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## WALGA SPECIFICATIONS

# Appendix 7 - Pavement Rehabilitation by Milling and Recycling or Stabilisation

**Submitted to:**

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SPECIFICATION



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## GENERAL

### 1.0 SCOPE

1. The work under this specification comprises the following:
  - Removal of bituminous surfacing (typically asphalt) by cold milling
  - Recycling existing pavement
  - *In situ* Stabilisation of existing pavement

The work shall be in accordance with the details included at Annexure A, the Drawings, or as otherwise may be directed or varied by the Local Government Representative.

Acknowledgment: ***The use of Main Roads WA specifications and guidelines and the Institute of Public Works Engineering Australia (WA Division) Local Government Guidelines for Subdivisional Development are gratefully acknowledged as the basis for these specifications.***

### 2.0 REFERENCES

1. Australian Standards, MAIN ROADS Western Australia Standards and MAIN ROADS Western Australia Test Methods are referred to in abbreviated form (e.g. AS 1234, MRS 67-08-43 or WA 123). For convenience, the full titles are given below:

#### Australian Standards

AS 1141	Methods for Sampling and Testing Aggregates
AS 1160	Bitumen Emulsion for Construction and Maintenance of Pavements
AS 1289	Methods of Testing Soils for Engineering Purposes
AS 1672	Limes and Limestones for Building
AS 2008	Residual Bitumen for Pavements
AS 2350	Methods of Testing Portland and Blended Cements
AS 3705	Geotextiles - Identification, Marking and General Data
AS 3706	Geotextiles - Methods of Test
AS 3972	Portland and Blended Cement
AS 2187	Parts 1 and 2 - Rules of Storage, Transport and Use of Explosives

#### MAIN ROADS Publications

Road Note No 5	Interim Guide to Prediction of Pavement Moisture for Strength Assessment of Granular Basecourse and Sub-Base Materials
Road Note No 8	Statistically Based Quality Control for Density in Road Construction
Road Note No 9	Procedure for the Design of Flexible Pavements
6706-02-133	Water to be used in Pavement Construction

#### MAIN ROADS Test Methods

WA 0.1	Random Sample Site Location
WA 100.1	Sampling Procedures for Soil and Granular Pavement Materials
WA 105.1	Preparation of Disturbed Soil and Granular Pavement Material Samples
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 115.2	Particle Size Distribution: Abbreviated Method for Coarse Materials
WA 120.2	Liquid Limit: Cone Penetrometer Method
WA 122.1	Plasticity Index
WA 123.1	Linear Shrinkage
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
WA 136.1	Moisture Ratio (Percent)
WA 140.1	Maximum Dry Compressive Strength
WA 141.1	California Bearing Ratio
WA 143.1	Determination of the Unconfined Compressive Strength of Laboratory Compacted Specimens
WA 216.1	Flakiness Index
WA 220.1	Los Angeles Abrasion Value
WA 220.2	Los Angeles Abrasion Value of Crushed Limestone
WA 313.2	Surface Profile: Three Metre Straight Edge
WA 324.2	Dry Density and Moisture Content: 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 Soils and Water
WA 915.1	Calcium Carbonate Content

### MAIN ROADS Specifications

SPECIFICATION 503 BITUMINOUS SURFACING  
SPECIFICATION 504 ASPHALT WEARING COURSE  
SPECIFICATION 604 PAVEMENT MARKING  
SPECIFICATION 201 QUALITY SYSTEMS

### WALGA Specifications

WALGA SPECIFICATION GRANULAR PAVEMENT MATERIALS  
WALGA SPECIFICATION SPRAYED BITUMINOUS SURFACING  
WALGA SPECIFICATION EARTHWORKS AND PAVEMENT CONSTRUCTION

### IPEA/AAPA Specifications

IPEA/AAPA TECHNICAL SPECIFICATION FOR SUPPLY AND LAYING OF ASPHALT  
IPEA Local Government Guidelines for Subdivisional Development

### Acts and Regulations

Environmental Protection Act 1986  
Environmental Protection Regulations 1987  
Aboriginal Heritage Act 1972  
Wildlife Conservation Act 1950  
Environmental Protection (Clearing of Native Vegetation) Regs 2004  
Health Pesticide Regulations 1956  
Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007  
Occupational Safety and Health Act 1984  
Occupational Safety and Health Regulations 1996  
Rail Safety Act  
Road Traffic Code 2000  
Main Roads Act 1930



## **PRODUCTS AND MATERIALS**

### **3.0 RAISED PAVEMENT MARKERS**

1. The temporary raised pavement markers shall be either “Swarovski Mini - star art .3091/22/001” or Road Marking Supplies Standup Temporary Raised Pavement Marker, Stimsonite Temporary Chip-seal, or their equivalent, in accordance with MAIN ROADS SPECIFICATION 604 PAVEMENT MARKING.

### **4.0 BITUMINOUS REPAIR MATERIALS**

1. Where required under the provisions of Clause 17.0, bituminous and associated materials used in repair work shall comply with the WALGA Specification Sprayed Bituminous Surfacing and IPEA/AAPA Technical Specification for Supply and Laying of Asphalt.

