

Technical Specification

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

November 2018

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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 reclaimer / stabiliser. The increased vertical height of the material is measured from the surface level prior to this incorporation process – refer Figure 8.7.11.
Curing materials	Materials applied to the exposed surfaces of the completed stabilised layer for the purpose of curing.
Design depth	As specified in the construction drawings and contract documents – refer Figure 8.7.11.
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.
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.
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.

Term	Definition
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 8.7.11.
Primary stabilising agent	See 'foamed bitumen'.
Quicklime	Quicklime is a granular form of lime consisting primarily of calcium oxide (CaO). Quicklime hydrates rapidly in the presence of water.
Reclaimer / 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.
Relative Moisture Ratio (RMR)	The relative moisture of the treated soil compared to optimum moisture content using standard compaction, expressed as a percentage.
Secondary stabilising agent	Hydrated lime or slaked quicklime included in the stabilisation process used to improve the dispersion of the foamed bitumen and increase the early strength of the stabilised material.
Stabilising agents	Primary and secondary stabilising agents – see definitions above.
Target depth	Target depth is the mixing depth required by the reclaimer / stabiliser to achieve the lower reference level and shall consider the bulking height – refer Figure 8.7.11.

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
AS 4486.1	<i>Test methods for limes and limestones - Lime index - Available lime</i>
AP-G41/02	<i>Austrroads' Bitumen Sealing Safety Guide (2nd Edition)</i>
AP-G41/08	<i>Austrroads' Bituminous Materials Safety Guide</i>
Version A – 14 February 2000	National AustStab Guidelines – Verification of Bitumen Application Rate
MRTS01	<i>Introduction to Technical Specifications</i>
MRTS05	<i>Unbound Pavements</i>
MRTS17	<i>Bitumen</i>
MRTS23	<i>Supply and Delivery of Quicklime and Hydrated Lime for Road Stabilisation</i>
MRTS35	<i>Recycled Material Blends for Pavements</i>
MRTS50	<i>Specific Quality System Requirements</i>

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 (e.g. see 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.
Selection of sampling and test locations	Q050
Sampling of soils, crushed rock and aggregates	Q060
Spot sampling of soils, crushed rock and aggregates	Q061
Moisture content	AS 1289.2.1.1, AS 1289.2.1.4, AS 1289.2.1.6
Laboratory reference density	Q142A, Q143, Q144A
Relative compaction	Q140A, Q141A, Q141B
Sulfate content	AS 1289.4.2.1
Road roughness surface evenness	Q708B, Q708C, Q708D
Surface spread rate of stabilising agent (for secondary stabilising agent)	Q719
Plastic limit and plasticity index	Q104A, Q105
Linear shrinkage	Q106
Particle size distribution	Q103A
Relative moisture ratio	Q250
Proof rolling test	RMS T198
Working time of foamed bitumen stabilised materials	Q136B
Available lime	AS 4489.6.1
Preparation and compaction of laboratory mixed foamed bitumen stabilised material	Q138A
Preparation and compaction of field mix foamed bitumen stabilised material	Q138B
Resilient modulus of foamed bitumen stabilised material	Q139
Wet strength	AS 1141.22
Wet/dry strength variation	AS 1141.22
Degradation factor	Q208B
Crushed particles	Q215
Flakiness index	Q201
California Bearing Ratio	Q113A
Deviation from a straight-edge	Q712

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		
8.6.1	5. Approval of compaction based on a process requirement		
8.6.2		1. Construction of trial section (if process standard specified for compaction)	
8.7.1		2. Removal and disposal of material not suitable for stabilisation	
8.7.2		3. Preliminary pulverisation	
8.7.4		4. Compacting and trimming surface prior to spreading of the stabilising agent	
8.7.6		5. Spreading secondary stabilising agent	
8.7.9.2		6. Nominating the target depth	
8.7.11	6. Foaming properties of bitumen		
8.8.1.1			Ordered spread rate of stabilising agents (14 days)
8.8.1.2		7. Bitumen tanker dipping	
9.9.2		8. Proof rolling test	

Clause	Hold Point	Witness Point	Milestone
9.10	7. 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. relative 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 the 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 pavement 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 straight edge 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 1, Type 2, Type 3 or Type 4 unbound pavement material complying with the requirements of MRTS05 *Unbound Pavements*, or, RM001 pavement material complying with the requirements of MRTS35 *Recycled Material Blends for 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 exceeding 1.9 grams of sulfate (expressed as SO₄) per litre.

