Table A3 Surface condition allowances for primerbinders.

Allowance (L/m^2)	Surface Condition
0.0 to + 0.1	Tightly bonded surfaces
+ 0.1	Fine surfaces
+ 0.2	Coarse surfaces
+ 0.2 to + 0.4	Crushed rock spread and compacted without surface finishing, for example by autograde or paver
Note: These allowances are not cumulative	

Appendix A Primerseal application rate data

The RTA Primerseal design specification follows the following steps:

A. Primerbinder

1. Establish pavement surface temperature (°C)
2. Type and grade of Primerbinder – refer to Table A1
3. Equivalent Cutter Oil in Mixture (%) - refer to Table A1
4. Adhesions agent type/concentration (1% recommended)
5. Traffic Volume (v/l/d)
6. Basic application rate for mixture at 15°C (L/m^2) - refer to Table A2
7. Adjusted application rate (T126) – refer to Table A2, Note 4 — A
8. Surface condition allowance (L/m^2) – refer to Table A2 — B
9. Aggregate absorption allowance (L/m^2) – refer to Table A3, Note 3) — C
10. Design application rate (L/m^2) = A + B + C

B. Aggregate

11. Type (Crushed, Partly Crushed or Rounded)
12. Nominal size (mm)
13. Design spread rate (m^2/m^3) – refer to Table A3

Table A1 **T**ypes and grades of Primerbinders for various road surface temperatures.

Pavement Surface Temperature	**Primerbinder**
> 20°C in summer	AMC4 or 13 - 16% cutback
> 20°C and not in summer	AMC4 or 16% cutback
10°C to 20°C	AMC3, AMC4 or 16 - 21% cutback
5°C to 10°C and fine conditions	Bitumen cut back with fast curing cutter oil or special grade cationic emulsion (Seek specialist advice)
< 10°C and damp conditions likely	Seek specialist advice

Table A2 Basic rates for Primerbinder and rates for aggregates.

Aggregate Size (mm)	**Basic Primerbinder Application Rate at 15°C(L/m^2) of mixture** Vehicles/lane/day			**Aggregate Application Rate (m^2/m^3)**
	< 300	**300 - 2000**	**> 2000**	
5	1.3			130 – 170
7	1.3	1.0 – 1.2	1.0 - 1.1	130 – 170
10	1.4	1.2 – 1.3	1.1 - 1.2	110 – 140

Notes:
1. The application rates given are intended as a guide only. Actual rates should be determined by on site trials.
2. The above Primerbinder application rates do not include any allowance for surface texture, or absorption by the base or by the aggregate.
3. Allowance for aggregate absorption > 1% = +0.1 L/m^2.
4. Use Compatibility Test (T126) to adjust application rate to desired penetration.

AustStab (2004) *Foamed bitumen stabilisation* Technical Note 2, Australian Stabilisation Industry Association, Artarmon.

RTA (2002a) *Sprayed sealing guide* Edition 2, Roads & Traffic Authority (NSW), Sydney.

RTA Form 395A (2002b) *Cutback bitumen prime or primerseal design calculation sheet* Roads & Traffic Authority (NSW), Sydney.

Smith, W (2004) *Private communication* Stabilised Pavements of Australia, Gymea Bay, NSW.

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pavement construction the typical drainage path off the carriageway will remain unusable until the asphalt is laid. Ponding of water in dips should be avoided as prolonged traffic may cause rutting in the first week after construction. However, if rutting should occur, the material may be remixed without the addition of binder[3] and compacted to the required density.

At intersections where granular pavement materials butt against foamed bitumen layers of the downhill side, a subsoil drain is required to reduce the potential for moisture to accumulate at the joint leading to a weaker granular pavement at the intersection.

It would not be prudent to form a pavement structure consisting of a granular base layer on a foamed bitumen stabilised subbase as water infiltrating from the granular layer is likely to pond at the top of the foamed bitumen layer leading to a reduction in strength of the granular base material.

5 SERVICES

It's inevitable that roads will be dug up to install a new trench or relace existing services. The current approach at this stage is to reuse the foamed bitumen material provided it is less than 1 month in age at the time of mixing. Otherwise, a trenching mix may be used with asphalt to a minimum thickness of the wearing course or 30 mm.