### **5.0 CEMENT FOR PAVEMENT STABILISATION**

1. Cement for stabilisation of any pavement layer shall comply with the requirements of AS 3972. Unless otherwise specified the cement shall be Type LH. Sampling and testing of cement shall be in accordance with AS 2350. The cement shall be sufficiently dry to flow freely during application.

### **6.0 LIME FOR PAVEMENT STABILISATION**

1. Lime for stabilisation of any pavement layer shall comply with the requirements of AS 1672. Unless otherwise specified the lime shall be hydrated lime or quicklime. The lime shall be sufficiently dry to flow freely during application.

### **7.0 BITUMEN**

1. Bitumen used for foamed bitumen stabilisation shall be Class 170 and shall comply with the requirements of AS 2008 Residual bitumen for pavements. Contractors shall nominate the source of supply of the bitumen with their quotation.

### **8.0 BITUMEN EMULSION FOR PAVEMENT STABILISATION**

1. The bitumen emulsion used to stabilise (modify) pavement layers shall comply with the requirements of AS 1160, “Bitumen Emulsion for Construction and Maintenance of Pavements”. Unless otherwise specified the emulsion shall be Grade ASS/170-60 emulsion. The bitumen used in the manufacture of the emulsion shall be class 170 bitumen conforming to AS 2008, Residual Bitumen for Pavements. Contractors shall nominate the source of supply of bitumen emulsion with their quotation. The Contractor shall make arrangements for the Local Government Representative to sample the emulsion or any of its components at any time during normal working hours. These arrangements shall include a means of identifying lots of emulsion or the component material, which will be used in the Works.

### **9.0 WATER**

1. The water used in rehabilitation works shall be from a source approved by the WALGA Member.





## COLD MILLING OPERATIONS

### 10.0 GENERAL

1. Cold milling shall be to the dimensions as specified, in accordance with the details included at Annexure A, the Drawings, or as otherwise may be directed or varied by the Local Government Representative.
2. The longitudinal grade shall follow the general grade of existing kerbs or gutters and/or other specified controlling factors at the location. Profile control shall preferably be performed automatically.
3. 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 milling.
4. Each day's milling shall be completed transversely across the full pavement width unless otherwise specified by the WALGA Member. Each day's section of work shall be completed prior to commencement of work in another section.
5. Profiling machines shall not be turned on the existing road surface if this process encroaches onto lanes carrying traffic.

### 11.0 PLANT AND EQUIPMENT

#### 11.1 Profiling Machine

1. The work shall be carried out by a pavement profiling machine which has been specifically designed for such work. The profiler(s) shall be equipped with automatic profile control including the ability to vary the depth of cut and transverse crossfall during cold milling operations. Water shall be sprayed during the profiling operation to reduce dust.
2. The profiler(s) shall be fitted with a milling drum for the type of work specified in Table 1. The drum shall be maintained in good working condition to produce a consistent surface finish. Maintenance should occur after each work shift.

Table 1: Drum Types

Type of Drum	Tool Spacing on Drum	Type of Work
Fine	Maximum 8 mm	<b>TYPE 1</b> Where a SAMI or GRS seal is to be applied to the cold planed surface Bridge Deck resurfacing
Fine	Maximum 8 mm	<b>TYPE 2</b> Milling to retexture a road surface Removal of surface defects such as shoving
Standard	15 mm	<b>TYPE 3</b> Asphalt without an underlying seal Other applications not requiring a fine drum

#### 11.2 Road Broom

1. Mechanical and/or suction road brooms used for sweeping operations shall be fitted with an operational and efficient method of dust suppression by the use of water. Such dust suppression must be used at all times during sweeping operations carried out by road brooms.



### 12.0 COLD MILLING OPERATION

- 1. The profiling machine shall be operated at a controlled forward speed appropriate for the works.
- 2. The use of water during profiling and brooming of the surface shall be limited to the suppression of dust. Where a profiling machine or broom is moving slowly such as the start and end of runs excess water shall not be applied to the surface.

### 13.0 SURFACE FINISH

- 1. The milled surface shall be uniform in texture, appearance and general finish including perimeter areas. For Type 1 works the surface texture, determined in accordance with WA 311.1, after sweeping shall meet the requirements of Table 2. In addition for Type 1 works the depth of grooves at any point on the planed surface after sweeping shall be no more than 5 mm, as defined in Figure 1. The requirements for Type 1 works are only applicable to cold milling of asphalt. Where the surface finish is non conforming the cold milling process shall be reviewed by the Contractor, including adjustment of equipment, before further work continues.

