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Rating\_Memo\_20190905  
Subject: CR141 Wheeo Creek Bridge\_ Load Rating



Transport  
Roads & Maritime  
Services

## MEMO

### Issue

The Upper Lachlan Shire Council (ULSC) has engaged Bridge and Structural Engineering (BSE) of RMS for load testing and assessment/evaluation of Bridge CR141 over Wheeo Creek on Boorowa Rd.

Currently, the bridge has load limit for General Access Vehicle as recommended by consultants in their assessment reports.

### Background

The Bridge was constructed circa 1936. It comprises 3 spans of 9.60m, 10.70m & 9.60m. The overall and trafficable bridge widths are 6.96m & 6.10m respectively that carries two lanes of traffic.

The superstructure includes monolithic decks that each comprises 3 cast-in-place concrete beams with cast-in-place slab.

The piers are identical and each is made up of two columns which with the headstock make a portal frame.

Each abutment is made up of three columns that integrated with their respective beams and the retaining wall.

All piers and abutments are supported on pad footings.

### Level-2&3 inspection findings

The ULSC provided two reports for review. The first one named "CR141:MR248W Boorowa Rd/Wheeo Crk – Level 3 Report" dated 25/06/2019 done by "pitt & sherry" and the second one prepared by "XAVIER KNIGHT" named "STRUCTURAL CONDITION REPORT" dated 14/08/2019.

Based on the mentioned reports, the bridge was inspected on foot and no Under Bridge Inspection Unit deployed. Both the Consulting Engineers identified some minor defects but rated the bridge in good overall condition.

Also, "pitt & sherry" recommended the following load limits be applied to the bridge including 14t gross vehicle mass.

Axle Group	Axle Group Load Limit (t)	Maximum Axle Group Load, General Access Vehicle (t)
Single Axle	7	11
Tandem Axle	8	16.5
Tri-Axle	11	20
Quad-Axle	12	20

In addition, based on the "XAVIER KNIGHT" report under single T44 loading which is a design vehicle in accordance with NASSRA 1976 Bridge Design Specification 1976, the minimum rating factors of 0.58 and 0.74 go to Edge Girders and Central Girder respectively.

### **Analytical Assessment**

A 3D structural model prepared by BSE for Analytical assessment and the following assumptions adopted,

- Yield strength of mild steel structural grade reinforcement bars = 230 MPa
- Concrete deck compressive strength = 17 MPa.
- Density of Concrete = 25KN/m<sup>3</sup>
- The number of standard design lanes = 1

Based on the analytical assessment results, the girders have live load rating factors more than 1.00 under General Access Vehicle (GAV) up to 42.5t on a six axle semi-trailer ST42.5 on the bridge.

### **Load Testing including Instrumentation**

Seven Strain Gauges and seven Displacement Transducers installed by RMS Assessment & Evaluation team, at the maximum sagging locations of Span 2, Span 3 and Headstock of Pier 2 (Figure 1) to determine the realistic bridge behaviour under test truck.

The Test Truck loaded for three different load levels i.e. ST37t, ST42.5t and ST50t and positioned at numbers of locations in transversal direction. Also, the Test Truck travelled toward the West and East directions (Figure 2).

