



Pavement Rehabilitation

Road Building Model Specification

July 2022



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Main Roads Western Australia (Main Roads WA) specifications and guidelines and the Institute of Public Works Engineering Australia, Western Australia Division (IPWEA-WA) **Local Government Guidelines for Subdivisional Development** have been heavily referenced in preparing this road building specification.

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Document Updates

The **Pavement Rehabilitation** road building model specification was originally published in July 2022. Subsequent document updates are shown in the table below:

Date	Updates	Contents and purpose	Edition No.	Amended Modules

Each update will be listed above with the model specification, as amended, available from the WALGA website.

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1. SCOPE

This road building specification details the requirements for supply of material and delivery of **Pavement Rehabilitation by Cold Planing and In Situ Stabilisation** to the profiles, levels and surface finishes specified or as shown in the Contract Drawings. Cold planing consists of the removal of bituminous surfacing from pavement using specialised plant. In situ stabilisation consists of supply, mixing, placing, compacting and finishing of pavement incorporating one or more chemical stabilising agents. Both sub-base and basecourse pavement layers are included in the scope.

Specifications for the supply of unmodified and centrally stabilised (plant-mix) pavement materials are provided in the Western Australia Local Government Association (WALGA) **Granular Pavement Materials** road building model specification.

Specifications for the delivery of construction using granular pavement materials are provided in the WALGA **Earthworks and Pavement Construction** road building model specification.

2. REFERENCES

Australian Standards and Main Roads Western Australia (Main Roads) test methods are referred to in abbreviated form (e.g. AS 1234 or WA 123). For convenience, the full titles are given below.

Equivalent Australian Standard test methods may be substituted for the Main Roads test methods quoted in the Specification.

Australian Standards

AS 1160	Bituminous Emulsions for the Construction and Maintenance of Pavements
AS 1672	Limes and Limestones
AS 2008	Bitumen for Pavements
AS 2350	Methods of Testing Portland, Blended and Masonry Cements
AS 3972	General Purpose and Blended Cements
AS 5101	Methods for Preparation and Testing of Stabilized Materials

Austroroads Test Methods

AG:PT/T301	Determining the Foaming Characteristics of Bitumen
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Main Roads Test Methods

WA 0.1	Random Sample Site Location
WA 110.1	Moisture Content: Convection Oven Method
WA 110.2	Moisture Content: Microwave Oven Method
WA 115.1	Particle Size Distribution: Sieving and Decantation Method
WA 133.1	Dry Density/Moisture Content Relationship: Modified Compaction Fine and Medium Grained Soils
WA 133.2	Dry Density/Moisture Content Relationship: Modified Compaction Coarse Grained Soils
WA 134.1	Dry Density Ratio (Percent)
WA 136.1	Moisture Ratio (Percent)
WA 143.1	Determination of the Unconfined Compressive Strength of Laboratory Compacted Specimens
WA 311.1	Texture Depth
WA 313.2	Surface Shape using a Straightedge
WA 324.2	Determination of Field Density: Nuclear Method
WA 330.1	Layer Thickness: Direct Measurement

WA 717.1	Dispersion of Bitumen in Soil
WA 730.1	Bitumen Content and Particle Size Distribution of Asphalt and Stabilised Soil: Centrifuge Method
WA 910.1	Chlorides and Total Soluble Salts in Soil and Water

Australian Technical Infrastructure Committee Specifications

SP43 Cementitious Materials for Concrete

WALGA Road Building Specifications

Aggregate and Cementitious Binders
 Earthworks and Pavement Construction
 Erosion Control and Foreshore Protection
 Granular Pavement Materials
 Pavement Rehabilitation
 Sprayed Bituminous Surfacing
 Supply and Laying of Asphalt Road Surfacing (IPWEA / AAPA)
 Supply of Recycled Road Base (IPWEA / WALGA)

Acts and Regulations

Aboriginal Heritage Act 1972
 Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007
 Environmental Protection Act 1986
 Environmental Protection Regulations 1987
 Environmental Protection (Clearing of Native Vegetation) Regulations 2004
 Health (Pesticide) Regulations 2011
 Main Roads Act 1930
 Occupational Safety and Health Act 1984
 Occupational Safety and Health Regulations 1996
 Rail Safety National Law (WA) Act 2015
 Road Traffic Code 2000
 Wildlife Conservation Act 1950

3. DEFINITIONS

The following particular definitions shall apply:

- “basecourse” shall be the material placed in the uppermost layer of the pavement providing the bulk of the structural capacity and upon which a surfacing may be applied.
- “cold planing” shall be the process of removing asphalt material from the surface of a pavement at a controlled depth using a self-propelled machine. “cold milling” and “profiling” shall have the same meaning.
- “half-life” shall be the time in seconds required for foamed bitumen to collapse from maximum expansion to one-half of the maximum expansion.
- “Lot” shall be a continuous section of the works having a uniform appearance, delivered using homogeneous materials and consistent processes and completed at the same time. Shall be limited to no more than one day’s production.
- “pavement” shall be the portion of the road, excluding shoulders, constructed above the subgrade for the purpose of supporting vehicular traffic.
- “stabilisation” shall be the incorporation of supplemental material or materials into a pavement layer for the purpose of improving the engineering properties.
- “sub-base” shall be the material placed between the subgrade and the basecourse to make-up the required pavement thickness (i.e. over-and-above basecourse) and/or to provide a working platform.

