UGL REGIONAL LINX

BRIDGES AND LEVEL CROSSINGS - ASSESSMENT PROCEDURE FOR HEAVY VEHICLES

CRN-MAN-CVL-713026361-705

CRN CM 307

LINKING COMMUNITIES. CONNECTING CUSTOMERS.

Table of Contents

Document Control

Function	Position	Name	Date
Author	Principal Bridge and Structures Engineer	Meysam Rad	06.02.2025
Reviewer	Head of Asset and Engineering	Luke Cunningham	06.02.2025
Controller	Document Controller	Julio Gupte-Arnau	06.02.2025
Approver	Head of Asset and Engineering	Luke Cunningham	06.02.2025

Revision	Issue Date	Revision Description
1.2	28.11.2021	UGLRL Operational Standards Template applied
2.0	12.12.2021	First approved and issued UGLRL version
3.0	24.01.2022	Issued for publish to intranet and webpage
4.0	06.02.2025	Issued to update the assessment processes for bridges and add the guidelines for assessing level crossings

Summary of changes made from previous version

Section	Summary of change
Chapter 1	Update terms and definitions; Add Notation and Abbreviations; Update the list of Normative and Informative references.
Chapter 2	Update heavy vehicle assessment framework.
Chapter 3	Update information requirements as per the latest changes made in CRN Heavy Vehicle Assessment Management processes.
Chapter 4	Add new information about the vertical clearance of CRN; Provide high level recommendation for the assessment of Underbridges.
Chapter 5	Revise the assessment process and conditional adjustments according to Australian standards and industry best practices.
Chapter 6	It is a new section that is added into the current revision to provide the assessment procedure of CRN level crossings.
Chapter 7	It is a new section that incorporates the context of chapters 6, 7, and 8 of the previous revision.

Chapter 1 - General

C1-1 Preface

This Manual has been developed to serve as an acceptable document for assessing the heavy vehicle applications through the Country Regional Network (CRN) network. It is part of the UGLRL CRN's engineering standards, which encompass standards, manuals, specifications, and technical directives. The procedures outlined in the current manual are designed to address the Heavy Vehicle assessment requirements thoroughly, consistently, and transparently.

In accordance with Standards Australia policy, the words “shall” and “may” are consistently used throughout this Manual to indicate mandatory provisions and acceptable alternatives, respectively.

The terms ‘normative’ and ‘informative’ are applied in this manual to define the application of the references and appendices. A ‘normative’ appendix is an integral part of the Manual, while the ‘informative’ appendices serve solely for information and guidance.

The most recent information about CRN assets, including asset population and asset configuration, shall be extracted from UGLRL asset management database, HxGN.

C1-2 Scope and Purpose

This manual outlines the procedures for assessing Heavy Vehicles (HV), as classified by the National Heavy Vehicle Regulator (NHVR), that travel on assets (overbridges, level crossings, and underbridges) managed by UGLRL located over the CRN or the Australian Rail Track Corporation (ARTC) rail networks. It is important to note that this manual is specific to the assessment of CRN assets in New South Wales, and procedures and requirements may vary in other states.

The purpose of this manual is to establish a comprehensive procedure for assessing Heavy Vehicles travelling through CRN assets, from both Engineering and Third-Party management perspectives. This assessment process operates outside the scope of AS 5100.7, necessitating the development of clear guidelines to ensure that best practices are adopted beyond the existing code.

C1-3 Who should use this manual?

This manual shall be used by UGLRL CRN personnel undertaking the access assessments of Heavy Vehicles on CRN bridges and level crossings in New South Wales.

