Department of Transport and Main Roads

Technical Specification

Transport and Main Roads Specifications MRTS11 Sprayed Bituminous Treatments (Excluding Emulsion)

July 2025

Queensland Government

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1 Introduction

This Technical Specification applies to the application of sprayed bituminous treatments but excludes the use of bituminous emulsions. It covers the treatment types listed in Table 1.

Table 1 – Treatment types

Treatment Type	Treatment Label
Initial Treatments	
Prime	P
Initial Single / Single Seal	I-S/S
Initial Double / Double Seal	I-D/D
Secondary Treatments and Retreatments	
Single / Single Seal	S/S
Double / Double Seal	D/D
High Stress Single / Single Seal for medium traffic loadings	HSS1-M
High Stress Single / Single Seal for heavy traffic loadings	HSS1-H
High Stress Double / Double Seal for medium traffic loadings	HSS2-M
High Stress Double / Double Seal for heavy traffic loadings	HSS2-H
Extreme Stress Double / Double Seal	XSS
Strain Alleviating Membrane for slow moving cracks	SAM-S
Strain Alleviating Membrane for rapid moving cracks	SAM-R
Strain Alleviating Membrane Interlayer	SAMI
Waterproofing Seal under asphalt[1]	WP-A
Geotextile Reinforced Seal with a Single / Single Seal	GRS-S/S
Geotextile Reinforced Seal with a Double / Double Seal	GRS-D/D
Surface Enrichment	SE
Scatter Coat	SC

Note:

[1] The WP-A treatment type is typically used to waterproof the underlying asphalt pavement when an open graded, dense graded or stone mastic asphalt surfacing is used. It may also be used to waterproof pavements that contain a lightly bound base. For unbound pavements with an asphalt surfacing, a S/S treatment is typically used to waterproof the pavement prior to placement of the asphalt surfacing.

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

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of terms

The terms defined in MRTS01 *Introduction to Technical Specifications* apply to this Technical Specification. Additional terminology relevant to this Technical Specification is defined in Table 2 below.

Table 2 – Definition of terms

Term	Definition
AfPA	Australian Flexible Pavement Association
Actual Spray Rate	The spray rate of bituminous material actually achieved during the surfacing operation
Actual Spread Rate	The spread rate of cover aggregate or prime cover material actually achieved during the surfacing operation
Additive	Cutter oil, flux oil and/or adhesion agent
Adjusted Designed Spray Rate	The spray rate of bituminous binder as adjusted by the Seal Designer's Delegate in accordance with Clause 6
Adjusted Designed Spread Rate	The aggregate spread rate as adjusted by the Seal Designer's Delegate in accordance with Clause 6
Binder	Bitumen, cutback bitumen and/or polymer modified binder
Bituminous material	Bitumen, cutback bitumen, bitumen with cutter oil and/or flux oil and/or adhesion agent, and polymer modified binder (which includes crumb rubber modified binder)
Cover aggregate	Aggregate complying with the requirements of MRTS22 *Supply of Cover Aggregate*, and which forms a permanent wearing surface on a pavement
Coverage Tracking (CT) roller	A rubber-tyred roller that incorporates equipment to track the position and number of passes using a global positioning system (GPS). Position and coverage results are displayed in real time to the plant operator and the data can be exported to provide a complete record of compaction and undertake further analysis with Veta.
Cutting back bitumen	The temporary reduction of binder viscosity by the addition of cutter oil
Crumb Rubber Modified Binder	Bitumen blended with crumb rubber. The bitumen is generally C170 and the crumb rubber is generally obtained from the shredding and grinding of scrap rubber from vehicle tyres.
Designed Spray Rate	The spray rate of bituminous binder as calculated by the Seal Designer in accordance with Clause 6
Designed Spread Rate	The aggregate spread rate as calculated by the Seal Designer in accordance with Clause 6
Double / double seal	2 applications of binder, each followed by an application of aggregate
Estimated Spray Rate	The estimated spray rate of bituminous binder stated in Clause 2 of Annexure MRTS11.1. It is not to be used as an actual designed spray rate.
Estimated Spread Rate	The estimated spread rate for cover aggregate or prime cover material stated in Clause 2 of Annexure MRTS11.1. It is not to be used as an actual designed spread rate.

Term	Definition
Geotextile reinforced seal (GRS)	An application of a bituminous binder into which both aggregate and geotextile are incorporated to provide a durable wearing surface. A layer of binder is applied first, followed by a layer of geotextile fabric, then a single / single or double / double seal is applied.
Homogeneous section	A continuous section of carriageway in one direction where: • the Adjusted Designed Spray Rate, when designed in accordance with the design procedure stated in Clause 6.1.1, does not vary by more than 0.1 L/m² in the longitudinal section, and • the underlying surface type does not change within the longitudinal section. For the purpose of testing for determining seal design inputs, the maximum size of each homogeneous section is one lot.
Initial seal	An application of a sprayed seal to a prepared base course, which has not been primed. It is intended to adhere to the base, whilst providing a temporary wearing course for traffic and consists of either a single / single seal, a single / single seal with a scatter coat or a double / double seal. Cutback bitumen binders (AMC4, AMC5, AMC6 or AMC7) or emulsion bitumen binders are typically used for initial seals.
Initial treatment	An application of a prime (prime coat) or initial seal to a prepared base course
Lot	A spray run or series of spray runs applied on any calendar day
NTRO	National Transport Research Organisation
Parts of additive	The number of parts by volume of additive to be added to 100 parts by volume of binder measured at 15ºC
Pavement temperature	The temperature measured at the surface of the pavement to be sprayed
Prime	An application of a primer to a prepared base, with or without cover aggregate, to provide penetration of the surface and to obtain a bond between the pavement and the subsequent seal or asphalt. It is a preliminary treatment to a more permanent bituminous treatment.
Reseal	A seal applied to an existing seal or asphalt surface
Retreatment	An application of a sprayed bituminous treatment on an existing bituminous surfacing
Roller Pass	One pass of both axles of a roller over a specific point in one direction
Scatter coat	A light application of small size aggregate to temporarily ‘lock in’ a larger size aggregate seal to reduce aggregate movement during rolling and initial trafficking
Seal	A thin layer of sprayed bituminous material into which aggregate is incorporated

Term	Definition
Seal Designer	A competent, trained designer who shall complete the seal design and shall determine the Designed Spray Rate and the Designed Spread Rate. The Seal Designer shall have successfully attained either: • an Australian Flexible Pavement Association (AfPA) *Statement of Successful Completion of Written Assignment* (or equivalent) for the AfPA course titled *Sprayed Sealing Selection and Design* • a National Transport Research Organisation (NTRO) *Statement of Successful Completion of Written Assignment* (or equivalent) for the NTRO course titled *Selection and Design of Sprayed Seals*, Unit 3
Seal Designer's Delegate	A competent, trained nominee of the seal designer who may modify, on behalf of the Seal Designer, the Designed Spray Rate and/or the Designed Spread Rate as follows: • determine the Adjusted Designed Spray Rate • determine the Adjusted Designed Spread Rate, and • determine the parts of cutter oil to add prior to spraying. The Seal Designer's Delegate shall have successfully attained either: • an Australian Flexible Pavement Association (AfPA) *Certificate of Attendance* (or equivalent) for the AfPA course titled *Sprayed Sealing Selection and Design* • a National Transport Research Organisation (NTRO) *Certificate of Attendance* (or equivalent) for the NTRO course titled *Selection and Design of Sprayed Seals*, Unit 3
Secondary treatment	An application of a sprayed bituminous treatment on an initial treatment
Single / single seal	One layer of binder covered with a single layer of aggregate
Spray run	The area of pavement selected for coverage with a bituminous material during one continuous operation of a sprayer
Spray sheet	Contractor's Bituminous Material Spraying Record Sheet
Sprayed bituminous treatment	An initial treatment, surface enrichment, secondary treatment or retreatment
Strain Alleviating Membrane (SAM)	A sprayed bituminous treatment with a polymer modified binder which is used to delay the onset of reflection cracking on existing cracked surfaces or where the potential for cracking exists
Strain Alleviating Membrane Interlayer (SAMI)	A sprayed bituminous treatment with a polymer modified binder which is used as an interlayer between asphalt and the underlying pavement. A SAMI is used to delay the onset of reflection cracking on existing cracked surfaces or where the potential for cracking exists.
Veta	A map-based software tool for Contractors and Administrators to standardise, display, analyse and report data collected by intelligent compaction (IC) and paver-mounted thermal profiling (PMTP) technologies during construction. Veta can import data from various IC machines and PMTP to perform editing, filtering, spot test correlation, and statistical analysis as a post-processing tool.

3 Referenced documents

The requirements of the referenced documents listed in Table 3 below apply to this Technical Specification. Where there are inconsistencies between this Technical Specification and the

referenced documents, the requirements specified in this Technical Specification shall take precedence.

