Transport for NSW

SEAL or RESEAL Design Calculation Sheet

Form 395K

Job Details

Roadloc:

Date: .... **Job/Order Number:** .... **Office:** ....

Road Number/Name: .... **Segment Number:** ....

														TO														

Location: from town .... towards town .... **Chainage:** .... km to ....km

Length: .... m **Width**: .... m **Area**: .... m^2 **Number of Lanes**: ....

Type of Treatment

Seal (**S**) or Reseal (**RS**) ☐

Single / Single (**S/S**)
Single / Double (**S/D**)
Double / Double (**D/D**) ☐

Geotextile Reinforced Seal (**GRS**) ☐

High Stress Seals (**HSS**) ☐

Strain Alleviating Membrane (**SAM**) or
Strain Alleviating Membrane Interlayer (**SAMI**) ☐

Other: ……………………………………………

Existing Surface Conditions

Prime **(P),** Primerseal (**PS**), Seal (**S**) ☐

Existing Aggregate Size (nominal) ☐ mm

Other: …………………………………..

Asphalt (**A**)**,** Slurry Surfacing (**SS**) ☐

Primed Cement Concrete (**CC**)
Primed Concrete Bridge Deck (**CBD**) ☐

Primed Timber Bridge Deck (**TD**) ☐

Lane Description *(e.g., Fast Lane, Slow Lane, Turning Lane etc.)*			
Surface Texture Depth (mm) (RMS T240)			
Ball Penetration Depth of Prime or Primerseal or Granular Base (mm) (RMS T271)			

Materials for Seal or Reseal

Aggregate Design for Seals or Reseals		1st layer	2nd layer
Nominal Aggregate Size (mm)		....	....
Aggregate Shape - Crushed (**C**), Partly Crushed (**PC**) or Rounded (**R**)		....	....
Compatibility with existing seal size checked	(Yes/No)	....	....
Average Least Dimension (**ALD**) (mm)		**ALD_1** = ...	**ALD_2** = ...
Basic Aggregate Spread Rate (m^2/m^3), **F**	(Table 1A or Table 1B)	....	....
Modification Factor for Seal Type Factor, **I**	(Table 2)	....	....
Design Aggregate Spread Rate (m^2/m^3), **H** = F x I (m^2/m^3)		....	....
Geotextile Type and Mass (g/m^2)		....	....
Binder Grade or Class (*RMS 3252 or RMS 3253*) *e.g., Class 170 or S45R or M500 etc.*		....	....
Bitumen Emulsion/Emulsion Binder Type and Grade (*RMS 3254*)		....	....

