

Main Roads Technical Standard

MRTS12

Sprayed Bituminous Emulsion Surfacing

June 09

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June 09

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Sprayed Bituminous Emulsion Surfacing

1 INTRODUCTION

This Technical Standard applies to the application of sprayed bituminous emulsion surfacing. The work covered includes primes, primerseals, seals, reseals and enrichments.

This Technical Standard shall be read in conjunction with MRTS01 *Introduction to Technical Standards*, MRTS50 *Specific Quality System Requirements* and other Technical Standards as appropriate.

This Technical Standard forms part of the Main Roads Specifications and Technical Standards Manual.

2 DEFINITION OF TERMS

The terms used in this Standard shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Standards*. Additional terms used in this Standard shall be as defined in Table 2. Further definitions are given in *Austroads Principles and Practice of Bituminous Surfacing, Volume 1 - Sprayed Work*. In the event of any conflict of definition, this publication shall have a priority rating immediately below the General Conditions of Contract.

Table 2 – Definition of Terms

Term	Definition
Actual Spray Rate	The spray rate of residual bituminous emulsion achieved during the operation, at 15°C.
Actual Spread Rate	The spread rate of cover aggregate or prime cover material achieved during the relevant operation.
anionic emulsion	The bituminous emulsion type in which the suspended bitumen particles are negatively charged.
bituminous emulsion	A liquid product in which a substantial amount of bitumen, with which some cutter oil and/or flux oil may be mixed or co-dispersed, is suspended in a finely divided condition in water by means of one or more emulsifying and stabilising agents.
cationic emulsion	The bituminous emulsion type in which the suspended bitumen particles are positively charged.
cover aggregate	Aggregate complying with the requirements of MRTS22 <i>Supply of Cover Aggregates</i> , and which forms a permanent wearing surface on a pavement.
Designed Spray Rate	The spray rate for the relevant bituminous material at 15°C as determined by the Seal Design in accordance with Clause 6.
Designed Spread Rate	The spread rate of cover aggregate or prime cover material as determined by the Seal Design in accordance with Clause 6.
Estimated Spray Rate	The spray rate of residual bituminous emulsion at 15°C stated in Clause 6 of Annexure MRTS12.1.
Estimated Spread Rate	The spread rate for cover aggregate or prime cover material stated in Clause 6 of Annexure MRTS12.1.
prime cover material	Material used to cover a prime to enable traffic to use the pavement. Prime cover material may be a clean sand, crusher dust or cover aggregate.
spray run	The area of pavement selected for coverage with a bituminous material during one continuous operation with a sprayer.

3 REFERENCED DOCUMENTS

Table 3 lists documents referenced in this technical standard.

Table 3 – Referenced Documents

Title
<i>Design of Sprayed Seals – Austroads</i>
<i>Bitumen Sprayers – Austroads</i>

4 STANDARD TEST METHODS

The standard test methods given in Table 4 shall be used in this Standard.

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

Table 4 – Standard Test Methods

Property to be Tested	Method No.
Ball embedment test	Q706
Field spread rate of cover aggregate	Q711A

5 QUALITY SYSTEM REQUIREMENTS

5.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Standards*.

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

Table 5.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.2	1. Permission to use handling procedures.		Procedures submitted.
6.2.2	2. Commencement of spraying operations		Submission of test plan (7 days)
6.2.3	3. Commencement of spraying operations		Submission of seal design (7 days)
9	4. Plant to be used.		
11.1	5. Ball embedment testing.		
11.3		Pavement temperature above minimum specified.	
12.5		Bitumen temperature within specified range prior to spraying.	

5.2 Construction Procedures

The Contractor shall prepare documented procedures for all handling processes as defined in Clause 5 of MRTS50 *Specific Quality System Requirements*.

These procedures shall be consistent with safe handling practices which apply to bitumen products as defined in the following publications –

- a) *Code of Practice for Safe Handling of Bitumen Products* (Australian Institute of Petroleum); and
- b) *Bitumen Sealing Safety Guide* (Austroads).

