pitt&sherry

CR129: Blue Hills Rd / Monkey Ck

Level 3 Report

Prepared for

Upper Lachlan Shire Council

Client representative

[redacted]

Date:

14 June 2019

Rev 0

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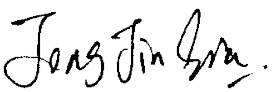
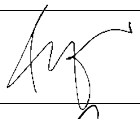
Prepared by: [redacted] Bridge Engineer		**Date: 14 June 2019**
Reviewed by: [redacted] Principal Bridge Engineer		**Date: 14 June 2019**
Authorised by: [redacted] General Manager Operations		**Date: 14 June 2019**

Revision History

Rev No.	Description	Prepared by	Reviewed by	Authorised by	Date
A	Draft	[redacted]	[redacted]	[redacted]	31/05/2019
0	Final	[redacted]	[redacted]	[redacted]	14/06/2019

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1. Introduction

pitt&sherry was engaged by Upper Lachlan Shire Council to undertake the Level 3 Inspection and Load Assessment of Blue Hills Rd / Monkey Ck, Asset No.CR129.

The findings of the works will assist in the development of a priority works program for the renewal and upgrade of the structures.

The scope of works included:

- Visual condition inspection of the structure in accordance with the NSW Roads and Maritime Services (RMS) methodology to document any defects and obtain key geometry of the structure required for load assessment;
- Load assessment of the bridge, in accordance with AS5100.7 – 2017 Bridge Design Part 7: Bridge assessment and RMS Guidelines; and
- Preparation of a report presenting the findings of inspection, load assessment results and recommendations for maintenance/rehabilitation/strengthening works.

2. Structure Description

The Blue Hills Rd / Monkey Ck is located on Blue Hills Rd (-34.256, 149.707). Structural details are provided in Table 1.

Table 1: Structure Details

Item	Description
Overall width	4.3 m
Traffic width	3.8 m
Overall length	16 m
Number of Spans	2
Skew	0˚
Provided date of construction	1970

The superstructure consists of 4 timber round girders with a diameter of 350 mm. The deck consists of 100 x 170 mm timber planks which are supported by spiking planks. The substructure consists of reinforced concrete abutment and wingwalls on both ends of the structure. For this report, the Eastern approach is approach one.

General photographs of the structure are shown in Figures 1 to 6 below:

Figure 1: Deck

Figure 2: Elevation 1

Figure 3: Elevation 2

Figure 4: Soffit

Figure 5: Waterway Side 1

Figure 6: Waterway Side 2

3. Site Inspection

3.1 General

On the 7th March 2019, [redacted] of pitt&sherry inspected Blue Hills Rd / Monkey Ck. The structure was inspected from locations that could be safely accessed on foot to confirm the structures geometry, measure structural components for assessment and obtain photographic evidence of structural defects.

Site observations and defects identified during the inspection are documented in the Level 2 Inspection Report provided in Appendix A.

3.2 Timber Drilling Records

Timber elements were inspected for pipe rot by drilling at sample locations (Table 2).

Table 2: Boring Records

Component	Position	Direction	Member sizer	Timber Condition
Girder 1	Abutment 1	H	350 dia.	60S, 150P, 140S
Girder 2	Abutment 1	H	350 dia.	350S
Girder 3	Abutment 1	H	350 dia.	350S
Girder 4	Abutment 1	H	350 dia.	105S, 140P, 105S
	Abutment 2	H	350 dia.	135S, 80P, 135S

Notes:

- D = soft wood but not rotten
- P = pipe (void)
- S = solid.

4. Load Assessment

4.1 Methodology

Load assessment of the bridge has been undertaken in accordance with AS 5100.7:2017 and the procedure described below, with component capacities calculated in accordance with AS1720.1-2010 for timber. Rating factors have been calculated for the primary structural components in the current condition under various traffic loads.

