Technical Note 175

Selection and Design of Sprayed Bituminous Treatments

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Queensland Government

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1 Introduction

Sprayed bituminous treatments (hereafter called sprayed seals) are the most common type of road surfacing on the road network administered by the Department of Transport and Main Roads.

The department has adopted the seal design method outlined in the Austroads Technical Report *Update of the Austroads Sprayed Seal Design Method* AP-T68/06 (Austroads 2006), hereafter referred to as AP-T68. Subsequently, the following Austroads technical reports, which have also been adopted by the department, have replaced sections of AP-T68:

- Austroads Technical Report *Update of Double / Double Design for Austroads Sprayed Seal Method* AP-T236-13 (Austroads 2013), hereafter referred to as AP-T236 replaces Sections 6, 7 and 8 and Table 11.1. These sections relate to the design of double / double sprayed seal surfacings and sprayed seal selection.
- Austroads Technical Report *Selection and Design of Initial Treatments for Sprayed Seal Surfacings* AP-T310-16 (Austroads 2016), hereafter referred to as AP-T310, replaces Section 12. This section relates to priming and primersealing (now called initial seals).

This Technical Note outlines variations to AP-T68 that apply to departmental projects.

For ease of reference, section numbers in this Technical Note align with the applicable section numbers in AP-T68. References to section numbers, tables, figures, equations and appendices are to be read as references to both this Technical Note and AP-T68. Where additional sections, tables, figures, equations and appendices are included in this Technical Note, these are numbered with a prefix of Q.

This Technical Note is not a prescriptive standard, rather it is intended to be a guide for professional, trained, experienced and knowledgeable sprayed seal designers who:

- Work within the confines of government policies, guidelines and road network requirements
- Are aware of, assess and apply risk management and budgetary constraints to the road system as a whole and its various components
- Optimise initial designs and in-service treatments to suit budget and whole-of-life cost issues
- Apply engineering principles and data to a design, construction or production activity, and
- Take into account local area or project-specific issues, including when the typical assumptions and standards in this technical note are being considered.

As this Technical Note is not a prescriptive standard for sprayed seal treatment selection, reference to it in contract documents will typically require project-specific requirements appropriate for the contract to be included in a project design brief.

Alternatives and exceptions to AP-T68 and this Technical Note’s typical design assumptions and standards may be necessary for the designer’s project-specific engineering design. In making these professional engineering decisions, designers are implicitly evaluating the engineering risks and benefits to the project based on application of the relevant engineering technology. Professional engineers will recognise that there may be compounding and interconnected risks and / or opportunities when multiple changes to typical values are applied in determining a design solution.

1.1 Average least dimension (ALD)

For sprayed seals on Transport and Main Roads projects, the ALD can be determined using Test Method Q202.

Q1.7 Summary of aggregate spread rates

Table Q1.7 summarises the different aggregate spread rates provided throughout AP-T68. However, adjustments to the spread rates nominated in AP-T68 have been made in Table Q1.7 for:

- Size 10 mm single / single bitumen seals
- Size 7 mm and smaller single / single 'armour coat' seals
- Single / single bitumen emulsion seals, and
- SAMI seals and waterproofing seals under asphalt (as described in Section 4.2.3 of this Technical Note).

Table Q1.7 – Summary of aggregate spread rate

Sprayed Seal Types	Application	Traffic	Aggregate Spread Rate (m^2/m^3)
Single / single seals – including initial seals (Bitumen binders)	Size 10 mm and larger	> 200 v/l/d	900 / ALD[1]
		≤ 200 v/l/d	850 / ALD
	Size 7 mm and smaller – Normal seal (ALD known)	All	900 / ALD
	Size 7 mm and smaller – Normal seal (ALD unknown)		200 – 250
	Size 7 mm and smaller – Correction seal to fill in coarse texture only		260 – 290
	Size 7 mm and smaller – 'Armour coat' seal	All	180 – 225
Single / single seals (Polymer modified binders)	Size 10 mm and larger – HSS1 and SAM seals	≥ 300 v/l/d	800 / ALD
		< 300 v/l/d	750 / ALD
	Size 10 mm and larger – SAMI seals and waterproofing seals under asphalt	N/A	1000 / ALD
	Size 7 mm and smaller – HSS1 seals (ALD known)	All	800 / ALD
	Size 7 mm and smaller – HSS1 seals (ALD unknown)	All	160 – 200
Single / single seals (Bitumen emulsion)	Single layer of aggregate	≥ 200 v/l/d	800 / ALD
		< 200 v/l/d	750 / ALD
	Single / single seal with scatter coat – First layer of large aggregate	≥ 200 v/l/d	850 / ALD
		< 200 v/l/d	800 / ALD
	Single / single seal with scatter coat – Second layer of aggregate (7 mm / smaller scatter coat)	All	400 – 600