Procedures shall be submitted to the Administrator not less than 7 days prior to their use. **Milestone**

Procedures shall not be implemented until permission to use has been granted by the Administrator. **Hold Point 1**.

The Contractor shall establish an Inspection and Test Plan for supply and delivery of bitumen. The Inspection and Test Plan shall address at least –

- a) traceability;
- b) conformance of bituminous emulsion supplied to the Site; and
- c) sampling and testing at the Site.

6 SPECIFIC SURFACING TREATMENTS AND SEAL DESIGN

6.1 Specific Surfacing Treatments

Where so stated in Clause 6 of Annexure MRTS12.1, the specific requirements for bituminous emulsion surfacing treatments shall be as set out therein. Where no such details are included in Clause 6 of Annexure MRTS12.1, bituminous emulsion surfacing treatments shall be as shown in the Drawings.

6.2 Seal Design

6.2.1 General

The seal design shall be carried out by either the Designer under the Contract or by the Contractor as stated in Clause 7 of Annexure MRTS12.1.

6.2.2 Seal Design by the Designer under the Contract

Where the seal design is carried out by the Designer under the Contract, the Contractor shall submit to the Administrator, at least 7 days prior to the commencement of bituminous emulsion spraying operations, a test plan which defines the relevant properties of the proposed cover material. **Milestone**

The Contractor shall allow a period of 7 days for the Designer to carry out seal design. Spraying operations shall not commence until the Contractor has been notified of the requirements of the seal design. **Hold Point 2**

6.2.3 Seal Design by the Contractor

Where the seal design is carried out by the Contractor, the Contractor shall submit to the Administrator, at least 7 days prior to commencement of bituminous emulsion spraying operations, the details of the intended spraying and/or seal design, including –

- a) its proposed Designed Spray Rate of residual bituminous material;
- b) its proposed Designed Spread Rate of cover material; and
- c) a test plan which defines the relevant properties of the cover material.

A separate seal design shall be submitted for each size and source of cover material and for each pavement type for which sprayed bituminous emulsion surfacing is to be applied. **Milestone**

Seal designs shall be determined in accordance with the processes defined in the Austroads publication *Design of Sprayed Seals* (latest edition).

Where the sprayed bituminous layer will be the final surfacing or shall be trafficked, ball embedment testing in accordance with test method Q706 shall be undertaken on the underlying pavement layer. Using the test results, the seal design shall be amended in accordance with the design method.

Spraying operations shall not commence prior to expiration of the 7-day period. **Hold Point 3**

7 MATERIAL

Materials shall comply with the requirements of the relevant standards listed in Table 7.

Table 7 – Material Standards

Material	Standard
Bituminous emulsion	MRTS12.2
Prime cover material and cover aggregate	MRTS22
Modified bituminous emulsion	As specified in Clause 1.1 of Annexure MRTS12.1
Adhesion agent	As specified in Clause 2 of Annexure MRTS12.1

8 CARE OF MATERIAL

8.1 Bituminous Emulsion

8.2 Storage

Storage of bituminous emulsion shall be arranged to minimise contact with air by using vertical tanks or keeping horizontal tanks full. When build-up of sludge requires removing, the tanks shall be flushed with hot water, preferably containing a compatible emulsifier.

Storage shall be at a temperature between 10°C and 85°C. Tanks shall be suitably insulated and, where necessary, heated to prevent freezing of the emulsion.

Drummed emulsion shall be stored at least one metre above the ground and protected against freezing. Drums shall be rotated end-over-end at least six times at intervals not exceeding 14 days.

Drummed emulsion shall be used within 90 days of manufacture.

8.3 Handling

Cationic and anionic emulsions are not compatible. Mixing cationic with anionic emulsion causes instantaneous break, with catastrophic damage to associated equipment.

