Design of sprayed seals

Technical directive

Supplement to Austroads guide to pavement technology Part 4K

NORTHERN TERRITORY GOVERNMENT

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1.0	29/11/2019	Andrew Batson	First version

Acronyms	Full form

Contents

1. Applicability of this guide note

This guide note has been prepared to assist Department of Infrastructure Planning and Logistics (DIPL) staff and Industry specialists in the design of sprayed seals during the delivery of roadworks projects for the NTG Civil and Infrastructure programs. It provides commentary on key elements within the sprayed seal design process.

It is also acknowledged that this guide may be used by industry and local government for various other internal and external purposes. Nonetheless, the context and recommendations in the guide have been derived from experiences and knowledge on Northern Territory Government roads.

2. Introduction

This guide note replaces the 2007 Construction Division work instruction – *Spray Seal Surfacing Part 2 – Design of Bituminous Application Rates.*

This guide note complements the Austroads 2018 guide note "Guide to Pavement Technology Part 4K, Selection and Design of Sprayed Seals, sections 5 and 6 (Austroads Part 4K).

The Austroads Part 4K is a general guide and does not have commentary or allowances for local variances in the seal design process. This guide note will set out where local data input changes are required to achieve a satisfactory sprayed seal design.

The guide note will **not** give exact spray seal designs but will give an indicative binder application rate that the designer can then apply or adjust to the conditions of the pavement to be sealed.

This guide note will also give general guidance for application rates of primes, primerseal and SAMI seals.

Testing regimes if not noted below shall be as per DIPL Standard Specification for Roadworks[1].

The finished pavement quality has a considerable influence when designing sprayed seals. The Department has a guide note "Road Pavement Acceptance During Construction[2]" which gives good commentary on this subject.

3. Treatment and selection

DIPL has a Technical Standard called "Bituminous Surfacing Works Treatment and Selection" which is located at Road surfacing standards page[3] in the DIPL website.

The purpose of this technical standard is to outline the default position for the selection of binder types, aggregate sizes and asset treatments type for spray sealing and asphalt surfacing works on all Northern Territory government road and civil assets. The guide note is applied to all regions in the NT.

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[1] https://dipl.nt.gov.au/infrastructure/technical-standards-guidelines-and-specifications/technical-specifications

[2] https://dipl.nt.gov.au/infrastructure/technical-standards-guidelines-and-specifications/road-surfacing-standards

[3] https://dipl.nt.gov.au/infrastructure/technical-standards-guidelines-and-specifications/road-surfacing-standards.

4. Seal design – input data and parameters

4.1 AADT

AADT - Annual Average Daily Traffic

Data for DIPL controlled roads can be sourced from traffic reports[4].

For the seal design process data needs to be calculated into vehicles per lane per day **(vld).**

Where traffic is required to be distributed over multi lanes refer to Table 5.1, page 47 of Austroads Part 4K for an estimation of design traffic.

4.2 ALD

Average least dimension (ALD) of the aggregate is critical to the seal design and if incorrect has a large impact on the outcome of the seal design.

This information is to be sourced through a NATA testing laboratory.

Sampling is to be of the actual materials being used and not sourced from quarry process test results.

Testing shall be from onsite stockpiles, before precoating.

Dispensation regarding on site testing can be given where very remote locations or very small areas are being resealed, seek Superintendent approval.

4.3 Texture Depth (As)

Obtained through performing the “Sand Patch” test using Austroads test method AG:PT/T250 modified surface texture depth (pestle method).

Testing in the NT has shown there is no real inconsistency in using sand or glass beads for this test. The main inconsistency of the test appears to be in site selection and operator error. For NT testing purposes glass beads used in pavement marking are an acceptable alternative to graded sand.

For resealing works testing shall be every 500m, or change of texture, in each wheel path and one test in the non wheel path areas.

4.4 Pavement Dry Back

This test is taken as part of the pavement acceptance criteria in the Standard Specification for Roadworks “Pavement and Shoulders” section.

Obtaining dry back is critical to ensuring *hardness* of the pavement to be sealed, and is used in the allowance section of the design, **Embedment (Ae)**.