	Binder Design for Seals or Reseals	Lane Description			
1st Layer	Traffic Volume (v/l/d)	(Table 3A)			
	Equivalent Heavy Vehicles (%)	(Table 3B Note 1)			
	Basic Voids Factor (L/m^2/mm), $\mathbf{V_{f1}}$	(Figure 1A or 1B)			
	Traffic Effects Adjustment (L/m^2/mm), $\mathbf{V_{t1}}$	(Table 3B)			
	Aggregate Shape Adjustment (L/m^2/mm), $\mathbf{V_{a1}}$	(Table 4)			
	Voids Modification Factor, $\mathbf{V_m}$	(Table 5)			
	Design Voids Factor (L/m^2/mm), $\mathbf{VF_1} = (\mathbf{V_{f1}} + \mathbf{V_{a1}} + \mathbf{V_{t1}}) \times \mathbf{V_m}$				
	Basic Binder Application Rate (L/m^2), $\mathbf{A_1} = \mathbf{VF_1} \times \mathbf{ALD_1}$				
	Emulsion Factor, $\mathbf{EF_1}$	(Table 6)			
	Polymer Factor, $\mathbf{PF_1}$	(Table 7A or Table 7B or Table 7C or Table 7D)			
	Surface Texture Allowance (L/m^2), $\mathbf{A_T}$	(Table 8)			
	Binder Absorption by Aggregate Allowance (L/m^2), $\mathbf{A_{BA1}}$	(Table 9)			
	Embedment Allowance (L/m^2), $\mathbf{A_E}$ - <u>seals only</u>	(Figure 2)			
	Binder Retention (L/m^2), $\mathbf{A_R}$ - <u>GRS only</u>	(Table 10)			
	Binder Absorption by Base (L/m^2), $\mathbf{A_{BB}}$	(Table 12)			
	Design Binder Application Rate, $\mathbf{B_{D1}}$				
	For conventional seal, $\mathbf{B_{D1}} = \mathbf{A_1} + \mathbf{A_T} + \mathbf{A_{BA1}} + \mathbf{A_E} + \mathbf{A_{BB}}$				
	For polymer modified binder seal, $\mathbf{B_{D1}} = (\mathbf{A_1} \times \mathbf{PF_1}) + \mathbf{A_T} + \mathbf{A_{BA1}} + \mathbf{A_E} + \mathbf{A_{BB}}$				
	For emulsion seal, $\mathbf{B_{D1}} = (\mathbf{A_1} \times \mathbf{EF_1} \times \mathbf{PF_1}) + \mathbf{A_T} + \mathbf{A_{BA1}} + \mathbf{A_E} + \mathbf{A_{BB}}$				
	For GRS application, $\mathbf{B_{D1}} = (\mathbf{A_1} \times \mathbf{EF_1} \times \mathbf{PF_1}) + \mathbf{A_T} + \mathbf{A_{BA1}} + \mathbf{A_E} + \mathbf{A_R} + \mathbf{A_{BB}}$				
2nd Layer	Basic Voids Factor (L/m^2/mm), $\mathbf{V_{f2}}$	(Figure 1A or 1B)			
	Traffic Effects Adjustment (L/m^2/mm), $\mathbf{V_{t2}}$	(Table 3B)			
	Aggregate Shape Adjustment (L/m^2/mm), $\mathbf{V_{a2}}$	(Table 4)			
	Design Voids Factor (L/m^2/mm), $\mathbf{VF_2} = \mathbf{V_{f2}} + \mathbf{V_{a2}} + \mathbf{V_{t2}}$				
	Basic Binder Application Rate (L/m^2), $\mathbf{A_2} = \mathbf{VF_2} \times \mathbf{ALD_2}$				
	Emulsion Factor, $\mathbf{EF_2}$	(Table 6)			
	Polymer Factor, $\mathbf{PF_2}$	(Table 7A or Table 7B or Table 7C or Table 7D)			
	Binder Absorption by Aggregate Allowance (L/m^2), $\mathbf{A_{BA2}}$	(Table 9)			
	Design Binder Application Rate, $\mathbf{B_{D2}}$				
	For conventional seal, $\mathbf{B_{D2}} = \mathbf{A_2} + \mathbf{A_{BA2}}$				
	For polymer modified binder seal, $\mathbf{B_{D2}} = (\mathbf{A_2} \times \mathbf{PF_2}) + \mathbf{A_{BA2}}$				
	For emulsion seal, $\mathbf{B_{D2}} = (\mathbf{A_2} \times \mathbf{EF_2} \times \mathbf{PF_2}) + \mathbf{A_{BA2}}$				
	For GRS application, $\mathbf{B_{D2}} = (\mathbf{A_2} \times \mathbf{EF_2} \times \mathbf{PF_2}) + \mathbf{A_{BA2}}$				

***Design by:*... ***Signature:*...

Organisation: .... ***Date:*** ....

Table 1A: Determination of Basic Aggregate Spread Rates (F) for 10 mm and 14 mm

Type of Binder	Aggregate Spread Rate (m²/m³)	
	10 mm	14 mm
C170, C240, C320, M500[1]	$\frac{800}{ALD}$ *to* $\frac{850}{ALD}$	$\frac{850}{ALD}$ *to* $\frac{900}{ALD}$
Polymer Modified Binder (PMB)[2] Polymer Modified Emulsion (PME)[2]	$\frac{750}{ALD}$ *to* $\frac{800}{ALD}$	$\frac{750}{ALD}$ *to* $\frac{800}{ALD}$
Bitumen Emulsion	$\frac{750}{ALD}$ *to* $\frac{800}{ALD}$	$\frac{750}{ALD}$ *to* $\frac{800}{ALD}$

Notes:
1. The basic aggregate spread rate for shoulder is 800/ALD.
2. For traffic greater than 750 v/l/d, the basic aggregate spread rate is 800/ALD.