6.2 Additional material for shape correction

The shape of the pavement shall be corrected prior to the importation of any overlay material.

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 1, Type 2, Type 3 or Type 4 unbound pavement material complying with the requirements of MRTS05 *Unbound Pavements*, or, RM001 pavement material complying with the requirements of MRTS35 *Recycled Material Blends for 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 not exceeding 1.9 grams of sulfate (expressed as SO₄) per litre.

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	Technical Specification
Primary stabilising agent	Class 170 Bitumen complying with MRTS17 <i>Bitumen</i>
Secondary stabilising agent	Hydrated lime or quicklime complying with MRTS23 <i>Supply and Delivery of Quicklime and Hydrated Lime for Road Stabilisation</i>

The estimated content and specified spread rate for the bituminous stabilising agent shall be given in Clause 11 of Annexure MRTS07C.1. Where not so stated in Clause 11 of Annexure MRTS07C.1, the total specified application rate shall be 18 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.

The estimated content and specified spread rate for the secondary stabilising agent shall be given in Clause 11 of Annexure MRTS07C.1. Where not so stated in Clause 11 of Annexure MRTS07C.1, the total specified application rate shall be 10 kg/m².

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

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

6.4 Water

Water used should be potable. Where potable water is not available, the Administrator may consider water from other sources. 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.

Recycled water shall not be used for any other purpose without the written approval of the Administrator.

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 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 and water

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.

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

7.3 Unbound pavement material

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

In all cases Type 1, Type 2, Type 3 and Type 4 material shall also comply with MRTS05 *Unbound Pavements* and RM001 materials shall also comply with MRTS35 *Recycled Material Blends for Pavements*.

8 Construction

Prior to acceptance (Clause 9.10), construction shall not proceed until the Administrator is satisfied that the requirements covered by Clause 8.1 to Clause 8.8.4.4.3 are satisfied. **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 11 of Annexure MRTS07C.1.

The datum for measurement of the target depth (refer to Figure 8.7.11) shall be as stated in Clause 12 of Annexure MRTS07C.1.

Details of measuring the actual thickness of stabilised layer is described in Clause 8.8.4.1.2.

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

The allowable working time, measured from the commencement of incorporating / mixing the first application of secondary additive into the unstabilised pavement materials, to the completion of trimming and compacting (excluding multi-tyre rolling) of the stabilised materials shall be 6.5 hours.

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

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 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 8.8.2.
- If the construction delay exceeds 24 hours, treatment with an additional 0.5% lime should be considered. Any extra lime addition (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.

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 11 of Annexure MRTS07C.1.

8.5.2 Construction based on process requirements

If a process requirement is specified in Clause 11 of Annexure MRTS07C.1, construction shall:

- a) incorporate the methodology and construction of trial sections in accordance with the requirements of Clause 8.6
- b) comply with the construction requirements stated in Clause 8.7, and
- c) comply with the product standards stated in Clause 8.8 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.

8.5.3 Construction based on product standards

If a product requirement is specified in Clause 11 of Annexure MRTS07C.1, construction shall:

- a) comply with the construction requirements stated in Clause 8.7, and
- b) comply with the product standards stated in Clause 8.8.

8.6 Process requirements

8.6.1 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 8.6.2.

The compaction of each trial section shall be tested in accordance with Clause 5.4 and checked for compliance with Clause 8.8.3. If the characteristic value of the relative compaction results for the trial section is not less than the value specified in Clause 8.8.3, 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 characteristic value of the relative compaction results for the trial section is less than the value specified in Clause 8.8.3, 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 8.6.

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**

8.6.2 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.

8.7 Construction requirements

8.7.1 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, and
 - 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 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 100mm.

8.7.2 Preliminary pulverisation

The material to be stabilised shall be pulverised in accordance with this clause. One pass of a reclaimer / stabiliser or profiler shall be used to pulverise the material to be stabilised 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.

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 8.7.1.

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.