Bituminous emulsion of one type shall not be placed into a container in which the other type has been held unless the container, pump, lines and spray bars have been emptied and very thoroughly cleaned with an approved detergent compatible with the emulsion type being removed.

8.4 Cover Aggregate

Cover aggregate shall not be exposed to contaminating agents, in particular, dust, and shall be handled so as to avoid contamination and any other deleterious effects.

9 PLANT

The Contractor shall have on the Site and in use as required the plant necessary for the performance of the particular operation. The respective minimum requirements for the plant listed in Table 9 shall apply. Additional minimum requirements for plant shall apply if such are specified in Clause 3 of Annexure MRTS12.1.

Table 9 – Minimum Requirements for Plant

Plant Item	Minimum Requirements
aggregate spreader	A mechanical spreader capable of accurately spreading a uniform layer of aggregate.
bituminous emulsion tank	A tank suitable for the storage and/or transport of bituminous emulsion.
drag broom	A mechanical broom suitable for the distribution of unevenly spread aggregate without disturbance of particles freshly embedded in binder.
road broom	A drawn rotary broom or self-propelled rotary broom suitable for sweeping or cleaning road surfaces. Where suitable, a vacuum system may be used.
rubber-tyred roller	A dual axle, multi-wheeled roller with a minimum load of one tonne per tyre. Tyres shall be smooth and be able to operate at a pressure of at least 550 kPa.

Plant Item	Minimum Requirements
sprayer	A bitumen sprayer which – a) complies with the relevant requirements of Austroads <i>Bitumen Sprayers</i> ; and b) has a current Sprayer Certificate issued by Department of Transport and Main Roads, Queensland.
steel-wheeled roller	A roller with steel wheels having a minimum diameter of 0.9 m and a maximum axle load of 5 tonnes. Vibratory equipment shall not be used unless approved by the Contract Administrator.
rubber-coated steel-wheeled roller	A steel-wheeled roller with rubber-coated steel wheels.

Not less than 7 days prior to sealing operations, the Contractor shall submit details of all plant to be used in the operations. **Hold Point 4**

10 PREPARATION PRIOR TO SPRAYING

10.1 Surfacing Preparation

The surface to be prepared shall include the surface to be sprayed plus either an area which is a minimum of 250 mm beyond the surface to be sprayed, or one which extends to the edge of the formation, whichever is the lesser.

The preparation work shall be carried out in a manner which shall promote the adhesion of the bituminous emulsion to the surface of the pavement. Such preparation work shall include that listed in Clauses 10.2 to 10.4.

10.2 Initial Treatment (No Existing Bituminous Treatment)

All foreign and loose material, including lenses of pavement material, shall be removed from the surface. The surface shall be swept with a road broom until the larger particles in the surface of the pavement are slightly exposed without dislodgment and/or excessive erosion of the surrounding finer material. A light watering shall be carried out just prior to spraying.

10.3 Re-treatment (An Existing Bituminous Treatment)

All foreign and loose material shall be removed from the surface with a road broom. On surfaces where a prime coat has been covered by a cover material, all the cover material shall be removed, without damage to the prime coat.

10.4 Disposal of Foreign and/or Loose Material

All foreign and/or loose material shall be removed from the road formation and utilised/disposed of in accordance with the requirements of Clause 11 of MRTS01 *Introduction to Technical Standards*.

10.5 Protection of Services

The Contractor shall take all necessary precautions to prevent any bituminous emulsion or other material used on the work from entering or adhering to any road furniture or roadside facility.

If any bituminous material does adhere to any road furniture or roadside facility, the Contractor shall remove all such material so that the road furniture or roadside facility is left in an as-found condition.

10.6 Setting Out

The Contractor shall set out sufficient marks on the pavement surface to permit the spraying of bituminous emulsion on the sections of pavement described in the Contract and in accordance with the requirements of this standard. The Contractor shall set out the work so that longitudinal joints coincide with lane lines, unless shown otherwise in the Contract. Tapers may be sprayed separately.

The start and finish point of each spray run shall be marked.

