

A CASE STUDY

PROJECT: Asphalt Reinforcement on Bridge
Mt. Zero Bridge, Horsham

PROJECT DATE: August 1991

CLIENT: Materials Technology Department,
Vic Roads, Victoria, Australia

DESIGN ENGINEER: Walter Holtrop, Materials Engineer
Roy Fisher, Bridge Engineer

CONTRACTOR: Boral Resources

PRODUCT EMPLOYED: GlasGrid* 8502 (Detail Repair System)

DESCRIPTION OF PROJECT:

Around the globe, GlasGrid* has been used to protect new asphalt wearing courses from forces reflecting upward from cracks in the underlay. This case however, demonstrates the product's ability to dissipate the downward forces of heavy traffic - forces that can be equally damaging when it comes to reflective cracking.

This case took place 160 miles west of Melbourne, Australia. A number of bridges had been constructed here using a deck of pre-cast, inverted U-form beams covered with a granular pavement with a sprayed chip seal. Depending on the bridge, the pavement may be anywhere from 90 mm to 260 mm thick.

Ineffective load distribution takes its toll.

In many cases, the wearing course has shown longitudinal cracking and rutting, casting doubt about the load distribution capabilities of the relatively thin overlay.

Non-uniform loading has led to differential movement of the U-form beams. The granular pavement and seal have not been able to cope with the deflections and have cracked badly.

According to Walter Holtrop, Manager, Surfacing, "The problem is that the bolts holding the inverted U-beams rust or break off and you get excessive movement. The beams no longer move as one unit but start to shift as individual components which have high deflections under a truckload."

In addition to having to repair the pavement, Holtrop's team was certain the U-beams would need repair, thereby requiring the pavement to be removed.

Searching for the most time and cost-effective solution.

The possibility of applying the same type of pavement was ruled out since it did not adequately distribute the load the first time around. Several options were considered.

Concrete. Too expensive. Too time-consuming.

The first option was to simply apply a full thickness of concrete without further resurfacing.

"In a similar case, our Western Region office had consulted us about another bridge located west of here", recalls Holtrop. "Their construction team leader, Doug Howes and the construction engineer, David Parker, questioned us about using asphalt as a cheaper and less time-consuming alternative to concrete."



Asphalt. Too susceptible to cracking.

Asphalt had numerous advantages over concrete. First, it would be lighter and, therefore, not detract as much from the overall load-carrying capacity of the bridge. Second, it would involve less time and expense to apply. Third, the shorter installation time would lessen the inconvenience to the public.

This led to the idea of laying a full depth of asphalt directly over the U-beams - a solution expected to last four or five years.

Holtrop continues, "We agreed asphalt would be worth a try, provided the problems of reflective cracking and the possibility of early failure could be reduced or overcome without incurring a huge cost."

Modified Asphalt. Too impractical.

"To control these problems, we considered putting a polymer-modified binder in the hot mix. But for such a small quantity, it's usually not worth the trouble to play around with a couple of tons of poly-modified bitumen."

Reinforced asphalt. The answer.

As an alternative to modifying the new asphalt, the fourth approach called for reinforcing it.

The final step in the process was to choose a suitable pavement reinforcement mesh.

"We looked at a polypropylene product", continues Holtrop, "which you have to stretch, making it a nuisance to apply. We saw GlasGrid* as a much more practical alternative because it's so easy to put down".

It was estimated that the new overlay would last 10 years without need of repair.

Testing GlasGrid* s performance.

The test was considered important because the team was seeking a cost effective means to repair a number of bridges in Victoria. In order to investigate the effectiveness of the GlasGrid* proposal, a typical U-beam bridge was chosen, 22.5 km south of Horsham on the Western Highway, near Mt. Zero.

The test bridge had two lanes and comprised two 4.4 m spans crossing an irrigation channel. Both lanes showed longitudinal cracking with depressions in the wheel paths. Under traffic, the beams appeared to show signs of localized movement. The southern lane was chosen for testing.

The behaviour of the bridge was tested under traffic load both before and after resurfacing.

"We mounted displacement transducers on a reference beam suspended under the centre of the Melbourne end span", says Holtrop. "This let us measure the deflection at ten points".

The vehicle used for the tests was a truck and trailer with a nominal gross weight of 21.7 and 20.9 tons respectively. The most measurable results were achieved with the truck moving at approximately 4 km/h over the deck.

GlasGrid* passes the test.

Prior to resurfacing, maximum deflection was shown to be 1.1 mm. In addition, relative movement between beams was determined by comparing the peak deflection for each channel. The two tyre paths produced deflections ten times greater than deflections on the adjoining beams. This clearly indicated poor load distribution.

After resurfacing with GlasGrid*, maximum deflection was reduced to a mere 0.3 mm. The results also revealed a much improved distribution of the load.

At this point, the bridge at Mt. Zero is being considered an experiment. The deflection is being closely monitored. Says Holtrop, "If we can get 10 years out of the asphalt, we are in front. So far, the bridge does not show any sign of cracking - so at this stage it looks very good. If we have sufficient funding, we'll start by using GlasGrid* on the Hopkins River bridge next year."

Holtrop concludes, "There are about 200 bridges like this one in Victoria. We would like to repair all of them in the next ten years but our limited funds won't allow for concrete. But hot-mix, reinforced with GlasGrid* would give us a very easy, inexpensive method. At about 40% of the cost of concrete, we could fix 2 1/2 bridges with asphalt for every one bridge we could repair with concrete".