8.7.3 Additional material for shape correction (if required)

The shape of the pavement shall be corrected prior to the importation of any overlay material.

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 administered through either product requirement (Clause 9.3) and/or process requirement (Clause 9.2). This shall be approved by the Administrator.

The 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.

8.7.4 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**

8.7.5 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 or reclaimer/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 or reclaimer / 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).

8.7.6 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/m² 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 additive are 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 8.8.1.3. 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 8.8.1.3. 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 8.7.7, 8.7.8, 8.7.9, 8.7.10 and 8.7.11. Further shaping, trimming and/or compaction as required (refer to Clauses 8.7.4, 8.7.12, 8.7.13 and 8.7.14) shall be completed before each spreading run.

8.7.7 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 slaking quicklime. This is to ensure the slaking procedures, plant and water is adequate for the purpose of slaking quicklime in accordance with this clause.

Where quicklime is used as the secondary stabilising agent, it shall be spread (refer to Clause 8.7.6) 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 potable water to allow complete hydration such that the material remains friable after slaking and no further exothermic reaction occurs when further water is added to the material.

All through traffic shall be stopped during any slaking operation.

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

8.7.8 Incorporation of the secondary stabilising agent

Incorporation of the secondary stabilising agent shall be achieved using a reclaimer / stabiliser 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 additive for a single pass as per Clause 8.7.6 with the addition of water by means of stabiliser / reclaimer to achieve 55–75% RMR. 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 8.7.11 and Table 8.7.19) and shaped prior to foamed bitumen pass by using a grader (refer to Clause 8.7.9.2).
2. If 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 reclaimer/stabiliser to the full target depth of stabilisation to achieve lower reference level (refer to Figure 8.7.11 and Clause 8.7.9.2).
3. If the secondary stabilising agent is GB (General Blend) cement, not more than two 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 reclaimer / stabiliser to the full target depth of stabilisation to achieve lower reference level (refer to Figure 8.7.11 and Clause 8.7.9.2).

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

1. Spread and mix the first pass at a rate of up to half the required rate of the secondary stabilising agent without 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 8.7.11 and Table 8.7.19).
2. Spread and mix remaining balance of the required secondary stabilising agent with the addition of water by means of stabiliser / reclaimer to achieve 55–75% RMR. 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 8.7.11 and Table 8.7.19) and shaped prior to final foamed bitumen pass using a grader (refer Clause 8.7.9.2).
3. If 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 reclaimer / stabiliser to the full target depth of stabilisation to achieve the lower reference level (refer Figure 8.7.11 and Clause 8.7.9.2).
4. If the secondary stabilising agent is GB cement, not more than two 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 reclaimer / stabiliser to the full target depth of stabilisation to achieve the lower reference level (refer Figure 8.7.11 and Clause 8.7.9.2).

After each spreading run, and before any other spreading run, secondary stabilising agent shall be incorporated as specified in Clauses 8.7.7, 8.7.8, 8.7.9, 8.7.10 and 8.7.11. Further shaping, trimming and/or compaction as required (refer to Clauses 8.7.4, 8.7.12, 8.7.13, and 8.7.14) shall be completed before each spreading run.

8.7.9 Incorporation of moisture

Moisture may be incorporated into the stabilised pavement material using a stabiliser or reclaimer / 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 reclaimer / 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 reclaimer/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 range indicated in Clause 8.8.2.

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 / reclaimer 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.

8.7.9.1 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.

8.7.9.2 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 8.7.11). **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.

8.7.10 Bituminous stabilising agent equipment

The bituminous stabilising agent shall be transported, stored and transferred using the recommended equipment and procedures described in *Austrroads' Bitumen Sealing Safety Guide* (2nd Edition) and *Austrroads' Bituminous Materials Safety Guide*. Notwithstanding this the bituminous stabilising agent shall also be transported, stored and transferred as specified in MRTS17 *Bitumen*. Further bituminous stabilising agent equipment shall also comply with the requirements given in Clause 8.7.19.

8.7.11 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 / reclaimer with at least the attributes stated in Clause 8.7.19.

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

Foaming agent should be added to bitumen tanker at last 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 reclaimer / stabiliser. Mixing shall be to the full depth of stabilisation to ensure mixing to the lower reference level whereby meeting the requirements of Clause 8.8.4.1. 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.