4. PRODUCTS AND MATERIALS

4.1 Cement

Cement used for stabilisation of pavement layers shall comply with the requirements of AS 3972 and SP43. Unless otherwise specified by the Local Government, the cement shall be Type LH. High-early strength cement, Type HE, shall not be used in the works. Cement shall be sufficiently dry to flow freely during application.

Sampling and testing of cement shall be in accordance with AS 2350.

The Contractor shall use cement in approximately the chronological order in which it is delivered from the manufacturer. Transportation units and storage bins for bulk cement shall be weatherproof and shall be constructed so that there is no dead storage. Cement delivered in bags shall be stored in weatherproof structures having floors raised above the ground. Cement that is more than three months old shall not be used.

The Contractor shall arrange cement delivery and have on site bulk storage facilities. The Contractor shall be responsible for all arrangements in regard to the transfer of cement between delivery vehicles, on site bulk storage facilities and spreaders.

4.2 Lime

Lime used for stabilisation of pavement layers shall comply with the requirements of AS 1672. Unless otherwise specified by the Local Government, lime shall be hydrated lime or quicklime. Lime shall be sufficiently dry to flow freely during application.

The Contractor shall use lime in approximately the chronological order in which it is delivered from the manufacturer. Transportation units and storage bins for bulk lime shall be weatherproof and shall be constructed so that there is no dead storage. Lime delivered in bags shall be stored in weatherproof structures having floors raised above the ground. Lime that is more than three months old shall not be used.

The Contractor shall arrange lime delivery and have on site bulk storage facilities. The Contractor shall be responsible for all arrangements in regard to the transfer of lime between delivery vehicles, on site bulk storage facilities and spreaders.

4.3 Bitumen Emulsion

Bitumen emulsion used for stabilisation of pavement layers shall comply with the requirements of AS 1160. Unless otherwise specified by the Local Government, the bitumen emulsion shall be Grade ASS/170-60. Bitumen used in the manufacture of the emulsion shall be Class 170 and shall meet the requirements of AS 2008. Contractors shall nominate the source of supply of bitumen emulsion with their quotation.

4.4 Foamed Bitumen

Bitumen used to produce foamed bitumen for stabilisation of pavement layers shall be Class 170 and shall meet the requirements of AS 2008. Unless otherwise specified by the Local Government, cutback bitumen and modified binder shall not be used to produce foamed bitumen. Contractors shall nominate the source of supply of bitumen with their quotation.

Foamed bitumen for stabilisation of pavement layers shall have minimum expansion of ten (10) times the original volume and minimum half-life of six (6) seconds in accordance with AG:PT/T301.

4.5 Water

Water used for stabilisation, construction and curing of pavement layers shall contain less than 3000 mg/L of total soluble salts in accordance with WA 910.1.

The Contractor shall ensure water is free from organic matter and other impurities that may deleteriously affect the setting, hardening or strengthening of stabilised pavement layers.

4.6 Raised Pavement Markers

Temporary raised pavement markers shall be either “Swarovski Mini - star art .3091/22/001”, Road Marking Supplies Standup Temporary Raised Pavement Marker, Stimsonite Temporary Chip-seal or equivalent products.

5. PLANT AND EQUIPMENT

5.1 Profiling Machine

Cold planing shall be carried out using a profiling machine that has been specifically designed for removing bituminous surfing from pavement surfaces. Profiling machines shall be equipped with automatic profile control including the ability to vary the depth of cut and transverse crossfall during cold planing operations.

Unless otherwise specified by the Local Government, profiling machines shall be fitted with a “fine” milling drum with maximum tool spacing of 8 mm. The milling drum shall be capable of producing a consistent surface finish.

5.2 Stabilising Machine

Stabilisation shall be carried out using a stabilising machine that has been specifically designed for cutting, pulverising, mixing, adding water and placing of pavement material. Unless otherwise specified by the Local Government, use of plant other than a stabilising machine, such as graders, profilers and agricultural mixing implements, is not permitted.

Stabilising machines shall be capable of maintaining constant rotor and forward speeds and be capable of producing a uniformly mixed material to the specified depth. The minimum power to mixing drum width ratio for stabilising machines shall be 130 kW/m.

Stabilising machines shall have the following features:

1. drum that rotates upwards into the direction of advance fitted with bullet teeth cutting tips;
2. mixing chamber capable of stabilising to the required depth;
3. level control system capable of controlling the stabilising depth to within ± 10 mm of the required depth during continuous operation;
4. provision for adding water automatically through a controlled pumping and metering system capable of increments of 0.1 L in relation to travel speed and mass of material being stabilised;
5. system of nozzles that promote a uniform application of water and/or fluid stabilising agent(s) across the full width of treatment; and
6. adjustable exit gate.