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Walter Holtrop has been with Vic Roads since 1966. Since the early 70's, he has specialized in bituminous surfacing - including asphalt and sprayed work for both new construction and rehabilitation. Walter currently holds the title of Manager, Surfacing, in the Asphalt and Pavement Group - part of the Materials Technology Department at Vic Roads.

GlasGrid* is now being manufactured at an ISO 9002-1987 registered facility BAYEX INC.

Bayex Inc., 14770 East Avenue,
P.O. Box 390, Albion, N.Y. 14411 USA
Continental USA 1-800-263-5715 - Fax 905-688-3745

Sales Offices

201 Hugel Avenue, Midland, Ont. L4R 4G1 Canada
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Tel: (905) 688-3160 Fax: (905) 688-3745

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Tel: 44 169 572 3946 Fax: 44 169 572 3947

Liaison Office

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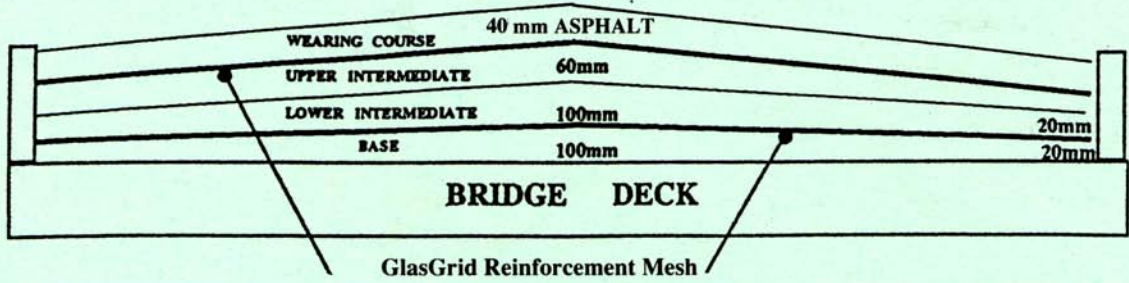


Mount Zero bridge U-form Beams.

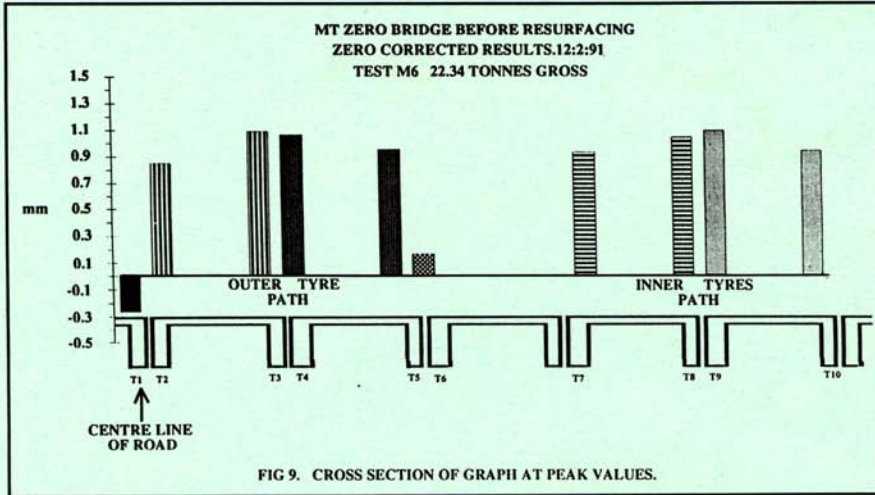


Placement of Intermediate course over GlasGrid*

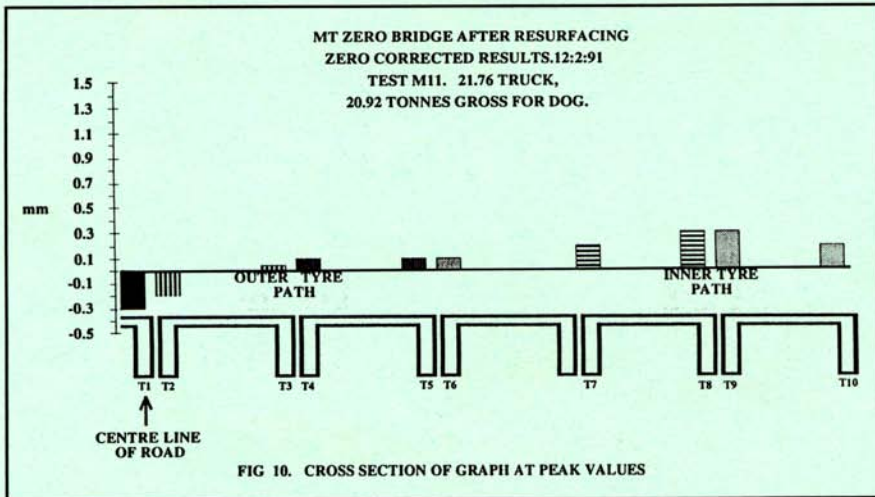
POSITION OF MESH REINFORCEMENT



Cross section showing position of two GlasGrid* layers.



Cross section of graph at peak values before resurfacing.



Cross section of graph at peak values after resurfacing.