C1-4 Normative References

The following are the normative documents referenced in this Manual:

C1-4.1 Australian and international standards

- AS 5100 Bridge Design Standard [9 parts] – Particularly Part 1, Part 2, and Part 7
- AS 1742.7 Manual of Uniform Traffic Control Devices – Part 7: Railway crossings

C1-4.2 CRN documents

- CRN CM 001 Civil Technical Competencies & Engineering Authority
- CRN CM 305 Structures Assessment
- CRN CM 308 Bridges - Load Rating
- CRN CS 520 Level Crossings
- CRN CM 521 Level Crossings

C1-4.3 Other documents

- Heavy Vehicle (Adoption of National Law) Regulation 2013

It should be noted that the documents referenced for informative purposes are listed in the Appendix 4- Bibliography.

C1-5 Definitions

- **Assessor**
  - Structures (overbridges and underbridges): A competent professional structures engineer whose competency is assessed and endorsed by level 5 – Principal Bridge and Structures Engineer against relevant criteria according to CRN CM 001 knowledge and skill matrix for Level 4 - Structures Engineer.
  - Level Crossing: A competent engineer or the Survey Lead whose competency is assessed and endorsed by level 5 – Principal Track and Corridor Engineer against relevant criteria according to CRN CM 001 knowledge and skill matrix.
- **Approver**
  - Structures (overbridges and underbridges): The technical head of the bridge and structures discipline in CRN (level 5 – Principal Bridge and Structures Engineer according to CRN CM 001), or delegated authority.
  - Level Crossing: The technical head of the track and corridor discipline in CRN (level 5 – Principal Track and Corridor Engineer according to CRN CM 001), or delegated authority.
- **Classes of Heavy Vehicles (as per HVNL)**

  The Heavy Vehicle National Law (HVNL) determines three heavy vehicle classes to manage access for different types of heavy vehicles, which are as follows:
  - Class 1 heavy vehicles mainly include: agricultural vehicles, Oversize Overmass (OSOM) vehicles and special purpose vehicles.
  - Class 2 heavy vehicles mainly include: B-doubles, Livestock vehicles, Performance Based Standards (PBS) vehicles, and Controlled Access buses (A bus, other than an articulated bus, that is longer than 12.5m but less than 14.5m).
  - Class 3 heavy vehicle, which is not a Class 1 or Class 2 heavy vehicles, and it is a heavy vehicle (together with its load) that does not comply with prescribed mass or dimension requirements.
- **CRN Heavy Vehicle Portal**

  It is an internal online portal that is accessible to UGLRL personnel and subject matter experts who are involved in the management and assessment of the CRN heavy vehicle applications.
- **General Access Vehicle (GAV)**

  A vehicle meeting the general mass limits and other regulatory requirements of the Heavy Vehicle (Mass, Dimension and Loading) National Regulation.
- **General Mass Limits (GML)**

  The mass limits that apply for all heavy vehicles unless they are operating under an accreditation or an exemption under the Heavy Vehicle National Law.

- **Heavy Vehicle Application (or "Application")**

  An official request submitted by the stakeholder external to UGLRL to seek permission for heavy vehicles traveling on CRN assets.

- **Heavy Vehicle Coordinator**

  A CRN Third-Party officer who facilitates the application process and liaises with internal assessors and external applicants.

- **HEXAGON (HxGN)**

  UGLRL asset management database that stores all data about CRN assets.

- **Higher mass limit (HML)**

  Higher mass limits as provided in the Heavy Vehicle (Mass, Dimension and Loading) National Regulation.

- **Intelligent Access Program (IAP)**

  An application that manages higher risk vehicles and loads on the road network. It monitors heavy vehicle operations against conditions of access set by road managers or regulators.

- **Load Rating**

  The process of determining a load-rating factor.

- **Load Rating Factor**

  A ratio of the available bridge capacity for traffic load effects to the traffic load effects of a nominated rated vehicle.

- **Nominated rated vehicle (NRV)**

  A design traffic load, a specific road vehicle, a specific train consist, or for a pedestrian bridge a specific pedestrian loading.

- **On Board Mass (OBM)**

  It is a system that monitors all the axle groups in the vehicle combination and provide the mass readings of these axle groups to the IAP system.