When a fluid stabilising agent is used, the stabilising machine shall also have the following features:

7. fluid injection system; and
8. flow meter capable of determining the amount of fluid added in relation to the forward speed and mass of material being stabilised to $\pm 0.2\%$ by volume.

When foamed bitumen stabilising agent is used, the stabilising machine shall also have the following features:

9. test nozzle capable of producing a replicate sample of the foamed bitumen being injected into the mixing chamber;
10. electrically heated, self-cleaning injection system that promotes a uniform application of foamed bitumen across the full width of treatment; and
11. bitumen pumping and transfer system capable of sucking bitumen from a road tanker and fitted with a non-return valve (or similar).

5.3 Stabilising Agent Spreader

Spreading of stabilising agents shall be carried out using a spreader specifically designed for consistently distributing dry stabilising agents to pavement surfaces. The spreader shall be capable of accurately controlling the spread rate relative to the forward speed to $\pm 10\%$ by mass of the specified application rate. The spreader shall be equipped with gates to vary the width of spread and with electronic weigh scales for product use verification.

Spreaders shall have the following features:

1. dust curtains to minimise the generation of airborne particles; and
2. release filters in the case of pressurised lime or cement powder.

5.4 Road Broom or Sweeper

The road broom/sweeper shall be mechanical or vacuum type capable of removing loose soil, aggregate and bituminous surfacing material from the pavement surface.

Road brooms and sweepers shall be fitted with a dust suppression system making use of water. Such dust suppression shall be used at all times during sweeping operations.

6. COLD PLANING

Cold planing shall be to the dimensions as specified in ANNEXURE A or as detailed in the Contract Drawings. Where necessary, the Local Government will order any variations to the dimensions specified.

The longitudinal grade shall follow the general grade of existing kerbs or gutters and/or other specified controlling factors at the location. Unless precluded by specific conditions on site, profile control shall be performed automatically.

Transverse levels will generally be established by the specification of depth of cut carried out whilst advancing at the prevailing longitudinal grade. The depth of cut and transverse crossfall shall be adjusted as required during profiling.

Unless otherwise specified by the Local Government, each day's profiling shall be completed transversely across the full pavement width. Each day's profiling shall be completed prior to commencement of work in another area.

6.1 Cold Planing Operation

The profiling machine shall be operated at a controlled forward speed appropriate for the works.

The use of water during profiling and sweeping of the surface shall be limited to the suppression of dust. Where a profiling machine or broom is moving slowly, such as at the start and end of runs, excess water shall not be applied to the surface.

6.2 Surface Finish

The profiled surface shall be uniform in texture, appearance and general finish including perimeter areas. The surface texture, determined in accordance with WA 311.1, after sweeping shall meet the requirements shown in Table 1. In addition, the groove depth at any point on the profiled surface after sweeping shall be no more than 5 mm, as depicted in Figure 1.

Table 1 Surface Texture Requirements

Location within Cold Planed Surface	Texture Depth	Sand Patch Diameter (50 cc sand)
Average	< 2.0 mm	> 180 mm
Any location	\leq 2.3 mm	> 170 mm

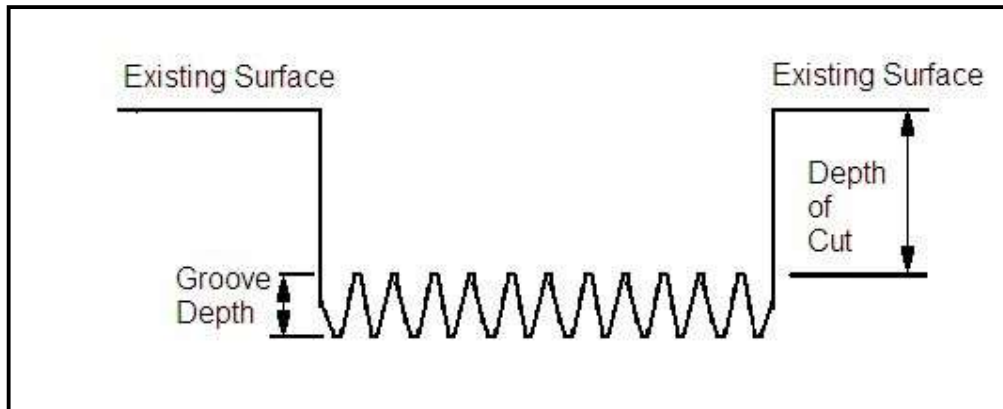


Figure 1 Depiction of Groove Depth & Depth of Cut

The Contractor shall ensure that the perimeter of the profiled areas are suitable for resurfacing. Generally, the final cut edge of the existing pavement surface shall be straight and free of all loose material.

Any bituminous surfacing remaining after cold planing that is not securely bonded to the underlying pavement shall be removed. The profiled surface shall be swept free of all dust, loose material and foreign matter whether or not resulting from profiling operations.

The average depth of cut shall be within ± 3 mm of the depth specified. Where the depth of cut penetrates multiple wearing course layers, the final cut edge of each layer shall be stepped back to allow for a construction overlap of 150 mm. Where the depth of cut penetrates structural layers, the final cut edge of each layer shall be stepped back to allow for a construction overlap of 500 mm.