[4] https://dipl.nt.gov.au/traffic-report

4.5 Basic Voids Factor (Vf)

4.5.1 Single Single Seals

Obtained through Figure 6.1 and Figure 6.2 in Austroads Part 4K Page 60 and 61.

For low volume roads a minimum of 100 vld is used for wheel path design, which is Vf of 0.213.

4.5.2 Double Double Seals

Obtained through Figures 6.3 and Figure 6.4 in Austroads Part 4K Page 61 and 62.

Basic voids factor for the double double seal design is obtained from two graphs "first application" and "second application".

The basic voids factor is adjusted for the shape of the aggregates, traffic effects and type of binder used to derive the "Basic Binder" application rate or the "Modified Basic Binder" application rate.

*The following attributes are **"Adjustments"** to the "Basic Voids Factor"*

4.6 Aggregate Shape (Va)

Adjustment for aggregate shape can be obtained from Table 6.1 in Austroads part 4K page 62.

The adjustment is related to the flakiness of the aggregates.

4.7 Traffic Effects (Vt)

Traffic effect is a critical part of design in the NT and Part 4 K has been slightly modified to suit our somewhat unique conditions with heavy vehicles and climate.

Table 6.2: Adjustment (Vt) to basic voids factor for traffic effects – page 63

Traffic	Adjustment to basic voids factor (L/,2/mm)			
	Flat or Downhill		Slow Moving or Climbing Lanes	
	Normal	Channelised	Normal	Channelised
0 to 15 EHV (%)	Nil	–0.01	–0.01	–0.02
16 to 25 EHV (%)	–0.01	–0.02	–0.02	–0.03
26 to 45 EHV (%)	–0.02	–0.03	–0.03	–0.04
46 + EHV (%)	–0.03	–0.04	–0.04	–0.05
Additional adjustments for local NT conditions				
Quad Roadtrains	–0.01			
Heavy Vehicle Intersections – turning lanes	–0.01			

Insertions:

- Adjustment for Quad Roadtrains
- Adjustment for Heavy vehicle intersections

Deletions:

- Requirement for overtaking lanes
- Non trafficked areas – use a fog spray
- Greater than 65% EHV, use quarry methodology

Where quarry approaches and intersection are to be designed and traffic data is not available then use the process described in Section 5.2.7 for access roads to quarries, mining locations, etc.

4.8 Design Voids Factor (VF)

This is obtained by calculation

VF= Vf + Va + Vt

Where

Vf is = Basic Voids Factor
Va = Aggregate shape
Vt = Traffic Effects

4.9 Polymer Factor (PF)

For New Seals and Primerseal there is **no** polymer factor used.

For two coat seals there is **no** polymer factor used.

Reseals use a polymer factor of 1.2, this is used for all grades of polymer modified bitumen's, excluding crumbed rubber.

4.10 Basic Binder Application Rate (Bb)

This is obtained by calculation

Bb = VF x ALD

Where

VF = Design Voids Factor
ALD = Average Least Dimension of the Aggregate

4.11 Modified Basic Binder Application Rate (Bbm)

This is obtained by calculation

Bbm = Bb x PF

Where

Bb = Basic Binder Application Rate
PF = Polymer Factor

*The following attributes are **"Allowances"** to the "Basic Binder Application Rate"*

Allowances are only used in the first coat of a two coat seal.

4.12 Surface Texture (As)

Surface texture is only used for resealing works.

Only used in the first coat of a double double seal.

Texture is related to the sand patch test and the allowance is dependent on what existing aggregate is in place and what aggregate is to be used for the resealing.

Table 6.3 in Austroads part 4K will give the adjustment in L/m2, pages 66 and 67.

Where texture depth measured exceeds the table allowances then add 0.1 L/m2.

All surfaces for reseal shall be tested for texture.

Electronic measurement for texture shall **not** be used.

In exceptional circumstances there may be a requirement for this allowance for new seals but currently it has **not** been used in the NT, seek specialised advice.

4.13 Embedment (Ae)

Embedment is derived from the Ball Penetration test.

Only used for the design of new seals.

This test shows the hardness of the pavement and should be performed after final trimming.

Allowances related to this test are given in Figure 6.5 of Austroads part 4K, page 69.

DIPL changes to Figure 6.5 include **no** ball penetration test result is to be greater than 3mm. Where 3mm is exceeded then several options can be put in place to reduce the embedment, further rolling with a multi tyred roller or further drying back of the pavement.

