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Technical Note

REDUCING REFLECTION CRACKING OVER JOINTED CONCRETE PAVEMENT

1. INTRODUCTION

The purpose of this Technical Note is to disseminate information gained from a 10 year old VicRoads trial which experimented with a number of treatment methods aimed at reducing reflective cracking over a jointed concrete pavement. The rigid pavement on the Western Highway in Braybrook had minimal differential movement between the slabs and was overlayed with asphalt to improve ride quality.

2. TREATMENT METHODS

The jointed concrete pavement was initially treated by cleaning the joints and sealing them with a polymer modified bitumen followed by:

(a) treating the joints as indicated below and overlaying with 30 mm of size 14 mm conventional dense graded asphalt:

- applying no further treatment (control section)
- applying joint bandages of the following types:
  - (i) a high tensile strength bandage, (i.e. woven fibre glass fabric bonded to the concrete with hot bitumen),
  - (ii) strain absorbing bandage that was a polymer modified bituminous compound with no reinforcing fibres and was pressed onto the concrete,
  - (iii) strain absorbing bandage that was a polymer modified bituminous compound with a minimal amount of reinforcing fibres (compared to the woven fibre glass fabric) which was heated and pressed onto the concrete surface.
- saw cutting the asphalt overlay at the joints (to provide a reservoir) and filling the saw cuts with a polymer modified bitumen compound.

(b) overlaying with 30 mm of crumbed rubber bitumen modified binder asphalt (alternatively referred to as a bitumen scrap rubber asphalt, BSRA).

3. EFFECTIVENESS OF TREATMENTS

Table 1 on Page 2, lists the experimental results after five and ten years service life.

Based on the measured reflective crack length compared to the original joint length, the effectiveness of the treatments were as follows:

- the crumbed rubber modified binder asphalt (BSRA) was the most effective with virtually no reflective cracking after ten years. This may be due to the high binder content used in crumbed rubber modified asphalt (8% bitumen and 2.7% crumb rubber) when compared to conventional asphalt (about 5 % bitumen).
- saw cutting the asphalt surfacing (to about 60% of the depth) directly above the joints in the concrete slabs and filling the saw cuts with polymer modified bitumen. This treatment has resulted in 2% to 3% of the treated joints cracking after 5 years with no further cracking noted after ten years service.
- the bandage treatments had variable effectiveness. Reflective cracking was evident in from 3% to 10% of the treated joints after 5 years and 10 % to 29 % after 10 years. The effectiveness of the individual strip treatments is further discussed below.
- in the untreated control areas reflective cracking was evident at 14% of the joints after 5 years and at 30% of the joints after 10 years.

Tranverse cracking in "saw cut and seal" joints. Note the reflective cracking does not extend into the BSRA section (foreground).

4. DISCUSSION OF TREATMENTS

The joint treatment that was most effective was to saw cut the asphalt immediately above the joint in the concrete pavement and fill the saw cut with polymer modified bitumen. It is believed that this was most effective because it controlled the cracking by concentrating it at the saw cut, thus preventing spalling of the joint.

The high tensile strength woven fibre glass fabric treatment appears to have significantly reduced the reflective cracking to between 15% and 30% of the length of cracking in the untreated control section. The reason for this is unknown but it could be due to the tensile strength of the bandage and it's ability to distribute the stresses and strains associated with the joint movement.

The remaining joint treatments used rubberised or polymer modified bitumen, one treatment had a minimal amount of fibre reinforcing (compared to woven fibre glass fabric) while the other treatment has no reinforcement. These treatments appear to have:

(a) reduced the reflective cracking to 5 % to 75 % of the cracking on the untreated control section after five years, and

(b) reduced the reflective cracking to 50% to 95% of the cracking on the untreated control section after ten years.

5. QUALIFICATION

Due to the relatively low differential movement between the concrete slabs, this information may not be transferable to other concrete or asphalt pavements.

6. REFERENCES

Reflective cracking trial on the Western Highway -Duke to Ashley Streets - VicRoads Internal Report, File No. 4861519.

7. CONTACT OFFICERS

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Table 1: Summary of Reflective Cracking Measurements in Joint/Bandage Treatments

Joint/Bandage Treatement	Percentage of Transverse joint reflection#		Percentage of Longitudinal joint reflection#	
	After 5 years	After 10 years	After 5 years	After 10 years
Rout and fill with rubberised bitumen	0	2	1	3
High tensile strength bandage (fibre glass bonded with bitumen to concrete slabs	6	10	0	9.5
Polymer modified bandage with minimal non woven fibre reinforcement	10	29	0.5	28
Polymer modified bandage with essentially no reinforcing fibres	3	15	6	48
No treatement (control sections)	14	30	10	59

These percentages are derived from four trial sections for each treatment