Sprayed Seal Types	Application	Traffic	Aggregate Spread Rate (m^2/m^3)
Double / double seals (Bitumen binders)	First (bottom) layer of aggregate	> 200	950 / ALD
		≤ 200	900 / ALD
	Second (top) layer of aggregate – Size 10 mm	All	1050 / ALD to 1100 / ALD
	Second (top) layer of aggregate – Size 7 mm (ALD known)	All	1100 / ALD to 1150 / ALD
	Second (top) layer of aggregate – Size 7 mm and smaller (ALD unknown)	All	250 to 300[2] 200 to 250[3]
Double / double seals (Polymer modified binders)	First (bottom) layer of aggregate	≥ 300 v/l/d	900 / ALD
		< 300 v/l/d	850 / ALD
	Second (top) layer of aggregate – Size 10 mm	All	950 / ALD to 1000 / ALD
	Second (top) layer of aggregate – Size 7 mm (ALD known)	All	1000 / ALD to 1050 / ALD
	Second (top) layer of aggregate – Size 7 mm and smaller (ALD unknown)	All	225 to 275[2] 180 to 225[3]
Double / double seals (Bitumen emulsion)	All	All	Spread rate shall be in accordance with the requirements of bitumen or PMB double / double seals (as appropriate)

1. Based on recent work it may be appropriate to use 850 / ALD for 10 mm aggregate
2. Light application rate to fill in coarse texture of first layer of aggregate
3. Heavy application rate consisting of 1 layer of small aggregate.

2 Single / single seals – size 10 mm and larger aggregates

2.1 Design binder application rate

2.1.3 Basic voids factor

The Basic Voids Factor (Vf) charts in Figure 2.2 and Figure 2.3 of AP-T68 were developed from the assessment of the performance of several trials around Australia in the early 1990s. Austroads report AP-T09 states that the trial sites had traffic volumes "ranging between 50 and 6000 vehicles/lane/day (v/l/d)" (Austroads, 2001).

It is unclear how the Vf at traffic volumes < 50 v/l/d was determined. This is especially critical, as the Vf curve increases significantly for traffic volume < 100 v/l/d. Anecdotal evidence from various practitioners is that the Vf curve is "too steep" at its bottom end (< 100 v/l/d) and greatly overestimates the Vf, thereby resulting in seals with an excessive spray rate which are prone to premature flushing and / or bleeding.

Given the above, roads with a traffic volume < 100 v/l/d should be designed using a basic voids factor (Vf) of 0.21.

2.1.4 Adjustments to the basic voids factor

a) Adjustments for aggregate shape

For sealing aggregate with Flakiness Index < 10%, a new category of aggregate shape 'very cubic' is included in Table Q2.1 to distinguish this from 'cubic' shaped aggregates. Table Q2.1 replaces Table 2.1 in AP-T68.

For single / single seals, an aggregate shape adjustment value of + 0.02 L/m²/mm is recommended for very cubic aggregate.

For double / double seals, the bottom larger aggregate should have a flakiness index of 10 - 30% (and be pyramidal / angular as such shapes promote interlock with the top smaller aggregate). Use of very cubic shaped aggregate in the first (bottom) layer of aggregate of a double/double seal may lead to poor aggregate interlock with the subsequent layer of aggregate and should be avoided.

Table Q2.1 – Adjustment to basic voids factor for aggregate shape (Va)

Aggregate Type	Aggregate Shape	Flakiness Index (%)	Shape Adjustment Va (L/m²/mm)
Crushed or partly crushed	Very flaky	> 35	Considered too flaky and not recommended for sealing
	Flaky	26 to 35	- 0.01
	Angular	15 to 25	Nil
	Cubic	10 to 15	+ 0.01
	Very Cubic	< 10	Single / single seals and top layer of aggregate for double / double seals + 0.02 (Note 1)
		N/A	Bottom layer of aggregate for double/double seals (Too cubic and not recommended)
Not crushed	Rounded	N/A	+ 0.01

Note 1: There have been reported stripping issues associated with single / single seals using very cubic aggregate. This suggests that additional binder may need to be sprayed to compensate for this.

b) Adjustment for traffic effects (Vt)

Table Q2.2 replaces Table 2.2 in AP-T68.