- **Oversize and/or Overmass (OSOM) Vehicles**

  Class 1 vehicles under the Heavy Vehicle National Law, which typically include agricultural machines, vehicle combinations carrying large indivisible items, and special purpose vehicles such as mobile cranes.

- **Permit or Permission Letter**

  A formal letter (PDF version) written to the relevant external stakeholders and signed by the UGLRL Approver to provide permission and clarify any requirements and conditions for heavy vehicles travelling on CRN assets.

- **Professional Engineer**

  Any one or a combination of the following:

  - A person registered in a relevant area of practice on the National Engineering Register.
  - Where applicable, a member of a scheme established under Professional Standards Legislation in the relevant jurisdiction.

- A chartered professional engineer (CPEng) or equivalent qualifications recognised by Engineers Australia.

➢ **Relevant authority**

An agency authorised by legislation or regulation to issue determinations, orders, or other instructions in respect of any subject covered by this Standard.

- **NOTE**: Where compliance with Australian Standard is not a requirement of a relevant authority but is a requirement of a body such as an insurance company or association, then that body or its nominees may perform the functions of the relevant authority for the purposes of this Manual.

➢ **Restricted Access Vehicle (RAV)**

Vehicles that operate under a notice or gazette and vehicles that operate under higher mass limits (HML) that can generally only access certain parts of the road network (a vehicle that is not a GAV).

Notes:

- An RAV may be a B-double, road train or high-performance vehicle.
- Examples of restricted access vehicles are HML semi-trailer, HML B-double, GML road train and HML road train.

➢ **Reviewer**

Experienced and professional engineers whose competency are assessed and endorsed by either level 5 – Principal Bridge and Structures Engineer (for reviewing structures applications) or level 5 – Principal Track and Corridor Engineer (for reviewing level crossing applications) against relevant criteria according to CRN CM 001 knowledge and skill matrix.

➢ **Telematics Monitoring Application (TMA)**

An alternative to IAP in New South Wales and Victoria for some vehicle types, and in Queensland as a requirement for eligible Class 2 and some specified Class 3 heavy vehicles.

➢ **Tiers of Assessment (adopt by Austroads Bridge Engineers to assess overbridges and culverts):**

- Tier 1 Assessment: Undertaking a line model analysis to compare the load effects of applicant's vehicle and nominated rated vehicle.
- Tier 2 Assessment: Carrying out the structural analysis of the bridge using a grillage model based on AS 5100, which may incorporate the structural condition.
- Tier 3 Assessment: Developing more advanced methods to perform the detailed structural analysis of the bridge based on international standards that are more sophisticated than AS 5100. Non-linear analysis and load testing can be used to support the recalibration of computer models and/or determination of the structural capacity.

Note: It should be noted that the above definitions are different from the definitions and classifications of Performance-Based Standards (PBS) scheme.

➢ **Weighbridge**

A platform is used to determine the weight of heavy vehicles such as prime mover and trailers, buses, etc, which can record the weight of axles (or groups of axles).

C1-6 Abbreviations

ALCAM	Australian Level Crossing Assessment Model
ALF	Accompanying Lane Factor
BM	Bending Moment
CML	Concessional Mass Limits
CRN	Country Regional Network
DLA	Dynamic Load Allowance
GAV	General Access Vehicle
GML	General Mass Limit
HLP	Heavy Load Platform
HML	Higher Mass Limit
HVNL	Heavy Vehicle National Law
HxGN	HEXAGON
IAP	Intelligent Access Program
LLF	Live Load Factor
NHVR	National Heavy Vehicle Regulator
NRV	Nominated Rated Vehicle
OBM	On Board Mass
OSOM	Over Size Over Mass
PBSE	Principal Bridge and Structures Engineer
PTCE	Principal Track and Corridor Engineer
QML	Quad-Axle Mass Limit
RAV	Restricted Access Vehicle
SF	Shear Force
TMA	Telematics Monitoring Application

C1-7 Notations

The symbols used in this manual, including their definitions, are listed below.