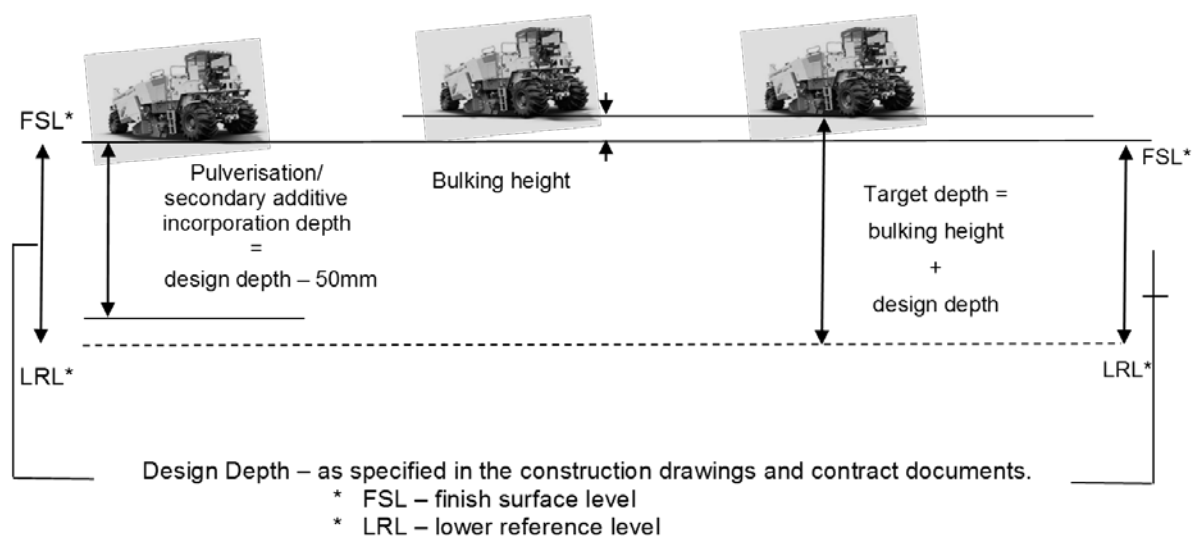
The bitumen shall be incorporated at a temperature between 180°C and 190°C. Bitumen temperature shall not fall below 170°C throughout the bitumen incorporation process.

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 / reclaimer.

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 6**

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 8.7.11 – Target depth sketch



Pulverisation / secondary additive incorporation	Bulking after secondary additive incorporation	Target depth / 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 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 reclaimer / stabiliser to reach the LRL shall account for the additional bulking above the FSL.

8.7.12 Initial compaction and trimming after completion of stabilisation but before final 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 / reclaimer. 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. Further final compaction and trimming of all materials shall be completed within the allowable working time of each material (refer to Clause 8.4).

The stabilised layer shall be compacted to the standard stated in Clause 8.8.3.

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 8.8.3.

8.7.13 Trimming after final compaction

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

Pad foot marks shall be removed to prevent differential compaction and the pad foot marks reflecting to the surface after trafficking. The Contractor shall ensure that no marks caused by a pad foot roller shall remain on the surface. A minimum cut to -100mm from the Finished Surface Level (FSL) of the stabilised layer is required to completely remove the pad foot marks and not create a thin false layer when the material is reinstated.

When removing 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.

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.

8.7.14 Period for compaction and trimming

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

8.7.15 Construction joints

8.7.15.1 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.