Table 1B: Basic Aggregates Spread Rates (F) for 5 mm and 7 mm

Seal Type	Aggregate Spread Rate (m^2/m^3)
Seal / Reseal	170 – 200
Scatter (rack-in) Coat	400 – 600

Table 2: Seal Type Factor (I)

Seal Type	Seal Type Factor (I)
Single/Single	1.0
Single/Double	
1st layer	1.1
2nd layer	2.0
Double/Double	
1st layer	1.1
2nd layer	1.0

Table 3A: Guide to the estimate of the Traffic Volume

Lane description	Traffic Volume (v/l/d)
Turning lane	Min. 150
Sealed shoulders	Min. 150
Single carriageway - Through lane - Climbing lane - Overtaking lane	 AADT x 0.5 70% x AADT x 0.5 40% x AADT x 0.5
Dual carriageway - rural - Slow lane - Fast lane	 80% x AADT x 0.5 30% x AADT x 0.5
Dual carriageway - urban - Slow lane - Fast lane	 60% x AADT x 0.5 40% x AADT x 0.5

Table 3B: Traffic Effects Adjustment (V_t)

Traffic effect	Adjustment to Basic Voids Factor (L/m²/mm)			
	Flat or Downhill Grade		Climbing Lanes	
	Normal	Channelised[3]	Normal	Channelised[3]
0 – 15 % EHV[1]	0	- 0.01	- 0.01	- 0.02
16 – 25 % EHV[1]	- 0.01	- 0.02	- 0.02	- 0.03
26 – 45% EHV[1]	- 0.02	- 0.03	- 0.03	- 0.04
> 45% EHV[1]	- 0.03	- 0.04	- 0.04	- 0.05
Overtaking lanes of multi-lane rural roads	+ 0.01	0	N/A[2]	N/A[2]

Notes:

1. Equivalent Heavy Vehicles (EHV) = Heavy Vehicles + 3 x Large Heavy Vehicles
   Where:
   Heavy Vehicles are Austroads vehicle Class 3 to Class 9
   Large Heavy Vehicles are Austroads vehicle Class 10 and above.
2. Not applicable
3. Channelisation is 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.

Table 4: Aggregate Shape Adjustment (V_a)

Aggregate Type	Aggregate Shape	Adjustment to Basic Voids Factor ($L/m^2/mm$)
Crushed	Flaky Angular Cubic	- 0.01 0.0 + 0.01
Partly Crushed	Rounded	+ 0.005
Not Crushed	Rounded	+ 0.01

Table 5: Voids Modification Factor (V_m)

Traffic Volume (v/l/d)	Seal Type and Voids Modification Factor (V_m)	
	Single/Single or Single/Double	Double/Double[1]
< 500	1.0	0.75
500 – 1000	1.0	0.80
1001 – 2000	1.0	0.85
> 2000	1.0	0.90

Note:
1. Only applicable to the 1st layer of a double/double seal.

Table 6: Emulsion Factor (EF)

Binder Type	Emulsion Factor (EF)
High Bitumen Content Emulsion (≥ 67 %) without polymer additives	1.1 – 1.2
Conventional Bitumen Emulsion (60%)	1.0
Polymer Modified Emulsion	1.0

Table 7A: PMB Factor for HSSs (PF)

Binder Class	S35E	10% Scrap Rubber	S45R
Polymer Factor (PF)	1.05	1.10	1.15

Table 7B: PMB Factor for SAMs (PF)

Binder Class	S15E	S20E	S45R, S15RF	S55R, S20RF
Polymer Factor (PF)	1.25	1.30	1.40	1.70
Note: Aggregate size for SAM treatments must be 10 or 14 mm.				

Table 7C: PMB Factor for SAMIs (PF)

Binder Class	S55R, S20RF	25% Scrap Rubber
Polymer Factor (PF)	1.80	2.00
Note: Aggregate size for SAMI treatments must be 10 mm.		