Symbol	Definition
R_F	Load Rating Factor
R_u	Calculated Ultimate Capacity
S_g^*	Load Effects due to Dead Load
S_{gs}^*	Load Effects due to Superimposed Dead Load
S_p^*	Load Effects due to Secondary Effects of Prestress
S_Q^*	Load Effects Due to The Traffic Load Used for The Assessment and Load Rating
S_s^*	Load Effects due to Shrinkage, Creep, Differential Settlement and Bearing Friction
S_t^*	Load Effects due to Temperature
W	A Factor Representing the ALF for Road Traffic Bridges
α	Dynamic Load Allowance (DLA)
γ_g	Load Factor for Dead Load
γ_{gs}	Load Factor for Superimposed Dead Load
γ_Q	Traffic Load Factor or Live Load Factor (LLF)
Ø	Capacity Reduction Factor

Both the numerator and denominator of a non-dimensional ratio in this manual are presented in identical units.

Chapter 2 Heavy Vehicle Assessment Framework

As it is shown in Figure 1, the key stages for the assessment of heavy vehicle applications submitted to UGLRL are as follows:

I. **Application lodgement / submission:** Heavy Vehicles (HV) applications are received by the Heavy Vehicle Coordinator. The proposed route(s) and vehicle configuration(s) shall be clarified in the application form.

   Note: The applicants submit their applications via NHVR portal or contact UGLRL Third-party team via the UGLRL public website: Heavy vehicle access.

II. **Input Data Review:** The Heavy Vehicle Coordinator assesses the proposed route and identifies impacted CRN assets (i.e. those inspected and maintained by UGLRL), which include Underbridges, Overbridges, and Level Crossings.

   After identification of the UGLRL assets, the coordinator submits the application information to the Assessors via the CRN Heavy Vehicle portal. Overbridges, Underbridges, and Level Crossings must be submitted to the relevant Subject Matter Expert.

   Note: The Heavy Vehicle Coordinator, with the support of the Assessors, ensures that applicants have provided required and sufficient information to undertake the assessment and, if required, requests more information and/or clarification from the applicant.

III. **Assess**: The Assessors analyse the impacted CRN assets based on Heavy Vehicle specifications submitted by the applicant.

IV. **Review and Approval**: The Reviewer and Approver review, endorse, and approve the assessment results and imposed conditions (if required).
   Note: Depending on the complexity of the applications and subject to the endorsement of the Principal Engineer, the review and approval stages can be done as one combined activity by one individual (i.e. PBSE and/or PTCE) or as two separate activities by different Subject Matter Experts.

V. **Issue [“Post Assessment”]:** The Heavy Vehicle Coordinator issue the signed permit (permission letter) to the applicant.

It should be highlighted that one of the key activities, which is independent of any given application assessment, is developing the asset database in which the asset configuration and structural capacity shall be documented. This activity shall be completed prior to the heavy vehicle assessment (i.e. it is a “**Pre-Assessment**” task).