10.7 Programming Spray Runs

The Contractor shall program operations to ensure that –

- a) Sufficient loaded aggregate trucks are ready to follow the sprayer to cover the spray run immediately (refer to Clause 4.3); and
- b) Not less than the minimum specified rolling is achieved on the day of spraying (refer to Clause 14.5).

Additional requirements, if any, relating to programming of spray runs are given in Clause 4.1 of Annexure MRTS12.1.

11 RESTRICTIONS TO SPRAYING

11.1 Condition of Underlying Pavements Prior to Bituminous Layers

Where the sprayed bituminous layer will be the final surfacing or shall be trafficked, ball embedment testing in accordance with Test Method Q706 shall be undertaken. **Hold Point 5**

Where testing indicates embedment measured by the test method exceeds 3 mm at any location along the pavement, placement of the sprayed bituminous layer shall not proceed for that pavement lot. Testing is to be conducted a maximum of 12 hours prior to the placement of the sprayed bituminous layer and shall be repeated following any wet weather or placement of excess water on the pavement.

11.2 Availability of Cover Aggregate

Prior to commencement of bituminous emulsion spraying operations on any day, the Contractor shall provide the Contract Administrator with evidence that sufficient uncontaminated precoated cover aggregate of the relevant category, nominal size and specified properties is available for the extent of bituminous emulsion spraying work to be undertaken on that day.

11.3 Pavement Surface Temperature

Spraying shall not commence until the temperature on the surface of the pavement is above the temperature given in Clause 4.2 of the Annexure MRTS12.1 or, if not so given, above 10°C for at least one hour before spraying commences. **Witness Point**

Spraying shall not continue unless all operations up to completion of the minimum rolling, as specified in Clause 14.5, can be completed before the temperature on the pavement surface drops below the temperature given in Clause 4.2 of Annexure MRTS12.1 or, if not so given, below 10°C. **Witness Point**

11.4 Weather Conditions

Spraying shall not take place during rain or if rain is likely to fall prior to the spreading of cover aggregate and rolling with a minimum of two passes.

11.5 Period between Bituminous Emulsion Treatments

The minimum period between seal treatments shall be as shown in Clause 4.3 of Annexure MRTS12.1. Where not so stated, the minimum period between a prime and a seal shall be three days.

12 SPRAYING

12.1 General

The Contractor shall spray the bituminous emulsion in a uniform manner and in a way which promotes adhesion of the bituminous emulsion to the pavement surface and to the cover aggregate, and in accordance with Clauses 12.2 to 12.8 inclusive.

12.2 Method of Application

Bituminous emulsion shall be applied by means of the mechanically operated spray bar of a bitumen sprayer. In areas where the use of a spray bar of a bitumen sprayer is not possible, and only in such areas, the hand spraying lance from the sprayer may be used.

12.3 Joints between Spray Runs

All joints, transverse and longitudinal, shall abut neatly and uniformly to adjacent spray runs, without gap or overlap.

Spraying on each spray run shall start on a protective strip of heavy paper, with a minimum mass of 120 g/m² and a minimum width of 500 mm. The paper shall be laid across the pavement surface for the full width of the spray run and shall be held securely in place.

The sprayer shall commence moving at a sufficient distance in advance of the protective strip to ensure that the road speed for correct application is attained prior to the commencement of spraying.

The spraying for each spray run shall terminate on a protective strip of paper as specified above.

After spraying, the protective strips of paper shall be removed, ensuring no excess bituminous emulsion is deposited on the pavement surface. The Contractor shall dispose of the strips of paper at the end of each day's operation.

12.4 Spray Bar Nozzles

The spray bar nozzles used shall be appropriate for each spray run and shall comply with the Sprayer Certificate and Austroads' publication *Bitumen Sprayers*.

