverisation and incorporation of secondary stabilising agent	Bulking after incorporation of secondary stabilising agent	Target depth on the final foamed bitumen incorporation pass
Preliminary pulverisation and incorporation of secondary stabilising agent shall be 50 mm less than the design depth.	After surface compaction and trimming, the materials will change in volume due to incorporation of the secondary stabilising agent. The bulking height above FSL needs to be identified and added to the design depth.	Mixing depth required on the final pass by the stabiliser to reach the LRL shall account for the additional bulking above the FSL.

8.6.12 Compaction

Immediately after incorporation of the bituminous stabilising agent, the stabilised area shall be initially compacted to eliminate the height differential between the bulked stabilised material, and any wheel ruts left by the stabiliser. This may be achieved with at least two passes of a vibrating roller.

After initial compaction, and before final compaction commences, the surface shall be trimmed to approximately the alignment, heights and shapes specified in the Contract for the completed work and any depressions shall be filled with additional material stabilised with both stabilising agents that is mixed and placed within its allowable working time.

For layer thicknesses 200 – 325 mm which are being compacted using a pad foot roller (refer to Clause 8.6.20), pad foot marks shall be removed to prevent differential compaction and the pad foot marks reflecting to the surface. The Contractor shall ensure that no marks caused by a pad foot roller shall remain on the surface. A minimum cut to -100 mm from the Finished Surface Level (FSL) of the stabilised layer is required to completely remove the influence of pad foot marks and not create a thin false layer when the stabilised material is reinstated.

Removing (or cutting out) of the pad foot or marks can be undertaken using a grader or stabiliser.

In both cases, a minimum cut to -100 mm from the Finished Surface Level (FSL) of the stabilised layer is required.

Where a grader is used to remove the pad foot marks, the stabilised material shall not be wasted. Once the pad foot marks have been completely removed, the stabilised material can be reinstated to allow the completion of compaction and trimming.

Where a stabiliser is used to remove the pad foot marks, the upper 'loose' stabilised materials can be compacted and trimmed in place to complete the stabilised layer. The stabiliser's tyre tread marks (or ruts) must be removed to prevent differential compaction and the tyre tread marks reflecting to the surface. A sufficiently deep cut with the grader is required to completely remove the influence of the tyre tread marks and not create a thin false layer when the stabilised material is reinstated.

For layer thicknesses < 200mm which are being compacted using smooth drum and multi-tyre rollers (refer to Clause 8.6.20), removal of pad foot marks is not required. However, the stabiliser's tyre tread marks (or ruts) shall be removed to prevent differential compaction and the tyre tread marks reflecting to the surface. The Contractor shall ensure that no marks caused by the stabiliser's tyre tread marks remain on the surface. A sufficiently deep cut with the grader is required to completely remove the influence of the tyre tread marks and not create a thin false layer when the stabilised material is reinstated.

Final compaction and trimming of all materials shall be completed within the allowable working time of each material (refer to Clause 8.4).

Compaction shall be undertaken on the single layer of stabilised material. Compaction shall be achieved for the full thickness of the single stabilised layer. The stabilised layer shall be compacted to the standard stated in Clause 8.7.4.

When finishing compaction using the vibrating smooth drum roller, adequate care and attention must be undertaken to avoid “over-compacting” the stabilised layer (also commonly referred to a “de-compacting” or “shattering”). Over-compaction can commonly occur when the smooth drum roller is operated on high amplitude vibration mode.

To avoid over-compaction and damaging the stabilised layer’s surface, typical best practise is low amplitude vibration mode for the forward direction, and static (or no vibration) for the backwards direction.

8.6.13 Trimming after compaction

Final trimming of the pavement shall be carried out as soon as practicable after rollers have completed compacting the pavement.

Localised depression and rises shall be treated as determined jointly by the Administrator and the Contractor. The trimmed surface shall be free from loose pockets, holes, bumps and lenses of material.

No marks caused by any roller or stabilisation plant shall be left on the surface of the stabilised layer.

All final trimming shall involve cutting to waste. All material cut to waste shall be disposed of in accordance with Clause 10 of MRTS01 *Introduction to Technical Specifications*. No separate or additional 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.

8.6.14 Period for compaction and trimming

Compaction and trimming (excluding static multi-tyre rolling) shall be completed within the allowable working time as specified in Clause 8.4.

8.6.15 Construction joints

8.6.15.1 General

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

A construction joint shall be deemed fresh when the material on each side of the joint has been stabilised, placed and compacted within the allowable working time (refer to Clause 8.4) of the stabilised material constructed first.

8.6.15.2 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.