6.3 Surface Features

6.3.1 Bridge Decks and Approach Slabs

Profiling of bituminous surfacing on bridge decks and approach slabs shall be carried out with extreme caution. Damage to the underlying waterproof membrane, or to the concrete deck itself, shall be repaired in accordance with Clause 7. Prior to the commencement of profiling on bridge decks or approach slabs the Contractor shall confirm the depth of profiling with the Local Government and shall seek confirmation of any other special precautions to be taken.

6.3.2 Bridge Expansion Joints

The profiling machine shall not operate within 300 mm of the nearest edge of any bridge expansion joint. Removal of the nominal 300 mm of bituminous surfacing adjacent to the expansion joint shall be by handwork. Bridge expansion joints shall be covered or protected such that profiled material does not enter the expansion joint.

6.3.3 Gullies and Manholes

The depth of cut adjacent to and around road furniture such as gully pits and manhole covers shall be as shown in the Contract Drawings or as otherwise specified by the Local Government. Handwork may be required. Gully grates shall be covered or protected such that profiled material does not enter the gully pit.

6.3.4 Kerbing

Profiling shall be to the edge of the concrete kerbing or edge of the trafficked lanes if no kerbing exists. Kerbing damaged as a result of profiling shall be removed and replaced at no cost to the Local Government.

6.3.5 Raised Pavement Markers

The Contractor shall be responsible for the removal and disposal of raised pavement markers, both permanent and temporary, prior to cold planing. The pavement markers shall only be removed at the commencement of works for each day and shall be removed only from the section to be cold planed that day.

The Contractor shall also be responsible for the supply and installation of temporary raised pavement markers on all areas cold planed prior to the area being opened to traffic. The temporary raised pavement markers shall be as specified in Clause 4.6 and:

single-sided white.

placed on all lane and edge lines at 12 m intervals.

6.4 Rain

Unless otherwise specified by the Local Government, cold planing shall not commence when rain is forecast prior to application of the subsequent bituminous surfacing.

6.5 Removal of Profiled Material

Unless otherwise specified, all profiled material shall remain the property of the Local Government. The Contractor shall load the profiled material into Local Government or designated third-party transport vehicles. Where the Local Government relinquishes its ownership of the profiled material, it shall be disposed to an authorised waste disposal site.

7. SURFACE REPAIRS

7.1 General

The Contractor shall be responsible for repairing the surface of any road pavement or bridge deck exposed by profiling operations. Damaged areas shall be corrected prior to application of bituminous surfacing and/or opening to traffic.

Damage resulting from disregard or ignorance of the specified depth and width of cut, or any other specified requirements or explicit direction, shall be repaired at no cost to the Local Government.

7.2 Bridge Decks and Approach Slabs

7.2.1 Waterproof Membrane

Where damage to the bridge deck or approach slab is confined to the waterproof membrane immediately above the concrete surface, the membrane shall be replaced. Repairs shall generally comprise:

1. removal of debris and loose material;
2. application of a suitable bituminous tack coat over the damaged area;
3. laying of a suitable waterproof membrane such as "Bituthene 5000", or an equivalent product approved by the Local Government.

If the area damaged is greater than 10 m², alternative waterproofing methods shall be proposed for Local Government approval prior to undertaking the works.

7.2.2 Concrete Decking

Where damage to the bridge deck or approach slab extends into the concrete surface, the damaged concrete shall be patched before repair of the waterproofing membrane and application of the bituminous surfacing commence. Patching shall generally comprise:

1. removal of debris and loose material;
2. dampen the exposed repair area with water;
3. apply an approved concrete mix;
4. thoroughly compact using a hand tamper; and
5. cure the repair material to achieve sufficient strength before repair of the waterproof membrane.

Where steel reinforcement is visible, the Contractor shall immediately notify the Local Government so that an inspection can be conducted prior to undertaking repair works.

7.3 Shallow Pavement Damage (Depth < 20 mm)

Any area of road pavement exposed by cold planing operations shall be repaired prior to subsequent work or opening to traffic. Damage extending less than 20 mm into the pavement surface (shallow) shall be repaired as follows:

1. remove debris and loose material;
2. apply CRS170-60 bitumen emulsion uniformly at 0.8 to 0.9 L/m²;
3. apply cover aggregate (nominal 5 mm) evenly over the sprayed area; and
4. following the break of the emulsion, sweep and remove any excess cover aggregate.

7.4 Deep Pavement Damage (Depth > 20 mm)

Any area of road pavement exposed by cold planing operations shall be repaired prior to subsequent work or opening to traffic. Damage extending greater than 20 mm into the pavement surface (deep) shall be repaired as follows:

1. remove debris and loose material;
2. apply tack coat to the base and sides of the excavation;
3. inlay the repair area using an approved asphalt mix;
4. thoroughly compact using a hand tamper or vibrating plant compactor; and
5. blind the asphalt with nominal 5 mm aggregate to avoid pick up by traffic, where required.