Table 7D: PMB Factor for Geotextile Reinforced Seals (PF)

Binder Class	S15E	S20E	S45R, S15RF	S55R, S20RF
Polymer Factor (PF)	1.25	1.30	1.40	1.70

Table 8: Surface Texture Allowance (L/m^2), A_T

Existing Seal/Primerseal			Proposed Reseal - Aggregate Size			
Agg. Size	**Condition**	**Texture Depth (T240)**	**5 mm**	**7 mm**	**10 mm**	**14 mm**
5 mm	Bleeding	< 0.4 mm	A	- 0.2	- 0.2	- 0.2
	Flushed	0.4 - 0.7 mm	A	- 0.1	0	0
	Smooth	0.8 - 0.9 mm	0	0	0	0
	Matt	1.0 - 1.2 mm	0	+ 0.1	+ 0.1	+ 0.1
	Hungry	1.3 - 1.8 mm	+ 0.2	+ 0.2	+ 0.2	+ 0.2
	Very Hungry	> 1.8 mm	+ 0.3	+ 0.3	+ 0.3	+ 0.3
7 mm	Bleeding	< 0.4 mm	A	- 0.2	- 0.2	- 0.2
	Flushed	0.4 - 0.7 mm	- 0.1	- 0.1	- 0.1	0
	Smooth	0.8 - 1.1 mm	0	0	0	0
	Matt	1.2 - 1.5 mm	0	+ 0.1	+ 0.2	+ 0.2
	Hungry	1.6 - 2.0 mm	+ 0.2	+ 0.2	+ 0.3	+ 0.3
	Very Hungry	> 2.0 mm	+ 0.3	+ 0.4	+ 0.4	+ 0.4
10 mm	Bleeding	< 0.4 mm	A	- 0.2	- 0.2	- 0.2
	Flushed	0.4 - 0.7 mm	- 0.1	- 0.1	- 0.1	0
	Smooth	0.8 - 1.2 mm	0	0	+ 0.1	+ 0.2
	Matt	1.3 - 1.7 mm	+ 0.1	+ 0.2	+ 0.3	+ 0.4[A]
	Hungry	1.8 - 2.2 mm	+ 0.2	+ 0.3	+ 0.4[A]	C
	Very Hungry	> 2.2 mm	+ 0.3	+ 0.4	C	C
14 mm	Bleeding	< 0.4 mm	B	A	- 0.3	- 0.3
	Flushed	0.4 - 0.7 mm	A	- 0.1	- 0.1	- 0.1
	Smooth	0.8 - 1.3 mm	0	0	+ 0.1	+ 0.2
	Matt	1.4 - 2.2 mm	+ 0.1	+ 0.2	+ 0.4[A]	+ 0.4[A]
	Hungry	2.3 - 3.2 mm	+ 0.2	+ 0.3	C	C
	Very Hungry	> 3.2 mm	+ 0.3	+ 0.4	C	C
20 mm	Bleeding	> 0.4 mm	B	A	- 0.3	- 0.3
	Flushed	0.4 - 0.7 mm	B	- 0.1	- 0.1	- 0.1
	Smooth	0.8 - 1.4 mm	0	0	+ 0.1	+ 0.2
	Matt	1.5 - 2.4 mm	+ 0.1	+ 0.2	+ 0.4[A]	+ 0.4[A]
	Hungry	2.5 - 3.5 mm	+ 0.2	+ 0.3	C	C
	Very Hungry	> 3.5 mm	+ 0.3	+ 0.4	C	C

Notes:
A: Not recommended
B: Specialised treatments necessary
C: Consider alternative treatments
(eg enrichment, small size seal etc)

Surface Texture Allowances for Seals over ...
primes: See Table 11A
asphalt: See Table 11B
primed concrete: See Table 11C
primed timber: See Table 11D
slurry surfacing: See Table 11E

Table 9: Allowances for Binder Absorption by Aggregate (A_{BA})

Binder Absorption (%)	Binder Absorption Allowance (L/m^2)
< 1	0.0
≥ 1 to ≤ 3	+ 0.1 to + 0.3
> 3	Not recommended unless performance in the field is proven

Table 10: Geotextile Binder Retention Allowance (A_R)

Density of Geotextile (g/m^2)	Binder Retention (L/m^2)
130 – 174	0.8 – 1.0
≥ 175	1.1 – 1.3

Table 11A: Surface Texture Allowance for Primed Surface (A_T)

Surface Condition	Surface Texture Allowance, A_T (L/m^2)
Hard, smooth and black	0.0
Hard, smooth and brown	+ 0.1
Hard, hungry and brown	+ 0.2

Table 11B: Surface Texture Allowance for Asphalt Surface (A_T)

Age (years)	Traffic (v/l/d)	Surface texture allowance, A_T (L/m^2)
0 - 2	> 750	- 0.1
	≤ 750	0.0
2 - 5	> 750	0.0
	≤ 750	+ 0.1
> 5	> 750	+ 0.1
	≤ 750	+ 0.2
Note: Only applicable to dense graded asphalt.		