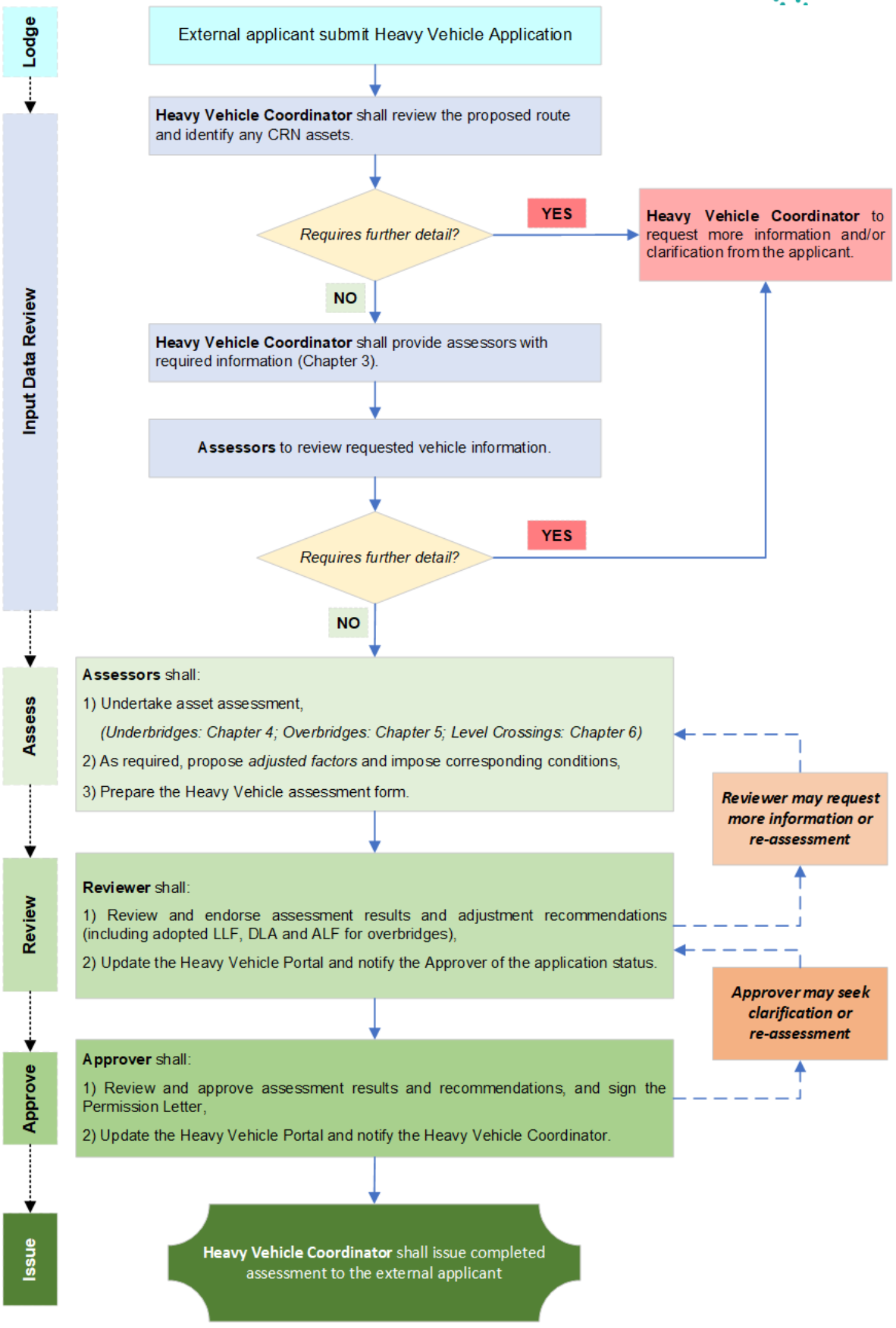


Figure 1- Assessment framework for Heavy Vehicle applications

Chapter 3 Heavy Vehicle Assessment Management

C3-1 Information Requirements for Heavy Vehicle Applications

Prior to starting the assessment process, the Heavy Vehicle Coordinator shall ensure that a Heavy Vehicle Application contains the following information:

- Applicant details:
  - Name (Company and its representative)
  - Address
  - Contact details
- General information:
  - Requested movement date
  - Route
- Vehicle information:
  - NHVR Class (NHVR Class 1, NHVR Class 2, NHVR Class 3)
  - Vehicle registration (only applicable for NHVR Class 1 and Class 3 applications)
  - Type of Vehicle (Crane, B-Double, A-Double, Road Train, Tanker, Bulk Carrier, Livestock, etc.)
  - Load Cases (HML, QML2, CML, QML1, GML)
  - Vehicle maximum dimensions in “mm” or “m” (length, width and height)
- Load configuration:
  - Axle spacing (in “mm” or “m”)
  - Number of axles
  - Maximum load per axle per load type.