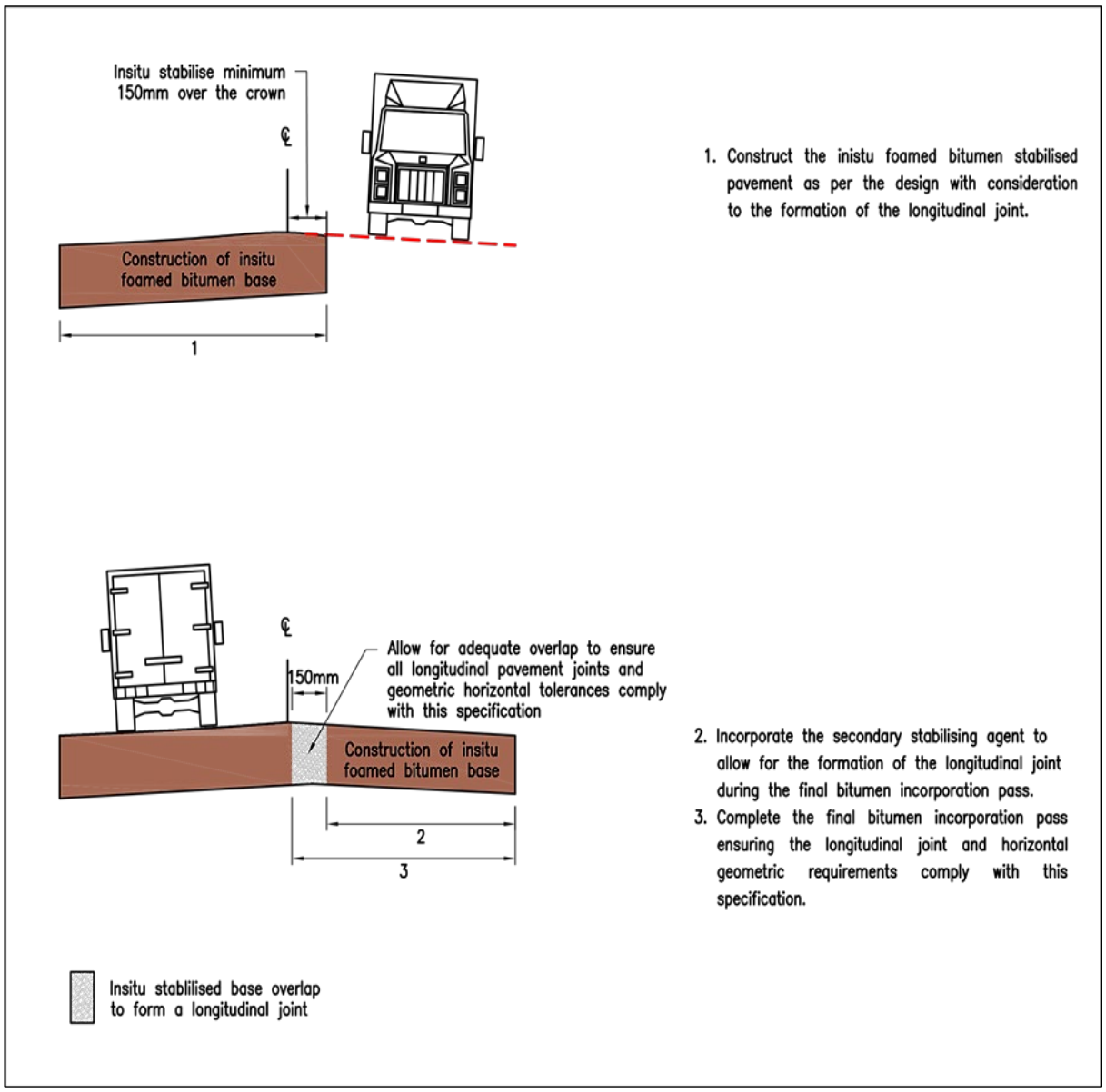
For longitudinal joints that are not fresh, to ensure complete stabilisation across the full width of the pavement, the minimum distance for cutting back / overlapping into previously stabilised material shall be the greater of 100 mm or the distance to a point where the stabilised material complies with this Technical Specification.

The overlap at a change of crossfall or crown shall be carefully considered to comply with the longitudinal joint requirements of this clause and Clause 8.7.5.

> Where there is more than one layer of insitu stabilised material, the formation of the longitudinal joint at the crown needs to be considered. Refer to MRTS07A *Insitu Stabilised Subgrades using Quicklime or Hydrated Lime*, Figure 8.6.7.2 – Typical construction process for guidance.

No separate or additional 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.

Figure 8.6.15.2 – Typical construction process



When constructing a longitudinal joint in accordance with this clause and Figure 8.6.15.2, the Contractor must ensure that the final bitumen incorporation pass encompasses the entire area where the secondary stabilising agent has been spread and mixed.

To achieve this, the Contractor may consider adopting the following process:

- Mix the secondary stabilising agent 150 mm offset from the longitudinal joint location which is commonly the crown and/or centreline as shown in Figure 8.6.15.2 (refer to *Step 2* in Figure 8.6.15.2).
- Complete the final bitumen incorporation pass ensuring the stabiliser cuts into the adjoining stabilised materials thus forming a sufficient overlap (refer to *Step 3* in Figure 8.6.15.2).

8.6.15.3 Transverse joints

For transverse joints that are not fresh, the adjoining stabilised section shall be remixed using a stabiliser by the greater of 1.5 m or the length ordered by the Administrator.

Where there is more than one layer of insitu stabilised material, the transverse joints of each layer shall be offset from the underlying layer's joint by a minimum distance of 150 mm.

8.6.16 Surface finish

The finished surface of any stabilised pavement layer shall:

- be hard and homogenous in appearance
- not be friable when subject to mechanical brooming
- not have any loose, segregated or contaminated areas
- have the course particles slightly exposed
- not be affected by delamination
- not have any cracking
- not show signs of water pumping, and
- not visibly deflect under load when proof rolled in accordance with Clause 9.9.

It is intended that these requirements apply to the condition of the pavement surface immediately prior to application of the surfacing treatment / layer. The Contractor may need to undertake additional controls beyond the basic construction activities (compaction, trimming and so on) to ensure these requirements are satisfied.

Where a stabilised pavement layer is required to be covered by a sprayed bituminous treatment, particular attention needs to be given to the surface finish of the stabilised pavement layer in order to ensure good adhesion.

Inadequate curing can lead to an excessively dusty surface, which may be difficult to prepare. To address this, curing should be undertaken in accordance with Clause 8.6.17 to ensure the pavement remains continuously damp.