Table 11C: Surface Texture Allowance for Primed Concrete Surface (A_T)

Surface Condition	Surface Texture Allowance, A_T (L/m^2)
Hard and black	+ 0.2
Hard and brown	+ 0.3

Table 11D: Surface Texture Allowance for Primed Timber Surface (A_T)

Surface Condition	Surface Texture Allowance, A_T (L/m^2)
Hard and black	+ 0.2
Hard and brown	+ 0.3

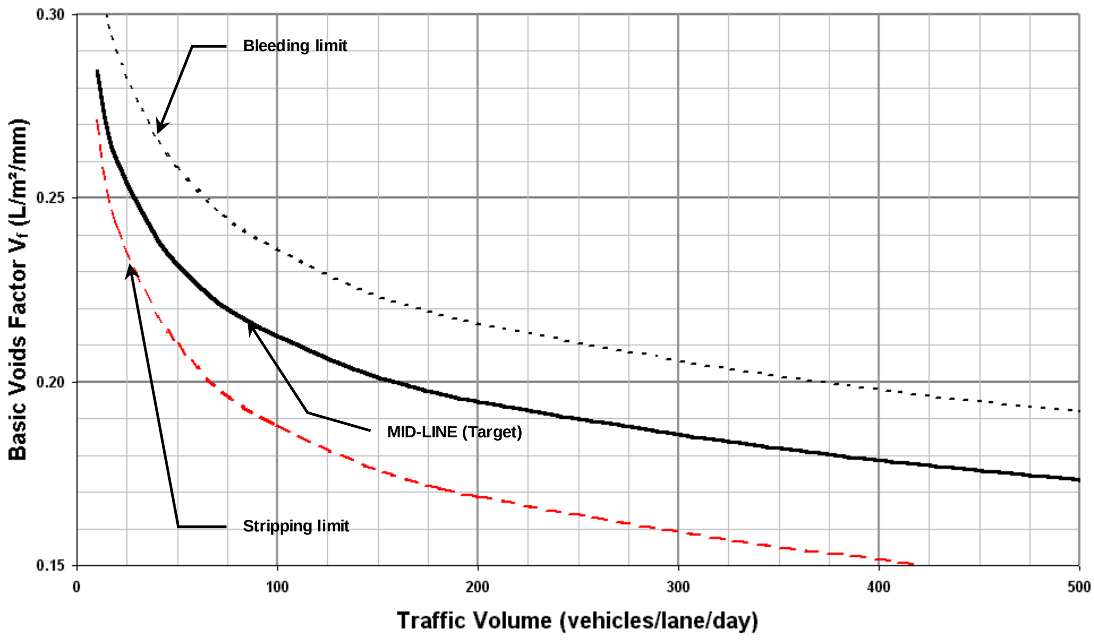
Table 11E: Surface Texture Allowance for Slurry Surfacing Surface (A_T)

Age (months)	Thickness (mm)	Surface Texture Allowance, A_T (L/m^2)
≤ 12	≤ 10	0.0
	> 10	0.0
> 12	≤ 10	+ 0.1
	> 10	+ 0.2

Table 12: Binder Absorption by Base Allowance (A_{BB})

Type of surface	Binder Absorption Allowance, A_{BB} (L/m^2)
Sealed or Resealed	+ 0.0
Primed or primersealed	+ 0.0
Unsealed base	+ 0.1 to + 0.4[1]