8. TEMPORARY RAMPS

Where the profiled surface will be opened to traffic, temporary ramps shall be constructed at all gullies, manholes, valves, bridge expansion joints and transverse differences in level, prior to opening. Ramps are not required in areas subject to occasional use, such as a designated shoulder or breakdown area. Temporary ramps shall be constructed at a slope of 1:10, structure to profiled surface, using an approved asphalt mix delivered in accordance with the relevant specification.

9. IN SITU STABILISATION

9.1 General

In situ stabilisation includes the supply, mixing, placing, compacting and finishing of pavement materials in accordance with the Contract Drawings.

The pavement shall be constructed in accordance with the levels, grades and cross-sections shown in the Contract Drawings or as otherwise specified by the Local Government.

Transverse joints shall be offset from one layer to the next by not less than five metres. Longitudinal joints shall not be located in the wheel paths.

If a stabilised pavement layer does not meet all of the requirements of the Specification and has to be reworked, the Contractor shall repeat all the processes for stabilisation, without the addition of additional binder, at no cost to the Local Government.

9.2 Environmental Considerations

Transfer of all stabilising agents into spreaders shall be undertaken in such a manner to avoid contamination of the environment.

9.3 Climate Considerations

Spreading of dry stabilising agents on the road ahead of the stabilising machine shall not continue in windy conditions if the stabilising agent may become airborne.

No spreading of stabilising agents shall commence if it is raining or if rain is forecast before the stabilising agent(s) can be mixed into the pavement material.

9.4 Time Considerations

Mixing shall commence as soon as practicable after spreading of the stabilising agent(s). Mixing and compaction shall be completed within the maximum working times in Table 2.

Table 2 Maximum Working Time for Stabilising Agents

Stabilising Agent	Maximum Working Time (hours)
LH Cement	7
Quicklime	8
Hydrated Lime	8
Bitumen Emulsion	12
Foamed Bitumen	12

Where two or more stabilising agents are used, the maximum working time shall be the lowest of the times specified for the individual agents.

9.5 Preliminary Treatment

Ripping of the existing pavement or multiple passes of the stabilising machine is not permitted if degradation of the material is likely. Where ripping is specified, the depth shall not exceed the total depth to be stabilised.

9.6 Trial

The Contractor shall carry out a preliminary trial of the proposed stabilising operations for each combination of stabilising agent and pavement material. The trial shall demonstrate:

1. the effectiveness of the plant and equipment;
2. whether a single pass of the stabilising machine is adequate to achieve the specified mixing or whether pre-treatment is required;
3. the bulking factor for trimming to spoil and level tolerances;
4. the additional moisture required to achieve specified compaction; and

5. the rolling pattern required to achieve specified compaction.

The trial section shall be located within the first relevant pavement stabilisation Lot of the works. Prior to commencing pavement construction, the Contractor shall submit the trial methodology to the Local Government for approval no less than 48 hours prior to the planned start of works. The Contractor shall not significantly change the approved methodology without prior approval from the Local Government.

9.7 Surface Preparation

Prior to commencing in situ stabilisation, the Contractor shall complete the following preparatory activities:

1. the surface of the area to be stabilised shall be suitable to achieve final longitudinal and transverse shape (i.e., no excessive shoving, rutting, high spots, or low spots);
2. the work area shall be accurately pre-marked to the proposed longitudinal cut lines on the existing road surface;
3. level control shall be installed; and
4. record the location of all road markings that will be removed in the stabilising process, through the installation of off-set pegs (or similar) or survey pick-up.

Excessive high spots shall be corrected by pulverising or pre-treatment.

Material imported for the purpose of shape correction shall be spread such that it will achieve the design longitudinal and transverse shape. Material imported for the purpose of modifying the quality of existing material, modifying the longitudinal profile or modifying overall pavement thickness shall be spread evenly as a layer of uniform thickness.

Prior to importing material, the Contractor shall provide conformance certification to the Local Government no less than 48 hours prior to the planned transport.

9.8 Supply Of Stabilising Agents

Prior to commencing in situ stabilisation, the Contractor shall provide conformance certification for each Lot of stabilising agent to the Local Government no less than 48 hours prior to the planned start of works. As a minimum, the conformance certification shall include the following information:

1. Lot identification details including certification number;
2. Product identification;
3. Name of the supplier;
4. Lot number and date of manufacture; and
5. Date, time, and place of loading.

9.9 Dry Stabilising Agents

Where in situ stabilisation involves the incorporation of lime or cement, the pavement layer shall contain the proportion of lime or cement as a percentage of the dry mass of pavement material as shown in ANNEXURE A. The cement or lime shall be spread uniformly at a controlled rate over the area to be stabilised using a suitable spreader meeting the requirements of Clause 5.3.

The lime or cement spread rate shall be determined by either:

1. placing a canvas mat of one square metre in front of the spreader and measuring the mass of lime or cement deposited on the mat for each Lot; or
2. use of an on-board calibrated electronic weight scale system.