Table 3 – Referenced documents

Reference	Title
Advisory Note 7	*Guide to the Heating and Storing of Binders for Sprayed Sealing and Asphalt Manufacture,* AfPA
AGPT04K-18	*Guide to Pavement Technology Part 4K: Selection and Design of Sprayed Seals*, Austroads
AP-G41-15	*Bituminous Materials Safety Guide*, Austroads
AP-T344-19	*Relationships Between Cutter Oil Properties and Sprayed Seal Performance*, Austroads
AS 2008	*Bitumen for Pavements*
ATS-3110	*Supply of Polymer Modified Binders*, Austroads
MRTS02	*Provision for Traffic*
MRTS17	*Bitumen and Multigrade Bitumen*
MRTS18	*Polymer Modified Binder (including Crumb Rubber)*
MRTS50	*Specific Quality System Requirements*
MRTS57	*Geotextiles for Geotextile Reinforced Seals*
PWT14-10	*Sprayed Seal Cutting Practice,* Austroads / AfPA
PWT24-00	*Sprayed Sealing – Rolling of Cover Aggregate,* Austroads / AfPA
PWT27-13	*Sprayed Sealing – Cutting Back of Polymer Modified Binders,* Austroads / AfPA
PWT33-14	*Sprayed Sealing – Selection of Spraying Nozzles,* Austroads / AfPA
TN175	*Selection and Design of Sprayed Bituminous Treatments,* Transport and Main Roads
TN186	*Sealing in Cold Weather Conditions,* Transport and Main Roads
-	*Registered Product List for Binder Adhesion Agents*, Transport and Main Roads

4 Standard test methods

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

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

Table 4 – Standard test methods

Property to be Tested	Method No.
Average Least Dimension	AS 1141.20.3
Ball Penetration	AG:PT/T251
Binder Stripping Value – Modified Plate	Q212B
Degree of Aggregate Precoating	Q216
Field spread rate of cover aggregate	Q711A

Flakiness Index	AS 1141.15
Loose aggregate on sprayed seals	Q720
Particle Size Distribution	AS 1141.11.1
Sampling of bitumen	AS 2008 or Q080
Sampling of bituminous binders and crumb rubber	ATM 101 or Q080
Texture Depth	ATM 250 or Q715

5 Quality system requirements

5.1 Hold Points, Witness Points and Milestones

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

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

Table 5.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.2	1. Permission to use construction procedures		Construction procedures submitted to the Administrator
6.1.2			Notification of binder class substitution
6.2	2. Contractor notified of Principal's seal design		Contractor provides Administrator with Ball Penetration test results
6.3.2	3. Consideration of the Contractor's seal design		Contractor seal design report submitted to the Administrator
8.2		1. Care of cover aggregate	
8.3.1		2. Binder storage temperature measured and recorded at delivery to site	
8.3.2		3. Heating of bituminous materials	
9	4. Plant to be used		
10.1.2	5. Excessive Ball Penetration test results		
11.1	6. Cover aggregate availability		
11.2		4. Pavement temperature above minimum specified	

Clause	Hold Point	Witness Point	Milestone
11.3	7. Permission to implement additional measures to reduce the risk of early life stripping when sealing in cold weather		
12.4		5. Current Queensland Sprayer Certificate to be sighted	
12.7		6. Nomination and recording of cutting requirements	
14.1		7. Loading of cover aggregate into aggregate spreader	
14.8	8. Loose aggregate / signage requirements prior to opening to traffic		

5.2 Construction procedures

The Contractor shall prepare documented procedures for all required processes as defined in Clause 5 of MRTS50 *Specific Quality System Requirements*. These shall include, but are not limited to:

- procedures for handling, storage, transport, heating and transfer of binder in accordance with the requirements of Clause 8 of MRTS17 *Bitumen and Multigrade Bitumen* or Clauses 5.2 and 8 of MRTS18 *Polymer Modified Binder (including Crumb Rubber)* and this Technical Specification as appropriate
- enhanced construction procedures, if sealing works will be undertaken during cold weather (refer Clauses 11.2 and 11.3) and other high-risk situations, and
- procedures that prevent:
    - wash-off of bituminous material used to prime pavement surfaces, and
    - environmental harm that may result from the wash-off of this material.

Enhanced construction procedures are typically adopted when sealing during cold weather conditions and other high-risk situations. Such procedures typically ensure the following:

a) the aggregate is in an ideal condition state, i.e. ≤ 10% stripping value when tested in accordance with Q212B and free from surface moisture at the time of sealing

b) aggregate spreading occurs without delay after the binder is sprayed on the road surface (which typically requires the use of shorter spray runs)

c) aggregate is rolled into the binder without delay after spreading occurs

d) additional aggregate spreaders and rollers are used to ensure the aggregate is spread and rolled into the binder more quickly than would normally be the case, and

e) ensuring the specified number of passes are applied to the seal by using Coverage Tracking rollers during the construction process.

TN186 *Sealing in Cold Weather Conditions* provides guidance on additional measures that can be implemented when sealing in cold weather conditions. Specific additional measures that must be included in the construction procedures are detailed in Clauses 5, 6.1 and 6.3 of Annexure MRTS11.1.

The Contractor shall establish an Inspection and Test Plan (ITP) for supply and delivery of binder. The Inspection and Test Plan shall address at least:

a) traceability

b) conformance of binder supplied to the Site, and

c) sampling and testing at the point of manufacture and point of delivery (refer MRTS17 and MRTS18 for details).

The Contractor shall submit the documented procedures and the ITP to the Administrator not less than 7 days prior to their proposed use. **Milestone**

Documented procedures and the ITP shall not be implemented until permission to use has been granted by the Administrator. **Hold Point 1**

5.3 Conformance requirements

The conformance requirements which apply to lots of work covered by this Technical Specification are detailed in Clauses 7.2, 8, 10, 11, 12, 13 and 14. Materials shall conform to the requirements of Table 7.1. The conformance records for all lots of work shall be compiled on a spraying record sheet as specified in Clause 16.

6 Seal design

6.1 General

6.1.1 Scope

Sprayed bituminous treatments shall be designed in accordance with the requirements of the department's TN175 *Selection and Design of Sprayed Bituminous Treatments* and any additional requirements stated in Clauses 3.1 and 3.2 of Annexure MRTS11.1.

Unless otherwise stated in Clause 1 of Annexure MRTS11.1, the seal design will be carried out by the Principal.

The specific treatments for work under this Contract shall be as set out in Clause 2 of Annexure MRTS11.1 and the Drawings. Acceptable binder classes that may be used for each treatment type are defined in Table 6.1.1.

Table 6.1.1 – Acceptable binder classes for initial treatments, secondary treatments and retreatments

Treatment Type	Technical Specification	Acceptable Binder Class
Initial Treatments		
Prime	MRTS20	AMC00, AMC0 [1]
I-S/S or I-D/D	MRTS20, MRTS17	AMC5, AMC6, AMC7 or C170 [2]
Secondary Treatments and Retreatments		
S/S or D/D	MRTS17	C170, C240, C320, M500 or a blend of C170 and 5 parts (5%) crumb rubber [3, 4, 5]
HSS1-M	MRTS18	S10E, S35E, S9R or S9RF
HSS1-H	MRTS18	S15E, S15R or S15RF
HSS2-M	MRTS18	S10E, S35E, S9R or S9RF
HSS2-H	MRTS18	S15E, S15R or S15RF
XSS	MRTS18	S20E, S15R, S15RF
SAM-S	MRTS18	S10E, S35E, S9R or S9RF [4]
SAM-R	MRTS18	S15E, S15R or S15RF
SAMI	MRTS18	S25E or S18RF
WP-A	MRTS18	S20E, S25E, S15R [6], S15RF [6] or S18RF
GRS-S/S or GRS-D/D	MRTS17	C170, C240, C320, M500 or a blend of C170 and 5% crumb rubber [3, 4, 5, 6]
Surface enrichment	MRTS20	Note 7

Treatment Type	Technical Specification	Acceptable Binder Class

Note:

[1.] Where no indication is given in Clause 2 of Annexure MRTS11.1 or on the Drawings, AMC0 shall be used.

[2.] Where no indication is given in Clause 2 of Annexure MRTS11.1 or on the Drawings, AMC7 shall be used.

[3.] Where no indication is given in Clause 2 of Annexure MRTS11.1 or on the Drawings, C170 shall be the nominated binder class.

[4.] Blends of Class 170 bitumen and 5% crumb rubber shall:

- be supplied in accordance with the requirements of MRTS18 *Polymer Modified Binder (including Crumb Rubber)*. Conformance of the binder at the point of manufacture shall be based on the Class 170 bitumen test results and the blending records for each batch
- use crumb rubber that conforms with the requirements of Table 8.4 of Austroads ATS-3110 *Supply of Polymer Modified Binders* (e.g. Size 30 Mesh rubber than has been processed from waste tyres generated in Australia)
- be sprayed within 48 hours of the crumb rubber being blended into the bitumen, unless otherwise approved by the Administrator
- be subject to continuous agitation while in storage, and
- be subject to sampling and testing in accordance with the requirements of Clause 6 of MRTS18 *Polymer Modified Binder (including Crumb Rubber)* for each batch of binder and the results reported as part of the lot records.