8.7.15.2 Longitudinal joints

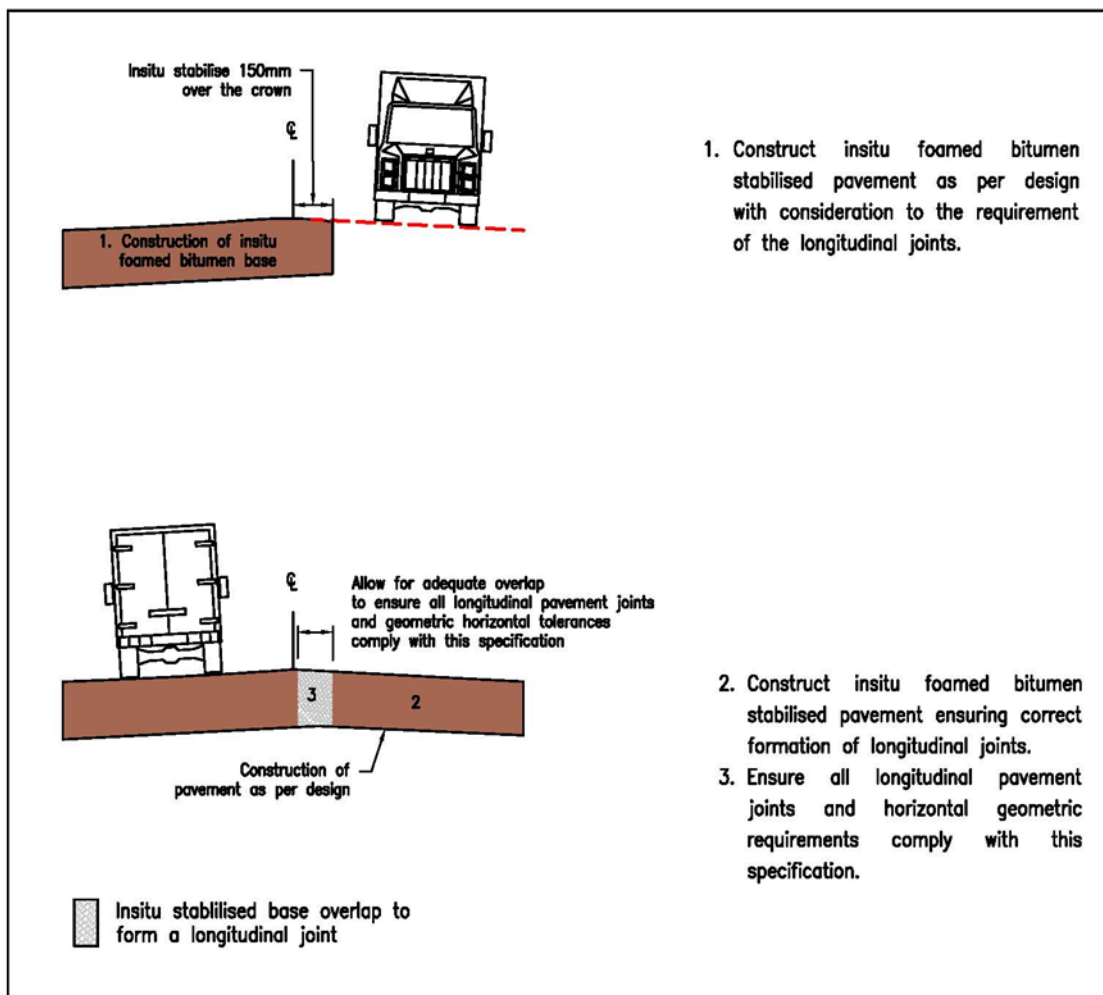
Longitudinal joints shall not be located in the through traffic wheel paths.

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.

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 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 8.8.4.

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 8.7.15.2 – Typical construction process



8.7.15.3 Transverse joints

For transverse joints that are not made during the allowable working time (refer to Clause 8.4) of the material stabilised, the adjoining section previously stabilised shall be cut back by the greater of 1.5 m and the distance to a point where the stabilised material complies with this Technical Specification. The cutback material shall be removed, disposed of and replaced in accordance with this Technical Specification. After this material has been replaced with material that complies with the requirements of Clause 6.1, the material shall then be included in the stabilisation process of the adjoining section to be stabilised.

Alternatively, with approval by the Administrator, the adjoining stabilised section shall be remixed using a stabiliser / reclaimer by the greater of 1.5 m or the length ordered by the Administrator.

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 work items.

8.7.16 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 the occasional application of a uniformly applied fine mist, until a bituminous surfacing with a cover aggregate is placed as described in Clause 8.7.17 has been applied. Water shall be applied in a manner such that slurring of the surface, pavement instability, pavement erosion flushing and/or leaching of the stabilising agents are all avoided.

8.7.17 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.

8.7.18 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.

8.7.19 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 8.7.19.