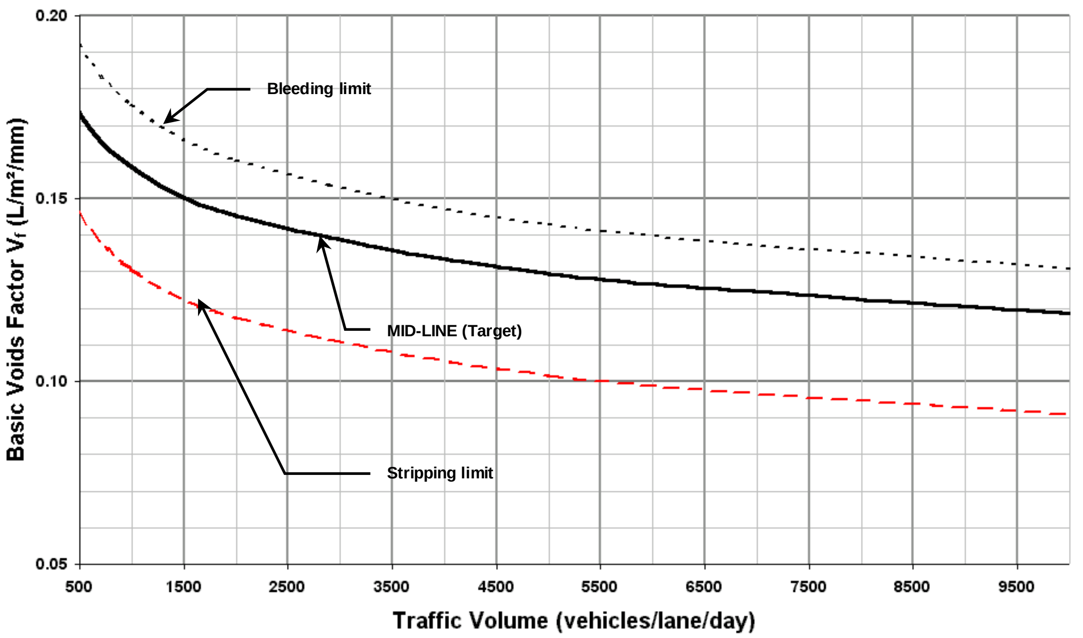
Note:
1. Based on test results obtained from RMS T126.



Source: Austroads

Note: For shoulders and medians, use the following Design Voids Factor:
- 0.21 for good quality crushed aggregate
- 0.23 for rounded or very cubical aggregates and larger size aggregates

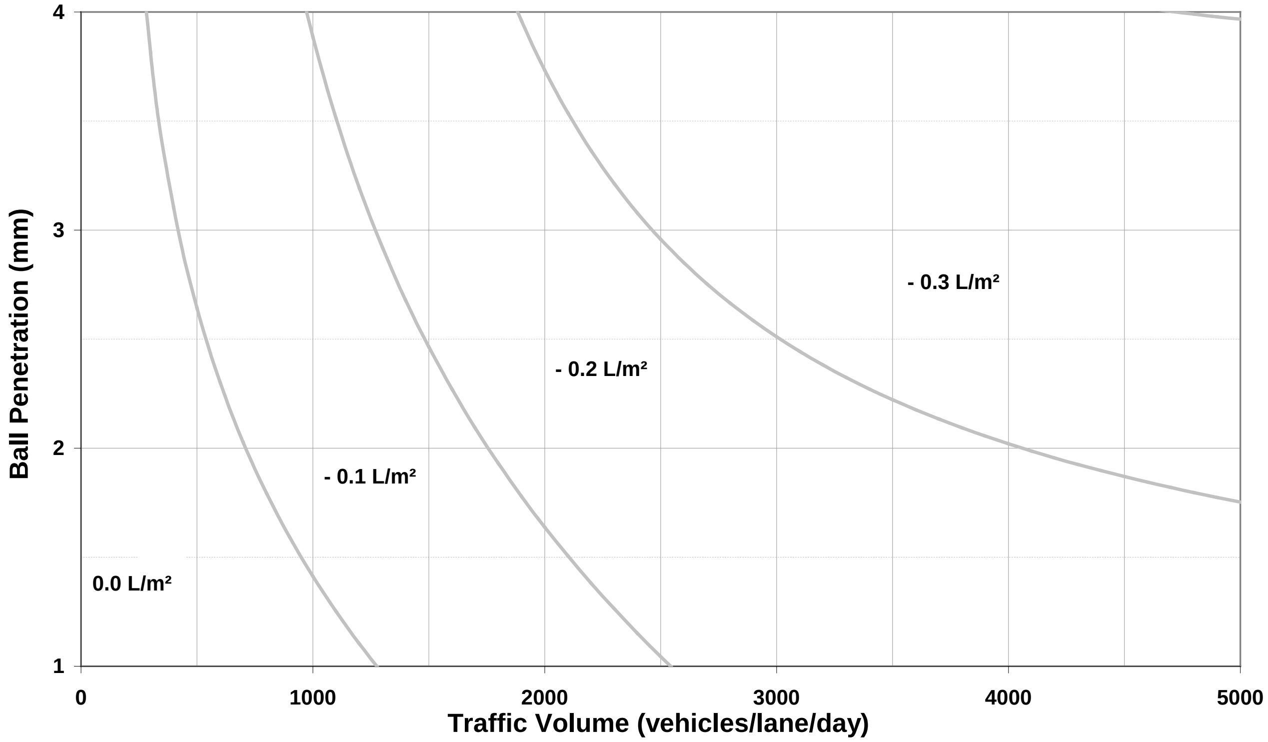
Figure 1A: Basic Voids Factor (V_f) – Traffic Volume 0 – 500 vehicles/lane/day