Procedure adopted in carrying out the load rating:

- Determine the material properties of the various components comprising the bridge. Information could be taken from the as-built drawings, if available or can be assumed using Appendix A of AS5100.7-2017, if applicable;
- Compute the section properties of the primary structural components for both ‘As-New’ and ‘As-Is’ conditions. Information is obtained from the as-built drawings if available or as per field measurement;

- Compute for the loads imposed on the structure. Dead loads comprised of the structure weight while superimposed dead load will include the barriers, pavement, asphalt, engineered fill, etc. Live load will comprise of the different assessment vehicle loads;
- Prepare an analysis model of the bridge depending on the proprietary structural analysis software to use, if required;
- Input the material properties, component section properties, soil properties, and loads into the analysis model, if required;
- Analyse the structure and record the resulting demands for the primary structural components of the bridge;
- Compute the capacities of the primary components; and
- Compute the rating factor for the primary components of the bridge.

The rating factor was computed using the equation below:

$$Rating\ Factor = \frac{Available\ Capacity\ for\ Live\ Load\ Effects}{Live\ Load\ Effects\ of\ nominated\ rating\ Vehicle} \times 100\%$$

A rating factor of more than 100% indicates that the structure in question complies with the requirements of AS5100.7 – 2017 and can safely carry the specified traffic loading. A rating factor of less than 100% implies that the bridge component is operating at a lower factor of safety than is required by the standard.

The following vehicles are used for the desktop assessment of the bridge:

- B Class Loading (Design Load assumed based on year of construction);
- General Mass Limit (GML) B-Double (62.5t);
- Higher Mass Limit (HML) B-Double (68t);
- Road Train: RAV GML (79t);
- Road Train: RAV HML (85t);
- AB Triple (102.5t);
- AB Triple (113t); and
- Quad Axle (50t).

Configuration diagrams for the above vehicles are included in Appendix B.

4.2 Assumptions and Limitations

The load assessment was based on the following assumptions and limitations:

- Dynamic Load Allowance = 0.25 in accordance with clause D1.3 of AS5100.8-2017;
- The structure was assessed for vertical loads only;
- The load factors for Dead Loads, Superimposed Dead Loads and Live Loads are in accordance to AS5100.7 – 2017;
- The material densities were taken in accordance with AS5100.2:2017;
- The timber girder grade was assumed to be F22 and timber deck grade was assumed to be F11 (RTA timber bridge manual 2008); and
- There was insufficient information to perform a quantitative assessment of the substructure and therefore the load rating results relate only to the superstructure.

4.3 Result Summary

The timber girders were found to be the critical elements during the load assessment. Table 3 summarises the rating factors for the girders obtained from the load assessment.

Table 3: Rating Factors

Vehicle	Rating Factor (As New)	Rating Factor (As Is)
B Class	49%	25%
GML B Double (62.5t)	23%	12%
HML B Double (68t)	21%	11%
Road train GML (79t)	23%	12%
Road train HML (85t)	21%	11%
AB triple (102.5 t)	23%	12%
AB triple (113t)	21%	11%
Quad axles (50t)	19%	10%

5. Discussion

No design drawings were provided, hence the age and design loading of the structure was unknown. Based on data provided by Council the bridge was constructed in 1970. The structure is most likely designed to A Class or B Class loading based on the year of construction. However, member capacities were calculated for the structural timber components which revealed the structure has insufficient capacity for B Class design loading. B Class represents a tractor and trailer with a maximum single axle load of 5t.

The structures useful life depends on the condition and capacity of the structure and its ability to provide the required level of service. Level of service factors to consider are the carriageway width, barrier performance level, traffic volume, alignment and flood immunity. These other factors may influence Council's decision when to upgrade the bridge. The bridge has been in service for approximately 49 years. The structure is in poor condition, as documented in the Level 2 inspection report in Appendix A. The nature of defects observed typically consist of maintenance defects, and the defects are impacting the structure's load carrying capacity.

Observations made during inspection of the bridge revealed significant splitting and piping internally occurred on girder 1 and 4 at span 1. Due to the extent of deterioration, the noted defects impact on the structure's load carrying capacity and hence the structure's 'As-Is' condition is significantly reduced.