For more information on trenches, refer to Austroads/AAPA Work Tip No. 16 (Austroads, 1999).

6 CONCLUSIONS

The successful use of foamed bitumen will be reduced if drainage is not considered in the pavement structure. Whilst foamed bitumen stabilised materials have better 'water proofing' characteristics then cement stabilised materials and have been used in floodways and constructed in wet environments like Innisfail (far north Queensland), the action of moisture and dynamic loading of axle loads will reduce the capacity of the material if subsoil drainage is not considered in wet subgrades.

For the insitu process, joints are less of a problem than plant mix material laid with a paver as the rolling pattern near edges may cause changes in depth and problems for ride quality and surface profile. The location of joints is usually carried out by the contractor and the experience of practitioners cannot be overlooked when 'things are not as they seem' on site.

Detailing of joints and drainage are important elements that should not be overlooked in planning and costing rehabilitation projects.

7 REFERENCES

Austroads and AAPA (1999) *Reinstatement of road openings* Work Tip No.16, Kew.

Austroads (2003) *Guide to best practice for the construction of insitu stabilised pavements* Sydney.

Austroads (2004a) Sprayed Sealing Guide AP-G76/04, Sydney

Austroads (2004b) *Pavement Design: A Guide to the Structural Design of Road Pavements* Sydney.

[3] If the age of the stabilised material exceeds 1 week, it may be prudent to remix the distressed are with about 1% of GB cement.

In traditional wide streets urban where traffic safety has led to the utilisation of two lanes of vehicles (ie restricted the trafficable lanes to the centre of the road), the foamed bitumen process could be carried out on the trafficable lanes (refer to Figure 2).

Figure 2 Foamed bitumen carried out in the trafficable lanes of Fitzwilliam Street, Toongabbie with a new asphalt surface from kerb to kerb.

Other construction tips are included in the Austroads best practice guide for insitu stabilisation (Austroads, 2003).

4 DRAINAGE

Adequate surface and subsoil drainage is essential for pavements to reach their desired pavement life. The Austroads pavement design guide (Austroads, 2004b) notes the following factors that influence the moisture regime within and/or beneath a pavement and which must be assessed at the design stage:

- rainfall/evaporation pattern;
- reactivity of subgrade to variation in the moisture regime;
- permeability of wearing surface;
- depth of watertable or to water-bearing strata;
- relative permeability of pavement layers;
- whether or not to seal shoulders;
- type of vegetation to be used in medians or on verges, and their proximity to the pavement;
- the form of pavement construction (boxed or full width); and
- pavement drainage, e.g. availability of table-drains, sub-surface drainage, etc.

The above factors are detailing issues that are unlikely to dictate pavement base and subbase layer thickness due to strength as the material would normally be tested under soaked conditions. Needless to say, most practitioners would seek to remove excess subsurface moisture to improve the bearing capacity of the pavement to repetitive loading.

In urban locations were 30 to 50 mm of asphalt is required as the wearing surface and it is common to stabilise the base layer to about 30 mm short of the lip to the kerb & gutter. During

For RTA road contracts, sprayed seals are applied according to RTA R106[1] with a 7 mm primer seal followed by a 10 or 14 mm final seal. More details of spray sealed design for RTA roads are found in the RTA sprayed sealing guide (RTA, 2002a). The adjusted application rate (see Appendix A) is typically set at -0.1 l/m^2 as per RTA Form 395A (RTA, 2002b).

Bitumen emulsion is also used as a primerbinder and the recommended use are (Austroads, 2004a):

- Suited to cool and/or damp conditions
- Final surfacing is to be applied immediately or before adequate curing of cutback bitumen
- Porus type pavements

A major source for sealing information may be sought from the Austroads Sprayed Sealing Guide (Austroads, 2004a) or refer to the Austroads/AAPA work tips (www.aapa.asn.au/docs/publications_worktips.html).

3 JOINTS

Mixing generally proceeds in lanes working from one side[2] of the pavement to the other, without intervening lanes of unmixed material. Typically the overlap is 100 to 200 mm and additional binder should not overlap beyond this region, as it may cause pavement cracking. Joints are deemed to be fresh when the pavement materials on both sides of the joint have been stabilised and compacted within the nominated working time.

Where joints are completed the outside 300 mm of material from the first run should be left uncompacted until the adjacent material is mixed. It has been found this approach reduces the potential for a longitudinal crack to be formed from different initial curing regimes.