Source: Austroads

Note: For shoulders and medians, use the following Design Voids Factor:
- 0.21 for good quality crushed aggregate
- 0.23 for rounded or very cubical aggregates and larger size aggregates

Figure 1B: Basic Voids Factor (V_f) - Traffic Volume 500 – 10,000 vehicles/lane/day



Source: Austroads

Note: Where the embedment allowances is - 0.3 L/m^2, consider alternative treatments (eg armour coating) in order to provide a surface on which a larger aggregate seal can then be placed.

Figure 2: Embedment Allowance (A_E)

Guide notes for using RMS Form 395K

This Form is only to be used for sprayed sealing works to RMS specifications R106 (RMS, 2013a), R107 (RMS, 2013) and R111 (RTA, 2006). The types of permitted binders for sprayed sealing are noted in RMS specifications 3252, 3253 and 3254.

For the selection of nominal size of the first layer of aggregate, a preliminary check is required to check the compatibility of the proposed aggregate with the existing seal. This is to discourage practitioners to use incompatible aggregate in reseals (eg the use of 14 mm reseal over a 10 mm seal with hungry surface texture).

The selection for the size of the second layer of aggregate must be selected to ensure that it interlock with the first layer of aggregate. This is usually achieved by choosing the size of the second layer of aggregate to be half the nominal size of the first layer of aggregate.

When using Table 1A or Table 1B, the designer should use the lower limit of the application rate (ie more aggregate is required) if the aggregate used is larger than normal (ie ALD ≥ 0.6 times the nominal size of the aggregate).

The determination of equivalent heavy vehicle (EHV) is detailed in Table 3B where (Austroads 2006):

- Heavy Vehicles = Austroads vehicle Class 3 to Class 9.
- Large Heavy Vehicles = Austroads vehicle Class 10 and greater.

For example, if the site has 2,000 v/l/d and it consists of 250 Heavy Vehicles and 50 Large Heavy Vehicles per day, then

EHV = 250 + 3x50 = 400

The percent of EHV = 400/2000 x 100 = 20%

Figures G1 to G5 shows typical crushed, partly crushed and not crushed aggregates, used for Table 4.

Figure G1: View of crushed flaky aggregate.

Figure G2: View of crushed angular shaped aggregate.

Figure G3: View of crushed cubic shaped aggregate.

Figure G4: View of partly crushed rounded shaped aggregate.

Figure G5: View of not crushed rounded shaped aggregate.

In Table 6, 1.1 is chosen for the 'Emulsion Factor' when the emulsion content is at 67% and as the residual bitumen content increases the higher value of 1.2 is chosen.