Table 8.7.19 – Minimum requirements and numbers of particular plant

Description	Minimum requirement for each piece of plant	Minimum number of units
Reclaimer / stabiliser with foamed bitumen spray bar in mixing chamber or Integrated spreader / reclaimer / 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 or stabiliser / reclaimer. 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.	1

Description	Minimum requirement for each piece of plant		Minimum number of units
	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 reclaimer width stabilisation. h) Bitumen temperature gauges to verify bitumen temperature. i) Capable of supplying both water and additive such that incorporation rates can be varied across the full width of the stabilising box and incrementally across the box. j) Computer controlled bitumen flow meter for verification of applied additive content, and k) Calibrated and capable of spreading varying widths (if integrated spreader / reclaimer / stabiliser).		
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 200-300 mm: 21 tonne	1
Vibrating smooth drum roller	For layer thickness < 200 mm: 18 tonne	For layer thickness 200-300 mm: 18 tonne	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 in order to achieve specified relative compaction.

When compacting an insitu stabilised layer thickness of 200-300 mm a padfoot roller is required for initial compaction. After the removal of padfoot marks (Clause 8.7.13), care needs to be taken by the Contractor to ensure that the final smooth drum rolling does not de-compact (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.

8.7.20 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 10°C, or
- f) when the air temperature, measured in the shade, exceeds 40°C.

8.8 Product standards

Compliance testing of the pavement shall be undertaken for each lot. Where a process standard is specified, the compaction requirements in this clause apply to trial sections but not to other sections. Where a product standard is specified, the compaction requirements in this clause apply to all sections / lots.

8.8.1 Stabilising agent content

8.8.1.1 Ordered spread rate

At least 14 days prior to the commencement of stabilisation works, the Administrator will confirm or adjust the estimated bituminous stabilising agent content and the estimated secondary stabilising agent content stated in Clause 11 of Annexure MRTS07C.1.

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

Milestone

8.8.1.2 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 reclaimer / 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 11 of Annexure MRTS07C.1.

The actual bituminous stabilising agent spread rate shall be within $\pm 10\%$ of the ordered bituminous stabilising agent spread rate defined in Clause 8.8.1.1.

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

8.8.1.3 Actual secondary stabilising agent content

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 $\pm 10\%$ of the ordered secondary stabilising agent spread rate defined in Clause 8.8.1.1.

8.8.2 Relative moisture ratio

The Relative Moisture Ratio (RMR) prior to incorporation of the bituminous additive shall be as stated in Clause 6 of Annexure MRTS07C.1 or, where not so stated, shall not be less than 55% nor greater than 75% of OMC under standard compaction (refer Clause 9.8).

8.8.3 Compaction standard

The characteristic value of the relative compaction results shall be as stated in Clause 7 of Annexure MRTS07C.1 or, where not so stated, shall not be less than 102% (standard compaction).

8.8.4 Geometrics

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 8.8.4.1 to Clause 8.8.4.4.

8.8.4.1 Geometrics, thickness

8.8.4.1.1 General

At any point of the completed stabilised layer, the measured actual stabilised layer thickness shall be within tolerance given in Clause 8.8.4.2.1 of the design depth specified in Clause 11 of Annexure MRTS07C.1.

8.8.4.1.2 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.

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 for each test location
- b) the position and measurement of the finished surface level for each test location (shall be recoverable in the horizontal plane to an accuracy of ± 50 mm)
- c) the actual stabilised layer thickness record obtained by subtracting the finish surface level measurement from the lower reference level measurement for each test location, and
- d) the characteristic value calculated in accordance with Clause 12 of MRTS01 *Introduction to Technical Specifications*, of all stabilised layer thickness measurements for each lot.

8.8.4.2 Geometrics, vertical tolerances

8.8.4.2.1 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 8.8.4.2.1. If no such indication is given, the primary tolerance shall be Alternative B (-5 and + 15 mm).

Table 8.8.4.2.1 – Primary tolerance for stabilised layers

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

In all cases, a primary tolerance shall also apply for the thickness of the completed stabilised layer (refer to Clause 8.8.4.1.1).

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

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

- a) height of collimation 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 9.6), 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 11 of Annexure MRTS07C.1.

8.8.4.3 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 8.8.4, 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.