[5.] At the point of delivery the softening point of blends of Class 170 bitumen and 5% crumb rubber shall be 48 – 55ºC and the torsional recovery at 25ºC, 30 seconds shall be ≥ 7%.

[6.] The use of binders that include crumb rubber in this application is experimental.

[7.] To be nominated in Clause 2 of Annexure MRTS11.1 or on the Drawings.

Transport and Main Roads has limited experience with the use of S15R and S15RF binder grades for WP-A treatments and the risk associated with the seal binder bleeding through the asphalt in hot weather has not yet been assessed. Similarly, the department has limited experience with the use of blends of bitumen and crumb rubber in geotextile reinforced seals. Usage of these binder grades in these applications should be limited to small scale trials until more experience is gained with these scenarios.

Further advice should be sought from the Principal Engineer (Sprayed Seals and Binders) when conducting these trials.

For all treatments to be incorporated into the Works, the treatment type, binder class, cover aggregate nominal size(s) and estimated application rates are specified in Clause 2 of Annexure MRTS11.1.

6.1.2 Use of an alternative binder class

Where a particular polymer modified binder class has been specified for a sprayed bituminous treatment, the Contractor may use an equivalent alternative binder class provided:

a) it complies with the requirements of Table 6.1.2(a)

b) the sprayed bituminous treatment conforms with all the requirements of this Technical Specification (including uniformity of binder application and limits for cutter oil content)

c) its use does not impact on the construction program, and

d) its use does not increase the cost of the sprayed bituminous treatment.

The equivalent alternative binder classes listed in Table 6.1.2(a) can be used as an alternative to the binder class specified without the need for Administrator approval for the following reasons:

a) they will provide long-term performance that is equivalent to the binder class specified, and

b) they can be applied at the same spray rate as the binder class specified (as the same 'polymer factor' is used for the seal design).

Table 6.1.2(a) – Acceptable alternative binder classes

Treatment Type	Class Specified	Equivalent Alternative Binder Class
S/S, D/D	C170	A blend of C170 and 5% crumb rubber
	C240	A blend of C170 and 5% crumb rubber
	C320	A blend of C170 and 5% crumb rubber
HSS1-M, HSS2-M, SAM-S	S10E	S35E, S9R or S9RF
	S35E	S9R or S9RF
	S9R	S35E or S9RF
	SR9F	S35E or S9R
HSS1-H, HSS2-H, SAM-R	S15R	S15RF
	S15RF	S15R
XSS	S20E	S15R or S15RF
	S15R	S20E or S15RF
	S15RF	S20E or S15R
SAMI	S25E	S18RF
	S18RF	S25E
WP-A	S15R	S20E or S15RF
	S15RF	S20E or S15R
	S25E	S18RF
	S18RF	S25E

The Contractor shall notify the Administrator of the binder class substitution not less than 14 days prior to the commencement of spraying. **Milestone**

Approval to use alternative polymer modified binder classes not listed in Table 6.1.2(a)

The alternative binder classes listed in Table 6.1.2(b) are typically considered to be acceptable alternatives to the binder class specified. However, as the use of these alternative binder classes will result in a change to the binder application rate, Administrator approval is required prior to use.

The Administrator would typically use the following criteria to evaluate these proposals:

- compliance with Clause 6.1.2 requirements,
- no increase in the cost of the treatment ($/m²), and
- no increase in the unit rate for the binder ($/L).

The Administrator should refer to the department's Technical Note TN175 for appropriate 'polymer factors' when evaluating the cost implications of these proposals.

Table 6.1.2(b) – Acceptable alternative binder classes requiring the Administrator's approval prior to use

Treatment Type	Binder Class Specified	Acceptable Alternative Binder Class
HSS1-H, HSS2-H, SAM-R	S15E	S15R or S15RF
	S15R	S15E
	S15RF	S15E

6.1.3 Seal Designer and Seal Designer's delegate

The seal design shall be undertaken by the Seal Designer. Prior to undertaking any seal design, the Seal Designer shall inspect each site in order to identify site-specific conditions for inclusion in the design.

The Seal Designer's delegate shall have facilities to be in communication with the Seal Designer at all times and shall be supervised by the Seal Designer.

The Seal Designer or the Seal Designer's delegate shall be on site during spraying to check designed rates. They shall adjust the Designed Spray Rate and Designed Spread Rate where this is required for the existing field conditions including, but not limited to, adjustments for test results from the ball penetration tests. These adjusted rates shall be called the Adjusted Designed Spray Rate and the Adjusted Designed Spread Rate.

6.2 Seal design by the Principal

Where the Principal is nominated to undertake the seal design, unless otherwise stated in Clause 3.1 of Annexure MRTS11.1, testing shall be undertaken by the Contractor at the test locations and minimum test frequencies detailed in Table 6.2 for the following properties:

a) Particle Size Distribution, Flakiness Index and Average Least Dimension of the cover aggregate (where cover aggregate is supplied by the Contractor)

b) Texture Depth, and

c) Ball Penetration.

Test results for the cover aggregate and texture depth shall be submitted to the Administrator with sufficient lead time to allow a period of 7 days following submission of the test results for the Principal to carry out the seal design. **Milestone**

The Contractor shall test and report the Ball Penetration in accordance with the requirements of Table 6.2 and Clause 10.1.2. Ball Penetration test results shall be forwarded to the Administrator on the day of testing. **Milestone**

Spraying operations shall not commence until the Contractor has been notified by the Administrator of the Designed Spray Rate and Designed Spread Rate. **Hold Point 2**

Table 6.2 – Testing for determining seal design inputs

Property to be Tested	Test Location(s)	Minimum Test Frequency
Particle Size Distribution Flakiness Index Average Least Dimension (ALD)	The test samples shall be sourced from the stockpiles to be directly used for the works.	Test frequency shall be: • 1 test for each aggregate type, nominal size and source, and • repeat tests at every 1000 tonnes.
Texture Depth	In and between the wheelpaths – that is, 3 tests at each test chainage per direction	Test frequency shall be the lesser of: • every 400 m, or • 3 test chainages per homogeneous section where the test sites selected are representative of the homogeneous section.
Ball Penetration	In the inner and outer wheelpaths – that is, 2 tests at each test chainage per direction Testing is required only for: • pavements in accordance with Clause 10.1.2 • primed or initial sealed surfaces, and • asphalt or slurry surfacing less than 6 months old.	Test frequency shall be 5 test chainages per homogeneous section where the test sites selected are representative of the homogeneous section. Testing shall be completed between 24 – 48 hours prior to spraying.

6.3 Seal design by the Contractor

6.3.1 Seal design inputs

Where the Contractor is nominated to undertake the seal design, the Contractor shall inspect each site and select inputs and associated design factors to be used in the seal design procedure. These inputs and factors shall be determined from:

a) the traffic stated in Clause 3.2 of Annexure MRTS11.1

b) project site conditions, and

c) sampling and testing by the Contractor in accordance with the requirements of Table 6.2 noting that:

   i. testing shall be sufficient to comply with the design procedure requirements, and

   ii. aggregate samples shall be taken from the material that is to be used on the project.

As part of the seal design, the Contractor shall review the selections of treatment types, binder classes, and aggregate nominal sizes nominated in Clause 2 of Annexure MRTS11.1 and, prior to commencing the design, shall notify the Administrator if the Contractor does not agree with any of the selections.

Where the Principal intends to apply aggregate size combinations not recommended by Austroads *Guide to Pavement Technology Part 4K: Selection and Design of Sprayed Seals* (such as using 14/10 or 16/10 mm aggregate combinations for double / double seals), the seal design should be conducted by the Principal.

Surface Enrichment treatments should always be designed by the Principal.

6.3.2 Seal design report

The Contractor shall submit the seal design report to the Administrator at least seven days prior to the commencement of bituminous spraying operations. **Milestone**

The seal design report shall detail:

a) separate seal designs for variations in any and each of:

   i. test results for seal design inputs stated in Table 6.2

   ii. binder class

   iii. cover aggregate size and source

   iv. homogeneity of sections of carriageway impacting on design in accordance with the design procedure, and

   v. underlying pavement type on which sprayed bituminous surfacing is to be applied.

b) test results, assumptions, inputs, the design method and calculations that were used to determine the Designed Spray Rate and the Designed Spread Rate

c) for each unique combination of treatment type, binder class, aggregate size and location, the following in a tabular form:

   i. binder class, aggregate types, reference location, and

   ii. Designed Spray Rate of bituminous material and the Designed Spread Rate of cover aggregate.

d) for seals involving multiple layers of binder and/or aggregate (e.g. double / double seals), the minimum and maximum period between bituminous treatments

e) documentary evidence of the Seal Designer's successful attainment of the AfPA *Statement of Successful Completion of Written Assignment* (or equivalent) for the course titled *Sprayed Sealing Selection and Design*, and

f) nomination of the Seal Designer's Delegate and documentary evidence of this delegate's successful attainment of AfPA's *Certificate of Attendance* for the course titled *Sprayed Sealing Selection and Design*.