    ! Important Note ! The CRN Overbridge Assessor assumes that the heavy vehicle loads are uniformly distributed on axles, unless noted otherwise by HV applicant.
- Asset information:
  - Asset ID and Description: The Heavy Vehicle Coordinator should specify the list of UGLRL CRN level crossings and bridge assets on the requested application route.

The Heavy Vehicle Coordinator, with the support of Subject Matter Experts, may need to request more information or clarifications from an applicant.

C3-2 Heavy Vehicle Permit

Based on the above information, the Heavy Vehicle Coordinator prepares the initial draft of the Heavy Vehicle permit (i.e. permission letter) and submits to the Assessors through the CRN Heavy Vehicle portal. The Heavy Vehicle permit contains the following information:

A) UGLRL application ID

B) NHVR reference (or Local Council reference if available)

C) Applicant name (company or person)

D) Company representative name

E) Applicant's address and contact details

F) Permit issuance date

G) Permit expiry date

H) NHVR classification

I) NHVR type of vehicle

J) Vehicle registration number (For Class 1 and Class 3 applications)

K) Vehicle maximum dimensions "mm" or "m" (length, width and height)

L) Asset information including asset number/ID, road name/location description

M) Load configuration of requested heavy vehicle (axle loading and spacing for various load cases)

N) The results of technical assessments, i.e. the status of assessed assets, that includes "Approved", "Conditionally Approved", or "Rejected".

O) Recommendations and/or restrictions imposed.

! Important Note ! Items (M), (N), and (O) above shall be completed by the Assessors and ultimately reviewed and approved by the Approver.

C3-3 Heavy Vehicle Application and Permit Status

The status of the Heavy Vehicle applications in the CRN Heavy Vehicle portal include:

- '*Empty*' for applications which have been received and waiting for the Heavy Vehicle Coordinator to review the proposes route and identify any CRN assets.
- *'Closed'* for applications that the Heavy Vehicle Coordinator has reviewed and identified no CRN assets. The Heavy Vehicle Coordinator notifies an applicant via an email that the application has been closed as no CRN assets has been identified on the route.
- '*In Progress'* for applications which have been received, but not been completely assessed;
- '*Awaiting Further Details'* for applications which have been received, but the Heavy Vehicle Coordinator has requested further information from the applicant;
- '*Ready for Approval'* for applications which have been assessed, but not been approved;
- '*Ready to Issue'* for applications which have been approved and signed, but not been issued;
- '*Completed'* for applications that have been issued to applicants and closed out in the CRN Heavy Vehicle Portal, i.e. "permits", which can be:
    - 'Active' for permits that have not reached their expiry date;
    - 'Expiring soon' for permits that will exceed the expiry date in less than 7 days;
    - 'Expired' for permits that have lapsed.

Chapter 4 Underbridge Assessment

Underbridge assessment focuses on assessing the vertical and horizontal clearances and is satisfied if there is enough clearance to allow the Heavy Vehicle to safely pass the CRN Underbridges.

Information on underbridge clearances can be found in available drawings, load rating reports, and bridge inspection report.

The Assessor shall assess the risk of CRN Underbridges strike based on the following factors and the TfNSW Risk Criteria for External Organisations (T MU MD 20002 ST) and the UGLRL Risk Management Framework (CRN-FRA-RLS-459032646-317):

- Road type
- Traffic count
- Geometry of the road
- Road width
- Road usage
- Vertical clearance (measured from the lowest level of the deck soffit to top of road)
- Previous bridge strike incidents
- Heritage status
- Heavy Vehicle speed
- Material
- Classification of rail corridor

If the risk rating of CRN Underbridge strike is “High” to “Very High”, the Heavy Application shall be rejected or conditionally approved subject to the review and endorsement of PBSE.