Table 2: Surface Texture Type 1 Work

Location within Cold Planed Surface	Texture Depth	Sand Patch Diameter (where 50cc of sand is used)
Average	< 2.0 mm	> 180 mm
Any location	≤ 2.3 mm	> 170 mm

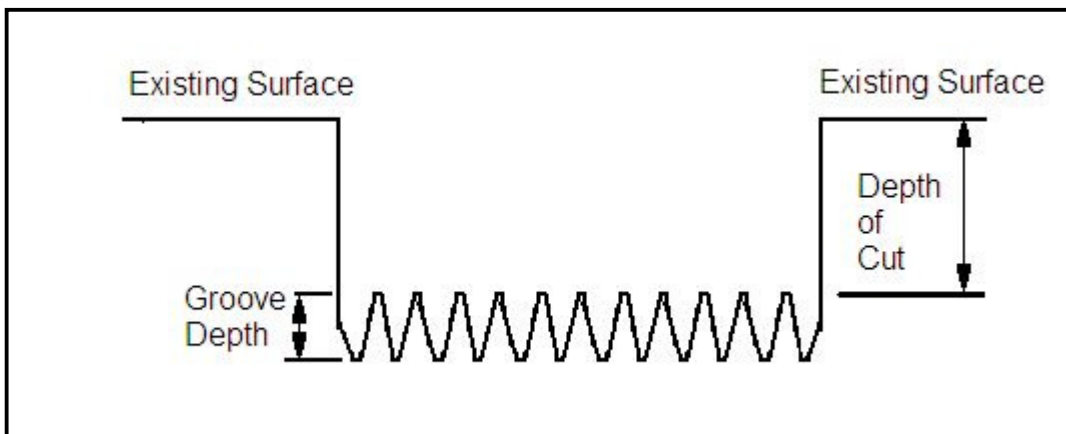


Figure 1: Groove Depth - Type 1 Works

- 2. The Contractor shall ensure that the perimeters of the planed areas are suitable for asphalt resurfacing. Generally, the final cut edge of the existing pavement surface shall be straight and free of all loose material.
- 3. Stopping and starting of the cold planning machine shall not damage the surface.
- 4. Irregularities not securely bonded to the underlying layer remaining after cold milling shall be removed by mechanical means or by handwork. The planed surface shall be swept free of all dust, loose material and foreign matter whether or not resulting from milling operations.
- 5. The average depth of cut shall be within  $\pm 3$  mm of the depth specified.
- 6. Where the depth of cut penetrates consecutive asphalt layers the final cut edge of each layer shall be stepped back to allow for a construction overlap of 150 mm on wearing courses. Where the depth of cut is deeper the final cut edge of each layer shall be stepped back to allow for a construction overlap of 500 mm.



### 14.0 SURFACE FEATURES

#### 14.1 Bridge Decks and Approach Slabs

1. Profiling of asphalt 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 17.0.
2. Where applicable, special requirements regarding the profiling of bridge decks and approach slabs are given in Annexure A. Such provisions may include a reduced depth of profiling.
3. Prior to the commencement of profiling on bridge decks or approach slabs the Contractor shall confirm the depth of profiling with the Local Government Representative and shall seek confirmation of any other special precautions to be taken.

#### 14.2 Bridge Expansion Joints

1. The pavement profiler shall not profile closer than 300 mm to the nearest edge of any bridge expansion joints. Removal of the 300 mm section immediately adjacent to the expansion joint shall be by handwork.
2. Bridge expansion joints shall be covered or protected such that planed material does not enter the expansion joints.

#### 14.3 Gullies and Manholes

1. The depth of cut adjacent to and around road furniture items such as gully pits and manhole covers and similar shall be as detailed in Annexure A, or as otherwise specified by the Local Government Representative. Some of this work may require to be carried out as handwork.
2. Gully grates shall be covered or protected such that planed material does not enter the gully pits.

#### 14.4 Kerbing

1. Milling shall be to the edge of the concrete kerbing or edge of the trafficked lanes if no kerbing exists.

#### 14.5 Raised Pavement Markers

1. The Contractor shall be responsible for the removal and disposal of raised pavement markers, both permanent and temporary, prior to surface treatment. 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.
2. 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:
  - a) single-sided white
  - b) placed on all lane and edge lines at 12 m intervals.

### 15.0 RAIN

1. The Local Government Representative may direct that work not be commenced on a section if significant rain is forecast to fall prior to applying the next surface treatment.

### 16.0 DISPOSAL OF MILLED MATERIAL

1. All milled material shall remain the property of the WALGA Member unless otherwise specified. The Contractor shall load the milled material into Local Government trucks unless otherwise specified. Where the WALGA Member does not wish to retain ownership of the milled material the Contractor shall be advised and shall dispose of the material to the Contractor's spoil sites.



### 17.0 SURFACE REPAIRS

#### 17.1 General

1. Where the milled surface is to be asphalt or spray sealed without rehabilitation of underlying granular pavement the Contractor shall be responsible for repairing and sealing the surface of any road pavement or bridge deck exposed by milling operations. Damaged areas shall be corrected prior to bituminous surfacing and/or asphalt surfacing or opening to traffic.
2. Damage caused by disregard or ignorance of the specified milling depth or width, or to any other specified requirements, or to any directions given by the Local Government Representative, shall be repaired at no cost to the WALGA Member.

#### 17.2 Bridge Decks and Approach Slabs

##### 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:

- a) removal of all loose material;
- b) application of a suitable bituminous tack coat over the damaged area;
- c) laying of a suitable waterproof membrane such as "Bituthene 5000", or an equivalent product approved by the Local Government Representative. If the damage is extensive in area, alternative waterproofing methods such as the application of a rubberised seal in accordance with WALGA Specification - Sprayed Bituminous Surfacing may be appropriate.