As the results in Table 3 indicate, the structure in 'As-Is' condition has insufficient capacity to accomodate any of the assessment vehicles. The obtained results demonstrate that due to the severe deterioration of the girder and undersized girders, all assessment vehicles impose greater load effects than the structure was designed for.

Should the bridge remain in service a load limit sign be placed to warn road users of the risks associated with the bridge.

The load limits shown in Table 4 could be used in the short term. If the bridge is to remain open it should be monitored reguraly and the load limit revised as required to account for further deterioration.

6. Recommendation

1. Continue to undertake routine inspections and general maintenance works to address defective areas and ensure the structure's full design life is achieved.
2. On the grounds of structural capacity, it is recommended that one of the following load limits be applied to the structure:
   a. Axle group load limits demonstrated in Table 4; or
   b. A 2 t gross mass limit, as demonstrated in Figure 7.

Table 4: Axle Group Load Limits

Axle Group	Axle Group Load Limit (t)	Maximum Axle Group Load, General Access Vehicle (t)
Single Axle	**1**	11
Tandem Axle	**1**	16.5
Tri-Axle	**2**	20
Quad-Axle	**2**	20

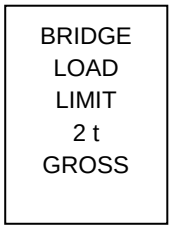


Figure 7: RMS R6-3 load limit sign

If Council requires the bridge to accommodate any assessedment vehicles, then detailed investigation works for analysis of the structure's capacity will be required to determine the magnitude of strengthening required. This will include bridge strengthening works and geotechnical investigation of the substructure. If strengthening of the substructure is required but not feasible, the structure will require replacement.

Level 2 Condition Inspection Report

Appendix A

Structure CR129

The structure CR129 was inspected on 7/03/2019 by [redacted]. Eastern approach is approach one. Heavy piping and splitting noted to corbels. 200mm pipe estimated to corbel 1. Up to 150mm piping noted to outer girders. Poor condition.The general view of condition for the structure is 3 - Poor.

Location

Latitude: -34.25553
Longitude: 149.70720

Generic Details

Structure CR129 is constructed from a closed girder with a timber deck. Generic photos are shown in Figures 1 to 9.

The bridge has the following properties

Item	Quantity
Length	16.00 m
Width	4.30 m
Number of beams	4
Structure over	Water
Structure usage	Road