Where the insitu stabilised layer is to be overlaid with another pavement layer (that is, not bitumen seal and/or asphalt), consideration needs to be given on how to adequately prepare the surface to maximise the bond between the pavement layers.

If the insitu stabilised layer is to be overlaid with another insitu stabilised layer, it is recommended that the overlying layer be insitu stabilised to a depth which will 'tuck in' to the underlying layer. The 'tuck in' details shall be provided in the Contract documents.

If the insitu stabilised layer is to be overlaid with a plant-mixed stabilised or granular layer, it is recommended that the finished surface be hard-cut and/or broomed to produce a roughly textured surface before placing the next layer.

8.6.17 Curing

A curing operation shall commence immediately after the completion of compaction. Curing operation shall be carried out with extreme care to avoid any damage to the stabilised layer.

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 is placed as described in Clause 8.6.19 has been applied.

Water shall be applied in a manner such that slurrying of the surface, pavement instability, pavement erosion flushing and/or leaching of the stabilising agents are all avoided.

8.6.18 Maintenance of the stabilised layer

The stabilised layer shall be maintained by the Contractor until a bituminous surfacing with a cover aggregate is applied, or until the stabilised layer is covered by another pavement layer, or until the Administrator accepts and takes responsibility for that area (whichever is the longer).

The surface of the stabilised layer shall be kept moist, in good order, in good condition and free from contamination. Construction and other traffic shall not traverse the stabilised layer where damage to the surface may occur.

No separate or additional payment shall be made for maintenance of the stabilised layer. The cost of all activities associated with maintenance of the stabilised layer shall be deemed to be incorporated into the relevant work items for the stabilised layer.

8.6.19 Bituminous surfacing

Unless otherwise approved by the Administrator, a bituminous surfacing with a cover aggregate shall be applied within seven calendar days of completion of the stabilised layer.

8.6.20 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 MRTS07C.1. This shall also be the plant used for the stabilisation. 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 8.6.19.

Table 8.6.19 – Minimum requirements and numbers of particular plant

Description	Minimum requirement for each piece of plant		Minimum number of units
Stabiliser with foamed bitumen spray bar in mixing chamber or Integrated spreader stabiliser with foamed bitumen spray bar in mixing chamber	a) Minimum power capacity of 155 kW/m of the drum width. b) Capable of mixing to the specified depth. c) Purpose built foamed bitumen spray bar located inside the mixing chamber of the stabiliser. d) Bitumen injection systems linked to the ground speed to ensure an accurate application of foamed bitumen throughout a run irrespective of the speed of the plant. e) Inspection or test jet to ensure uniform flow of bitumen and that the required expansion ratio and half-life of the foamed bitumen are being achieved. f) Self-cleaning bitumen jets. g) Bitumen foaming jets can be shut off individually for partial width stabilisation. h) Bitumen temperature gauges to verify bitumen temperature. i) Bitumen injection bar and supply lines equipped with a heating system to maintain the bitumen temperature. j) Capable of supplying both water and agent such that incorporation rates can be varied across the full width of the stabilising box and incrementally across the box. k) Computer controlled bitumen flow meter for verification of applied agent content, and l) Calibrated and capable of spreading varying widths (if integrated spreader stabiliser).		1
Purpose-built calibrated spreader	Calibrated with load cells and capable of uniformly spreading stabilising agent using a fixed bulk bin feeding a mechanical or hydraulic driven spreading rotor to varying widths.		1
Vibrating pad foot roller	For layer thickness < 200 mm: not required	For layer thickness 200 – 325 mm: 21 tonnes	1
Vibrating smooth drum roller	For layer thickness < 200 mm: 16 tonnes	For layer thickness 200 – 325 mm: 16 tonnes	1
Multi-tyre roller	Minimum 12 tonnes		1
Water truck	Minimum capacity of 6000 litres		2
Grader	Manned by final trim operator		1

The Contractor shall utilise adequate roller sizes and rolling patterns to achieve the specified relative compaction.

When compacting an insitu stabilised layer thickness of 200 – 325 mm a padfoot roller is required for initial compaction. After the removal of padfoot marks (refer to Clause 8.6.12), care needs to be taken by the Contractor to ensure that the final smooth drum rolling does not de-compact (or crack) the stabilised layer.

Typically, insitu stabilised layer thicknesses are not less than 200 mm. However, for layer thickness < 200 mm, the Contractor shall use a combination of smooth drum and multi-tyre rollers which has demonstrated it will achieve the specified relative compaction. After the removal of the stabiliser's tyre tread marks (refer to Clause 8.6.12), care needs to be taken by the Contractor to ensure that the final smooth drum rolling does not de-compact (or crack) the stabilised layer.

8.6.21 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 secondary stabilising agent to become airborne

d) during conditions that may result in the work causing nuisance or danger to people, property or the environment

e) when the pavement temperature, measured 50 mm below the surface, drops below 10ºC, or

f) when the air temperature, measured in the shade, exceeds 40ºC.

8.7 Product standards

8.7.1 General

Compliance testing of the stabilised layer shall be undertaken for each lot. Where a process standard is specified (refer to Clause 8.5.1), the compaction requirements in Clause 8.7.4 shall apply to the trial section(s) but not to other sections. Where a product standard is specified (refer to Clause 8.5.1), the compaction requirements in Clause 8.7.4 shall apply to all lots.

8.7.2 Stabilising agent spread rates

8.7.2.1 Ordered spread rate

At least 14 days prior to the commencement of stabilisation works, the Administrator will confirm or adjust the specified bituminous stabilising agent spread rate and the specified secondary stabilising agent spread rate stated in Clause 10 of Annexure MRTS07C.1.

The secondary stabilising agent content shall not be less than 1.25% of the dry mass density of the material to be stabilised.

