WATERPROOFING OF PAVEMENTS

INTRODUCTION

In 1999/2000 VicRoads undertook two related research projects, one on the effectiveness of waterproofing treatments and the other on acceptance limits for waterproofing pavements.

The projects addressed this by:

- Investigating methods of measuring "waterproofing". This resulted in proposed acceptance limits (of cracking) for waterproofing measurements
- Assessing the waterproofing performance of surfacing treatments to provide the most cost-effective strategy for pavement maintenance.

THE NEED TO WATERPROOF

Experience has shown that for a pavement to maintain integrity, it must be waterproof. It was believed that various types of treatment may influence the waterproofing ability of a pavement differently. It was anticipated that the waterproofing ability of a particular treatment type may affect the rate at which the roughness of the pavement deteriorated, i.e. pavements treated with a better waterproofing treatment would get rougher slower than a less successful waterproofing treatment where the pavement could get rougher quicker.

METHODS OF MEASURING WATERPROOFING

The project investigated the practicality of the following methods of measuring waterproofing performance:

- Measuring moisture in pavement materials
- Measuring the permeability of pavement surfacing materials for intact sections and cracked or repaired sections
- Monitoring the increase in roughness as an indicator of moisture damage
- Measuring the nature and extent of cracking in the pavement surface

The investigation concluded that the only practical method of measuring waterproofing was to measure pavement cracking.

A procedure was developed to measure the degree of cracking as a surrogate measure of waterproofing. To keep the measurement procedure simple, cracking was defined as cracking visible to the naked eye and no differentiation was made between types of cracking. A sketch showing an outline of the method is attached as Figure 1. (Note: There is now a Test Method describing the procedure.)

RESULTS OF THE INVESTIGATION

The investigation based on 60 sites showed that:

- The majority of the pavements were performing satisfactorily and had minimal cracking.
- It was possible to determine performance measure limits for longitudinal cracking at 5 years of age. The proposed limits:-
  1. 10m of cracking in 200 metres of a lane that was not treated or unsuccessfully treated, and,
  2. 20m of cracking in 200 metres of a lane that is:
     a) successfully treated (crack sealed), or
     b) either untreated and unsuccessfully treated

These limits are being considered for inclusion in future performance based contract sprayed sealing contracts.

- The current "Stitch in Time" maintenance strategy on highways appears to be effective and is maintaining a rate of roughness progression at a very low level (about 0.5 NAASRA roughness units/year)
- It is possible to subjectively develop performance matrices for sprayed seal treatments and various asphalt treatments.

These matrices, as presented in Figures 2 and 3, provide a guide for the selection of appropriate surfacing.

REFERENCES

VicRoads Corporate R&D 748 – Performance of waterproofing treaments

VicRoads Corporate R&D 739 – Acceptance limits for waterproofing pavements:

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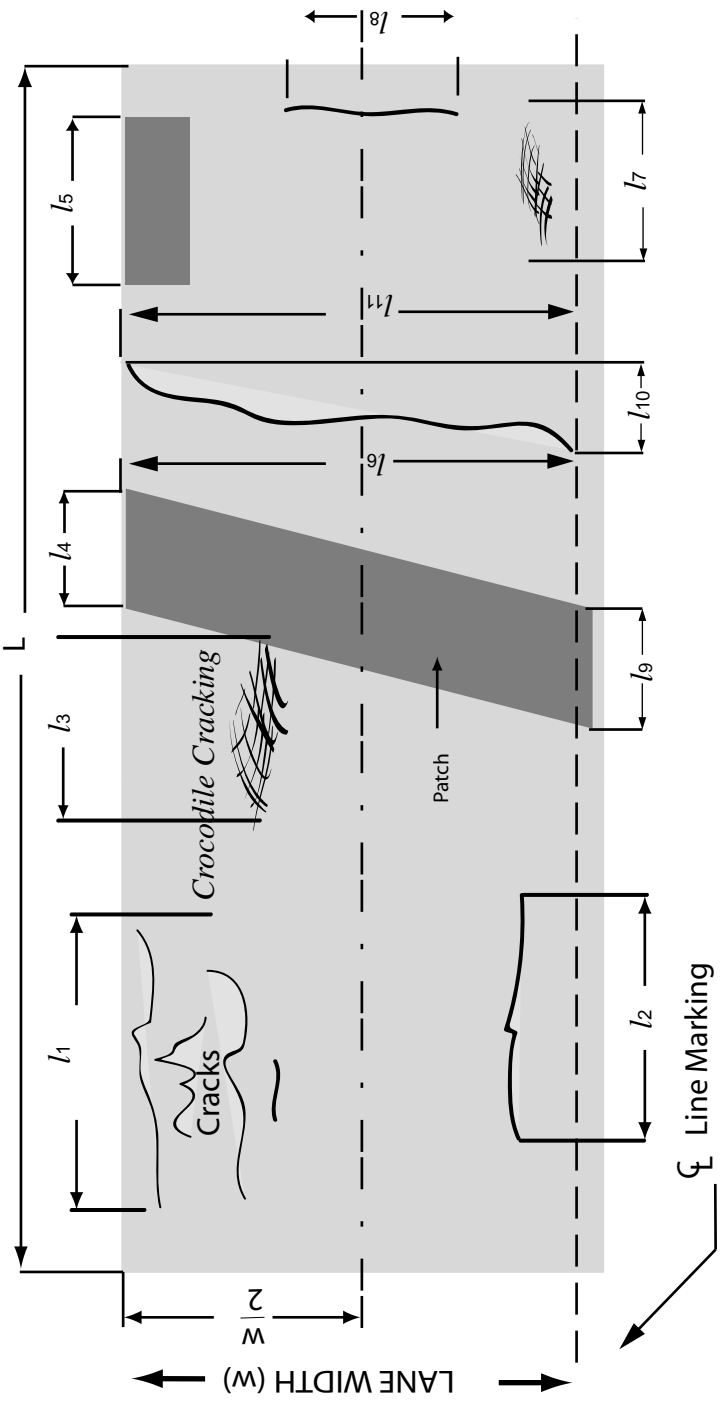