##### 2. Concrete Decking

If damage to the bridge deck or approach slab extends into the concrete surface, the concrete damage shall be repaired prior to any other repairs being attempted. Repairs to concrete decking shall generally comprise:

- a) removal of debris and loose material;
  - b) dampen the exposed repair area and fill with an approved concrete mix, and thoroughly compact using a hand tamper. The surface level of the repair shall be within  $\pm 5$  mm of the surrounding cold planed surface;
  - c) allow the concrete to cure and achieve sufficient strength before proceeding with repair of the waterproof membrane.
3. Prior to commencing any repairs to the concrete bridge decking or approach slabs, the Contractor shall immediately notify the Local Government Representative if damage has occurred to the steel reinforcement of the bridge deck or approach slab, and shall provide details of the method of disposition to the Local Government Representative.

#### 17.3 Pavement Damage Depth Less Than 20 mm

1. Any area of road pavement exposed by cold milling operations shall be sealed, and if necessary corrected, prior to subsequent work, or opening to traffic.
2. Pavement surface damage up to a depth of 20 mm shall be repaired as follows:
  - a) remove all loose material by hand or mechanical brooming;
  - b) spray cationic rapid setting emulsion evenly at a rate of approximately 0.8 to 0.9 litres per square metre;
  - c) apply cover aggregate (nominal 5 mm size) evenly over the sprayed area;
  - d) following the break of the emulsion, sweep and remove any excess cover aggregate.



### 17.4 Pavement Damage Depth Exceeding 20 mm

1. Pavement surface damaged to a depth of 20 mm or greater shall be repaired as follows:
  - a) remove all loose material by hand or mechanical brooming to ensure a solid base and sides;
  - b) lightly tack coat the base and sides of the hole with bitumen emulsion;
  - c) fill the repair area with approved asphalt, and thoroughly compact using a hand tamper or vibrating plant compactor. The surface level of the repair shall be within  $\pm 5$  mm of the surrounding cold planed surface;
  - d) where necessary, blind with nominal 5 mm aggregate to avoid pick up by traffic.

### 18.0 TEMPORARY RAMPS

1. Temporary ramps shall be constructed in trafficked lanes at all gullies, manholes, valves, bridge expansion joints and transverse differences in level, prior to milled sections being opened to traffic. Ramps will not be required when these features are within a designated shoulder or breakdown area.
2. The temporary ramps shall be constructed using approved asphalt or coldmix at a slope of 1:10 from the edge of the structure to the planed surface, and adequately compacted.

### 19.0 CONFORMANCE

1. The Contractor shall rectify all non-conforming work by appropriate methods acceptable to the Local Government Representative, at no cost to the WALGA Member.

## RECYCLING EXISTING PAVEMENT

### 20.0 GENERAL

1. Recycling existing pavement after milling off the bituminous surfacing may be carried out using conventional graders for mixing in accordance with WALGA Specification - Earthworks *and* Pavement Construction or using *in situ* mixing using a stabilising/mixing machine. Mixing using stabilising/mixing machines shall be in accordance with this specification.
2. Additional granular material may be added to the existing pavement to increase the thickness of the pavement or to improve the quality of the pavement material.
3. Where additional granular material is required to be added to the existing pavement material it shall comply with requirements specified by the WALGA Member.
4. The WALGA Member shall specify the optimum moisture content of the material to be recycled, the properties and proportion of any additional granular material to be added and the thickness of layer to be recycled.

### 21.0 MIXING/STABILISING MACHINE

The mixing/stabilising machine shall be a purpose built for mixing/stabilising road making materials that shall satisfy the following requirements:

- A minimum power capability to ensure breaking up the all materials in the existing pavement to a maximum size of 25 mm, thorough mixing of materials and moving the stabilising machine and a water tanker along the pavement.
- Variable depth of cut control with an accurate gauge of depth cut readily visible to the operator. The depth of cut shall have a tolerance of -0, +10%.
- A mixing chamber capable of pulverising and thoroughly and uniformly mixing the pavement materials and water to the moisture content and condition necessary for compaction.
- The mixing chamber shall be equipped with a spray system to allow controlled variable widths and application rates of water to be incorporated into the pavement material.



- The water pumping and injection system shall be linked to the ground speed of the machine to ensure accurate water application irrespective of the speed of the plant.
- Suitable connection points to allow rigid connection to a water tanker and connection of flexible water supply hoses from the water tanker.
- A water pumping system to pump water from the water tanker to the mixing chamber.
- Be capable of screeding the mixed material to an even finish.

Note a water tanker shall be supplied by the Contractor unless otherwise specified by the WALGA Member.

## 22.0 MIXING/STABILISING

### 22.1 Trial Section

When specified by the WALGA Member, the Contractor shall demonstrate the suitability of the equipment and method of mixing/stabilising proposed by carrying out the process on a trial section of road. The trial section shall be approximately 100 m<sup>2</sup> in area and to an agreed depth and width on a road nominated by the WALGA Member.

Further works shall not be carried out until the Local Government Representative approves the process.

### 22.2 Surface Preparation

1. The surface of the existing pavement after milling shall be trimmed and lightly compacted to ensure an even regular surface that will facilitate finishing the final pavement to the specified alignment, levels and cross section.