The seal design report shall include a statement signed by the Seal Designer that the seal design complies with the seal design method for the test results, assumptions and inputs used.

The Administrator will have three days to consider the seal design report and spraying operations shall not commence prior to the Administrator releasing a hold point for this consideration. **Hold Point 3**

For each lot or homogeneous section, at the time before spraying commences, the Seal Designer's Delegate shall determine the adjustments to be made to arrive at the Adjusted Designed Spray Rates and any addition of additives including cutter oil and the Adjusted Designed Spread Rates. The Seal Designer's Delegate shall record these adjustments and modifications on the Contractor's spray sheet. If no adjustments or modifications are made to the designed rates, the spray sheet record shall record the non-adjusted rates accordingly. The Contractor shall certify with a signature that the Seal Designer's Delegate has approved the spray sheet record of the adjustments and modifications.

7 Materials

7.1 Specifications

Contractor-supplied materials shall comply with the requirements of the relevant Technical Specifications stated in Table 7.1.

Table 7.1 – Material Technical Specifications

Material	Specification
Bitumen and multigrade bitumen	MRTS17
Polymer modified binder (including crumb rubber)	MRTS18
Cutter oils	MRTS19
Cutback bitumen	MRTS20
Adhesion agent	As specified in Clause 4.1 of Annexure MRTS11.1
Prime cover material and cover aggregate	MRTS22
Geotextiles for paving applications	MRTS57

7.2 Supply of material

The Principal will supply the materials stated in the Principal Supplied Material List (Form C7827). All other materials shall be supplied by the Contractor.

7.3 Transport of material

The responsibility for transport to the Site of materials supplied by the Principal will be as stated in the Principal Supplied Material List (Form C7827). Transport to the Site of all other materials shall be the responsibility of the Contractor.

8 Care of materials

8.1 Cutter oil

Cutter oil shall be handled and stored in a way which prevents any ingress of water. Water detection paste shall be available at all times and used if water contamination of the cutter oil is suspected.

Cutter oil which is suspected as being water contaminated shall be investigated and, if found to be water contaminated, shall not be used.

8.2 Cover aggregate

Cover aggregate shall not be exposed to contaminating agents, particularly dust, and shall be handled so as to avoid contamination and any other deleterious effects. Unless otherwise stated in Clause 4.2 of Annexure MRTS11.1, cover aggregate shall be protected with a light plastic or similar material to prevent the ingress of moisture and other contaminants. The protective material shall be sufficiently anchored to ensure the optimal fixture that can be achieved consistent with the protective material properties. **Witness Point 1**

8.3 Bituminous materials

8.3.1 Delivery (storage and transport)

Binder shall be delivered to the Works in accordance with Clause 8 of MRTS17 *Bitumen and Multigrade Bitumen* or Clause 8 of MRTS18 *Polymer Modified Binder (including Crumb Rubber)* as appropriate.

The temperature at delivery to site shall be measured and recorded. **Witness Point 2**

8.3.2 Heating

The Contractor shall ensure that strict controls are applied to heating of bituminous materials in accordance with the requirement of Austroads AP-G41 *Bituminous Materials Safety Guide*, Section 7: Heating, and the Contractor's Safety Plan and Clause 5.2 of MRTS18 *Polymer Modified Binder (including Crumb Rubber)*.

Heating requirements shall be strictly observed. **Witness Point 3**

8.3.3 Incorporation of additives

Volatile additives, e.g. cutter and flux oils, shall not be heated and shall be introduced into the sprayer tank through the sprayer's pumping system. Volatile additives shall not be added to the top of hot bitumen.

Non-volatile additives, e.g. adhesion agent, shall be introduced into the sprayer tank through the sprayer's pumping system in accordance with any relevant standards and/or manufacturer's instructions.

Additive shall be incorporated in accordance with Transport and Main Roads' *Registered Product List for Binder Adhesion Agents*.

The appropriate concentration of binder adhesion agent to be used (% expressed as parts by volume) will depend on the particular characteristics of the aggregate as well as the product's performance level. As a guide, the following are suggested:

- For Level 1 products, an adhesion agent concentration of 0.3% should be used for aggregates with average adhesion properties, and 0.6% for difficult aggregates known to possess high stripping tendencies
- For Level 2 and Level 3 products, increasingly higher adhesion agent concentrations will be required but should not exceed 1.0%, and
- Adhesion agent concentrations should be doubled when using polymer modified binders but should not exceed 1.0%.

Use of adhesion agent concentrations above those suggested may cause cutting of the binder with little improvement in adhesion promoting properties.

When additive is incorporated:

a) the additive shall be dissolved in hot binder, and
b) the hot binder and additive shall be circulated, after the addition of the last component, at a rate of at least 1000 litres per minute for a period until the sprayer contents have been circulated twice.

Where adhesion agent is to be used, the binder shall then be sprayed as promptly as field circumstances allow and within three hours. If the binder and adhesion agent has not been sprayed within three hours, additional adhesion agent may be added to the remaining binder at a dosage concentration then equivalent to one third of the original adhesion agent dosage.

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 5 of Annexure MRTS11.1.

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

Table 9 – Minimum requirements for plant

Plant Item	Minimum Requirements
Aggregate spreader	A mechanical spreader capable of accurately spreading a uniform layer of aggregate and, on the day of spreading, satisfactorily meets the requirements of the field spread rate of cover aggregate test (Q711A). Additional requirements are detailed in Clause 14.4.
Bitumen tank	A tank suitable for the storage and/or transport of bitumen.
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.
Sprayer	A bitumen sprayer which has a current Queensland Sprayer Certificate issued by Department of Transport and Main Roads. The spray bar width of the bitumen sprayer shall not operate beyond the width range for which the spray bar has been certified.

Field production of Crumb Rubber Modified Binder	For field produced crumb rubber modified binders, mobile plant consisting of a crumb rubber modified binder blending mill and agitated digestion and storage tanks.

10 Preparation prior to spraying

10.1 Surface preparation

10.1.1 General

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 will promote the adhesion of the bituminous material to the surface of the pavement. Such preparation work shall include that set out in Clauses 10.1.2 to 10.1.4 inclusive.

10.1.2 Initial treatments

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 but ensuring excessive erosion of the surrounding finer material does not occur.

A light watering shall be carried out on dry or dusty surfaces just prior to spraying.

For initial seals on new granular, stabilised or lightly bound pavement layers, Ball Penetration testing shall be completed in accordance with the requirements of Table 6.2 on the following surfaces:

a) after priming, or

b) before application of an initial seal.

Where a Ball Penetration test result exceeds 3.0 mm, the surface shall not be sprayed unless otherwise approved by the Administrator. **Hold Point 5**

10.1.3 Secondary treatments and retreatments

All foreign and loose material shall be removed from the surface using a road broom.

On surfaces where a prime coat has been covered by a cover material, all loose cover material shall be removed without damage to the prime coat.

10.1.4 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 10 of MRTS01 *Introduction to Technical Specifications*.

10.2 Protection of road furniture and roadside facilities

The Contractor shall take all necessary precautions to prevent any bituminous 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 bituminous material so that the road furniture or roadside facility is left in an as-found condition.

Any damage or defacement shall be made good by the Contractor at no cost to the Principal immediately after surfacing work on a section has been completed.

10.3 Limit of work and setting out

The Contractor shall set out sufficient marks on the pavement surface to permit the spraying of bituminous material on the sections of pavement described in the Contract and in accordance with the requirements of this Technical Specification.

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.

Unless otherwise specified, the Works shall include all existing traffic lanes, sealed shoulders, pavement widenings (turn lanes), tapers, and bell mouths at intersecting roads.

10.4 Programming spray operations

The Contractor shall program the operations to ensure that:

a) sufficient loaded aggregate trucks are ready to follow the sprayer to cover the spray run immediately (refer to Clause 14.3), and

b) not less than the minimum specified rolling is achieved (refer to Clause 14.5).

Additional requirements, if any, relating to programming of spray operations are given in Clause 6.1 of Annexure MRTS11.1.

11 Restrictions to spraying

11.1 Availability of cover aggregate

Prior to commencement of bitumen spraying operations on any day, the Contractor shall provide the Administrator with evidence that sufficient uncontaminated, precoated cover aggregate of the relevant category, nominal size and specified properties is available for the extent of bitumen spraying work to be undertaken on that day. **Hold Point 6**

11.2 Pavement temperature

Spraying shall not commence until the temperature of the pavement surface is above the temperature given in Clause 6.2 of Annexure MRTS11.1 or, if not so given, the pavement temperature listed below for at least one hour before spraying commences:

a) 10ºC for primes

b) 15ºC for initial seals containing AMC5 to AMC6 cutback bitumen

c) 20ºC for treatments containing AMC7 cutback bitumen, bitumen (i.e. Class 170, 240, and 320 bitumen), multigrade bitumen (i.e. M500 bitumen), crumb rubber binders (i.e. S9R, S9RF, S15R, S15RF and S18RF binder classes), as well as a blend of Class 170 bitumen and 5% crumb rubber, and

d) 25ºC for treatments containing polymer modified binders (other than crumb rubber binders) (i.e. S10E, S15E, S20E, S25E and S35E binder classes), unless the Administrator has given written permission to relax the temperature to a minimum of 20ºC. **Witness Point 4**

Spraying shall not continue unless all operations up to the completion of the minimum rolling, as specified in Clause 14.5, can be completed before the temperature of the pavement surface drops below the temperature given in Clause 6.2 of Annexure MRTS11.1 or, if not so given, the minimum temperatures listed in this clause.