Appendix 2 presents the location and vertical clearances of CRN Underbridges over roads. The vertical clearances dataset in Appendix 2 of CRN CM 307 is intended as a general reference source and provided for information purposes only.

Information, data and advice in Appendix 2 is provided on the basis that the heavy vehicle operators and drivers are responsible for assessing the relevance and accuracy of its content. UGLRL make no representations, express or implied, as to the accuracy, currency or usefulness of the presented information. UGLRL accept no liability to any person for the information, data or advice (or the use of such information, data or advice) which is provided in this document.

Chapter 5 Overbridge Assessment

C5-1 Process Overview

Evaluating the structural capacity of overbridges against heavy vehicle loads is the key step of the heavy vehicle access management. This chapter presents Tier 1 Assessment methodology in which a line model analysis is undertaken to assess the capacity of CRN overbridges. The overview of the heavy vehicle assessment procedure for CRN overbridges is shown in Figure 2.

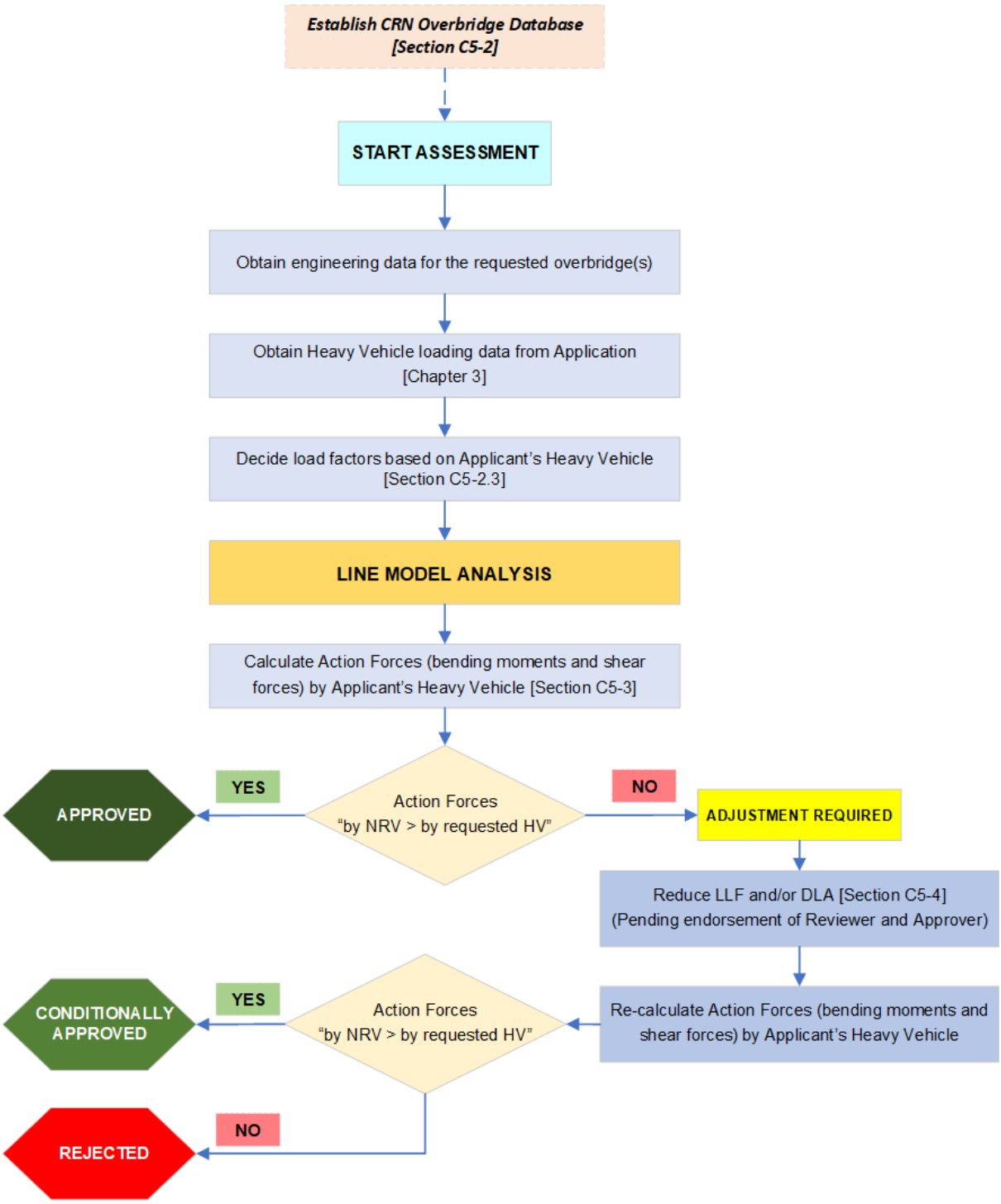
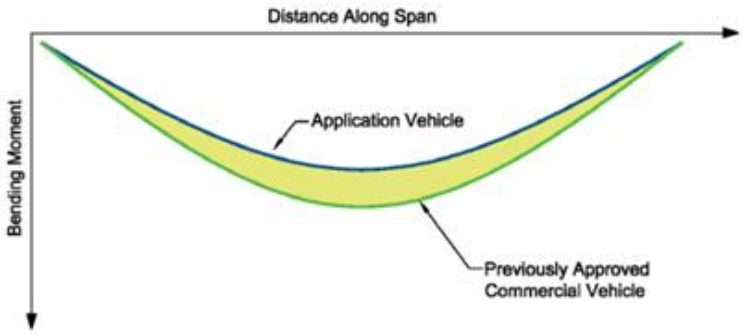