The confirmed or adjusted stabilising agent spread rates shall be defined as the ordered bituminous stabilising agent spread rate and the ordered secondary stabilising agent spread rate respectively. **Milestone**

8.7.2.2 Actual bituminous stabilising agent spread rate

The actual bituminous stabilising agent spread rate shall be represented either by the average of the measured application rates, measured by the flow meter on board the stabiliser, or the average of the tanker dipping readings measured at the start and end of each stabilising run. **Witness Point 7** The system to be used for this Contract shall be as stated in Clause 10 of Annexure MRTS07C.1.

The actual bituminous stabilising agent spread rate shall be within -2.5% and +10% of the ordered bituminous stabilising agent spread rate specified in Clause 8.7.2.1.

The Principal will only pay for quantity of bituminous and secondary stabilising agents required to meet the tolerances given above in this clause. The Contractor shall be liable for bitumen and secondary stabilising agents more than the ordered spread rate plus 10%.

8.7.2.3 Actual secondary stabilising agent spread rate

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

The actual secondary stabilising agent spread rate shall be within ±10% of the ordered secondary stabilising agent spread rate specified in Clause 8.7.2.1.

8.7.3 Moisture ratio

The moisture ratio of the uncompacted materials during the incorporation of the bituminous agent shall be as stated in Clause 6 of Annexure MRTS07C.1 or, where not so stated, shall comply with the requirements specified in Table 8.7.3. The moisture ratio (uncompacted) (MR_u) shall be determined in accordance with Clause 9.8.

Table 8.7.3 – Moisture ratio requirements

Property	Minimum value (%)	Maximum value (%)
Moisture ratio (uncompacted) (MR_u) during the incorporation of the bituminous agent	55	75

8.7.4 Compaction standard

The minimum characteristic value of the relative compaction results for the full thickness of the stabilised layer shall be as stated in Clause 7 of Annexure MRTS07C.1 or, where not so stated, shall not be less than the value specified in Table 8.7.4.

Table 8.7.4 – Compaction requirements

Layer	Minimum relative compaction value
Foamed bitumen stabilised layer	102% (standard compaction)

8.7.5 Geometrics

8.7.5.1 General

The stabilised layer shall be constructed so as not to depart from the alignment, widths, thicknesses, lengths, heights and shapes specified in the Drawings or Contract by more than the tolerances stated in Clause 8.7.5.2 to Clause 8.7.5.5.

When constructing the stabilised layer, the Contractor shall consider the geometric tolerances of any overlaying layer(s) and shall prepare the stabilised layer in such a manner that will permit the geometric conformance of the stabilised layer, and any overlying layer(s).

8.7.5.2 Geometrics, vertical tolerances

8.7.5.2.1 Primary tolerance

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

The primary tolerance shall be as stated in Clause 8.1 of Annexure MRTS07C.1 as one of the alternatives in Table 8.7.5.2.1. If no such indication is given, the primary tolerance shall be Alternative B (-5 and + 15 mm).

Table 8.7.5.2.1 – Primary tolerance for stabilised layers

Alternative	Primary tolerance (mm)
A	-5 to + 10
B	-5 to + 15
C	Thickness only

Alternative A primary tolerance (-5 to + 10 mm) is recommended for an insitu stabilised layer when the subsequent overlying layer is asphalt.

In all cases the primary tolerance shall also apply for the thickness of the completed stabilised layer (refer to Clause 8.7.5.3.1).

Where Alternative C (thickness only) has been specified in Clause 8.1 of Annexure MRTS07C.1, the following shall apply:

a) height of collimation (also known as a 'dumpy level' technique) shall be used to determine the actual stabilised layer thickness

b) minimum testing frequency for determining the actual stabilised layer thickness shall be at each compaction test location (refer Clause 9.7), and

c) any point of the completed stabilised layer the measured thickness shall be within -5 mm and +15 mm of the design depth stated in Clause 10 of Annexure MRTS07C.1.

8.7.5.3 Geometrics, thickness tolerances

8.7.5.3.1 General

At any point of the completed stabilised layer, the measured actual stabilised layer thickness (refer to Clause 8.7.5.3.2) shall be within the primary tolerance nominated in Clause 8.7.5.2.1 of the design depth specified in Clause 10 of Annexure MRTS07C.1.

8.7.5.3.2 Measuring actual stabilised layer thickness

During each final bituminous incorporation pass and prior to compaction, depth checks shall be undertaken to determine the lower reference level at the bottom of the stabilised layer. The frequency of the depth checks shall be stated in Clause 5.4. Depth checks shall be undertaken by a Surveyor in accordance with the limits of accuracy defined in MRTS56 *Construction Surveying*.

Following compaction and final trim, levels shall be obtained from the top of the finished stabilised layer. They shall be recovered in the horizontal plane to an accuracy of ± 50 mm of the same location as those from which the lower reference levels were obtained. The difference between the finished surface level and lower reference level shall be recorded as the actual stabilised layer thickness.

The actual stabilised layer thickness shall be recorded by the Contractor and reported to the Administrator. The record for each thickness determination shall include:

a) the position and measurement of the lower reference level at each depth check location

b) the position and measurement of the finished surface level at each depth check location.

c) the actual stabilised layer thickness result obtained by subtracting the finish surface level measurement from the lower reference level measurement for each test location (rounded to the nearest 1 mm), and

d) the minimum characteristic value calculated in accordance with Clause 12 of MRTS01 *Introduction to Technical Specifications*, of all stabilised layer thickness measurements for each lot.

As an alternative to measuring the finished surface level recovered in the horizontal plane to an accuracy of ± 50 mm of the same location as the lower reference level measurements, a Triangular Irregular Networks (TIN) surveyed surface may be used by the Contractor.