The lime or cement content (P) shall be calculated according to Equation 1:

$$P = \frac{M \times 100}{A \times T \times MDD} \quad \text{Equation 1}$$

where: *M* is the mass of lime or cement measured using a canvas mat or electronic scale;
A is the area over which the measured mass of lime or cement was spread;
T is the design thickness of the stabilised pavement layer; and
MDD is the maximum dry density (kg/m³) of the existing pavement material, prior to addition of the stabilising agent(s).

The lime or cement content shall be maintained in accordance with the tolerances in Table 3.

Table 3 *Dry Stabilising Agent Content Tolerance*

Method	Frequency	Tolerance (%)
Canvas mat (1 m ²)	Daily and/or start of each Lot	± 10
Electronic scale ¹	Daily and/or upon emptying spreader	± 10

Notes:

1) Reconciliation against bulk storage measurement or transport delivery docket.

Traffic, including construction traffic, shall not be permitted to travel over any area where dry stabilising agent(s) have been spread prior to mixing.

The Contractor shall provide the Local Government with daily records of lime and/or cement use and actual spread rates within 24 hours or prior to commencing the next day's works.

9.9.1 Slaking Of Quicklime

Slaking of quicklime shall be achieved using a purpose-built pressurised spray bar fitted to a water tanker. Slaking shall continue until no further reaction with additional water is visible and the slaked lime is completely converted to powdered form. Where slaking of quicklime is conducted adjacent to traffic, the Contractor shall ensure the visibility of passing traffic is not impaired by the slaking process (steam).

9.10 Wet Stabilising Agents

Where in situ stabilisation involves the incorporation of bitumen emulsion or foamed bitumen, the pavement layer shall contain the proportion of bitumen as a percentage of the dry mass of pavement material as shown in ANNEXURE A. The bitumen shall be dispersed uniformly at a controlled rate over the area to be stabilised using a suitable stabiliser meeting the requirements of Clause 5.2.

The bitumen content shall be maintained in accordance with the tolerances in Table 4.

Table 4 *Wet Stabilising Agent Content Tolerance*

Method	Frequency	Tolerance (%)
Flow meter	Continuous	± 0.2
Stabilising machine microprocessor	Daily and/or end of each Lot	± 0.1
Bulk storage reconciliation	Daily and/or upon emptying tanker	± 0.1

The Contractor shall provide the Local Government with daily records of bitumen use and actual spray rates within 24 hours or prior to commencing the next day's works.

Bitumen shall not be heated above the maximum temperatures set out in Table 5. Any bitumen heated above the maximum values in Table 5 shall not be used in the works and shall be disposed to an authorised waste disposal site at no cost to the Local Government.

Table 5 Temperature Limits for Bitumen

Bitumen Class	Maximum Storage Temperature (°C)		Spray Temperature (°C)	
	≥ 24 hours	< 24 hours	Minimum	Maximum
C170	125	175	175	195

For in situ stabilisation using foamed bitumen, the expansion and half-life of each bitumen tanker load shall be checked prior to use. The minimum expansion and the minimum half-life shall be as specified in Clause 4.4.

9.11 Mixing

9.11.1 Cut Depth

In situ stabilisation shall be undertaken to the depth specified in ANNEXURE A with a maximum variation from the specified depth of -5 mm and +15 mm. The depth of the cut shall be measured at 20 m intervals (longitudinally) on both sides of the stabilised layer.

9.11.2 Longitudinal Joints

Longitudinal joints between successive runs shall overlap by a minimum of 100 mm, taking care to control water and binder addition along the joints.

All joints shall be mixed, compacted and finished satisfactorily, so that the final surface does not have permeable or loose patches.

Longitudinal joints between in situ stabilised pavement and un-treated pavement shall not be located in wheel paths.

9.11.3 Transverse Joints

Transverse joints shall be established at the end of each in situ stabilising run. The transverse joint shall coincide with the position of the centre of the mixing drum and shall be clearly marked on site. To ensure continuity of the in situ stabilised layer, the next run shall be started no less than one (1) metre behind the mark.

9.12 Stabilising Agent Content

The stabilising agent content of the mixed material shall be as presented in ANNEXURE A, with consideration of the tolerances specified in Table 3 and Table 4. Double application of stabilising agents is not permitted and should be closely monitored and carefully controlled.

9.13 Construction Moisture

The characteristic moisture content ratio (CM_c) of the stabilised material shall be maintained in accordance with Table 6.

Sufficient water shall be added during the in situ stabilisation process to achieve and maintain the construction moisture content within the range set out in Table 6. Care shall be taken to prevent any portion of the work from excessive wetting.

The optimum moisture content (OMC) of the stabilised materials shall be determined in accordance with WA 133.1 or WA 133.2, as applicable. The field moisture content of the stabilised material shall be determined in accordance with WA110.1 or WA110.2 to confirm compliance with Table 6.

Table 6 Construction Moisture Content Limits

Stabilising Agent	Characteristic Moisture Content Ratio (%)
Lime or cement	90 – 110
Bitumen emulsion	70 – 85 (excl. emulsion)

Stabilising Agent	Characteristic Moisture Content Ratio (%)
	85 – 100 (incl. emulsion)
Foamed bitumen	85 - 100

The Contractor is responsible for achieving and maintaining the characteristic moisture content ratio (CM_c) by controlling the amount of water added during the mixing process. This shall include the use of an experienced operator following the stabiliser during mixing.