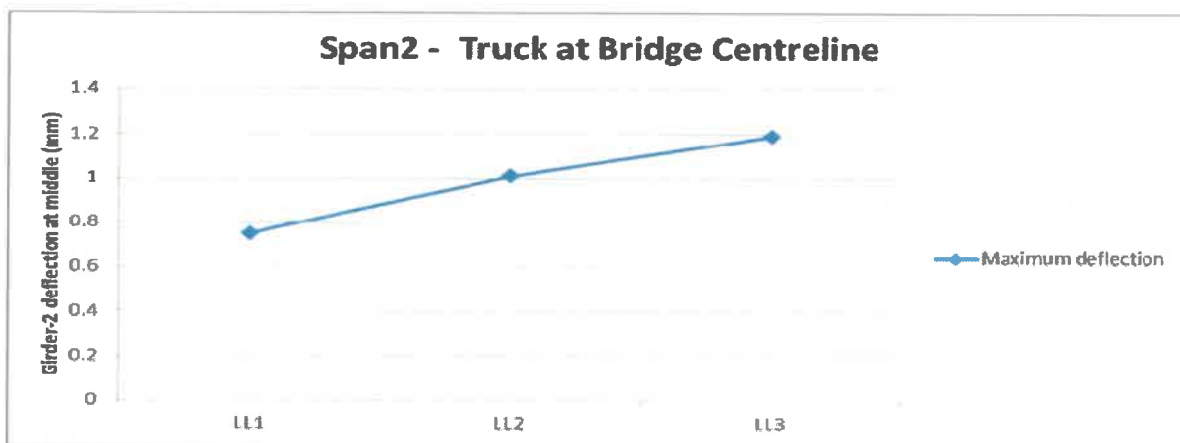
The results show the bridge is behaving linearly with the increase load level as shown in Figure 3. Also, the bridge demonstrated linear behaviour for all the load cases.



**Figure 1 – Bridge Elevation**



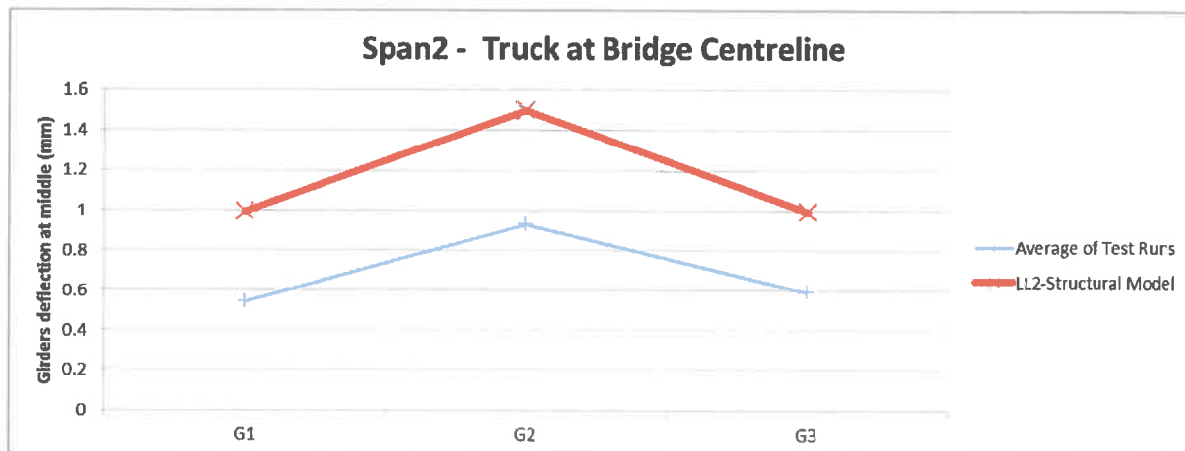
**Figure 2- Test Truck at the Bridge Centreline**



**Figure 3- Central girder deflection increases linearly with increasing live load on test truck**

In addition, the test results used for both validation of the structural model and investigation for the bridge behaviour/strength under various truck locations.

For instance, the diagram below shows that the deflection distribution extracted from the model is similar to the test results. Also, the test results demonstrate the deck is stiffer than what the model shows as the absolute values of deflections from the model are about 60% of the respective test results (Figure 4).



**Figure 4- Comparison between deflections from the Structural model & Test results**

## Comments

Considering the analytical assessment results, bridge behaviour under Test Truck loading and condition of the structure, the bridge is suitable to carry General Access Vehicle (GAV), ST42.5t on one lane.

However, if the bridge is subject to one GAV per marked lane then Live load factor will be less than 1.00. Considering the current usages of the bridge and the chances of heavy vehicles movement simultaneously on both lanes, it is concluded no load limit per lane for the bridge.