Figure 52. Level 2 Blue Hills Rd Monkey Ck_Abutment.-2019-03-07.jpg

Figure 53. Level 2 Blue Hills Rd Monkey Ck_AP1-2019-03-07.jpg

Figure 54. Level 2 Blue Hills Rd Monkey Ck_AP2-2019-03-07.jpg

Figure 55. Level 2 Blue Hills Rd Monkey Ck_Deck-2019-03-07.jpg

Figure 56. Level 2 Blue Hills Rd Monkey Ck_Elevation Side 1-2019-03-07.jpg

Figure 57. Level 2 Blue Hills Rd Monkey Ck_Elevation Side 2-2019-03-07.jpg

Figure 58. Level 2 Blue Hills Rd Monkey Ck_Soffit-2019-03-07.jpg

Figure 59. Level 2 Blue Hills Rd Monkey Ck_Waterway Side 1-2019-03-07.jpg

Figure 60. Level 2 Blue Hills Rd Monkey Ck_Waterway Side 2-2019-03-07.jpg

Load Rating

Vehicle / Load	Year Determined	Methodology

Condition rating

Component Number	Description	Exposure Class	Qty	Condition				Risk
				1	2	3	4	
MAPP	Approach Carriageway: Other	2 - Mildly Aggressive	2 Each	0 Each	1 Each	1 Each	0 Each	0
TTDK	Timber - Transverse Deck Plank: Timber	1 - Relatively Benign	68.8 m^2	0 m^2	58.8 m^2	10 m^2	0 m^2	0
MWWY	Waterway: Other	2 - Mildly Aggressive	1 Each	0 Each	1 Each	0 Each	0 Each	18.9
TGCG	Timber - Girder/ Cross Girder: Timber	1 - Relatively Benign	4 Each	0 Each	0 Each	3 Each	1 Each	0
MBAT	Batter Protection: Other	2 - Mildly Aggressive	8 m^2	0 m^2	8 m^2	0 m^2	0 m^2	0
CABW	Concrete-Abutment and Wingwalls: Cast In-Situ Concrete	2 - Mildly Aggressive	20.4 m^2	0 m^2	20.4 m^2	0 m^2	0 m^2	0
TCOR	Timber - Corbel: Timber		4 Each	0 Each	0 Each	3 Each	1 Each	0
TDBO	TImber - Deck Bolts: Timber	1 - Relatively Benign	10 Each	0 Each	10 Each	0 Each	0 Each	0
TSTR	Timber Truss - Stringer: Timber	1 - Relatively Benign	3 Each	0 Each	3 Each	0 Each	0 Each	0
TWBR	Timber - Wale/ Brace: Timber	1 - Relatively Benign	2 Each	0 Each	2 Each	0 Each	0 Each	0
CPIL	Concrete-Pile: Cast In-Situ Concrete	2 - Mildly Aggressive	6.4 m^2	0 m^2	6.4 m^2	0 m^2	0 m^2	0
CPHS	Concrete - Pier Headstock: Cast In-Situ Concrete	1 - Relatively Benign	5.9 m^2	0 m^2	5.9 m^2	0 m^2	0 m^2	0

Defects

In this section defects identified with the bridge are listed along with their likely cause and methods that may be used for their repair.

MAPP Approach Carriageway: Other

Defect Id: 20369 - Settlement

Settlement of 80 mm at approach 2.

Figure 62. CR129_Defect_2019-03-07.jpg

This problem may be solved using repair item '202.00: M9 Surface Correction Repair (bridge approaches)'. Approximately 1.00 Each of the component is affected.

The treatment priority is rated: Urgency 2: Within12 months (Structure).

The repair is summarised as follows:

Repair approach wearing surface.

The cost of the repair works is estimated to be $1,000.

Defect Id: 20370 - Deterioration

Cracking and breakdown of approach 1 wearing surface. .

Figure 63. CR129_Defect_2019-03-07.jpg

This problem may be solved using repair item '000.00: Other'. Approximately 1.00 Each of the component is affected.

The treatment priority is rated: Urgency 3: Within 2 years (Structure).

The repair is summarised as follows:

Reinstate wearing surface.

The cost of the repair works is estimated to be $2,000.

TTDK Timber - Transverse Deck Plank: Timber

Defect Id: 20366 - Rotting

Rotting of deck planks throughout. .

Figure 64. CR129_Defect_2019-03-07.jpg

Figure 65. CR129_Defect_2019-03-07.jpg

This problem may be solved using repair item '763.02: M762 Replace Transverse Deck Plank (TTDK)'. Approximately 10.00 m^2 of the component is affected.

The treatment priority is rated: Urgency 4: Within 5 years (Structure).

The repair is summarised as follows:

Replace defective transverse deck planks.

The cost of the repair works is estimated to be $1,500.

Defect Id: 20367 - Other

Buildup of debris between planks. .

Figure 66. CR129_Defect_2019-03-07.jpg

This problem may be solved using repair item '000.00: Other'. Approximately 2.00 m^2 of the component is affected.

The treatment priority is rated: Urgency 2: Within12 months (Structure).

The repair is summarised as follows:

Clean debris.

The cost of the repair works is estimated to be $750.

MWWY Waterway: Other

Defect Id: 20368 - Debris In Waterway

Debirs has built up in the waterway on side 1.

Figure 67. CR129_Defect_2019-03-07.jpg

This problem may be solved using repair item '706.00: M700 Clear Waterway, Minor'. Approximately 1.00 Each of the component is affected.

The treatment priority is rated: Urgency 2: Within12 months (Structure).

The repair is summarised as follows:

Remove any flood debris, maintain clean waterway.

The cost of the repair works is estimated to be $1,250.

TGCG Timber - Girder/ Cross Girder: Timber

Defect Id: 20371 - Splitting

Significant splitting noted to girder 1 and 4 in span 1.