Longitudinal Defects $L_{1T1} = l_1+l_3+l_4+l_5$
$L_{1T2} = l_2+l_7+l_9+l_{10}$

Transverse Defects $L_{tT} = l_6+l_8+l_{11}$

Figure 1 - Sketch Outlining Proposed Test Method

Crack Severity (Increasing ↓)	Cracking	Treatment Type			Comment
	Minor	7	10	14(PMB)	Sprayed seals may not be suitable
	Moderate	10	14	GRSS	Sprayed seals may not be suitable
	Severe	14	14(PMB)	GRSS	Sprayed seals may not be suitable
		Light	**Moderate**	**Heavy**	**Very Heavy/ Severe**
	Traffic Volume Increasing →				

Figure 2 - Waterproofing Performance Matrix for Sprayed Seals

Notes

i. Increased levels of waterproofing may be required for pavements consisting of moisture sensitive materials.
ii. Increased levels of waterproofing may be required where the existing surfacing consists of a single thin layer of asphalt or sprayed seal only, compared to older pavements that may have multiple layers of bituminous materials.
iii. Increased binder application rates may be used on lightly trafficked roads (<600vpd) to provide a significant increase in both waterproofing and durability with minimal risk of flushing or texture loss.
iv. Waterproofing effectiveness increases with increasing binder application rates and increasing levels of modification in polymer modified binders. Higher binder application rates and higher levels of polymer modification must, however, be balanced by requirements for surface texture and aggregate retention.
v. A lower level of waterproofing performance could be accompanied by higher levels of routine maintenance to preserve pavement condition.

Definitions:

1. PMB = polymer modified binder
2. GRSS= Geotextile Reinforced Sprayed Seal

Crack Severity ↓ Increasing	Cracking	Treatment Type			
	Minor	DGA	DGA	a) DGA b) SMA c) OGA with SAMI	a) DGA b) SMA
	Moderate	DGA with SAMI	DGA with SAMI	DGA, OGA OR SMA all with SAMI	SMA
	Severe	DGA with SAMI	UTA with SAMI	UTA with SAMI	SMA with SAMI
		Light	**Moderate**	**Heavy**	**Very Heavy/Severe**
	Traffic Volume Increasing →				

Figure 3 - Waterproofing Performance Matrix for Asphalt Surfacing

Notes

i. The above tabulation refers to thin (<50 mm) asphalt surfacing treatments only and is provided for general guidance.
ii. Increased levels of waterproofing protection may be required for pavements consisting of moisture sensitive materials.
iii. Increased levels of waterproofing may be required where the existing surfacing consists of a single thin layer of asphalt or sprayed seal only, compared to older pavements that may have multiple layers of bituminous materials.
iv. Increased levels of waterproofing in the SAMI layer is required where porous surfacing materials are used (OGA and UTA).
v. A lower level of waterproofing performance could be accompanied by higher levels of routine maintenance to preserve pavement condition.
vi. High stress areas are likely to require thick layers of asphalt. Open graded types of asphalt may not be suitable in high stress areas.

Definitions:

1. DGA = dense graded asphalt
2. SAMI = strain alleviating membrane interlayer (a special sprayed seal placed beneath an asphalt surfacing)
3. UTA = ultra thin asphalt
4. OGA = open graded asphalt
5. SMA = stone mastic asphalt