Table Q2.2 – Adjustment (Vt) to basic voids factor for traffic effects

Traffic	Adjustment to Basic Voids Factor (L/m²/mm)			
	Flat or Downhill		Slow Moving – Climbing Lanes	
	Normal	Channelised*	Normal	Channelised*
On overtaking lanes of multi-lane rural roads where traffic is mainly cars with ≤10% of HV	+ 0.01	0.00	N/A	N/A
Non-trafficked areas such as shoulders, medians, parking areas	+ 0.02	N/A	N/A	N/A
0 to 15% Equivalent Heavy Vehicles (EHV)	Nil	- 0.01	- 0.01	- 0.02
16 to 25% Equivalent Heavy Vehicles (EHV)	- 0.01	- 0.02	- 0.02	- 0.03
26 to 45% Equivalent Heavy Vehicles (EHV)	- 0.02	- 0.03	- 0.03	- 0.04**
46 to 65% Equivalent Heavy Vehicles (EHV)***	- 0.03	- 0.04**	- 0.04**	- 0.05**
> 65% Equivalent Heavy Vehicles (EHV)***	Use of the method outlined in Section 1.5.6 in AP-T68 is recommended.			

N/A Not applicable

EHV Equivalent heavy vehicles, includes both heavy vehicles and large heavy vehicles x 3 (see Section 1.5.4)

* Channelisation - a system of controlling traffic by the introduction of an island or islands, or markings on a carriageway to direct traffic into predetermined paths, usually at an intersection or junction. This also applies to approaches to bridges and narrow culverts.

** See 'Key point' highlighted in the grey box below.

*** The last row of Table 2.2 in AP-T68 refers to the most severe loading, viz., > 45%. Some extreme traffic loadings can give %EHV much higher than 45% (e.g. 100% or more). In such extreme cases, it would be unreasonable to adopt the Vt values from Table 2.2 for > 45% as this would mean "stretching" the range much more than 20% (the average range of the other three categories is 15% with a maximum of 20%). So, for the last row, adopting 20% as a maximum range gives a cut off value of 65%.

Key Point

If adjustments for aggregate shape and traffic effects result in a reduction in Basic Voids Factor of 0.04 L/m²/mm or more, special consideration should be given to the suitability of the treatment and possible selection of alternative treatments (including the use of variable rate spraying which is discussed in Section Q2.1.8). Note that the recommended MINIMUM Design Voids Factor is 0.10 L/m²/mm in all cases.

2.1.7 Allowances applied to basic binder application rate

b) Embedment allowance (Ae)

Initial treatments

Notwithstanding the requirements of AP-T68, feedback from practitioners in Queensland has indicated that excessive embedment of seals and primerseals (now called initial seals) into underlying pavements is typically avoided when the prepared surface is sufficiently “hard” to produce ball penetration test results not more than the following limits at the time of sealing:

a) 3.0 mm on high traffic roads (> 2000 v/l/d), and

b) 4.0 mm on low traffic roads (≤ 2000 v/l/d).

In situations where the above ball penetration criteria is not met, one or more of the following treatments may be required to reduce the ball penetration of the prepared pavement surface to acceptable levels immediately prior to sealing:

a) If due to moisture, defer sealing to allow the surface to harden as it dries back. The surface should be retested once it has dried sufficiently.

b) Re-prepare the pavement, for any of the following issues:

- insufficient density has been achieved in the base course
- laminations within the base course
- loose or bony surface preparation, and / or
- excessive slurrying of the base course.