Figure 68. CR129_Defect_2019-03-07.jpg

Figure 69. CR129_Defect_2019-03-07.jpg

Figure 70. CR129_Defect_2019-03-07.jpg

This problem may be solved using repair item '000.00: Other'. Approximately 1.00 Each of the component is affected.

The treatment priority is rated: Urgency 2: Within12 months (Structure).

The repair is summarised as follows:

Install anti split bolts and monitor.

The cost of the repair works is estimated to be $1,500.

Defect Id: 20373 - Rotting

Areas of rotting noted to girders throughout. Piping observed, refer to drilling survey. .

Figure 71. CR129_Defect_2019-03-07.jpg

This problem may be solved using repair item '000.00: Other'. Approximately 4.00 Each of the component is affected.

The treatment priority is rated: Urgency 5: Monitor (Structure).

The repair is summarised as follows:

Monitor.

The cost of the repair works is estimated to be $750.

CABW Concrete-Abutment and Wingwalls: Cast In-Situ Concrete

Defect Id: 20374 - Slipping or Movement

Separation of grouted rock from concrete by 20mm.

Figure 72. CR129_Defect_2019-03-07.jpg

This problem may be solved using repair item '000.00: Other'. Approximately 1.00 m^2 of the component is affected.

The treatment priority is rated: Urgency 3: Within 2 years (Structure).

The repair is summarised as follows:

Install grout repair.

The cost of the repair works is estimated to be $1,000.

TCOR Timber - Corbel: Timber

Defect Id: 20372 - Rotting

Heavy piping and splitting noted to corbels. 200mm pipe estimated to corbel 1.

Figure 73. CR129_Defect_2019-03-07.jpg

This problem may be solved using repair item '000.00: Other'. Approximately 4.00 Each of the component is affected.

The treatment priority is rated: Urgency 5: Monitor (Structure).

The repair is summarised as follows:

Monitor.

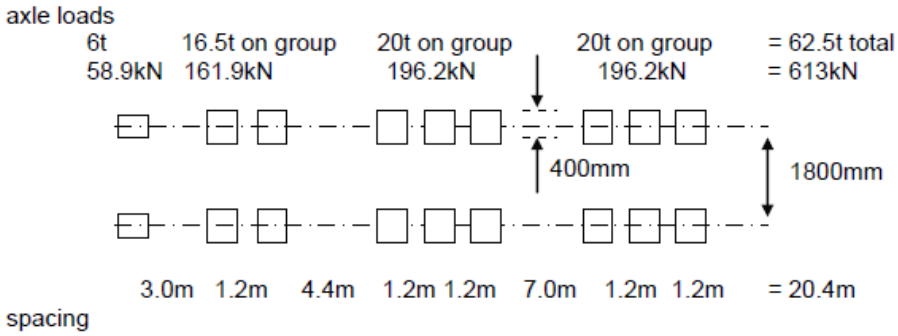
The cost of the repair works is estimated to be $1,250.