### 22.3 Operation

1. The mixing/stabilising machine shall be operated by experienced personnel qualified to use the particular machine being used so as to provide a uniform mixture of the recycled pavement material and water at between 90 and 100% of modified maximum dry density optimum moisture content of the pavement material.
2. Where necessary to suitably break up the pavement material and properly mix in the water the operation shall be carried out in multiple passes of the mixing/stabilising machine.
3. The screeded finish shall be even and to a suitable shape and level to minimise the requirement for grading and trimming.

### 22.4 Finishing and Compaction

1. The Contractor shall compact the recycled pavement layer to the Minimum Characteristic Dry Density Ratios specified in Annexure B.
2. The Contractor shall trim and finish the surface to be uniformly tight and free of loose uncompacted material, segregated or bony material or soft, over wet areas and roller indentations. The basecourse must retain those characteristics after rotary brooming and be suitable to receive bituminous surfacing.
3. The finished surface shall comply with the surface shape, levels and finish specified in WALGA Specification 4 - Earthworks and Pavement Construction.
4. No bituminous surfacing shall be applied to a basecourse lot until it has dried back such that the Dryback Characteristic Moisture Content of both the upper half and lower half of the basecourse layer is less than or equal to the proportion of the Optimum Moisture Content (OMC) as shown in Annexure B as determined by WA 133.1 or 133.2. Where no such proportion of OMC is shown in Annexure B, the Dryback Characteristic Moisture Content of the basecourse shall be dried back to 85% of OMC or less. The Dryback Characteristic Moisture Content shall be determined in accordance with Clause 31 Quality Control.



### STABILISING WITH CEMENTITIOUS BINDERS

#### 23.0 GENERAL

1. The stabilisation of recycled pavement with cement or lime shall be carried out in accordance with WALGA Speciation 4 - Earthworks and Pavement Construction.
2. The WALGA Member will specify the depth of stabilisation and the optimum moisture content of the material to be treated plus the type and percentage of cementations binder to be incorporated in the recycled pavement.
3. Where necessary to suitably break up the pavement material and properly mix in the water the operation shall be carried out in multiple passes of the mixing/stabilising machine.
4. Unless otherwise specified the Contractor shall supply all equipment and materials necessary for stabilisation including water trucks and cement or lime trucks.

#### 24.0 TRIAL SECTION

When specified by the WALGA Member, the Contractor shall demonstrate the suitability of the equipment and method of mixing/stabilising proposed by carrying out the process on a trial section of road. The trial section shall be approximately 100 square metres in area and to an agreed depth and width on a road nominated by the WALGA Member.

Further works shall not be carried out until the Local Government Representative approves the process.

#### 25.0 SURFACE PREPARATION

1. The surface of the existing pavement after milling shall be trimmed and lightly compacted to ensure an even regular surface that will facilitate finishing the final pavement to the specified alignment, levels and cross section after stabilisation.

#### 26.0 CURING

1. The stabilised pavement shall be protected from moisture loss for a period of not less than seven days after completion by keeping the pavement damp by means of a water spray or until a bituminous surfacing is applied. Where practicable a bituminous surfacing should be applied as soon as possible after stabilisation to prevent carbonation.



# STABILISATION WITH BITUMINOUS BINDERS

## 27.0 GENERAL

1. Stabilisation with bituminous binders shall be with bitumen emulsion or foamed bitumen as specified by the WALGA Member.
2. Where foamed bitumen is specified, the foamed bitumen shall have a minimum expansion rate of a factor of ten and the half life shall be a minimum of ten seconds.
3. The WALGA Member will specify the depth of stabilisation and the optimum moisture content of the material to be treated plus the type and percentage of bituminous binder to be incorporated in the recycled pavement.
4. Where necessary to suitably break up the pavement material and properly mix the materials the operation shall be carried out in multiple passes of the mixing/stabilising machine.
5. Where specified supplementary cementitious binders shall be added prior to or during bituminous stabilisation. The WALGA Member shall specify the type and percentage of cementitious binder required.
6. Unless otherwise specified the Contractor shall supply all equipment necessary for stabilisation including water tankers and bitumen tankers.

## 28.0 STABILISING MACHINE

The stabilising machine shall be a purpose built for stabilising road making materials with bituminous binders and shall satisfy the following requirements:

- A minimum power capability to ensure breaking up the all materials in the existing pavement to a maximum size of 25 mm, thorough mixing of materials and moving the stabilising machine and a water cart along the pavement.
- Variable depth of cut control with an accurate gauge of depth cut readily visible to the operator. The depth of cut shall have a tolerance of -0, +10%.
- A mixing chamber capable of pulverising and thoroughly and uniformly mixing the pavement materials, water and bituminous binder to the moisture content and condition necessary for compaction.
- A mixing chamber equipped with separate water and bituminous binder injection systems that are linked to the ground speed to allow controlled variable and accurate water and bituminous binder to be incorporated into the pavement material irrespective of the speed of the plant.
- The binder injection system for production of foamed bitumen shall be purpose built to ensure production of foamed bitumen complying with the requirements of this specification.
- Have bitumen temperature gauges to verify bitumen temperature.
- Have a computer controlled bitumen flow meter for verification of binder content.
- Have an inspection or test jet fitted to allow verification that the flow of bitumen and the required expansion and half life qualities of the foamed bitumen.
- Have self cleaning jets.
- Suitable connection points to allow rigid connection to a water tanker and connection of flexible water supply hoses from the water tanker.
- A water pumping system to pump water from the water tanker to the mixing chamber.
- A bituminous binder pumping system to pump water from the bitumen/bitumen emulsion tanker to the mixing chamber.