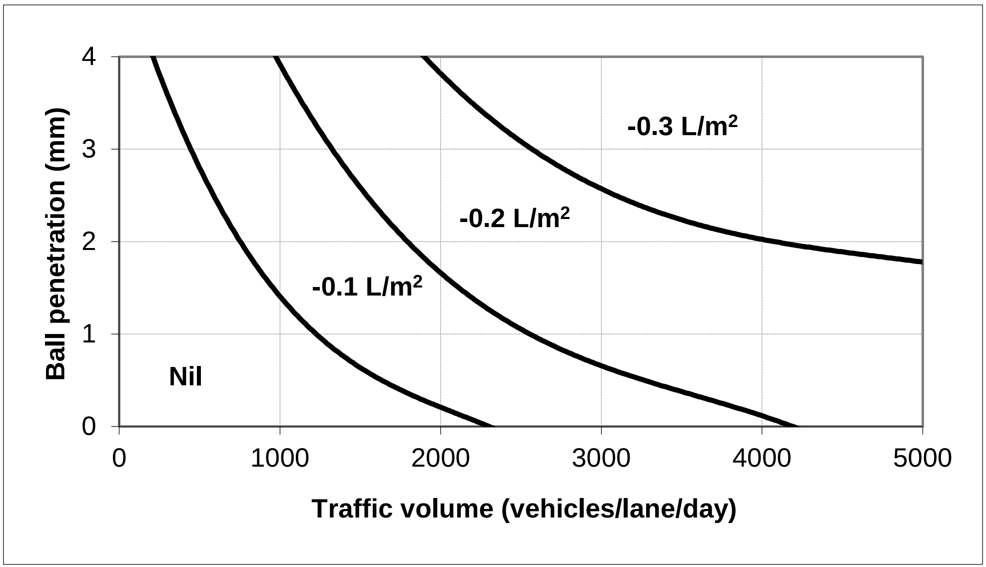
c) Strengthen the base course if a relatively low quality base course material has been used. This may include:

- improving the quality of the base course material
- stabilising the base course material, and / or
- ‘armour-coating’ the surface of the base course with a thin layer of good quality material.

d) Apply a small aggregate (≤ 7 mm) seal as the first seal to act as an ‘armour-coat’ to minimise the amount of embedment of the larger aggregate applied at a later date.

Figure Q2.4 replaces Figure 2.2 in AP-T68.

Figure Q2.4 – Embedment allowance for initial seals and sealing over primed surfaces



Q2.1.8 Sprayed sealing with a Variable Rate Spray Bar

Sealing with a variable rate spray bar is the process of spraying different binder application rates across the width of a spray run in a single pass.

This process facilitates the optimisation of the seal design to address the most common types of defects in sprayed seal surfacings, which are:

- Flushing / bleeding in the wheel paths, and / or
- Stripping in non-wheel path areas (i.e. around the centreline, between wheel paths and on shoulders).

Sealing with a variable rate spray bar could be considered in the following situations:

- As a remedial treatment for existing seal defects (e.g. flushed / bleeding wheel paths),
- Where there is significantly different surface texture across the lane (e.g. where the difference in texture allowance is ≥ 0.3 /m² between the wheel path and non-wheel path areas), and / or
- Where there is a high percentage of equivalent heavy vehicles (EHVs) and / or a high AADT.
  - This combination can sometimes result in a uniform spray rate across the road which is too low to avert stripping in untrafficked areas (i.e. around the centreline, between wheel paths and on shoulders) and, yet, too high to avert flushing in the wheel paths.

The underlying principle of variable rate seal design is to:

- Design for the wheel paths, and
- Increase the spray rate for the non-wheel path areas to account for the higher risk of stripping in these areas.

When determining the spray rates to be adopted, the limitations of the actual variable rate sprayer to be used must be considered.

A special note on variable rate seals and seasonal considerations:

Due to the reduced binder application rate in low-spray areas, sufficient time under traffic at higher temperatures is required to ensure adhesion of the aggregate before the onset of cold weather. Therefore, it is highly desirable for any variable rate seal to be subjected to at least one month of hot / warm weather under traffic. Variable rate seals are not typically used when the expected daily minimum air temperatures is < 10°C within one month after completion of the works.

2.2 Aggregate Spread Rate

Aggregate spread rates for single / single seals are summarised in Table Q1.7 of this Technical Note.

3 Single / single seals – size 7 mm and smaller aggregate

Single / single sprayed seals with aggregate sized 7 mm and smaller are to be designed in accordance with Section 3 of AP-T68. No further amendment is proposed at this stage.

3.3 Aggregate Spread Rate

Aggregate spread rates for single / single seals are summarised in Table Q1.7 of this Technical Note.