Joints, other than fresh joints, are formed by cutting back into the previously stabilised and compacted work. The material disturbed during cutting back is remixed to full depth and incorporated into the new work. The minimum distances of cutback into previously stabilised material are typically:

- longitudinal joints 75 mm
- transverse joints – 2 metres.

The contractor sets a layout of all joints based on the following requirements:

- Minimise the number of joints to be formed.
- Longitudinal joints should be offset by at least 300 mm from design location of wheel paths
- Transverse joints are formed at right angles to the road centreline.
- Longitudinal joints are formed on the separation lines of the travel lanes and a minimum of 300 mm outside the edge lines in the shoulder area.
- Internal longitudinal joints are formed such that each is at a constant offset to the road centreline.
- The nominal width of the stabilisation rotor is 2.4 m and this rotor works on the full width of mixing whereas the foaming nozzles can be turned off in the overlap region.

At intersections the extent of stabilisation should be shown on drawings.

[1] RTA R106Ed3Rev1 - Sprayed bituminous surfacing (with cutback bitumen)
[2] Usually starting at the centreline of the roadway.

Where a bitumen seal is used as the wearing course the following practices are being used (Smith, 2004):

- If the final seal is applied soon after the construction phase, no primer seal is applied.
- If the final seal is to be applied after a number of months, the interim primer seal should have a reduced bitumen application rate (typically 10%).

In both situations the final bitumen seal should have a reduced bitumen application of approximately 10% as noted in Table 1.

Table 1 Proposed interlayer treatments for different wearing surfaces.

Wearing Surface	Interlayer	Comment
Spray sealed	Primerseal[1]	A primerseal with lower bitumen content is applicable in this instance, with a 12-month waiting period before the application of the final seal.
Stone Mastic Asphalt (SMA)	Primerseal[1]	Assist to direct the water to the side in the SMA layer rather than 'soaking' into foamed bitumen material (see Figure 1).
Thin layer of asphalt (30 mm)	Tack coat	A primerseal would normally require 12 months to allow the cutter to migrate from the bitumen. In local roads this duration may not be appropriate due to abrupt changes in drainage paths and steps for pedestrians and gutters prior to placing the asphalt wearing course. The current practice is to apply a tack coat rather than a primerseal on the surface just prior to laying asphalt.
Asphalt as base layer	Primer	A primer is essential but lower levels of cutter may be required.
NOTE: All primerseals should have reduced bitumen content.		

Figure 1 Water draining on the kerbside of an SMA layer on a foamed bitumen base.

Pavement detailing for foamed bitumen works

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ABSTRACT

This paper provides an overview of the detailing of foamed bitumen stabilised layers within a pavement structure. Detailing in this paper refers to interlayer treatments, joints, drainage and managing services.

1 INTRODUCTION

Pavement detailing is critical to the success of any pavement type. There are many examples where early distress has occurred due to major detailing mistakes. For instance, a recent heavy duty asphalt road showed signs of stripping after 12 months operation and the pavement is rutting in the wheel paths. The preliminary cause of the incident was that no seal had been applied over the final structural asphalt layer prior to constructing the porous asphalt wearing surface.

Foamed bitumen materials are currently being used as either a base or subbase layer with the following surface layers above the material:

- Spray sealed
- Stone Mastic Asphalt
- Thin layer of asphalt (30 to 50 mm)

Current review of practices in Australia indicates that there is no evidence that foamed bitumen would be used for unsealed roads due to the higher initial construction costs compared to other binders. However, with cost considerations aside foamed bitumen materials are suitable for unsealed rural roads.

The use of an interlayer is an important function for long service life of the wearing surface or base layer, and some practices about the various interlayer types are noted in the next section (AustStab, 2004).

This paper will address the following detailing issues:

- Application of sprayed seals and asphalt on foamed bitumen layers
- Joints
- Drainage
- Management of services

2 SPRAYED SEALS AND INTERLAYER TREATMENTS

The adhesion of bitumen wearing surfaces is very good due to the presence of bitumen in foamed bitumen stabilised materials. However, the application rates for these bitumen wearing courses need to be considered as to prevent excess bitumen problems (i.e. bleeding of seals and instability of asphalt layers).