- Suitable connection points to allow rigid connection to a water tanker and bitumen tanker and connection of flexible supply hoses.
- Be capable of screeding the mixed material to an even finish.

### 29.0 STABILISATION

#### 29.1 Trial Section

When specified by the WALGA Member, the Contractor shall demonstrate the suitability of the equipment and method of stabilising proposed by carrying out the process on a trial section of road. The trial section shall be approximately 100 m<sup>2</sup> in area and to an agreed depth and width on a road nominated by the WALGA Member.

Further works shall not be carried out until the Local Government Representative approves the process.

#### 29.2 Surface Preparation

1. The surface of the existing pavement after milling shall be trimmed and lightly compacted to ensure an even regular surface that will facilitate finishing the final pavement to the specified alignment, levels and cross section.

#### 29.3 Operation

1. The mixing/stabilising machine shall be operated by experienced personnel qualified to use the particular machine being used so as to provide a uniform mixture of the recycled pavement material binder and water. The moisture content shall be between 90 and 100% of the modified maximum dry density optimum moisture content of the pavement material.

2. Where necessary to suitable break up the pavement material and/or properly mix in the water and binder the operation shall be carried out in multiple passes of the mixing/stabilising machine.

3. The screeded finish shall be even and to a suitable shape and level to minimise the requirement for grading and trimming.

#### 29.4 Finishing, Compaction and Dryback

1. The Contractor shall compact the stabilised pavement layer to the Minimum Characteristic Dry Density Ratios specified in Annexure B.

2. The Contractor shall trim and finish the surface to be uniformly tight and free of loose uncompacted material, segregated or bony material or soft, over wet areas and roller indentations.

3. The finished surface shall comply with the surface shape, levels and finish specified in WALGA Specification 4 - Earthworks and Pavement Construction. The basecourse must retain those characteristics after rotary brooming and be suitable to receive bituminous surfacing.

4. No bituminous surfacing shall be applied to a basecourse lot until it has dried back such that the Dryback Characteristic Moisture Content of both the upper half and lower half of the basecourse layer is less than or equal to the proportion of the Optimum Moisture Content (OMC) as shown in Annexure B as determined by WA 133.1 or 133.2. Where no such proportion of OMC is shown in Annexure B, the Dryback Characteristic Moisture Content of the basecourse shall be dried back to 85% of OMC or less. The Dryback Characteristic Moisture Content shall be determined in accordance with Clause 31 Quality Control.

### 30.0 QUALITY CONTROL

#### 30.1 General

The Contractor shall implement a quality control system to ensure that all construction and material supplied complies in all respects to the specified requirements.



Testing shall be carried out in accordance with the relevant Main Roads or equivalent Australian Standard test method. Unless otherwise approved by the WALGA Member all Test Reports/certificates shall be NATA endorsed.

Prior to the supply of any material the Contractor shall certify that the material supplied by the Contractor complies in all respects with the specified requirements and shall provide test certificates that demonstrate compliance.

Test reports/certificates shall be provided for each production lot. Production lots shall be no more than one (1) days production and shall be homogeneous in terms of quality.

The quality control system shall include the minimum testing requirements given in Annexure C unless otherwise approved by the WALGA Member.

### 30.2 Density Testing

1. For the Works in general, density shall be measured *in situ* by use of a nuclear moisture/density meter in accordance with WA 324.2. All measurements shall be made using the direct transmission mode.

2. If the *in situ* density is outside the range of densities 1.5-3.05t/m<sup>3</sup> for which the nuclear moisture/density meter can be calibrated then WA 324.1 shall be used.

For the purpose of measuring conformance of all work under the Contract, the *in situ* density shall be expressed as a percentage of the maximum dry density. This percentage shall be calculated in accordance with WA 134.1.

4. The maximum dry density shall be determined by WA 133.1 or WA 133.2 (modified compaction). 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 the work under the Contract with respect to density shall be determined by comparing the Characteristic Dry Density Ratio of the Lot and the limits specified in the Specification.

The dry density ratio shall be determined at no less than the number of test locations per Lot defined in Table 1. The locations shall be selected in accordance with WA 0.1.

The Characteristic Dry Density Ratio,  $R_C$ , of a Lot shall be calculated thus:

$$R_C = R - ks$$

where; R is the mean of the results of dry density ratio tests on the Lot being assessed, reported to the nearest 0.1 percent

k is the multiplier as detailed in Table 3

s is the standard deviation of the results of dry density ratio tests (or the standard deviation of the results of the on the Lot being assessed).