It is also concluded that this bridge will be satisfactory to carry 62.5t B-Double i.e. BD62.5t as a Restricted Access Vehicle (RAV) per lane.

## Recommendations

It is recommended that

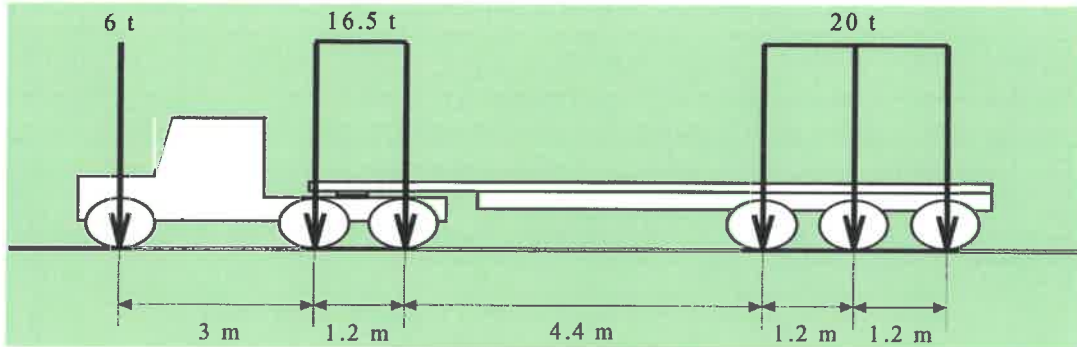
- the bridge be opened for General Access Vehicle ST42.5 and BD 62.5t as a restricted Access Vehicle per laned with a speed limit of 40 Km/h.
- the bridge be allowed one semitrailer ST45.5t or one B-Double 68t under Higher Mass Limit (HML) ie one heavy vehicle at a time..
- the bridge be monitored by inspection regularly to see any sign of distress in the concrete beams.
- all required maintenance works as identified in the consultant's inspection Report.to be completed..

## References

As-Executed drawings "B6572 WHEEO Creek-WAE drawings" Sheets 1 & 2.

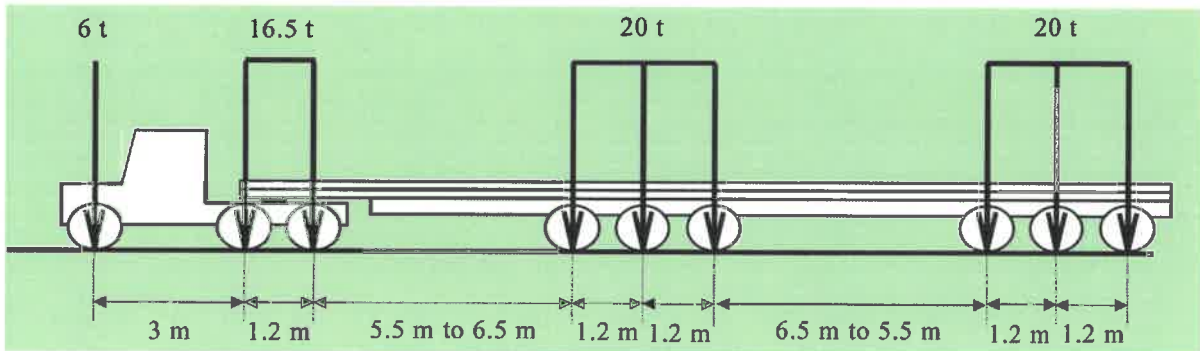
**Appendix**

**GENERAL/ RESTRICTED ACCESS VEHICLES**



Semi-Trailer 42.5t (ST 42.5)

ST42.5t is a 1,2,3 axle configured six axle articulated\* vehicle with GVM 42.5 tons.



B-Double 62.5t (BD62.5)

BD62.5t is a 1,2,3,3 axle configured nine axle articulated\* vehicle with GVM of 62.5 tons.