Assessment Vehicle Configurations

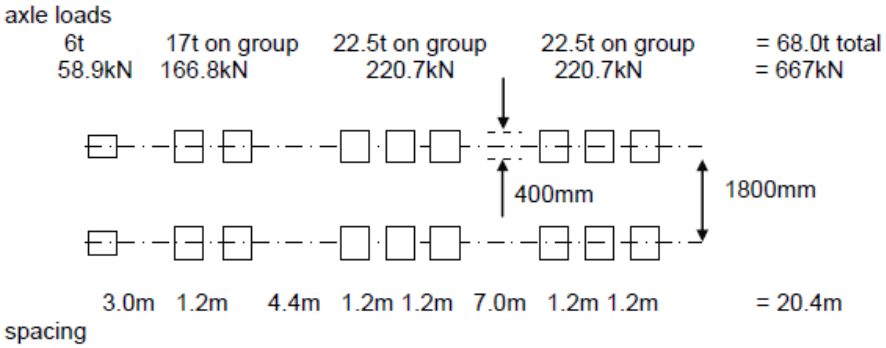
Appendix B

Central NSW Councils – Assessment Vehicle Configuration

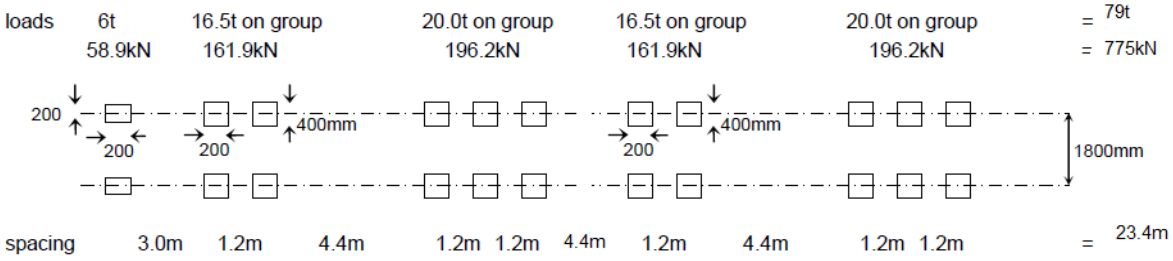
1. Bridge design loading
2. GML B-Double (62.5t)



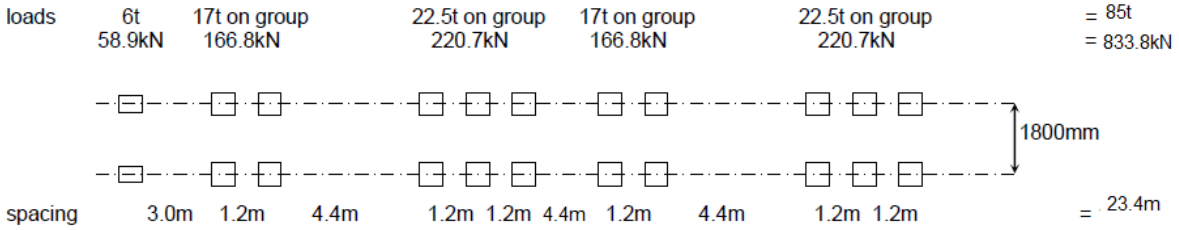
3. HML B-Double (68t)



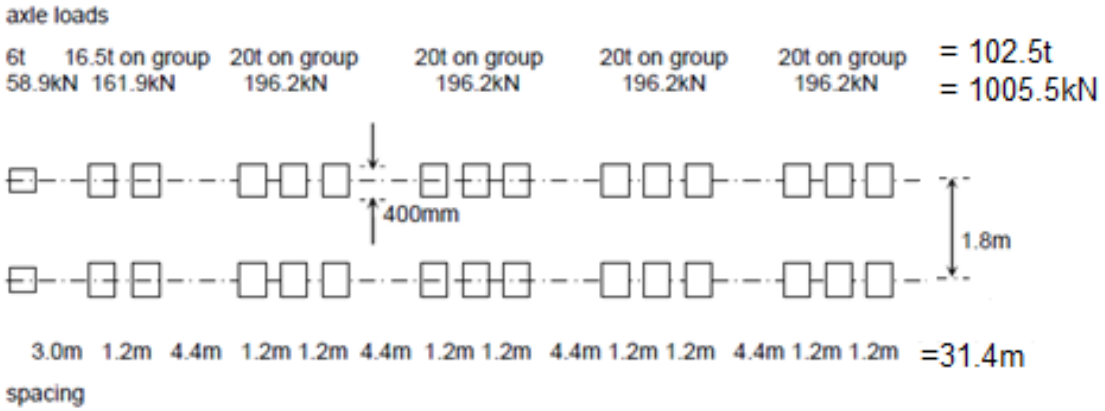
4. Road trains: Restricted Access Vehicle (up to 36.5m length) – GML (79t)