4 Single / single seal with polymer modified binder

4.1 General

In general, polymer modified binders are used in applications where conventional binder cannot provide adequate service. Applications include:

- waterproofing seals under asphalt
- single / single high stress seal for moderately severe and severe sites (HSS1)
- double / double high stress seal for medium and heavy traffic loading (HSS2)
- double / double extreme stress seals for high stress areas (XSS)
- strain alleviating membrane (SAM)
- strain alleviating membrane interlayer (SAMI), and
- where improved aggregate retention is required.

Table Q4.1 replaces Table 4.1 in AP-T68-06. In this regard, Table Q4.1 reflects current departmental practice and simplifies the guidance in AP-T68 and AP-T236.

Waterproofing seals under asphalt are typically designed as a SAMI seal, except that a lower polymer factor is typically applied to the Design Voids Factor.

Table Q4.1 – PMB factors (PF)

Austroads PMB Class (AGPT/T190)	Previous PMB Class (MRTS18 – November 2011)	Typical PMB factor
High Stress Seal (HSS1-M and HSS2-M) for medium traffic loadings		
S10E, S35E	S0.25S, S0.3B	1.0[1]
S45R, S15RF	S1.8R, S15RF	1.2[1,2]
High Stress Seal (HSS1-H and HSS2-H) for heavy traffic loadings		
S15E	0.7S	1.1[1]
S45R, S15RF	S1.8R, S15RF	1.2[1,2]
Extreme Stress Seal (XSS)		
S20E	N/A	1.1
S45R, S15RF	S1.8R, S15RF	1.1
Strain Alleviating Membrane (SAM-S) (to address slow moving cracks)		
S10E[2], S35E[2]	S0.25S[2], S0.3B[2]	1.1[3]
S45R, S15RF	S1.8R, S15RF	1.3[3]
Strain Alleviating Membrane (SAM-R) (to address rapid moving cracks)		
S15E	S0.7S	1.2[3]
S45R, S15RF	S1.8R, S15RF	1.3[3]
Strain Alleviating Membrane Interlayer (SAMI)		
S25E	S.4.5S	1.5
S18RF	S18RF	1.5
Waterproofing seal under asphalt (not a SAMI)		
S20E	N/A	1.3
S25E	N/A	1.3
S45R, S15RF	S1.8R, S15RF	1.3
S18RF	S18RF	1.3

1. Typical PMB factor may be increased by 0.1 in low stress, low traffic volume (≤ 750 v/l/d and ≤ 25% EHV) applications.
2. Typical PMB factor may be reduced by 0.1 to minimise potential bleeding and provide adequate surface texture over the life of the seal in the following situations:
    - on high trafficked roads (> 2,000 v/l/d)
    - the sealing work is completed during extreme hot weather (refer AP-PWT-52), and / or
    - in high stress locations.
3. Use PMB factors for HSS1, HSS2 or XSS where site conditions, as defined in Appendix A of AP-T236, indicate one of these seal types is required.

4.2 Design for size 10 mm and larger aggregate

4.2.3 Aggregate spread rate

Experienced practitioners have advised that current aggregate spread rates provided in AP-T68 are too heavy for Strain Alleviating Membrane Interlayer (SAMI) seals and the Aggregate Spread Rate needs to be lighter than for conventional seals with bitumen and multigrade binders to:

- prevent binder pick-up on the wheels of the paving train, and
- enable interlock between the seal and the overlying asphalt mix.

Aggregate spread rates for polymer modified binder seals, including adjusted spread rates for SAMI seals, are summarised in Table Q1.7 of this Technical Note.

5 Single / single seals with bitumen emulsion binder

Single / single sprayed seals with bitumen emulsion binder are to be designed in accordance with Section 5 of AP-T68.

Aggregate spread rates for single / single seals with bitumen emulsion are summarised in Table Q1.7 of this Technical Note.

6 Double / double seals

An update of the design of double / double sprayed seal surfacing was published in Austroads publication AP-T236, which supersedes Sections 6, 7 and 8 in AP-T68.

Aggregate spread rates for double / double seals are summarised in Table Q1.7 of this Technical Note.

7 Double / double seals with PMB

Section 7 of AP-T68 is superseded by the Austroads publication AP-T236. For PMB factors, refer to Table Q4.1 provided in this technical note.