The Contractor shall submit to the Administrator the proposed reporting positions (grid pattern and offsets) for the finished surface level survey capture. The use of TIN shall not be accepted until the Administrator has approved the Contractor's methodology.

In some locations, the finished surface level design geometry may be sub-optimal in crossfall and/or longitudinal grade and therefore not suitable for TIN surface creation. In these locations, the use of TIN shall not be accepted by the Administrator.

A Surveyor shall undertake the as-constructed survey capture of the finished stabilised layer in accordance with the geometrics conformance requirements of this Specification, and the As Constructed Survey requirements of MRTS56 *Construction Surveying*. From the as-constructed survey capture, a TIN surface can be developed and used to represent the finished surface level of the stabilised layer.

The actual stabilised layer can be measured and reported to the Administrator using this TIN surface as per the requirements of this Clause.

In all cases,

- the reported positions must be recovered within the bounds of the developed TIN surface, and
- the finished surface level and lower reference level measurements are recovered in the as-constructed survey to an accuracy of ± 1,000 mm.

8.7.5.4 Geometrics, horizontal tolerances

The horizontal position of any point on the pavement shall not differ from the corresponding point shown on the drawings or as otherwise specified in the Contract, calculated as described in Clause 8.7.5, by more than ± 50 mm, except where alignment of the pavement with an existing pavement or structure is necessary. In this case, the new work shall be joined neatly to the existing work or structure in a smooth manner as shown on the drawings or as otherwise specified in the Contract. If the drawings or other Contract documents do not show, describe or specify how new work is to join to existing pavement or structures then it shall be done in a manner that is acceptable to the Administrator.

8.7.5.5 Additional tolerances

8.7.5.5.1 General

Where required by Clauses 8.7.5.5.2, 8.7.5.5.3 and 8.7.5.5.4, additional tolerances shall apply to the pavement lots in a stabilised layer.

The Contractor may have to carry out additional work to achieve these additional tolerances. Payment for any such work shall be deemed to be included in the Contractor's scheduled rate for the relevant work items.

8.7.5.5.2 Deviation from a straightedge

Clause 8.2.1 of Annexure MRTS07C.1 specifies whether a deviation from a straightedge tolerance is to be applied. If no indication is given, deviation from a straightedge tolerance shall apply.

The deviation from a 3 m long straightedge placed anywhere on the surface of a layer shall not exceed the limit stated in Clause 8.2.2 of Annexure MRTS07C.1, due allowance being made for design shape, where relevant.

The limit stated in Clause 8.2.2 of Annexure MRTS07C.1 shall be one of the alternatives given in Table 8.7.5.5.2. If no limit is given, it shall be Alternative D (5 mm).

Table 8.7.5.5.2 – Tolerance for deviation from a straightedge

Alternative	Maximum value (mm)
D	5
E	8
F	15

Alternative D tolerance (5 mm) is recommended for an insitu stabilised layer that will be bitumen sealed and trafficked, or when the subsequent overlying layer is asphalt.

8.7.5.5.3 Crossfall

Clause 8.3 of Annexure MRTS07C.1 specifies whether a crossfall tolerance applies. If no indication is given, crossfall tolerance shall 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 two metres apart except where a pavement verge is less than two metres wide. For pavement verges less than two 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.

8.7.5.5.4 Road roughness (surface evenness)

Clause 8.4.1 of Annexure MRTS07C.1 specifies whether a surface evenness tolerance applies to the stabilised layer. If no indication is given, surface evenness tolerance shall apply.

The surface evenness of a stabilised layer shall be such as to provide a road roughness value not exceeding the specified road roughness (R_s) stated in Clause 8.4.2 of Annexure MRTS07C.1 or, where not so stated, not exceeding the value specified in Table 8.7.5.5.4.

Table 8.7.5.5.4 – Road roughness requirements

Property	Maximum value (m/km)
Road roughness (R_s)	1.94

The roughness of the following features is required to be reported during roughness testing, but shall be excluded from the ride quality assessment:

- roundabouts
- railway crossing and grids
- bridge joints, and
- inspection pit covers (for example, drainage access chambers).

The Contractor shall nominate a methodology and provide calculations on ride quality for the Administrators acceptance, showing how each feature has been excluded from the assessment and the subsequent lot structure.

Pavement features (including joints) or signalised / unsignalized intersections (other than roundabouts) shall not be excluded from the ride quality assessment unless agreed by Administrator.

The Administrator may increase the specified maximum road roughness (R_s) value to 2.31 m/km when the stabilised layer will be overlaid with asphalt or another pavement material within the same Contract, and there is a roughness requirement specified elsewhere in the Contract for the overlying layer.

In all cases, when applying extended limits and reduced values in accordance with MRS07C *Insitu Stabilised Pavements using Foamed Bitumen*, the specified maximum road roughness (R_s) value shall be as stated in Clause 8.4.2 of Annexure MRTS07C.1 or, where not so stated, not exceeding the value specified in Table 8.7.5.5.4.

9 Construction compliance testing

9.1 General

Unless otherwise stated in this Technical Specification, 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 bituminous stabilising agent content (Clause 9.5)

c) the surface spread rate of the secondary stabilising agent (Clause 9.6), and

d) proof rolling of pavement layers (Clause 9.9).

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 5.4.

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 apply to trial sections and do not apply to other sections.

Notwithstanding this, the requirements of Clause 8.5.2 shall apply.

9.3 Product standards

Where construction has been carried out using product standards, compliance testing of the pavement 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.

Notwithstanding this, the requirements of Clauses 8.5.3 shall apply.