**Table 3: Number of Tests per Lot Density and Moisture Content**

Works Component	Primary Distributors		District and Local Distributors		Access Streets	
	No. of tests/lot	k	No. of tests/lot	k	No. of tests/lot	k
Basecourse/Sub-base	9	0.81	7	0.54	4	0.21



### 30.3 Moisture Content Testing

The Moisture content shall be determined using WA 110.1. If it is not practicable to use this method, then WA 110.2 or WA 324.2 may be used. However, correlation must be established with WA 110.1 before proceeding with the subsidiary methods WA 110.2 and WA 324.2.

The conformance of any Lot with respect to *in situ* moisture shall be determined by comparing the Dryback Characteristic Moisture Content or Construction Characteristic Moisture Content of the Lot and the limits specified in the Specification.

The moisture contents shall be determined at not less than the number of test locations per Lot defined in Table 3. The test locations shall be selected in accordance with WA 0.1.

i) Construction Moisture Control

The Construction Characteristic Moisture Content  $CM_C$ , of a Lot shall be calculated thus:

$$CM_C = m \pm ks$$

- where;
- m is the mean of the results of *in situ* moisture content tests on the Lot being assessed, reported to the nearest 0.01 percent
  - k is the multiplier as detailed in Table 3
  - s is the standard deviation of the results of *in situ* moisture content tests on the Lot being assessed, calculated in accordance with Clause 1.4 and reported to the nearest 0.01 percent.

ii) Basecourse Dryback

The Dryback Characteristic Moisture Content  $DM_C$ , of a Lot shall be calculated thus:

$$DM_{Upper} = m_1 + ks_1 \text{ and}$$

$$DM_{Lower} = m_2 + ks_2$$

- where;
- $m_1$  average of the sample moisture contents on the Lot being assessed, taken from the upper half of the Basecourse layer and determined in accordance with WA 110.1 reported to the nearest 0.01 percent.
  - $m_2$  average of the sample moisture contents on the Lot being assessed, taken from the lower half of the Basecourse layer and determined in accordance with WA 110.1 reported to the nearest 0.01 percent.
  - k is the multiplier as detailed in Table 201A-2
  - $S_1$  standard deviation of the sample moisture content determinations taken from the upper half of the layer, calculated using the following relationship and reported to the nearest 0.01.



## ACCEPTANCE

### 31.0 ACCEPTANCE GENERAL

1. All works shall be constructed in accordance with this Specification to satisfy the criteria shown in Annexures A to C.
2. Where a pavement material has been supplied by the Contractor, the Contractor must undertake sufficient testing of that material sampled from the stockpiles, in accordance with Clause 31 Quality Control, to demonstrate that the material complies in all respects with the specified requirements.

### 31.1 Acceptance Compaction and Dryback

1. Each pavement layer shall be constructed to the dimensions and details shown on the Drawings and to the requirements of the Specification and shall be compacted to the Characteristic Dry Density Ratio shown in Annexure B or greater. Each pavement layer shall be dried back to the Dryback Characteristic Moisture Content shown in Annexure B or lower. Where the sub-base material contains more than 20% by mass of material retained on a 37.5 mm sieve, the Optimum Moisture Content and the Maximum Dry Density shall be determined on that portion of the material that passes a 37.5 mm sieve.

### 31.2 Acceptance Layer Width

1. The outer top edge of any layer of the pavement shall be no closer to the road centreline and no more than 100 mm further from the road centreline than the positions shown in the drawings.

### 31.3 Acceptance Surface Shape

1. The shape of the basecourse shall be judged to be acceptable when the maximum deviation from a 3 metre straight edge placed in any position on the surface does not exceed 6 mm.
2. Additionally, for widening work, the cross fall measured at any position on the new surface at right angles to the centreline shall be within 0.5% of the existing cross fall or of the cross fall on the outer 2 metres of the adjacent traffic lane at that location.

### 31.4 Acceptance Surface Levels

#### a) Construction or Reconstruction Sections

1. The level of the completed basecourse surface shall be judged to be acceptable when the level measured at any point on the surface is within the following tolerances for the basecourse level for that point as determined from the drawings:

iii) where final surface is asphalt - 5 mm, + 10 mm

iv) elsewhere - 5 mm, + 20 mm

2. Where the basecourse is stabilised, the depth of stabilisation shall be deemed to be acceptable when the actual depth of the stabilised material after compaction shall nowhere depart from the specified depth by more than - 0 mm, + 25 mm.

#### b) Pavement Widening Sections

1. The level of the completed basecourse surface shall be judged to be acceptable when the levels of the basecourse at its junction with the existing seal are within -0 mm, +5 mm of the top cut edge level of the existing seal.



### **31.5 Acceptance Surface Finish**

1. Completed pavement layers shall be in a homogeneous, uniformly bonded condition with no evidence of layering, cracking, disintegration or surface tearing. The finished surface should appear as a stone mosaic interlocked with fine material and shall be dense, even textured and tightly bonded. The basecourse must retain those characteristics after rotary brooming and be suitable to receive bituminous surfacing. Prior to the application of a bituminous surfacing the surface of the basecourse shall be uniformly dry.