10. ACCEPTANCE

10.1 Surface Finish

Completed pavement layers shall be in a homogeneous, uniformly bonded condition with no evidence of layering, cracking, disintegration or surface tearing.

The finished surface shall appear as a stone mosaic interlocked with fine material and shall be dense, even textured and tightly bonded. Accumulation of fines on the surface shall be avoided.

10.2 Surface Width

The outer top edge of each pavement layer, measured at any location, shall lie within -0 mm to +100 mm of the position shown in the Contract Drawings.

10.3 Surface Shape

The pavement surface shall not deviate by more than 10 mm from a 3-metre straight edge, measured in any direction and placed at any position.

For widenings, the cross fall measured at right angles to the road centreline shall be within ±0.5% of the existing cross fall, or within ±0.5% of any cross fall detailed in the Contract Drawings.

10.4 Surface Level

The level of the completed pavement surface, measured at any location, shall lie within -20 mm to +5 mm of the position shown in the Contract Drawings.

10.5 Compaction and Dryback

Each pavement layer shall be compacted to the minimum Characteristic Dry Density Ratio (R_c) shown in ANNEXURE B - COMPACTION AND DRYBACK. Each pavement layer shall be dried back to the maximum dryback Characteristic Moisture Content Ratio (CM_c) shown in ANNEXURE B - COMPACTION AND DRYBACK.

11. MAINTENANCE

The surface of compacted pavement layers shall be maintained in a manner to minimise dust generation, ravelling, erosion, deformation or any other damage. The surface shall be kept clean and free from contamination until subsequent pavement works commence.

Completed pavement layers shall be maintained to the specified standards of surface finish, width, shape, level, compaction and dryback until the bituminous surfacing is applied.

Watering shall be continued as necessary to prevent shrinkage cracking, dusting and loosening of the surface.

12. QUALITY CONTROL

12.1 General

The Contractor shall implement a quality management system to ensure material supplied under the Contract complies in all respects to the specified requirements for the Type of material purchased.

Testing shall be carried out in accordance with the relevant Main Roads or equivalent Australian Standard test method. Sampling methods shall be random and unbiased. Random site selection shall be undertaken in accordance with WA 0.1.

The frequency of tests shall always be adequate to demonstrate that the material complies with the Specification. As a minimum, testing frequencies shall be as shown in Table 8 and Table 9. Prior to supply, the Contractor shall certify that the material complies in all respects with the specified requirements and shall provide National Association of Testing Authorities, Australia (NATA) endorsed test certificates to demonstrate compliance.

Unless otherwise specified, all testing shall be performed by a Laboratory holding current NATA accreditation for the methods undertaken. NATA accreditation shall be maintained until the completion of the Contract. All test reports shall be NATA endorsed by a current approved signatory for the Laboratory conducting the testing.

The Contractor shall allow, or cause to allow, the Local Government ready access to the quarry, pit, production and/or manufacturing site to inspect the works and/or to collect material samples.

12.2 Density Testing

Unless otherwise specified by the Local Government, density shall be measured in situ using a nuclear moisture/density meter in accordance with WA 324.2. Nuclear moisture/density meters shall be calibrated in accordance with WA 135.1 on standard blocks. All measurements shall be made using the direct transmission mode at the maximum depth that can be accommodated within the layer.

For materials with in situ densities less than 1.4 t/m³ or greater than 3.05 t/m³, density shall be measured using sand replacement in accordance with WA 324.1.

Where the pavement material is stabilised or modified with Portland Cement, the maximum dry density determinations shall be commenced two (2) hours after mixing is complete and shall be completed within a further two (2) hours. If Low Heat (LH) Cement or Lime is used for the stabilisation or modification, these determinations shall be commenced three (3) hours after mixing is complete and shall be completed within a further three (3).

The conformance of every Lot of work under the Contract with respect to density shall be determined by comparing the characteristic dry density ratio (R_c) of the Lot to the limit specified in the Specification. The characteristic dry density ratio (R_c) shall be calculated as shown in Equation 2.

$$R_c = R - (k \times s) \quad \text{Equation 2}$$

where: R is the mean of dry density ratio tests for the Lot being assessed, reported to the nearest 0.1%;
 k is the application specific multiplier presented in Table 7; and
 s is the standard deviation of dry density ratio tests for the Lot being assessed.

The mean of dry density ratio tests (R) for each Lot shall be calculated from no less than the number of sample site locations (n) specified in Table 7. Sample site selection shall be done in accordance with WA 0.1 and no portion of the works shall be excluded from testing.

Table 7 Application Specific Factors for Characteristic Value Determination

Works Component	Primary Distributors		District and Local Distributors		Access Streets	
	n	k	n	k	n	k
Sub-base	9	0.59	7	0.54	4	0.21
Basecourse	9	0.59	7	0.54	4	0.21

12.3 Moisture Content Testing

Unless otherwise specified by the Local Government, moisture content shall be measured using the oven method in accordance with WA 110.1. Where it is not practicable to apply the oven method, the microwave method (WA 110.2) may be used after a correlation between the oven and microwave methods has been determined for the material being measured.