When selecting the surface texture allowance from Table 8, the existing surface condition descriptions are as follows:

- Bleeding - A surface defect in which an excess of binder completely covers the aggregate. It results from the upward migration of the binder, due to a combination of traffic action, warm temperatures and other factors. It leads to a loss of surface texture.
- Flushed - A pavement surface defect in which the binder is near the top of the aggregate particles. There is minimal surface texture.
- Smooth - A surface condition in which the aggregate is worn and the texture depth is minimal.
- Matt - A surface condition in which the aggregate is proud of the surface and the binder is approximately two thirds of the way up the sides of the aggregate particles.
- Hungry - A surface condition in which the aggregate is proud of the surface and the binder is approximately half way up the sides of the aggregate particles.
- Very Hungry - A surface condition in which the aggregate is proud of the surface and the binder is approximately one third of the way up the sides of the aggregate particles.

In Table 8, lists values for the surface texture allowance for various aggregate sizes and seal conditions. Where the surface is a prime, dense graded asphalt, primed concrete or timber, and slurry surface, the designer is to use the values in Tables 11A to 11E. Also, 'note C' recommends the seal designer selects alternative treatments and it recommended that advice be sought from the Pavement Surfacings Section. Advice should also be sought when seals are being applied to SMA and OGA surfaces.

In Table 10, the 'Binder Retention Allowance' is chosen as the required volume of binder needed to saturate the fabric and depends on the grade (thickness) of the geotextile used.

When applying a sprayed seal on dense graded asphalt, the 'Surface Texture Allowance' increases as the age of the asphalt and traffic volume increases.

In Tables 11A, 11C and 11D, the description of the surface condition is as follows:

- Hard and black – The surface may give the impression of flushing but without excess binder on the surface as shown in Figure G6.
- Hard and brown - The surface appears to be dry and hungry as shown in Figure G7.

Figure G6: Hard and black primed surface.

Figure G7: Hard and brown primed surface.

The ‘Binder Absorption Allowance’ for an unsealed base varies from 0.1 to 0.4 as determined using RMS T126 (RMS, 2012b). The test method determines the average depth of penetration of the seal and reported in mm. Using Table 12, for low surface absorption, the ‘Binder Absorption Allowance’ value is 0.1 and as the ball penetration reading increases so does the value.

In Figures 1A and 1B, the mid-line is used to read the ‘Basic Voids Factor’ from the vertical axis (Austroads, 2009) for the traffic lanes. For sealing shoulders and medians, adopt a ‘Design Voids Factor’ as per the notes.

When using Figures 1A and 1B the seal designer should ensured that the ‘Design Voids Factor’ does not go beyond the dashed lines (ie the bleeding limit and the stripping limit).

In Figure 2, the ‘Embedment Allowance’ compensates for loss of voids in the seal under traffic and is a function of traffic and surface hardness as measured by RMS T271 (RMS, 2012a). This ‘Embedment Allowance’ only applies to seals and not reseals.

For more information on sprayed seal design, refer to Austroads Guide to Pavement Technology Part 4K: Seals (Austroads, 2009).

References

Austroads (2006) *Update of the Austroads sprayed seal design method,* AP-T68/06*,* Austroads, Sydney, NSW.

Austroads (2009) *Guide to Pavement Technology Part 4: Seals,* AGPT4K/09, Austroads, Sydney, NSW.

RTA (2006) *Sprayed bituminous surfacing (with bitumen emulsion)*, Specification R111, Roads and Traffic Authority, North Sydney, NSW.

RMS (2012a) *Ball penetration test,* Test Method T271, Roads and Maritime Services, North Sydney, NSW.

RMS (2012b) *Assessment of primer or binder absorption by road gravel*, Test method T126, Roads and Maritime Services, North Sydney, NSW.

RMS (2013a) *Sprayed bituminous surfacing (with cutback bitumen)*, Specification R106, Roads and Maritime Services, North Sydney, NSW.

RMS (2013b) *Sprayed bituminous surfacing (with polymer modified binder)*, Specification R107, Roads and Maritime Services, North Sydney, NSW.

Further reading

RTA (2009a) *Polymer Modified Binder*, Specification 3252, Roads and Traffic Authority, North Sydney, NSW.

RTA (2009b) *Bitumen for Pavements*, Specification 3253, Roads and Traffic Authority, North Sydney, NSW.

RTA (2009c) *Bitumen Emulsion*, Specification 3254, Roads and Traffic Authority, North Sydney, NSW.

RMS (2012c) *Road surface texture depth*, Test method T240, Roads and Maritime Services, North Sydney, NSW.