These minimum pavement surface temperature limits do not apply to WP-A and SAMI treatments that are:

a) placed over an existing seal or asphalt, and

b) overlaid with asphalt prior to trafficking.

In some situations, the Principal may limit the maximum amount of cutter oil to be used for long term performance reasons (e.g. reduce the potential for bleeding during the first period of hot weather after the works are completed). In these situations, consideration should be given to either:

- increasing the minimum pavement temperature limits for spraying in Clause 6.2 of Annexure MRTS11.1 using Table 12.7 as guidance, and/or
- require the adoption of enhanced construction procedures for the spreading and rolling of cover aggregate into the binder.

11.3 Weather conditions

Generally, sprayed bituminous treatments should be programmed for construction during favourable (i.e. warm and dry) conditions. TN186 *Sealing in Cold Weather Conditions* provides guidance on the time of year when sprayed sealing works should be programmed to minimise the risk of stripping (early failure by loss of aggregate) due to cold weather early in the life of a sprayed bituminous treatment.

Spraying shall not take place during rain or if rain is likely to fall prior to the spreading of cover aggregate and the completion of rolling.

The Contractor shall stop sealing immediately if rainfall occurs during sealing operations. Any seal sprayed during rainfall or on a wet surface shall be rejected.

Spraying shall not take place during winds of greater than 30 km/h or during dust storms.

Clause 6.3 of Annexure MRTS11.1 nominates the time of year when the application of sprayed bituminous treatments that will be trafficked by the public at speeds greater than 40 km/h is either:

a) not permitted, or

b) requires the implementation of additional measures as nominated in Clause 6.3 of Annexure MRTS11.1 to minimise the risk of early life stripping. The risk mitigation measures nominated in Clause 6.3 of Annexure MRTS11.1 are minimum requirements and the Contractor may choose to implement additional measures to manage risks associated with sealing during cold weather conditions.

The months of the year when application of sprayed bituminous treatments is not permitted and the months of the year when additional measures must be implemented to minimise the risk of stripping due to cold weather should be determined for each project location in accordance with TN186 *Sealing in Cold Weather Conditions*. Relying on the default requirements in Clause 11.3 is not recommended.

Where no indication is given in Clause 6.3 of Annexure MRTS11.1, the following shall apply for sprayed bituminous treatments (other than initial seals) that will be trafficked at speeds greater than 40 km/h by the public:

a) spraying is not permitted during the months of June to August (inclusive), and

b) requires the implementation of additional measures during the months of May and September to minimise the risk of early life stripping.

Where the implementation of additional measures is required to minimise the risk of early life stripping, the contractor must submit their procedures to the Administrator for review not less than 14 days prior to the commencement of spraying.

Spraying shall not commence until these procedures have been deemed suitable by the Administrator. **Hold Point 7**

TN186 *Sealing in Cold Weather Conditions* provides guidance regarding possible risk mitigation measures when sealing during cold weather conditions.

Where sealing is to occur during the time of year when the Sealing Risk Level is Level 2, the Administrator must review the additional measures to be implemented by the Contractor to reduce the risk of early life stripping.

Where sealing is to occur during the time of year when the Sealing Risk Level is Level 3 (i.e. the highest risk level) in accordance with TN186 *Sealing in Cold Weather Conditions*, the Administrator must obtain approval from the District Director prior to the commencement of spraying. If approved by the District Director, appropriate risk mitigation measures, consistent with the requirements for Sealing Risk Level 2, must be implemented.

The relevant details of this procedure are to be documented by the Administrator in the Project Details and Authority to Proceed forms contained in TN186 *Sealing in Cold Weather Conditions*.

11.4 Minimum period between bituminous treatments

Unless otherwise stated in Clauses 6.4 and 6.5 of Annexure MRTS11.1, the minimum periods of time between bituminous treatments shall be:

a) a prime shall not be covered with a secondary treatment and/or asphalt until both of the following conditions are satisfied:

   i. the prime shall be completely dry and trafficable by light construction traffic (< 20 vehicles per day), and

   ii. the prime has been placed for a minimum period of 3 days.

All traffic shall be kept off the primed surface unless prime cover material has been applied.

b) between an initial seal, secondary treatment or retreatment containing > 2% by volume cutter oil and subsequent bituminous treatment (such as a secondary treatment, retreatment or asphalt) at the same location, the minimum period is:

   i. 3 months in warm weather (minimum nightly temperatures > 10ºC), and

   ii. at least 6 months in cooler conditions (minimum nightly temperatures ≤ 10ºC).

The minimum curing periods to be adopted should be based on local experience and must consider the environmental conditions and traffic loading during the curing period as well as the binder class / category, amount of cutter oil, and nominal size(s) of aggregate used. The default minimum periods between an initial seal and a secondary treatment typically results in adequate curing of the initial seal binder to avoid performance related issues associated with insufficient curing.

Adoption of shorter curing periods (than the default minimums) may require an adjustment (i.e. a reduction in the binder application rate) to the seal design based on local experience.

Insufficient curing may lead to bleeding of the overlying treatment during the next period of significant hot weather.

Delaying the application of a secondary treatment to an initial seal excessively may lead to deterioration of the initial seal by the action of traffic, particularly during periods of hot weather, where the initial seal is subject to heavy traffic and/or high shear stresses (such as intersections or sharp curves).

c) prior to asphalt overlay, SAMI treatments shall not be left exposed for more than 2 days when subject to traffic other than construction vehicles. Where SAMI treatments are trafficked by only construction traffic, aggregate removed from the SAMI binder by construction traffic shall be replaced prior to asphalt overlay

d) for single / single seals with a scatter coat, the scatter coat aggregate shall be applied on the same day, and

e) for seals with multiple layers of binder and/or aggregate (e.g. double/double seals), the period shall not exceed one day.

12 Spraying

12.1 General

The Contractor shall spray the bituminous material in a uniform manner and in a way which promotes adhesion of the material to the pavement surface and to the cover aggregate, in accordance with Clauses 12.2 to 12.9 inclusive.

The sprayer shall maintain a constant road speed throughout the length of each sprayer run (except where permitted by an approved Construction Procedure for achieving a specified variable application rate).

The Contractor shall take all reasonable steps to prevent:

a) wash-off of bituminous material used to prime pavement surfaces (such as not priming pavement surfaces immediately prior to rainfall), and

b) environmental harm that may result from the wash-off of this material.

The Contractor shall notify the Administrator as soon as practicable upon becoming aware of any wash-off of bituminous material used to prime pavement surfaces. Any adverse environmental impacts such as contamination of land and waterways caused by the wash-off of bituminous material used to prime pavement surfaces shall be made good by the Contractor to the satisfaction of the Administrator.

12.2 Method of application

Bituminous materials shall be applied by a certified bitumen sprayer. Hand spraying is only permitted for areas where the bitumen sprayer cannot access.

12.3 Joints between spray runs

All joints, transverse and longitudinal, shall abut in a manner to ensure that the Adjusted Designed Spray Rate is applied uniformly across the joint.

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 material is deposited on the pavement surface. The Contractor shall dispose of the strips of paper at the end of each day's operation in accordance with the waste management requirements of MRS51 *Environmental Management*.

12.4 Spraybar nozzles

The spraybar nozzles used shall be appropriate for each spray run and shall comply with the Queensland Sprayer Certificate for the sprayer. Substitution with other nozzle types and sizes is not permitted. **Witness Point 5**

Any nozzles that are damaged or become unduly worn or defective shall be replaced by new nozzles of the same type and size. A sufficient number of nozzles for this purpose shall be available on site at all times.

The type and positioning of nozzles on the spraybar shall be compatible with the nature of the binder to be sprayed and its application rate.

Austroads/AfPA PWT33-14 – *Sprayed Sealing – Selection of Spraying Nozzles* provides guidance on the appropriate selection of nozzles for sprayed sealing.

Photos showing the most common types and sizes of nozzles used on sprayers in Queensland are provided below.

A18 (Copley)

B36 (Copley)

SS80/50 (Spray Systems)

Table 12.4 – Typical application for sprayer nozzles

Nozzle Type	Nominal Flow Rate	Typical Application
A18[1]	18 L/min	Standard nozzle type used for most spraying applications.
SS80/50	11.2 L/min	Nozzle type, typically used in combination with A18 nozzles, to produce a variable transverse distribution spray pattern.
B36[2]	36 L/min	Big nozzles typically used to spray highly modified classes of crumb rubber modified binder.