9.4 Geometrics

9.4.1 General

All geometric tolerances, except for surface evenness as specified in Clause 9.4.2, shall be checked at regular intervals not greater than those specified in Clause 5.4.

9.4.2 Road roughness (surface evenness)

The surface evenness of a stabilised pavement layer shall be measured by road roughness as per Test Method Q708B, Q708C, and Q708D.

For road roughness testing, a lot shall be 100 m in length.

9.5 Bituminous stabilising agent spread rate

The bituminous stabilising agent spread rate shall be determined by either the average of the measured application rate, measured by the flow meter onboard the stabiliser, or by the average of the tanker dipping readings measured at the start and end of each run as specified in Clause 10 of Annexure MRTS07C.1.

In all cases, the bituminous stabilising agent spread rate shall be within the allowable tolerance specified in Clause 8.7.2.2.

The results of all dipping and flow meter results shall be recorded and included in the quality records and reported to the Administrator. The record and report for each application rate test shall include:

a) the position, date and time

b) all values and calculations, including assumptions, used to calculate the application rate, and

c) the calculated application rate of bitumen.

The testing program for determination of the bituminous stabilising agent content shall be discussed and agreed with the Administrator prior to commencement of stabilising operation.

In addition, the quantity of bituminous stabilising agent incorporated during each stabilising run shall be recorded and included in the quality records and reported to the Administrator.

The record and report for each 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) when tanker dipping is undertaken:

   i. the volume of bitumen in the tanker at the start of the run

   ii. the volume of bitumen in the tanker at the midpoint of the run (if the length of the run exceeds 500 m)

   iii. the volume of bitumen in the tanker at the end of the run

   iv. the volume of bitumen incorporated into the pavement between each dip reading

   v. the total volume of bitumen incorporated into the pavement for the entire run

f) when a flow meter is used:

   i. The total volume of bitumen incorporated into the pavement for the entire run measured by the flow meter onboard the stabiliser

g) the temperature of the bitumen in the tanker during stabilisation

h) the average bitumen application rate, and

i) expansion ratio and half-life.

All records shall be such that the actual bitumen application rate for each stabilisation run shall be calculated at 15ºC prior to the next stabilising run.

All volume conversions, in relation to changes in temperature of bituminous materials, shall be carried out in accordance with the relevant factors listed in Table 9.5 using the following formula:

$$V_B = V_{BH} \times F_T$$

where: V_B = volume of bitumen at 15ºC (L)

V_{BH} = volume of bitumen at high temperature (L) immediately prior to incorporation into the materials to be stabilised, and

F_T = factor in high temperature from Table 9.5.

The mass of bitumen is then calculated from the volume of bitumen at 15ºC using the following formula:

$$M_B = V_B \times 1.04$$

where: M_B = mass of bitumen at 15ºC (kg), and

V_B = volume of bitumen at 15ºC (L).

Table 9.5 – Equivalent volumes at 15ºC of 1 litre of bituminous material measured at higher temperatures

Temp (ºC)	Factor	Temp (ºC)	Factor	Temp (ºC)	Factor
15	1	80	0.9597	145	0.9207
20	0.9969	85	0.9566	150	0.9177
25	0.9938	90	0.9536	155	0.9148
30	0.9907	95	0.9506	160	0.9118
35	0.9876	100	0.9476	165	0.9089
40	0.9844	105	0.9446	170	0.906
45	0.9813	110	0.9416	175	0.9031
50	0.9782	115	0.9385	180	0.9002
55	0.9751	120	0.9355	185	0.8973
60	0.972	125	0.9326	190	0.8945
65	0.9689	130	0.9296	195	0.8916
70	0.9658	135	0.9266	200	0.8888
75	0.9627	140	0.9236	205	0.886

9.6 Secondary stabilising agent spread rate

The secondary stabilising agent spread rate shall be determined by testing using the surface spread rate of the secondary stabilising agent (Test Method Q719). The secondary stabilising agent content shall be within the allowable tolerance specified in Clause 8.7.2.3.

The results of all surface spread rate tests shall be recorded and 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(s), 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 for determination of the secondary stabilising agent content shall be discussed and agreed with the Administrator prior to commencement of stabilising operation.

In addition, the tonnage of stabilising agent placed during each spreading run shall be recorded in the quality records and reported to the Administrator. The record and report for each run shall include the:

a) start position, date and time

b) end position, date and time

c) length of the run

d) width of the run

e) tonnage of stabilising agent in the spreader at the start of the run

f) tonnage of stabilising agent at in the spreader 500 m intervals (if the length of the run exceeds 500 m)

g) tonnage of stabilising agent in the spreader at the end of the run

h) tonnage of stabilising agent spread for each 500 m interval (if the length of the run exceeds 500 m), and

i) tonnage of stabilising agent spread for the entire run.

9.7 Compaction

The compaction standard for each lot shall be represented by the minimum characteristic value of the compaction results. The characteristic value shall be calculated as stated in Clause 12 of MRTS01 *Introduction to Technical Specifications* or Test Method Q020 using the individual relative compaction results determined from testing each lot.

Where the minimum characteristic value of a lot's compaction results does not comply with the requirements of this Technical Specification, the Contractor shall raise a suitable non-conformance report. The Administrator should review each individual compaction result. The review may necessitate the need for additional investigation to identify the underlying cause(s) for the noncompliance. The Administrator should also review the homogeneity of the works.

The locations of all tests undertaken for the determination of insitu dry density and relative compaction shall be at the same locations of samples taken to determine the corresponding laboratory MDR.