8.8.4.4 Additional tolerances

8.8.4.4.1 General

Where required by Clauses 8.8.4.4.2, 8.8.4.4.3 and 8.8.4.4.4, 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.

8.8.4.4.2 Deviation from a straight-edge

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

The deviation from a 3 m long straight-edge placed anywhere on the surface of a layer shall not exceed the limits 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 8.8.4.4.2. If no limit is given, it shall be Alternative D (5 mm).

Table 8.8.4.4.2 – Tolerance for deviation from a straight-edge

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

8.8.4.4.3 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.

8.8.4.4.4 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 1.94 m/km.

Calculation of road roughness should accurately represent the ride quality of the complete pavement. It is generally accepted that the inclusion of other road features within the pavement are likely to reduce ride quality.

In accordance with the test method adopted, these features are required to be noted during roughness testing. The following features are typically allowed to be excluded from the ride quality assessment:

- roundabouts
- railway lines
- bridge joints, and
- inspection pit covers (for example, drainage manholes).

The Contractor should 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.

Under no circumstances should pavement features (including joints) or signalised / unsignalised intersections (other than roundabouts) be excluded from the ride quality assessment without the express agreement of the Administrator.

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 9.6)
- c) the surface spread rate of the secondary stabilising agent (Clause 9.7), 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 and 8.6 shall be met and the requirements of Clause 8.7 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.

The requirements of Clauses 8.5.3, 8.7 and 8.8 shall also 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 Surface evenness

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

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

9.5 Compaction

Where construction has been carried out using product standards, the compaction standard for each lot shall be represented by the characteristic value of the relative compaction results.

The characteristic value shall be calculated as stated in Clause 12 of MRTS01 *Introduction to Technical Specifications* using the individual relative compaction results determined from testing each lot.

The locations of all samples taken for the determination of reference density, insitu dry density and relative compaction shall be at the same offset and positioned one metre longitudinally in a direction opposite to the travel of the stabiliser or stabiliser / reclaimer from the location of samples taken to determine the corresponding laboratory reference density.

Sampling of stabilised materials to determine the laboratory reference density as detailed in Test Method Q142A shall take place after the final mixing run, but prior to the commencement of compaction of the stabilised material.

The relative compaction of the stabilised material, as detailed in Test Method Q140A, is stated in Clause 9 of Annexure MRTS07C.1. If it is not so stated, it shall be determined using the ratio of the compacted dry density to the maximum dry density. The relative compaction shall be determined for the entire thickness of the stabilised layer.

9.5.1 Reference density laboratory compaction time

Following sampling, reference density testing shall be completed to a stage where laboratory compaction has been completed within three hours of the commencement of bituminous stabilisation for the corresponding lot. Additionally, following sampling, oven drying of any specimens used to determine the moisture content shall commence within three hours of the commencement of bituminous stabilisation for the corresponding lot.

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

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

9.6 Bituminous stabilising agent content

The bituminous stabilising agent content shall be determined by either the average of the measured application rate, measured by the flow meter onboard the stabiliser or reclaimer / stabiliser, or by the average of the tanker dipping readings measured at the start and end of each run as specified in Clause 11 of Annexure MRTS07C.1.

In all cases, the bituminous stabilising agent content shall be within the allowable tolerance specified in Clause 8.8.1.2. Further results of all dipping tests recorded and included in the quality records shall be reported to the Administrator. This shall be done irrespective of the method used to determine the bituminous stabilising agent content.

The results of all dipping tests 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) the quantity of bitumen in the tanker at the start of the run
- f) the quantity of bitumen in the tanker at the midpoint of the run (if the length of the run exceeds 500 m)
- g) the quantity of bitumen in the tanker at the end of the run
- h) the quantity of bitumen incorporated into the pavement between each dip reading (if the length of the run exceeds 500 m)
- i) the quantity of bitumen incorporated into the pavement for the entire run
- j) the temperature of the bitumen in the tanker during stabilisation
- k) the average bitumen application rate, and

l) expansion ratio and half-life.

All records shall be such that the actual bitumen application rate for each stabilisation run shall be calculated at 15°C 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 9.6 using the following formula:

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

or

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

where:

V_B = volume of bitumen at 15°C (litres)

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

F_T = factor in high temperature from Table 9.6.