Aggregate spread rates for double / double seals with PMB are summarised in Table Q1.7 of this Technical Note.

8 Double / double seals with bitumen emulsion binder

Section 8 of AP-T68 is superseded by the Austroads publication AP-T236.

Aggregate spread rates for double / double seals with bitumen emulsion binder are summarised in Table Q1.7 of this Technical Note.

9 Geotextile reinforced seals (GRS)

9.1 General

9.1.1 Applications

C170 bitumen is typically used as the binder in geotextile reinforced seals (GRS) on Transport and Main Roads projects. M500 multigrade bitumen has also been trialled as the binder in GRS on departmental projects.

9.2 Binder application rate

9.2.2 Binder fabric retention allowance

Where possible, the allowance for retention of the binder by fabric should be determined using Test Method ASTM D6140 with the following modifications:

- Class 170 bitumen is used as the binder, and
- testing is undertaken at 160°C.

10 Fibre reinforced seals

Fibre reinforced sprayed seals are to be designed in accordance to Section 10 of AP-T68. No further amendment is proposed at the current stage.

11 Selection of treatment types

For a sprayed seal to perform satisfactorily during its intended design life, it is essential that the appropriate seal treatment is selected. Sprayed seal designers should refer to the selection table in Appendix A of AP-T236 as a preliminary guide to the selection of sprayed seals treatments to be placed over primed surfaces, primerseals (now called initial seals) and existing seals. This selection table supersedes Table 11.1 of AP-T68.

In addition to the guidance provided in Appendix A of AP-T236, a scatter coat can be used to temporarily ‘lock in’ the large aggregate of single / single seals early in their life. The use of a scatter coat can be a particularly effective treatment on low volume rural roads at property entrances and other turnouts subjected to HV turning movements where changing from a single / single to a double / double seal type is not warranted.

12 Priming and primersealing (now called initial sealing)

Section 12 of AP-T68 is superseded by AP-T310.

12.2 Prime

12.2.2 Selection and design for priming

Table 2.1 of AP-T310 provides some guidance on the typical rate of application of primer. However, the application rate may need refinement when using new material sources and also to account for the porosity of the final prepared pavement surface. This issue can be addressed by undertaking a priming trial.

Figure Q12.2.2 – Small scale priming trial

Source: Metropolitan District

The priming trial usually involves the application of different grades and/or application rates by hand to small areas of prepared pavement. The appearance of the resulting primed surfaces are then compared and used to determine the most appropriate grade and rate of application.

12.3 Primerseal (now called Initial Seal)

12.3.2 Selection of primerbinder (binder for an initial seal)

Section 3.3 of AP-T310 proves general guidelines for selection of initial seals based on traffic and climatic conditions. The following additional guidance should be considered by designers:

- Although the use of initial seals with polymer modified binders (in either hot binder or emulsion form) has been trialled by a number of jurisdictions in Australia, the department has limited experience with the use of these binders in initial seal applications.
- Austroads report AP-T276-14 provides further information about the design and performance of initial seals where crumb rubber modified binders have been used.
- AAPA Advisory Note 20 provides further guidance on the requirements for PMB emulsions as these binders are not covered by the department's bituminous emulsion Specification.

Risk management principles should be applied when selecting, designing and constructing initial seal treatments with polymer modified binders (in either hot or emulsion form) on departmental projects, particularly at high risk sites, until more experience has been gained with their use.

Whilst there are potential performance benefits from the use of polymer modified binders for initial seals, they may be more susceptible to failures for other reasons (e.g. stripping, poor adhesion to the underlying pavement), and should be used with care and regard to supplier advice.

Poor pavement surface preparation (i.e. provision of a dry and / or dusty surface that has not been adequately broomed) can lead to the initial seal not adhering adequately to the underlying pavement. This is particularly the case for:

- cementitiously stabilised/modified pavements

- cutback bitumen where the percentage of cutter oil used is relatively low (e.g. AMC7), and
- bituminous emulsions.

Transport and Main Roads projects have typically utilised a more limited range of binders for initial seals than that outlined in Table 3.1 of AP-T310. The primary factor influencing the selection of binder for initial seals on departmental projects has been the prevailing weather conditions. The viscosity of the binder must be sufficiently low post-spraying so that coverage of the binder is achieved across the pavement surface and contact/adhesion with the stone is aided.