Sampling of stabilised materials to determine the laboratory MDR as detailed in Test Method Q142A shall take place immediately after the incorporation of the bituminous stabilising agent, but prior to the commencement of compaction of the stabilised material.

The relative compaction of the stabilised material as detailed in Test Method Q140A shall be determined for the entire thickness of the stabilised layer.

Inherently, the insitu stabilisation process involves the mixing of existing materials whose properties can be unpredictable and may also vary within the Project limits. Therefore, caution must be applied when seeking to determine nuclear gauge biases (refer to Nuclear Gauge Testing Manual (NGTM) Test Method N01), and/or, attempting to establish and monitor assigned values (refer to Test Method Q144A).

9.7.1 Time limits for MDR laboratory compaction

Following sampling, the MDR testing shall be completed to a stage where laboratory compaction has been completed within three hours of the commencement of the incorporation of the bituminous stabilising agent for the corresponding lot.

To comply with the above requirements, the Contractor may need to consider the establishment of an annex laboratory facility onsite.

Additionally, following sampling, oven drying of all specimens used to determine the moisture content shall commence within the same work shift as the stabilisation works for the corresponding lot.

9.7.2 Time limits for the determination of compacted density

Unless otherwise approved by the Administrator, the determination of compacted density using Test Method Q141A or Test Method Q141B shall be completed to a stage where the wet density has been determined within 24 hours after the end of the work shift where stabilisation works were completed for the corresponding lot.

Additionally, any moisture sub-sample is being oven dried within the same work shift as the compacted density testing for Test Method Q141A or Test Method Q141B is being undertaken.

9.7.3 Time limits for the determination of material biases

For the determination of material biases for Test Method Q141A, compacted density testing using Test Method Q141B shall be completed to a stage where the wet density has been determined within 24 hours after the end of the work shift where stabilisation works were completed for the corresponding lot.

Additionally, any moisture sub-sample is being oven dried within the same work shift as the compacted density testing for Test Method Q141B is being undertaken.

9.8 Moisture ratio

The moisture ratio of the uncompacted materials (MR_u) shall be determined in accordance with Test Method Q250.

The moisture sample locations shall be identical to the MDR sampling locations for compaction testing (refer to Clause 9.7). The moisture samples shall be extracted immediately after the incorporation of the bituminous stabilising agent by the stabiliser and prior to the addition of any additional moisture for the purposes of compaction and trimming.

Following sampling, oven drying of all specimens used to determine the moisture content shall commence within the same work shift as the stabilisation works for the corresponding lot.

The moisture ratio shall be calculated using the individual moisture content compared to the optimum moisture content for each corresponding location (refer to Clause 9.7). As a minimum frequency, the moisture ratio of the uncompacted materials shall be assessed at each test location for compaction. The results shall be reported to the Administrator as soon as it is available.

9.9 Proof rolling

9.9.1 Proof rolling prior to early trafficking

No trafficking shall be allowed until the requirement of Clause 9.9 is carried out and no perceptible surface deformation is observed. Additional curing time may be required prior to traffic.

9.9.2 Proof rolling of stabilised layers

The proof rolling test specified in this clause shall apply to a completed stabilised layer unless stated otherwise in Clause 9 of Annexure MRTS07C.1. If no indication is given, the proof rolling test shall apply.

Each stabilised layer shall be tested for perceptible surface deformation by ‘proof rolling’ the stabilised layer, in the presence of the Administrator **Witness Point 8** All areas of the stabilised layers shall be ‘proof rolled’, including all trafficked lanes, shoulders and other areas.

Testing shall be in accordance with Test Method Q723 unless otherwise approved by the Administrator. Testing for perceptible surface deformation is exempt from the requirement for NATA accreditation or Construction Material Testing (CMT) registration.

Where the surface of any section of a stabilised layer displays perceptible surface deformation under proof rolling, the Administrator may require the Contractor to carry out additional compliance testing to ensure that the affected section of the stabilised layer complies with Clauses 8.7.2, 8.7.3 and 8.7.4. No additional payment shall be made by the Principal for such additional testing.

Where the surface of any section of a stabilised layer displays perceptible surface deformation under proof rolling, the construction of any overlying pavement layer and/or spray seal shall not proceed until the Administrator grants the Contractor permission to proceed in accordance with Clause 9.10.

The proof rolling result reported for any stabilised layer lot shall be representative of the condition of the lot immediately prior to it being covered by another pavement layer or spray seal. If the stabilised layer lot has been subjected to rainfall or moisture ingress in any way since proof rolling was undertaken, the Administrator may direct the Contractor to retest the lot to prove conformance. If the retested results do not comply with the requirements of this Technical Specification, the Contractor shall rectify the stabilised layer such that it complies with the requirements of this Technical Specification. No additional payment will be made by the Principal for any such additional efforts.

Test Method Q723 provides a method for using a loaded water tanker for proof rolling.

9.10 Acceptance

For any completed stabilised pavement lot, the Contractor shall submit to the Administrator all compliance testing relevant to that lot within 72 hours after the completion of the lot's bituminous incorporation pass (refer to Clause 8.6.11). Construction shall not proceed until the Administrator has received these compliance test results. The Contractor shall allow at least one working day for a response from the Administrator.

> Compliance test results need to be provided by the Contractor to the Administrator in a timely manner (within 72 hours after the completion of the lot's bituminous incorporation pass). This will allow the Contractor and Administrator to monitor the progress and quality of the works and address any non-conformances promptly.

No stabilised pavement lot shall be covered by a subsequent layer of pavement or by surfacing until all compliance testing has been completed and the layer has been presented to the Administrator for permission to proceed. **Hold Point 8**

No stabilised pavement lot shall be covered by a subsequent layer of pavement or by surfacing until the As Constructed Survey requirements for the stabilised pavement lot have been met as specified in MRTS56 *Construction Surveying* and notice of such works has been provided to the Administrator.