The conformance of every Lot of work under the Contract with respect to moisture content shall be determined by comparing the characteristic moisture content ratio (CM_c) of the Lot to the limit specified in the Specification. The characteristic moisture content ratio (CM_c) shall be calculated as shown in Equation 3.

$$CM_c = M + (k \times s) \quad \text{Equation 3}$$

where:

- M is the mean of moisture content ratio tests for the Lot being assessed, reported to the nearest 0.1%;
- k is the application specific multiplier presented in Table 7; and
- s is the standard deviation of moisture content ratio tests for the Lot being assessed.

The mean of moisture content ratio tests (M) for each Lot shall be calculated from no less than the number of sample site locations (n) specified in Table 7. Sample site selection shall be done in accordance with WA 0.1 and no portion of the works shall be excluded from testing.

12.4 Frequency of Testing

Table 8 Minimum Testing Frequency for In Situ Stabilised Material

Method		Material Type	Minimum Frequency
AS 5101.3.1 or 5101.3.2	Lime content	Lime stabilised	1 : Lot
AS 5101.3.1 or 5101.3.2	Cement content	Cement stabilised	1 : Lot
WA 143.1	Unconfined compressive strength	Lime stabilised; cement stabilised; bitumen stabilised	1 : Lot
WA 730.1	Bitumen content	Bitumen stabilised	1 : Lot
WA 717.1	Bitumen dispersion	Bitumen stabilised	1 : Lot

Table 9 Minimum Testing Frequency for Pavement

Method		Material Type	Minimum Frequency
WA 115.1	Particle Size Distribution	Sub-base; Basecourse	2 : Lot
WA 134.1	Dry Density Ratio	Sub-base; Basecourse	n : Lot ¹
WA 136.1	Moisture Ratio (construction)	Sub-base; Basecourse	n : Lot ¹

Method		Material Type	Minimum Frequency
WA 136.1	Moisture Ratio (dryback)	Sub-base; Basecourse	n : Lot ¹
WA 313.2	Surface Shape	Sub-base; Basecourse	3 : Lot
WA 330.1	Layer Thickness	Sub-base; Basecourse	2 : 20 m

Notes:

- 1) Application specific n-value presented in Table 7.

13. REGULATORY REQUIREMENTS

The Contractor shall conform to all statutory and regulatory requirements concerning the environment, aboriginal heritage, wildlife conservation, dangerous goods, occupational safety and health, rail safety, and road safety.

ANNEXURE A - SCHEDULE OF WORKS

Road	Type of Works	Section <i>and</i> Lane(s) Description	Nominal Depth of Profiling (mm)			Comments, Special Precautions, etc.
			Road Pavement	Adjacent to Road Furniture	Bridge Deck <i>and</i> Appr. Slabs	

Cement stabilised pavement layers shall be constructed at the locations and with the parameters as shown in Table 10:

Table 10 *Cement Stabilised Pavements Schedule*

Road	Section		Depth of Stabilisation (mm)	Width of Stabilisation (m)	Cement Content (% by dry mass of Pavement Layer)
	From	To			
Sub-Base Layers					
Basecourse Layers					

Lime stabilised pavement layers shall be constructed with the parameters as shown in Table 11:

Table 11 *Lime Stabilised Pavements Schedule*

Road	Section		Depth of Stabilisation (mm)	Width of Stabilisation (m)	Equivalent Pure Lime Content (% by dry mass of Pavement Layer)
	From	To			
Sub-Base Layers					
Basecourse Layers					

Bitumen stabilised pavement layers shall be constructed with the parameters as shown in Table 12:

Table 12 *Bitumen Stabilised Pavements Schedule*

Road	Section		Depth of Stabilisation (mm)	Width of Stabilisation (m)	Bitumen Content (% by dry mass of Pavement Layer)
	From	To			
Sub-Base Layers					
Basecourse Layers					

ANNEXURE B - COMPACTION AND DRYBACK

Pavement layers shall be compacted to the densities shown in Table 13.

Table 13 Compaction of Pavement Layers

Pavement Layer	Minimum Characteristic Dry Density Ratio % (Rc)
Recycled or Stabilised Sub-Base	94%
Recycled Basecourse (final surfacing - sprayed seal)	96%
Recycled Basecourse (final surfacing - asphalt)	98%
Cement Stabilised Basecourse	96%
Lime Stabilised Basecourse	96%
Bitumen Stabilised Basecourse	96%

Basecourse or other pavement layers shall be dried back to the requirements shown in Table 14 prior to the application of bituminous binder or the construction of the overlying layer.

Table 14 Dryback of Pavement Layers

Material Type	Maximum Dryback Characteristic Moisture Content (DMc) as a Proportion of Optimum Moisture Content
Sub-Base	85%
Basecourse (final surfacing - sprayed seal)	85%
Basecourse (final surfacing - asphalt)	70%
Crushed Rock Base (all surfacing types)	60%