4.14 Binder Absorption (Aba)

Binder absorption shall only be used for resealing works.

No absorption allowances have been made for new seals in the NT, if highly porous new pavements are in place then absorption should be addressed at the time of priming.

Absorption shall **not** be used in design unless specialised advice from the DIPL Bitumen group has been sought.

Absorption allowance is generally used on low volume roads only and **not** recommended for high volume roads.

Allowances for absorption is highly dependent on the age of the existing seal, its porosity and how badly cracked it is.

The Department use the following allowances for absorption:

- Old and Cracked +0.05 L/m2
- Porous +0.02 L/m2
- Some Life 0.00 L/m2 – no change
- Lively -0.1 L/m2
- Microsurfacing - Slurry + 0.2 L/m2

Texture allowance for Microsurfacing is recommended at +0.2 L/m2, plus the existing texture.

Allowances for asphalt surfaces is dependent on traffic volumes, asphalt age and the porosity of the layer to be resealed, specialised advice should be sought before sealing takes place.

4.15 In Field Adjustments

This is related to the onsite factors that are the “unknowns” of sealing works.

This could be additional local traffic, cattle and military vehicles, environmental issues (heat) and construction issues, design issues and laminations or poor surfaces.

This task will generally be performed by experienced staffs and or the sealing crews.

5. Priming

Priming is covered in DIPL Standard Specification for Roadworks.

Prime should be a minimum of 0.9 l/m2

No blinding off of primes with dust shall take place, alternate methods of emulsion seal shall be used.

A general rule is:

5.2 Fine crushed rock

AMC0 100/0/80 @ 1.0 L/m2

If during wet periods then use AMC00 @1.0 l/m2 so environmental issues with run off does not occur

5.2 Natural gravels

High Plasticity Index use AMC00 (100/0/100) @ 1.0 L/m2, ensure prime is mixed on site and is at maximum temperature allowed, so absorption occurs

Low Plasticity Index use AMC00 (100/0/90) @ 1.0 L/m2

If during wet periods then use AMC00 @ 0.9 - 1.0 l/m2 so environmental issues with run off don't occur

5.2 Sand clays

100/0/70 @1.2 L/m2 this will reduce the occurrence of drainage of the bitumen into the pavement, it will also require a 7mm armour coat to stop embedment into the base materials and allow trafficking.

5.2 Salt affected pavements

Where there are circumstances that the pavement for construction has a high salt content the following alternate methods for priming shall be used.

Emulsion type primes are to be used and then sealed the next day.

Designers need to get specialised advice when dealing with salt effected pavements and design accordingly.

6. Primerseals

Primerseal are designed as per normal single or double seal design with no adjustment for the cutter in the application rate

Single primerseals are to be resealed within 12 months of placement.

High plasticity index use AMC5 (100/0/12).

Low plasticity index use AMC6 (100/0/7).

Double seals shall have the following:

Generally 14 and 7.

First coat to be AMC 5 or 6.

Second coat to be S10E.

7. SAMI seals

SAMI seals are only used under Asphalt wearing courses

A general rule of placement is to not place where there is a possibility of high stress

- Not placed at high traffic volume intersections
- Do not place within 50m of a hold line in Urban area intersections
- Do not place in areas of heavy vehicle movement
- Do not place at sharp corners where there are high stresses
- Do not place where there is moisture or dirt present

8. Seal design request

Pavement acceptance and seal design request			
Project			
Location and Chainage			
New Seal or Reseal			
Date			
Bitumen Type			
Aggregate Size			
Pavement conformance And test results	Date	**Accepted**	**Project Officer**
Compaction Results			
Dry Back Results (attach results)			
Final Trimming Are there laminations Make comment on acceptance			
Ball Penetration Tests (attach results - should be <=3) If not seek advice / don't accept pavement			
Accept Pavement (ensure surface is tight) Note: if there is a time lapse or damage to the surface redo the ball penetration tests			
Aggregate Results minimum 3 tests or 1 per 250 tonne must be from on site - (attach results)			
Seal Designer - (name)			
Application Rate - l/m2			
Comments – (from designer) Make the assumptions here etc			