10 Supplementary requirements

The requirements of MRTS07C *Insitu Stabilised Pavements Using Foamed Bitumen* are varied by the supplementary requirements given in Clause 12 of Annexure MRTS07C.1.

Appendix A: Maximum lot sizes and minimum testing frequencies

Table A1 – Maximum lot size requirements

Construction Activity	Maximum Lot Size
Supply of unbound granular materials for shape correction and new material to replace unsuitable material	5,000 tonnes
Construction of insitu stabilised pavements using foamed bitumen	The area (in m²) of production, of completed stabilised layer, achieved during a single work period, provided the material is, in the opinion of the Administrator, essentially uniform.
Road roughness (surface evenness)	100 m

Table A2 – Unbound granular materials for shape correction and new material to replace unsuitable material – source and product compliance testing requirements

Material Property	Test Method	Normal Testing Level		Reduced Testing Level	
		Minimum Testing Frequency	Minimum No. of Tests	Minimum Testing Frequency	Minimum No. of Tests
Source Testing		For Type 2, Type 3 or Type 4 unbound granular material refer to MRTS05 *Unbound Pavements*			
Petrographic assessment of aggregates	Q188				
Wet strength	AS 1141.22				
Wet / dry strength variation	AS 1141.22				
Water absorption	AS 1141.6				
Degradation factor	Q208B				
Product Testing					
Flakiness index	Q201				
California Bearing Ratio*	Q113A				
Particle size distribution (grading)	Q103A				
Fines ratio	Q103A				
Liquid limit	Q104A				
Linear shrinkage	Q106				
UCS (Type 2 materials containing recycled concrete)	Q115				
Foreign Material (Type 2 materials containing recycled material)	Q477				
pH (Type 2 materials containing recycled concrete)	AS 1289.4.3.1				
Sulfate content	AS 1289.4.2.1#	1 test per material source			
Sulfate content (water)	AS 1289.4.2.1#	1 test per water source			

Notes:

* Refer to MRTS05 *Unbound Pavements* for CBR testing requirements for Type 2, Type 3 and Type 4 materials.

Or other published or validated classical chemistry technique or instrumentation technique.

Table A3 – Construction compliance testing requirements

Construction Activity	Test Method	Normal Testing Level		Reduced Testing Level	
		Minimum Testing Frequency	**Minimum No. of Tests**	**Minimum Testing Frequency**	**Minimum No. of Tests**
Compaction	Q140A	1 test per 500 m²	4 tests per lot	1 test per 1000 m²	2 tests per lot
Moisture ratio (uncompacted) (MR_u)	Q250	1 test per 500 m²	4 tests per lot	1 test per 1000 m²	2 tests per lot
Surface spread rate of secondary stabilising agent	Q719^	Minimum 1 per spreading run			
Slaking spot checks (quicklime)	Clause 8.6.7	1 per 25 linear m			
Foamed bitumen properties (half-life and expansion ratio)	Clause 8.6.11	1 per bitumen tanker within the first 35 m of bitumen incorporation pass			
Surface spread rate of bituminous stabilising agent	Clause 9.5	1 per bitumen incorporation pass			
Depth checks	Survey	a) 1 per 5 linear m within the first 20 m of each final bitumen incorporation pass, and b) 1 per 20 linear m for the remaining length of each final bitumen incorporation pass		a) 1 per 5 m within the first 20 m of each final bitumen incorporation pass, and b) 1 per 50 m for the remaining length of each final bitumen incorporation pass.	
Proof Rolling	Q723	Refer to Clause 9.9			

Note:

^ For Q719, the requirement for the test to be carried out by a registered NATA and Construction Materials Testing (CMT) Supplier in accordance with MRTS50 *Specific Quality System Requirements*, shall be relaxed.

Table A4 – Geometrics compliance testing requirements

Construction Activity	Test Method	Normal Testing Level		Reduced Testing Level	
		Minimum Testing Frequency	**Minimum No. of Tests**	**Minimum Testing Frequency**	**Minimum No. of Tests**
Geometrics horizontal position	Survey	Each 20 linear m - measured at all shoulder edges, lane lines and other changes in grade across the pavement			
Geometrics vertical levels	Survey				
Geometrics layer thickness	Survey	1 per 20 linear m		1 per 50 linear m	
Deviation from a straightedge	Q712	a) **within lane:** 1 per 20 linear m along each stabilising run, unless otherwise approved by the Administrator. Measurements shall be taken in both the transverse and longitudinal directions. b) **longitudinal joint:** 1 per 20 linear m along each joint, unless otherwise approved by the Administrator. c) **transverse joint:** 1 measurement per joint in each wheel path in each lane. For the measurement of joints, place the straightedge on the completed layer, perpendicular to the joint. With the end of the straightedge directly over the joint, gradually move the straightedge across the joint for its full length and identify the point on the layer that produces the largest deviation under the straightedge (between two points of contact). Record the deviation at this point. d) **joint to existing pavement (not constructed under the Contract):** 1 measurement per joint in each wheel path in each lane. For all joints that tie the new works to existing pavement (not constructed under the Contract), place the straightedge on the road surface perpendicular to the joint. With the end of the straightedge directly over the joint and the other end located within the works, record the largest deviation under the straightedge (between two points of contact).			
Crossfall	Survey	1 per 20 linear m – measured for all crossfalls shown in the design documentation at the point of testing			
Road roughness (surface evenness)	Q708B, Q708C or Q708D	Refer to Clause 8.7.5.5.4 and Clause 9.4.2			