A guide to the selection of common types and grades of cutback bitumen used for initial seals on departmental projects (excluding foamed bitumen stabilised pavements) is shown in Table 12.1.

Table 12.1 – Typical grades of cutback bitumen used for initial seals on the department's projects

TMR District	Typical Winter Grade	Typical Summer Grade
Far North	AMC6	AMC7
Northern	AMC6	AMC7
North West	AMC6	AMC7
Central West	AMC5	AMC7
Fitzroy	AMC6	AMC7
Mackay / Whitsunday	AMC6	AMC7
North Coast	AMC5	AMC6[2]
Wide Bay / Burnett	AMC6	AMC7
Darling Downs	AMC5[1]	AMC6[2]
South West	AMC5[1]	AMC7
Metropolitan	AMC5	AMC6[2]
South Coast	AMC5	AMC6[2]

1. Binder grade is sometimes changed to AMC4 if cold, wet weather is anticipated on the days following construction.
2. Binder grade is sometimes changed to AMC7 if extreme hot weather is anticipated during construction and/or on the days following construction.

Adjustment to the cutback bitumen grade or cutter oil content may be required due to the following factors:

- porosity of the pavement surface, and / or
- Site specific conditions (such as unusual traffic and environmental conditions).

For some highly absorptive pavement materials, the use of C170 bitumen may also be an appropriate binder in warm to extreme high temperature conditions. In certain circumstances the manufacture of cutback bitumen from C320 base bitumen (in place of C170) may be considered where more rapid curing is desired or where the initial seal is in a high stress situation.

Bituminous emulsions (such as high binder content CRS bituminous emulsion) are also sometimes used for initial seals on Transport and Main Roads projects. They are more suited to:

- cooler and / or damp conditions, or
- when a secondary treatment is to be applied:
  - shortly after application of the initial seal, or
  - where the construction program does not allow sufficient time for curing of a cutback bitumen initial seal prior to application of the secondary treatment.

However, it is important that the compatibility of the bituminous emulsion with the pavement material and cover aggregate is checked prior to use.

12.3.4 Selection of aggregate size for primerseals (now called initial seals)

In addition to the guidance provided in Section 3.3.2 of AP-T310, selection of aggregate size for initial seals requires consideration of a number of factors including the traffic loading, time period between initial seal and the secondary sealing treatment as well as the aggregate size to be used for the secondary sealing treatment. Table 2.3 of AP-T68 can be used as a guide to assess the compatibility of aggregate used in the initial seal and the follow-up sealing treatment.

12.3.5 Aggregate spread rate for primerseals (now called initial seals)

Initial spread rates for initial seals are summarised in Table Q1.7.

Q12.3.6 Initial seals on foamed bitumen stabilised pavements

In addition to the guidance provided in Section 3.6.2 of AP-T310, binder types typically used for initial sealing of foamed bitumen stabilised pavements are summarised in Table Q12.3.6.

Table Q12.3.6 – Binder grades typically used for initial sealing of foamed bitumen stabilised pavements

Ambient Temperature	Binder Type
Cool	Bituminous emulsion
Warm	Bituminous emulsion, or C170 bitumen with up to a maximum of 3 parts cutter
Hot	C170 or C320 bitumen

A small size (e.g. 7 or 10 mm) aggregate is typically used for initial sealing of foamed bitumen stabilised pavements.

13 References

1. AAPA 2015, *Emulsion Primes, Rubber Latex Modified and PMB Emulsion Specifications, Advisory Note 20*
2. Austroads 2001, *Austroads Provisional Sprayed Seal Design Method Revision 2000*, AP-T09
3. Austroads 2006, *Update to the Austroads Sprayed Seal Design Method*, AP-T68/06
4. Austroads 2013, U*pdate of Double/Double Design for Austroads Sprayed Seal Design Method*, AP-T236-13
5. Austroads 2014, *Double/Double Primerseal Inspections*, AP-T276-14
6. Austroads 2014, *Specification Framework for Polymer Modified Binders*, AGPT/T190-14
7. Austroads 2016, *Selection and Design of Initial Treatments for Sprayed Seal Surfacings*, AP-T310-16
8. Austroads/AAPA, 2014 *Pavement Work Tip No 52, Sprayed Sealing – Extreme Hot Weather*, AP-PWT52-14