Note:

[1] Previously designated A4.

[2] Previously designated B8.

When spraying some of the more highly modified classes of crumb rubber modified binder, it may not be possible to achieve a satisfactory fan pattern with A18 nozzles (refer Clause 12.6). In these situations, the use of a sprayer that has been calibrated with B36 nozzles may be required to achieve a satisfactory fan pattern and to avoid blockages.

Where either blockages or partial blockages of nozzle(s) occur, spraying shall cease immediately. If the blockage is due to the condition of the binder being sprayed, the condition shall be rectified sufficiently to avoid future blockages.

12.5 Spraying temperature

The acceptable temperature range for spraying bituminous material is listed in Table 12.5. Spraying of bituminous material shall not occur below the relevant minimum temperature nor heated on site above the relevant maximum temperature in Table 12.5. However, when cutback bitumen is delivered to the Works above the maximum temperature indicated in Table 12.5, spraying is permitted within the temperature range of the minimum given in Table 12.5 and the delivered temperature provided no further heating occurs. Any binder delivered to site at a temperature above 200ºC shall be rejected.

Table 12.5 – Spraying temperature range

Material	Grade	Spraying Temperature Range (ºC)	
		Minimum	Maximum
Cutback bitumen	AMC00	Ambient	Ambient

Material	Grade	Spraying Temperature Range (ºC)	
		Minimum	Maximum
	AMC0	35	55
	AMC5	120	150
	AMC6	135	160
	AMC7	150	175
Bitumen	Class 170	160	190
	Class 240	165	190
	Class 320	170	190
Multigrade bitumen	Class M500	175	190
A blend of C170 bitumen and 5% crumb rubber		170	190
Crumb rubber modified binder	S9R, S15R, S9RF S15RF and S18RF	185	195
Polymer modified binder (other than crumb rubber modified binder)	S10E, S15E, S20E, S25E and S35E	180	190

12.6 Faults during spraying

Spraying shall cease immediately if:

- any fault develops in the spraying equipment or operation and shall not recommence until the fault has been rectified, or
- the bituminous material is not being uniformly applied (e.g. "tram-tracking" or a blocked jet in the spray bar).

Spraying shall not recommence until the cause of the non-uniform binder application has been rectified.

Achieving a uniform application of binder is critical to maximising the life of a sprayed seal. The impact of non-uniform binder application can lead to premature flushing or aggregate loss from a sprayed seal and will not always become apparent during the first 12 months after application. The uniformity of binder application can be assessed visually at the time of application and examples of acceptable, marginal, and unacceptable binder uniformity are provided below.

Acceptable binder uniformity

Marginal binder uniformity

Unacceptable binder

uniformity

12.7 Cutting back binder

The first application of binder in a geotextile reinforced seal or any secondary treatments or retreatments placed immediately below a layer of asphalt shall not be cut back unless otherwise specified in Clause 6.6 of Annexure MRTS11.1 or approved by the Administrator.

Notwithstanding the requirements of Clause 6.6 of Annexure MRTS11.1, secondary treatment or retreatments placed immediately below asphalt should not be cut by more than the addition of 2.0 parts of cutter oil by volume.

Assessment of pavement temperatures shall take into account the cooler condition inherent in shaded areas of pavement.

Where the road pavement and/or temperature is such that a temporary reduction in binder viscosity is necessary to enhance initial adhesion between the binder and the cover aggregate, cutter oil shall be added to the binder for initial seals, secondary treatments and retreatments. The amount of cutter oil to be used shall be determined by the Seal Designer's Delegate and be appropriate to:

a) achieve a strong bond between the binder and the cover aggregate, and

b) avoid stripping or flushing / bleeding of the seal or overlying asphalt during the first year of operation or the defects liability period, whichever is the longer.

The binder must have a sufficiently low viscosity at the time of sealing to achieve adequate initial wetting of the aggregate. Where the temperature of the binder is too low to achieve this viscosity, it may be necessary to cut back the binder to reduce its viscosity. Cutting practice varies considerably across Queensland due to differences in environmental conditions (both seasonally and geographically). Table 12.7 can be used as a starting point but is often varied based on local practice.

Table 12.7 – Basic cutting practice guide for trafficked seals

Pavement Temperature (ºC)	Parts cutter for:					
	Class 170 and 240 bitumens **Blends of Class 170 bitumen and 5% crumb rubber** **Binder Classes S9R and S9RF**	**Class 320 bitumen and M500 multigrade bitumens**	**Binder Classes S10E and S35E**	**Binder Class S15E**	**Binder Class S20E**	**Binder Classes S15R and S15RF[1]**
20 – 25	6	8	N/A[2]	N/A[2]	N/A[2]	6
26 – 32	4	6	4	5	6	4
33 – 38	2	4	2	3	4	3
39 – 45	0	2	0	1	2	2 min
≥ 45	0	0	0	0	0	2 min

Note:

[1] Cutter rates will vary depending on the nozzle size used (to ensure adequate fanning) and local experience.

[2] Not applicable. Avoid sealing when these weather conditions are present (due to increased risk of stripping).

The amount of cutter oil is typically adjusted as follows:

- reducing the amount of cutter oil by 2 parts when pavement temperatures are rising (for example, early mornings), and
- increasing the amount of cutter oil by 2 parts when the pavement temperatures are falling (for example, late afternoon) or pavement temperatures are likely to fall below 5ºC during the first 24 hours after spraying.

Further reductions in cutter oil rates may be appropriate if:

a) enhanced construction procedures are adopted, and/or

b) sealing commences early in the morning and high pavement temperatures are expected later in the day, i.e.

   i. ≥ 65ºC for S20E binder class

   ii. ≥ 55ºC for S15E binder class, and

   iii. ≥ 45ºC for all other binder classes.

Cutting practice may also be varied as a result of a number of other factors, which are discussed in detail in Austroads Technical Report AP-T39-05 *Sprayed Seal Cutting Practice*.

Additionally, for double / double seal applications, where the second application is applied with little or no trafficking between applications, the proportion of cutter oil in the first application should be reduced to:

- 0 – 2 parts for all binder classes other than S15R and S15RF, and
- 0 – 4 parts for S15R and S15RF binder classes.

Seals that require the addition of more than 4 parts of cutter oil should be referred to the Administrator prior to spraying. Use of excessive cutter oil can lead to poor cohesive strength of the binder and flushing and/or bleeding of the treatment during subsequent warm / hot weather.

Use of insufficient cutter oil can lead to poor wetting of the aggregate and aggregate loss (stripping) during initial trafficking of the seal.

In addition, use of insufficient cutter oil in initial seals and/or poor pavement surface preparation can lead to poor bonding of the initial seal and the underlying pavement.

Further information on the relationship between binder temperature and aggregate adhesion can be found in Austroads Technical Report AP-T344-19 *Relationship between Cutter Oil Properties and Sprayed Seal Performance*.

Incorporation of cutter oil into the binder shall be carried out in accordance with Clause 8.3.3. The cutter oil, without previously being heated, shall be sucked into the hot bitumen in the sprayer. Before spraying, after the addition of the last component, the Contractor shall circulate the full sprayer load of cutback bitumen at a rate of at least 1000 litres per minute for a period until the sprayer contents have been circulated twice.

Prior to each operation, the Seal Designer's Delegate shall nominate the cutter oil adjustments, which shall be recorded. **Witness Point 6**

Experience has shown that inadequate circulation of crumb rubber modified binder following the addition of cutter oil can result in tramlining of binder when sprayed. It is therefore critical that the minimum circulation times stated in Clause 8.3.3 are adhered to when spraying crumb rubber modified binders.

12.8 Spray rate

For all applications other than primes, initial seals and surface enrichments using cutback bitumen, the Estimated Spray Rate, Designed Spray Rate, Adjusted Designed Spray Rate and Actual Spray Rate referred to in this Technical Specification shall be the quantities, at 15ºC, of the bitumen or polymer modified binder as appropriate.

For primes, initial seals and surface enrichments using cutback bitumen, the Estimated Spray Rate, Designed Spray Rate, Adjusted Designed Spray Rate and Actual Spray Rate referred to in this Technical Specification shall be the quantity, at 15ºC, of cutback bitumen.

Any spray rates given in Clause 2 of Annexure MRTS11.1 are Estimated Spray Rates.

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

To comply with the above requirements, 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 15ºC (Refer to Table 16(a)), and

b) the increased volume of the material to be sprayed where there are other materials to be added to the binder for the relevant operation (e.g. cutter oil and/or adhesion agent in a sealing operation).

12.9 Quantities retained in sprayer tank

To ensure a uniform spray rate, each sprayer run shall be programmed so that the bituminous material retained in the tank at the completion of the spray run shall be the greater of 250 litres and the manufacturer's recommended minimum limit.

12.10 Tolerances

The sprayed binder edges shall not deviate from the specified edge by more than – 0 mm and + 150 mm.

