WESTRAIL

EASTERN GOLDFIELDS RAILWAY

Cracking in Concrete Railway Sleepers

Summary of Investigations

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EXECUTIVE SUMMARY

1 Prestressed concrete sleepers were introduced into the EGR track as part of the 1978 to 1982 upgrade, during which the Avon Valley line was converted to dual gauge. The sleepers were made at Meckering using local aggregate and sand.

2 Cracks began to appear in some sleepers in 1987. The earliest observed cracks appeared in the sleepers installed between Northam and Tammin during 1979, but subsequent surveys have shown the problem to be progressive and is now becoming evident throughout the line, in sleepers of all ages. The latest line survey completed in 1992 indicated that 8.1 % of all sleepers showed cracking to some extent.

3 From the first, it was thought that the problem was due to Alkali Aggregate Reaction (AAR), a process in which potentially reactive aggregate reacts with alkalinity in concrete to form expansive gels. AAR leads to weakening of the concrete and cracking.

4 Early investigations by outside consultants did not find evidence of AAR. This was because the granite aggregate contains strained quartz, which is only slowly reactive. Strained quartz only became widely identified as being potentially reactive during the mid to late eighties.

5 Later investigations, primarily those carried out by Dr. Ahmad Shayan of the CSIRO, demonstrated that strained quartz AAR is the cause of the failure. At present Dr Shayan is one of the world's leading experts on AAR, and he will be chairman of the 10th International Conference on AAR to be held in Melbourne in 1995.

6 The cracked sleepers vary in condition between those only just showing crack initiation to those with fully developed wide cracks along their entire length. Load testing has shown that the cracking has not caused a decrease in load bearing capacity. However failure will occur when the shoulders split off resulting in loss of gauge.

7 While there is no known cure for AAR, it can be controlled by preventing water entry into the concrete. A number of overseas instrumentalities specify impregnation with silane as a mitigating treatment for AAR.

8 Field trials at Northam and Meckering have shown that treatment with isobutyltriethoxysilane leads to an extension of the residual life. For the 840,000 sleepers that are as yet uncracked, an average increase in life from 12.5 years to 25 years was postulated.

9 Present Net Value analysis by Westrail have shown that at the quoted price for treating the sleepers with silane, the payback period is less than 10 years.

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