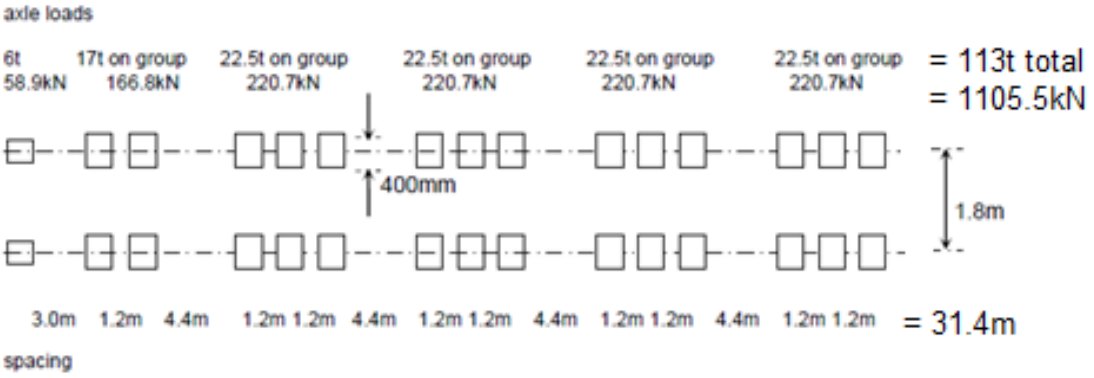
5. Road trains: Restricted Access Vehicle (up to 36.5m length) – HML (85t)



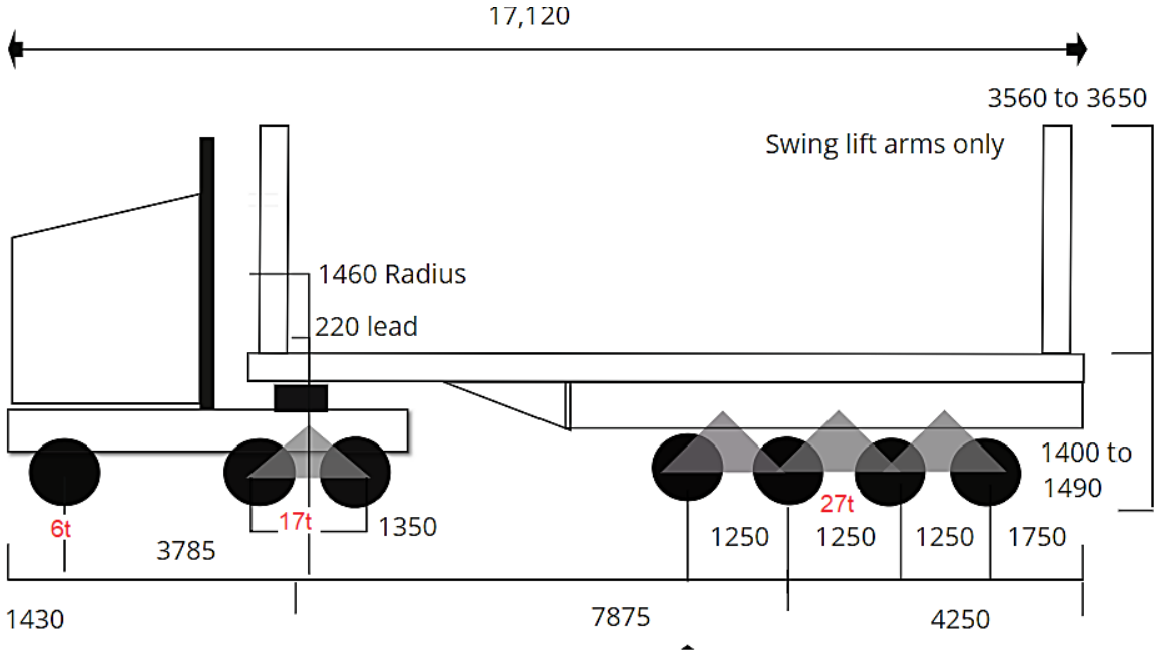
6. AB Triple (up to 36.5m) – 102.5t (similar to TMR Assessment Vehicle 6G – GML AAB Quad)



7. AB Triple (up to 36.5m) – 113t (similar to TMR Assessment Vehicle 6H – HML AAB Quad)



8. Quad Axles – 50t



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