13 Spreading prime cover material

13.1 General

The Contractor shall spread the prime cover material, where specified, 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 spread rates stated in Clause 2 of Annexure MRTS11.1 are Estimated Spread Rates.

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 by the Seal Designer's Delegate during the spreading operation to ensure a complete and even distribution. The adjusted rate shall then be the Adjusted Designed Spread Rate.

13.3 Time limit

To permit penetration of the prime, at least 2 hours shall elapse between priming and the application of the cover material unless traffic requirements dictate otherwise, and approval is granted by the Administrator.

13.4 Spreading

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

The Actual Spread Rate shall not vary outside the range of plus or minus 10% of the Adjusted Designed Spread Rate.

13.5 Removal of excess cover material

Unless otherwise stated in Clause 7.1 of Annexure MRTS11.1, 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 10 of MRTS01 *Introduction to Technical Specifications*.

14 Spreading cover aggregate

14.1 General

Wet cover aggregate containing free surface water shall not be loaded into the aggregate spreader. **Witness Point 7**

The Administrator may order that wet aggregate be tested using the Binder Stripping Value – Modified Plate test (Q212B). Test results shall be reported to the Administrator.

During spreading and rolling, the Contractor shall ensure that the aggregate effectively adheres to the binder without breaking down or crushing the aggregate particles.

The Contractor shall spread the cover aggregate in a uniform manner, which after rolling and initial trafficking shall:

a) produce a generally dense tight mat, and

b) form a single layer on the pavement surface, the aggregate being partly interlocked.

14.2 Spread rate

The spread rates stated in Clause 2 of Annexure MRTS11.1 are Estimated Spread Rates. The Designed Spread Rate shall be that nominated in the seal design determined in accordance with Clause 6.

In order to achieve the requirements of Clause 14.4, the Seal Designer’s Delegate may adjust the Designed Spread Rate during the spreading operation. This Adjusted Designed Spread Rate shall be recorded on the spray sheet.

14.3 Time limit

The spreading of cover aggregate shall commence as soon as possible after the spraying of the binder. Under no circumstances shall any portion of the binder be left without cover aggregate after spraying for longer than the time limit given in Clause 7.2 of Annexure MRTS11.1. Where no indication is given in Clause 7.2 of Annexure MRTS11.1, the following time limit shall apply:

a) 10 minutes for treatments containing cutback bitumen, bitumen and multigrade bitumen binders, or

b) 5 minutes for treatments containing polymer modified binders (including crumb rubber).

In the event that cover aggregate is not applied to any one spray run within this time limit, the Contractor shall demonstrate to the Administrator that arrangements have been made to prevent a recurrence of the nonconformance before bitumen spraying may continue. **Nonconformance**

14.4 Spreading

Spreading of cover aggregate shall be carried out with suitable mechanical aggregate spreaders. Minimum requirements for aggregate spreaders shall be as stated in Clause 7.3 of Annexure MRTS11.1. If no indication is given, a Type A or Type B spreader, as defined in Clause 7.3 of Annexure MRTS11.1, shall be used.

On each day of spreading, each spreader shall be tested in accordance with the Field Spread Rate of Cover Aggregate test (Q711A) and shall comply with the spread rate tolerance requirements of this clause. The test frequency shall be one test per spreader per day.

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. Over spreading or under spreading of the aggregate shall be avoided.

If there is an uneven distribution of cover aggregate, it shall be broomed until it is evenly distributed with minimum dislodgment of any embedded cover aggregate. Areas of under-spread aggregate shall be filled in immediately behind the normal spreading operation and these areas shall receive additional rolling.

Any initial under spreading shall be rectified by a further light spreading of aggregate and brooming until it is evenly distributed with minimum dislodgement of any embedded cover aggregate.

The amount of aggregate spread shall be calculated from either:

a) the volume used as recorded on the spray sheets, or

b) by using Test Method Q711A.

The Actual Spread Rate shall not vary outside the range of plus or minus 10% of the Adjusted Designed Spread Rate.

14.5 Rolling

14.5.1 General

Steel-wheeled or rubber coated steel wheel rollers shall not be used unless approved by the Administrator.

For treatments with multiple layers of binder and/or aggregate (e.g. double / double seals), the rolling shall comply with the requirements of this clause for each application of aggregate. Any damage to the first coat shall be repaired by the Contractor at no cost to the Principal prior to spraying the binder for the second and subsequent coats.

14.5.2 Minimum number of rollers

The minimum number of rubber-tyred rollers to be available and in use on the Site shall be the greater of:

a) Two, and

b) the number required to complete the minimum amount of rolling required for the average coverage rate per hour as a continuous operation with successive spray runs in accordance with Clauses 14.5.3 and 14.5.4.

Additionally, for polymer modified binders, there shall be enough rollers to cover the full width of the spray run with one pass.

14.5.3 Rolling speed

The initial passes shall be done at a low speed (5 – 10 km/h) to achieve the aim of pressing the aggregate into the binder. After that, the rolling speed shall be increased to between 15 – 25 km/h to move and reorientate the aggregate particles to their correct position.

14.5.4 Roller coverage

For bitumen and multigrade binders, Table 14.5.4 specifies the maximum sprayed area (m²) that can be effectively rolled per hour, taking into account the effect of traffic and aggregate size.

For polymer modified binders, the maximum sprayed area (m²) that can be effectively roller per hour shall be two thirds of the rate specified in Table 14.5.4, taking into account the effect of traffic and aggregate size.

Table 14.5.4 – Area that can be effectively rolled per hour with each self-propelled multi-wheeled roller for cutback bitumen, bitumen and multigrade bitumen binders

Aggregate Size (mm)	**Traffic Volume (Vehicles per Lane per Day)**		
	< 300	**300 – 1200**	**> 1200**
	Area – m² per roller hour[1]		
7 or smaller	4000 – 4500	5000 – 5500	6000 – 6500
10	3000 – 3500	3500 – 4000	4500 – 5000
14 or larger	2500 – 3000	3000 – 3500	3500 – 4000

Note:

[1] 'roller hours' is defined as the product of the number of specified rollers by hours of application.

Examples of the use of Table 14.5.4 can be found in Austroads / AfPA Pavement Work Tip No. 24.

14.5.5 Number of roller passes

After spreading, the cover aggregate shall be rolled as soon as practicable with multi-tyred rollers with a sufficient number of roller passes to ensure adhesion of the cover aggregate to the binder.

The minimum number of roller passes shall be as stated in Clause 7.4 of Annexure MRTS11.1, or if not so stated:

a) 6 passes for cutback bitumen, bitumen and multigrade bitumen binders, and

b) 9 passes for polymer modified binders.

14.5.6 Coverage tracking rollers

Use of Coverage Tracking (CT) rollers may be specified for high-risk projects (such as when Sealing Risk Level 2 or 3 apply as per TN186 *Sealing in Cold Weather Conditions*). A Contractor may also elect to use CT rollers as part of their enhanced construction procedures to ensure and confirm complete coverage and number of roller passes are achieved.

If specified in Clause 5 of Annexure MRTS11.1, CT rollers must be used in the sealing process to demonstrate that satisfactory roller coverage and number of roller passes has been achieved for each lot.

The CT rollers have the following characteristics:

a) CT rollers are self-propelled rollers equipped with GPS to measure the coverage and number of passes of the Seal

b) CT rollers are capable of recording and displaying:

   i. real-time colour-coded maps of the roller position and coverage

   ii. number of roller passes, and

   iii. roller speeds

c) The data output from the CT roller must be compatible with Veta.

The CT roller data must be made available to the Administrator within one day of the data being collected.

14.6 Removal of loose aggregate after rolling

Loose aggregate shall be lightly swept and/or vacuumed from the pavement surface without dislodgment of the embedded aggregate. A rotary broom is permitted to remove loose aggregate from the pavement surface. Loose aggregate shall not be removed until the aggregate is properly embedded into the binder by either trafficking or additional rolling.

Areas of aggregate that have been overspread (generally at joins, turnouts and overlaps) shall be broomed off on the same day with hand brooms or mechanical sweepers.

For seals of nominal size greater than or equal to 10 mm, the number of loose aggregate particles (in any square metre of pavement) after sweeping and before opening to traffic shall not exceed the values shown in Clause 7.5 of Annexure MRTS11.1. If values are not specified in Clause 7.5 of Annexure MRTS11.1, the values shown in Table 14.6 shall apply. The number of loose particles shall be determined in accordance with Test Method Q720 at locations that are representative of each homogeneous section and as agreed by the Administrator. Testing for loose aggregate particles is exempt from the requirement for NATA accreditation.

Table 14.6 – Maximum allowable loose aggregate particles by area prior to opening to traffic

Location	Maximum Allowable Loose Aggregate Particles
Principal Cycle Network[1]	20 particles/m²
Urban area	20 particles/m²
Other medium to high traffic (greater than or equal to 250 vehicles / lane / day)	30 particles/m²
Other low traffic (less than 250 vehicles / lane / day)	40 particles/m²

Note:

[1] Information about roads that form part of the Principal Cycle Network can be found of the department's website www.tmr.qld.gov.au.