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

$$M_B = V_B \times 1.04$$

or

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

where:

M_B = mass of bitumen at 15°C (kg)

V_B = volume of bitumen at 15°C (litres).

Table 9.6 – Equivalent volumes at 15°C of 1 litre of bituminous material measured at higher temperatures

Temp (°C)	Factor	Temp (°C)	Factor	Temp (°C)	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

Temp (°C)	Factor	Temp (°C)	Factor	Temp (°C)	Factor
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

9.7 Secondary stabilising agent content

The secondary stabilising agent content 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 8.8.1.3.

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 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.

9.8 Relative moisture ratio

The relative moisture ratio of the stabilised material shall be determined in accordance with Q250. The moisture sample locations shall be identical to the reference density testing locations for compaction testing. The moisture samples shall be extracted immediately following the final bituminous stabilising agent incorporation by the stabiliser or reclaimer / stabiliser and prior to the addition of any additional moisture for the purposes of compaction and trimming. The relative moisture ratio shall be calculated using the individual moisture content compared to the optimum moisture content for each corresponding location (refer Clause 9.5). As a minimum frequency, the relative moisture ratio of stabilised 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 10 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 RMS Test Method T198 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 pavement layer complies with Clauses 9.5, 9.6, 9.7 and 9.8. 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.

RMS Test Method T198 provides a method for using either a pneumatic-tyred static roller or a 10,000 L loaded water tanker for proof rolling.

9.10 Acceptance

Construction shall not proceed until the Administrator has received the results of all compliance testing for all lots constructed in the preceding two work periods except where less than two work periods have passed since the commencement of stabilisation works. **Hold Point 7** The Contractor shall allow at least one working day for a response from the Administrator.

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

10 Supplementary requirements

The requirements of MRTS07C *In situ Stabilised Pavements Using Foamed Bitumen* are varied by the supplementary requirements given in Clause 13 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 pavement materials for shape correction and new material to replace unsuitable material	5,000 tonne
Construction of insitu stabilised pavements using foamed bitumen	The area (in m ²) 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	500 m

Table A2 – Minimum material testing frequencies for additional material for shape correction and new material to replace unsuitable material

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 1, Type 2, Type 3 or Type 4 unbound material refer to MRTS05 For RM001 material refer to MRTS35			
Petrographic Analysis	ASTM C295				
Wet strength	AS 1141.22				
Wet/dry strength variation	AS 1141.22				
Degradation factor	Q208B				
Product Testing					
Crushed particles	Q215				
Flakiness index	Q201				
California Bearing Ratio	Q113A				
Particle size distribution (grading)	Q103A				
Fines ratio	Q103A				
Liquid limit	Q104A				
Plastics limit and plasticity index	Q105				
Linear shrinkage	Q106				
Sulfate content	AS 1289.4.2.1				
Sulfate content (water)	AS 1289.4.2.1	1 per water source			

Table A3 – Minimum construction standard testing

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 m ²	4 tests per lot	1 test per 1000 m ²	2 tests per lot
Relative moisture ratio	Q250	1 test per 500 m ²	4 tests per lot	1 test per 1000 m ²	2 tests per lot
Surface spread rate of secondary stabilising agent	Q719	1 per spreading run			
Slaking spot checks (quicklime)	Clause 8.7.7	1 per 25 linear m			
Foamed bitumen properties (half-life and expansion ratio)	Clause 8.7.11	1 per bitumen tanker within the first 35 m of bitumen incorporation pass			
Surface spread rate of bituminous stabilising agent	Clause 9.6	1 per bitumen incorporation run			
Geometrics 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	T198	Refer to Clause 9.9			

Table A4 – Minimum geometrics testing

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	Survey	Each 20 linear metres - measured at all shoulder edges, lane lines and other changes in grade across the pavement			
Geometrics vertical	Survey				
Geometrics thickness	Survey	1 per 20 linear m		1 per 50 linear m	
Deviation from a straight-edge	Q712	a) within lane: 1 per 20 linear metres 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 metres 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 metres – measured for all crossfalls shown in the design documentation at the point of testing			
Surface evenness	Q708B, Q708C or Q708D	Refer to Clause 9.4.2			