12.5 Spraying Temperature

Bituminous emulsion shall be sprayed at a temperature consistent with the requirements detailed in Table 12.5. **Witness Point**

Table 12.5 – Spraying Temperature Range

Material	Spraying Temperature Range
Bituminous emulsion – 60% bitumen content.	Ambient.
Bituminous emulsion – 67% bitumen content.	Minimum: 30°C. Maximum: 80°C.
Modified Bituminous emulsion.	As shown in Clause 1.2 of Annexure MRTS12.1.

12.6 Defects during Spraying

Spraying shall cease immediately if any defect develops in the spraying equipment or operation and shall not recommence until the fault has been rectified.

12.7 Spray Rate

The Estimated Spray Rate, Designed Spray Rate and Actual Spray Rate referred to in this Standard shall be the quantities in litres per m², at 15°C, of the residual bitumen for the relevant operation.

The Actual Spray Rate shall be within ± 5% of the Designed Spray Rate defined in the nominated seal design as determined in accordance with Clause 6.

To comply with the above requirement, the Contractor shall make adjustments to the operation of the sprayer to account for the following –

- a) the increased volume of the material to be sprayed where the temperature of the material is higher than 15°C (Refer to Table 12.5); and
- b) the increased volume of the material to be sprayed where there are other materials in the bituminous emulsion for the relevant operation, eg. the water included in, or added to, the emulsion.

12.8 Quantities Retained in the Sprayer Tank

To ensure a uniform spray rate, each sprayer run shall be programmed so that at least 250 litres of bituminous emulsion is retained in the tank at the completion of the spray run.

13 SPREADING PRIME COVER MATERIAL

13.1 General

The Contractor shall spread the prime cover material so as to produce a complete and even distribution. Wet cover material containing free surface water shall not be used.

13.2 Spread Rate

The Designed Spread Rate shall be that nominated in the seal design determined in accordance with Clause 6.

The Designed Spread Rate may be adjusted during the spreading operation to ensure a complete and even distribution.

The adjusted rate shall then be the Designed Spread Rate.

13.3 Time Limit

The cover material shall not be applied until the emulsion has broken, as evidenced by a change in its colour from brown to black.

13.4 Spreading

Bare or insufficiently covered areas shall be re-treated as soon as possible with a further light run, or by hand spreading.

The Actual Spread Rate shall not vary from the Designed Spread Rate by more than $\pm 10\%$.

13.5 Removal of Excess Cover Material

Unless otherwise stated in Clause 5.1 of Annexure MRTS12.1, all excess cover material shall be lightly swept and/or vacuumed from the pavement surface with a road broom and/or vacuum truck and completely removed from the road formation. All excess material shall be utilised/disposed of in accordance with the requirements of Clause 11 of MRTS01 *Introduction to Technical Standards*.

14 SPREADING COVER AGGREGATE

14.1 General

The Contractor shall spread the cover aggregate in a uniform manner which produces a dense tight mat after trafficking and also ensures that the bituminous emulsion adheres to the stone.

Wet cover aggregate containing free surface water shall not be used.

14.2 Spread Rate

The Designed Spread Rate shall be that nominated in the seal design determined in Clause 6.

The Designed Spread Rate may be adjusted during the spreading operation to ensure that the requirements of Clause 14.4 are achieved. **Nonconformance**

The adjusted rate shall then be the Designed Spread Rate.

14.3 Time Limit

The spreading of cover aggregate shall commence as soon as possible after the spraying of the bituminous emulsion.

The spreading of the cover aggregate shall be completed while the bituminous emulsion is still brown in colour. If aggregate is picked up on the wheels of trucks or rollers, spreading shall be delayed.

14.4 Spreading

Spreading of cover aggregate shall be carried out with an aggregate spreader. Minimum requirements for aggregate spreaders shall be as stated in Clause 5.2 of Annexure MRTS12.1. Cover aggregate shall be spread so that, after compaction, it forms a single layer on the pavement surface, the aggregate being partly interlocked.