Loose aggregate in excess of the maximum allowable loose aggregate particle requirement shall be removed and transported from the job site as follows:

a) from trafficked lanes and sealed shoulders within a time period that ensures compliance with the requirements of Clause 14.8 and MRTS02 *Provision for Traffic*

b) from concrete channels, traffic islands, open drains, footpaths, nature strips or verges within 24 hours, and

c) all other areas within 5 days.

Loose aggregate shall be utilised / disposed of in accordance with the requirements of Clause 10 of MRTS01 *Introduction to Technical Specifications*.

Any damage to the seal resulting from removal of loose aggregate shall be repaired by the Contractor at no cost to the Principal.

During the Defects Liability Period up to the issue of the Final Certificate, where the Contractor is the nominated Seal Designer, the Contractor is required, at no cost to the Principal, to ensure that the maximum allowable loose aggregate particles requirement given in Table 14.6 is met.

14.7 Protection of fresh seals from traffic

The Contractor shall take precautions to protect the work from damage until such time as the prime or seal (including initial seals, secondary treatments and retreatments) has developed sufficient strength to carry normal traffic without dislodgement of the cover aggregate or cover material, as applicable.

Special attention is required at intersections.

14.8 Early trafficking minimum requirements

Unless otherwise stated in Clause 8 of Annexure MRTS11.1, the Contractor shall complete the following early trafficking minimum requirements in order to address both loose stone considerations in accordance with Clause 14.6 and the protection of the fresh seal from traffic in accordance with the requirements of Clause 14.7:

a) in areas where the posted speed limit is equal to or less than 60 km/h and which are opened to traffic prior to final sweeping, the Contractor shall install temporary 'loose stones' and 'slippery' warning signs and temporary 40 km/h speed signs until the maximum allowable loose aggregate requirements of Clause 14.6 are met

b) in areas where the posted speed limit exceeds 60 km/h and which are opened to traffic prior to final sweeping, the Contractor shall install temporary 'loose stones' and 'slippery' warning signs and temporary speed signs not exceeding 60 km/h until the maximum allowable loose aggregate requirements of Clause 14.6 are met, and

c) for a period of between 24 hours and 48 hours after the maximum allowable loose aggregate requirements of Clause 14.6 have been met, the temporary speed limit shall be not greater than 80 km/h and the posted speed limit, and the Contractor shall install signs accordingly.

For primes, traffic including construction traffic shall not be permitted on the surface where the traffic exceeds 50 v/l/d. Where the traffic is less than 50 v/l/d, traffic including construction traffic shall not be permitted on the surface:

a) within 24 hours of spraying or until the prime has dried sufficiently so as not to be damaged by vehicles, and

b) until prime cover material is applied.

All signage shall comply with the requirements of MRTS02 *Provision for Traffic*.

The requirements of Clause 14.8 are **Hold Point 8** and the road shall not be opened to traffic until the release of this Hold Point by the Administrator.

15 Geotextile reinforced seals

The geotextile used in a GRS shall be supplied and constructed in accordance with the requirements of MRTS57 *Geotextiles for Geotextile Reinforced Seals*.

16 Measurement and recording

The volume of bituminous material sprayed of each run shall be determined by dipping the tank after each run and recording the volume of bituminous material in the tank to the nearest 50 L. The sprayer shall be dipped whilst parked on level ground. Sprayers with electronic process control and data recording may, with the approval of the Administrator, be exempt from this requirement.

For each spray run, the Contractor shall record all details of the sealing operations on an appropriate spray sheet, which shall include details of at least the following:

a) Job number

b) The Queensland Sprayer Certificate number and its expiry date

c) Date, start time and end time of the spray run

d) Description of the weather throughout the spray run

e) Name and signature of the Spray Seal Designer's Delegate determining the Adjusted Designed Spray Rate and Adjusted Designed Spread Rate

f) Pavement temperature at the start and end of the spray run, and when there is significant change in temperature (record time / temperature degrees Celsius)

g) Gazettal chainages for start and finish of the spray run

h) Area of the spray run (m^2)

i) Hot volume of binder prior to addition of cutter and additives (L)

j) Binder type(s) used on the spray run

k) Additive (including adhesion agent and cutter) types used, if any

l) Design cutter oil proportions (parts per 100 parts of binder) used, if any (refer Clause 12.7)

m) Actual cutter oil proportions (parts per 100 parts of binder) used, if any

n) Quantity of adhesion agent (parts per 100 parts of binder)) used, if any

o) Temperature of mixture at start of the spray run

p) Adjusted Designed Spray Rate(s) and Actual Spray Rate(s) for each run (at 15ºC)

q) Nominal aggregate size used for the spray run

r) Quantity of aggregate spread for the spray run

s) Adjusted Designed Spread Rate(s) and Actual Spread Rate(s)

t) Number of and type of rollers used, and

u) A statement of whether the spray rate complied with the tolerance requirements detailed in Clause 12.8, and whether the aggregate spread rate complied with the tolerance requirements detailed in Clauses 13.4 and 14.4.

The bituminous materials spraying record sheet shall be made available to the Administrator for verification, within one day of the sealing operations applicable to the run.

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

All volume conversions, in relation to changes in temperature of bituminous materials, shall be carried out in accordance with the relevant factors listed in Tables 16(a) and 16(b).

Table 16(a) – Equivalent volumes at higher temperatures of 1 Litre of bituminous material measured at 15ºC

Temp (ºC)	Factor	Temp (ºC)	Factor	Temp (ºC)	Factor
15	1.0000	80	1.0420	145	1.0861
20	1.0031	85	1.0453	150	1.0897
25	1.0062	90	1.0487	155	1.0932
30	1.0094	95	1.0520	160	1.0967
35	1.0126	100	1.0553	165	1.1003
40	1.0158	105	1.0587	170	1.1038
45	1.0191	110	1.0620	175	1.1074
50	1.0223	115	1.0655	180	1.1109
55	1.0255	120	1.0689	185	1.1145
60	1.0288	125	1.0723	190	1.1180
65	1.0321	130	1.0757	195	1.1216
70	1.0354	135	1.0792	200	1.1252
75	1.0387	140	1.0827	205	1.1287

Table 16(b) – Equivalent volumes at 15ºC of 1 Litre of bituminous material measured at higher temperatures

Temp (ºC)	Factor	Temp (ºC)	Factor	Temp (ºC)	Factor
15	1.0000	80	0.9597	145	0.9207
20	0.9969	85	0.9566	150	0.9177
25	0.9938	90	0.9536	155	0.9148
30	0.9907	95	0.9506	160	0.9118
35	0.9876	100	0.9476	165	0.9089
40	0.9844	105	0.9446	170	0.9060
45	0.9813	110	0.9416	175	0.9031
50	0.9782	115	0.9385	180	0.9002
55	0.9751	120	0.9355	185	0.8973
60	0.9720	125	0.9326	190	0.8945
65	0.9689	130	0.9296	195	0.8916
70	0.9658	135	0.9266	200	0.8888
75	0.9627	140	0.9236	205	0.8860

17 Construction compliance

17.1 General

Material compliance shall be tested and checked in accordance with the requirements of the material technical specifications detailed in Table 7.1.

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

In the event of any fuel or oil leaks or spillages by the Contractor onto the newly sealed surface, or any other damage to the newly sealed surface, the Contractor shall reinstate the surface and the underlying base course to its pre-damage condition at no cost to the Principal.

The Contractor and Administrator shall jointly investigate and provide the Principal with a written report on the causes where any of the following occurs on more than 10% of any wheel path length of any run at any time to the end of the Defects Liability Period:

a) stripping which is defined as areas where more than 10% cover aggregate has been lost from the seal's aggregate matrix

b) flushing which is defined as where surface texture depth is < 0.5 mm when tested by ATM 250 or Q715, and/or

c) debonding which is defined as separation of the seal from the underlying layer.

17.2 Surface texture

Where the seal is the final surfacing or shall be opened to public traffic, surface texture shall be tested, recorded and reported to the Administrator as follows:

a) surface texture shall be assessed by either the Pestle Method or Laser Method

b) testing shall be carried out:

   i. at sections of through pavement that have a homogeneous visual appearance, and

   ii. at each of the following locations:

      - pedestrian crossings, railway level crossings, roundabouts, intersections, including the maximum 50 m approaches and departures to these
      - curves with radius ≤ 250 m
      - gradients ≥ 5% and ≥ 50 m long
      - on / off ramps, including merge and diverge areas, and/or
      - merge and diverge areas of overtaking lanes and intersections

c) Testing shall be completed after the loose aggregate requirements of Clause 14.6 are met.

All surface texture depths shall achieve the requirements stated in Clause 9 of Annexure MRTS11.1.

18 Supplementary requirements

The requirements of MRTS11 *Sprayed Bituminous Treatments (Excluding Emulsion)* are varied by the supplementary requirements given in Clause 10 of Annexure MRTS11.1.