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To:	Booth Associates	Fax	02 69 64 54 40
Attention:	Sue Grey	Tel	02 69 64 99 22
From:	Kevin Kelly		
Reference:	SKM Report on Eulo Road Bridge Loadings		
Date:	9 March 2006	Number of Pages including cover	8

Sue,

Please find following the August 2002 SKM report, "Structural Assessment of Eulo Road Bridge Structures". Information from this report may be used in your report provided that the source of the information is referenced.

The critical overload on these bridges is a triaxle group, mid span, on the outside bridge beam. Of particular concern is when the capacity of the load sharing between the adjoining bridge beams is reduced where the bridge-beam shear-keys have deteriorated and there are longitudinal cracks in the deck overlay slab.

There is evidence of all of the above factors contributing to critical overload on these bridges. Of the three bridges we have demolished in the last few years, there has been evidence of the shear key grout crumbling. Many of the bridges have visible longitudinal cracking above the edges of the bridge beams.

To reduce the overloading, the SKM report suggests placing an extra 150mm thick reinforced concrete overlay to spread the load across the beams.

Winter 2005, we removed the deck overlay and re-laid a thicker deck slab on a bridge on Main Road 596. The removal of the deck overlay was far more difficult than expected. The cost of an all-weather, two lane bypass track was about 25% of a total bridge replacement. The bridge is no wider and the foundations are still 40 years old.

We have an earlier report on the Eulo Rd/DC400 Bridge undertaken by Rail Services Australia where strain gauges were glued to the beams to analyse dynamic loadings.

Yours Sincerely

Kevin J Kelly.

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SINCLAIR KNIGHT MERZ

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26 August, 2002
Document2
WT01666.001

Attention: Mark Bramston

Dear Mark

Eulo Road Bridges

Please find attached a copy of the report titled "Structural Assessment of Eulo Road Bridge Structures", Revision 01 dated August 2002.
Note that these structures were assessed for B-Double vehicles that showed that the critical loading was the single bogie consisting of three axles of 7.5 tonnes at 1.4m centres. This axle/load configuration is not unique to B-double vehicles but is common on 19m and 25m prime mover and semi-trailer combinations.
If we can be of further assistance please contact the undersigned.

Regards

Chris Mooney
Project Manager

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Fax: 03 5833 5444
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Coleambally Irrigation Limited

Structural Assessment of Eulo Road Bridge

Structures

Rev. 01

August 2002

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Document History and Status

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Introduction

At the request of Coleambally Irrigation Limited an assessment has been conducted on three bridges crossing irrigation channels.

The primary objective with the assessment was to determine their capacity to carry the loads imposed by B-double vehicles.

The bridges comprise pre-cast concrete U-slabs with a composite concrete deck for the superstructure and piers and abutments supported on spread footings. The arrangement of each of the bridges is as follows:

DC400/Eulo Road
Single 9.25m span x 6.7m wide with 7 No beams

DC500/Eulo Road
Two spans of 6.17m span x 6.1m wide with 6 No beams

Boona/Eulo Road
Two spans of 7.6m span x 6.1m wide with 6 No beams

Documentation

The bridges were assessed using the following documentation:

DC400/Eulo Road IF 1194

General Arrangement	222/863
Details of 30 ft Deck Beams	186/1029
30 ft Deck Beam Structure Details	222/206
Deck Details	186/1146

DC500/Eulo Road IF 1306

General Arrangement	186/1044
Details of 20 ft Deck Beams	186/1034
Deck Details	186/1146

Boona/Eulo Road IF 0234

General Arrangement	222/53A
Details of 25 ft Deck Beams	186/1033
Deck Details	186/1146

Methodology

The bridges were analysed using a grillage model and the bending moments and shear forces derived from this analysis were used to assess the capacity of the superstructure in accordance with the Australian Bridge Design Code. The assessment included

consideration of the capacity of both the beams and the in-situ deck, generally in accordance with the VicRoads Guidelines for Assessing the Capacity of Bridges, June 1999.

In making this assessment, the following was assumed

- The structural details were as shown on the drawings listed above
- The capacity of the bridge was unaffected by the behaviour or capacity of the foundation
- The concrete deck and the shear key between the tops of the beams are intact throughout and able to transfer transverse bending moments and shear forces

The maximum load condition was for the three-axle bogie of the B-double in the centre of the span to one side of the bridge. Consistent with the guidelines only one lane of traffic was considered. However, for the governing load condition, the most heavily loaded beam was the outermost beam and whether there is one lane of traffic or two on the bridge was not a significant issue.

We have not conducted a detailed evaluation of the substructure of these bridges. This matter deserves further comment.

For the bridge substructures and foundations, there was not sufficient data available to undertake a worthwhile quantitative rating of the total substructure. This is commonly be the case with such bridges. Furthermore, even when more complete details are available there will usually remain doubt as to the condition of the portions of the substructure that are not visible and the foundation conditions. The proven performance of the bridge over its observed history, as demonstrated by its present condition is commonly the best indicator of the reliability of the substructure under existing or slightly increased loadings. An earth retaining structure can be expected to show signs of movement well before it reaches a state of collapse.

Findings & Comments

The findings from the structural assessment of the superstructure of the bridges are as follows:

DC400/Eulo Road IF1194

Ultimate flexural capacity of typical beam	323.6 kNm
Maximum beam ultimate bending moment for B-double bogie	412.4 kNm
Ratio live load capacity/B-double loading	0.54

DC500/Eulo Road IF1306

Ultimate flexural capacity of typical beam	179.6 kNm
Maximum beam bending moment for B-double bogie	232.8 kNm
Ratio live load capacity/B-double loading	0.60

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Boona/Eulo Road IF0234

Ultimate flexural capacity of typical beam	237.8 kNm
Maximum beam bending moment for B-double bogie	319.6 kNm
Ratio live load capacity/B-double loading	0.54

We note reference on the drawings to a design load of H15-S12-44 loading. We have checked the bridges for the this loading and found that its effect, as measured by the maximum bending moment in the beams, is between 60% and 70% of the effect of the B-double loading. This finding is generally consistent with the figures listed above for the capacities determined from our assessment of these bridges.

The thickness of the in-situ concrete overlay is 75mm. The integrity of the shear key between the tops of the beams is therefore critical to the lateral distribution of load and hence the capacity of the bridge. There have been instances where bridges of this form have been subjected to overload and the concrete in the shear key has been damaged or dislodged. Without the shear key, the 75mm deck may not be sufficient to achieve the required transverse distribution of load. Failure of the shear key would be evidenced by relative vertical movement of adjacent beams under load. If there were any sign of this relative vertical movement of adjacent beams, the load carrying capacity of the superstructure would be less than the figures quoted above.

Conclusion

The Eulo Road bridge structures have been assessed for their capacity to carry B-double loadings. We have concluded that the superstructure would not be adequate to carry these loadings. The critical loading is the single bogie, comprising 3 No 7.5t axles at 1.4m centres. There have been instances where structures of this form have been strengthened by the addition of a reinforced concrete overlay around 150mm thick. Given that there is already an overlay on the bridges, the addition of a further overlay would not make a material difference to the margin between the existing capacity and that required to carry the B-double loading.

An assessment of the load carrying capacity of such bridges of the form reported on above would commonly include a detailed inspection to establish its condition, particularly the condition of the piers and abutments. Such an inspection could only lead to a reduction rather than an increase in load capacity by comparison with the figures quoted above and would therefore not alter the conclusion regarding the capacity to carry the B-double loading..