## **MAINTENANCE**

### **32.0 BASECOURSE MAINTENANCE**

1. Completed basecourse construction shall be maintained to the specified standards of surface shape, level, compaction, dryback and finish up to the time of application of the bituminous surfacing.
2. Watering shall be continued as necessary to prevent shrinkage cracking, dusting and loosening of the surface.

## **RECORDS**

### **33.0 DAILY WORKS RECORDS**

1. The Contractor shall supply daily docket for all milling work showing the following details:-
  - a) Contract No.
  - b) Job Location
  - c) Date of Work
  - d) Area Worked.

### **34.0 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.





**A2. CEMENT STABILISED PAVEMENTS**

Cement stabilised pavement layers shall be constructed at the locations and with the parameters as shown in Table A2:

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				

**A3 LIME STABILISED PAVEMENTS**

Lime stabilised pavement layers shall be constructed with the parameters as shown in Table A3:

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

**A4 BITUMEN STABILISED PAVEMENTS SCHEDULE**

Bitumen stabilised pavement layers shall be constructed with the parameters as shown in Table A4:

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



### 36.0 ANNEXURE B COMPACTION AND DRYBACK

#### B1 COMPACTION OF PAVEMENT LAYERS

Pavement layers shall be compacted to the densities shown in Table B1.

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%

#### B2. DRYBACK OF PAVEMENT LAYERS

Basecourse or other pavement layers shall be dried back to the requirements shown in Table B2 or Table D3 prior to the application of bituminous binder or the construction of the overlying layer.

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%





### 37.0 ANNEXURE C - MINIMUM TESTING FREQUENCY

The minimum frequency of testing to determine the conformance of Works Processes with specified characteristics shall be as detailed in the Minimum Testing Frequency Table of the Specification or in the following Table:

PRODUCT/PROCESS	QUALITY VERIFICATION REQUIREMENT	MINIMUM TESTING FREQUENCY
Basecourse/Sub-base	FOR CONTROL OF BASECOURSE/SUB-BASE SUPPLIED BY THE CONTRACTOR	
	<ul style="list-style-type: none"> <li>PSD (WA 115.1)</li> </ul>	1 per 1,000m <sup>3</sup> of stockpile
	<ul style="list-style-type: none"> <li>LA Abrasion (WA 220.1)</li> </ul>	1 per 5,000m <sup>3</sup> of stockpile
	<ul style="list-style-type: none"> <li>Flakiness Index (WA 216.1)</li> </ul>	1 per 5,000m <sup>3</sup> of stockpile
	<ul style="list-style-type: none"> <li>CaCO<sub>3</sub> (WA 915.1)</li> </ul>	1 per 5,000m <sup>3</sup> of stockpile
	<ul style="list-style-type: none"> <li>MDCS (WA 140.1)</li> </ul>	1 per 5,000m <sup>3</sup> of stockpile
	<ul style="list-style-type: none"> <li>Liquid Limit (WA 120.2)</li> </ul>	1 per 1,000m <sup>3</sup> of stockpile
	<ul style="list-style-type: none"> <li>Plasticity Index (WA 122.1)</li> </ul>	1 per 1,000m <sup>3</sup> of stockpile
	<ul style="list-style-type: none"> <li>Linear Shrinkage (WA 123.1)</li> </ul>	1 per 1,000m <sup>3</sup> of stockpile
	<ul style="list-style-type: none"> <li>Dust Ratio (Contract)</li> </ul>	1 per 1,000m <sup>3</sup> of stockpile
	<ul style="list-style-type: none"> <li>Soaked CBR (WA 141.1)</li> </ul>	1 per 5,000m <sup>3</sup> of stockpile
	<ul style="list-style-type: none"> <li>Wet/Dry Strength Variation (AS 1141.22)</li> </ul>	1 per 5,000m <sup>3</sup> of stockpile
	<ul style="list-style-type: none"> <li>Secondary mineral content in basic igneous rock (AS 1141.26)</li> </ul>	1 per 10,000m <sup>3</sup> of stockpile
	<ul style="list-style-type: none"> <li>Accelerated soundness index by reflux (AS 1141.29)</li> </ul>	1 per 10,000m <sup>3</sup> of stockpile
	FOR CONTROL OF BITUMINOUS BINDERS SUPPLIED BY THE CONTACTOR	
Bitumen Emulsion	<ul style="list-style-type: none"> <li>Bitumen Emulsion (AS 1160)</li> </ul>	1 suite of tests per production batch
Bitumen	<ul style="list-style-type: none"> <li>Bitumen (AS 2008)</li> </ul>	1 suite of tests per production batch
Compaction	FOR CONTROL OF COMPACTION	
	<ul style="list-style-type: none"> <li>Dry Density Ratio</li> </ul>	As per Table B1
Dryback	Dryback Characteristic Moisture Content	As per Table B2
Additional requirements for Cement or Lime or Bitumen Stabilised Basecourse	FOR CONTROL OF STABILISATION	
	<ul style="list-style-type: none"> <li>Control of foamed bitumen quality</li> </ul>	5 tests per lot
	<ul style="list-style-type: none"> <li>Layer depth</li> </ul>	9 sites per Lot
	<ul style="list-style-type: none"> <li>Cement, Lime or Bitumen content</li> </ul>	6 sites per Lot



## Report Signature Page

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