Every attempt shall be made to achieve the required spread pattern on the first spreading pass. Bare or insufficiently covered areas shall be re-treated as soon as possible with a further light spreading run or by hand spreading. Overspreading or underspreading of the aggregate shall be avoided.

If there is an uneven distribution of cover aggregate, it shall be drag broomed until it is evenly distributed without dislodgment of any embedded cover aggregate.

Cover aggregate shall be spread so that the amount of material spread is not less than that represented by the Design Spread Rate or greater than 5% above that represented by the Design Spread Rate. Any initial underspreading shall be rectified as specified above.

The amount of aggregate spread shall be calculated from the volume used or by using Test Method Q711A.

14.5 Rolling

After satisfactory spreading, the cover aggregate shall be rolled with multi-tyred rollers at not less than the rate –

- a) as stated in Clause 5.3 of Annexure MRTS12.1; or, if not stated,
- b) 6 passes within 1 hour of spraying at every point on the surface.

There shall be a minimum of two rubber-tyred rollers available on the Site. There shall also be sufficient rubber-tyred rollers on Site and in use to complete the specified minimum amount of rolling as a continuous operation with successive spray runs.

Steel-wheeled rollers shall not be used.

A rubber-coated steel wheel roller may be used provided that it can be demonstrated that the use of such a roller shall provide a finished product in accordance with this Standard.

14.6 Removal of Excess Cover Aggregate

All excess cover aggregate shall be lightly swept and/or vacuumed from the pavement surface, without dislodgment of the bedded aggregate. It shall be completely removed from the road formation and utilised/disposed of in accordance with the requirements of Clause 11 of MRTS01 *Introduction to Technical Standards*.

Except where the work is being carried out under traffic, this work shall be completed before the work is opened to traffic.

Where the work is being carried out under traffic, the speed of traffic shall be adequately controlled until the work is swept.

14.7 Two Applications of Cover Aggregate with a Single Application of Binder

The intent of this work is to slightly reduce the amount of material spread on the first coat of cover aggregate to accommodate the second, smaller aggregate coat.

The following exceptions to the previous procedures for the spreading of cover aggregate shall apply to this work –

- a) The first application of cover aggregate shall be spread so that small gaps are left. This may require a 5% to 10% reduction to the normal amount of material spread;
- b) The first application of cover aggregate shall not be rolled in accordance with Clause 14.5 but shall be rolled with a multi-tyred roller for four complete passes at every point on the surface; and
- c) Removal of excess cover aggregate, in accordance with Clause 14.6 shall not take place after the first application.

All of the other requirements of Clauses 14.1 to 14.6 inclusive shall apply to each application of cover aggregate.

15 RECORDING

After each spray run, all details of the sealing operations shall be recorded and included in the quality records.

All records shall be such that the actual spray rate for each spray run shall be calculated at 15°C prior to the next spray run.

16 CONSTRUCTION COMPLIANCE

16.1 General

The process requirements shall be checked for compliance with the specified requirements during and after construction for each lot.

16.2 Lot Sizes and Testing Frequency

Sufficient testing shall be carried out to ensure that the material complies with this Standard.

For the checking of compliance for sprayed bituminous layers, a lot shall be no larger than a series of spray runs applied on any calendar day.

Sampling and testing of bituminous emulsion shall be undertaken in accordance with MRTS21 *Bituminous Emulsion*.

Testing frequencies shall comply with the requirements stated in Table 16.2.

Table 16.2 – Standard Test Methods

Property	Method No.	Minimum Testing Frequency
Field spread rate of cover aggregate	Q711A	1 per lot
Ball Penetration Test	Q706	5 per Pavement Lot for the Pavement Layer on which the sprayed bituminous layer is placed

A lot which has defects such as stripping of cover aggregate or fattiness of the finished seal under traffic shall be rejected.

17 SUPPLEMENTARY REQUIREMENTS

The requirements of MRTS12 *Sprayed Bituminous Emulsion Surfacing* are varied by the supplementary requirements given in Clause 8 of Annexure MRTS12.1.