Figure 2- Overbridge Heavy Vehicle Assessment Procedure

Tier 1 line model assessment is a relatively simple method in which the bridge is modelled as a single line or beam supported at designated points. The line model analysis must account for both simply supported and continuous spans, as these conditions can significantly affect load distribution.

This approach facilitates the comparison of maximum load effects —including hogging and sagging moments, shear forces, and support reactions—between the applicant's vehicle and a Nominated Rating Vehicle (Figure 3). It is necessary to acquire accurate information about both axle masses and spacings during the assessment, as these factors influence forces acting on the bridge structure.

! Important Note ! The reviewer should consider the appropriateness of the line model analysis for the bridge structure type. There may be exceptions where a different approach will be a more appropriate representation of the structural behaviour. In such cases, PBSE is to be consulted to endorse the use of an alternative analysis method.



Source: Based on Austroads (2016).

Figure 3- Example of reference vehicle technique using a line model (for bending moment)

[Source: Research Report AP-R582-18, Austroads 2018.]

C5-2 Pre-Assessment Requirements

Prior to commencing the Heavy Vehicle assessments, a thorough database of overbridges shall be established in which the following information (sections C5-2.1 to C5-2.3) for each individual overbridge shall be documented based on available design or as-built drawings, load rating reports, and bridge inspection reports.

The overbridge database shall be reviewed and endorsed by the Principal Bridge and Structures Engineer.

The overbridge database shall be regularly updated if more accurate information (such as updated load rating studies) becomes available.

C5-2.1 Structural Configuration

The minimum structural configuration data that shall be documented in the overbridge database are as follows:

- Total number of spans
- Length of each span (in meters)
- Type of supports/connections for each span (simple/fixed/continuous supports)
- Width of overbridge (in meters)
- Number of lanes in each direction
- Width of lanes in both directions

The construction year of an overbridge (if available) can be documented in the overbridge database as well.

C5-2.2 Nominated Rating Vehicle (NRV)

The Nominated Rating Vehicle (NRV), or the "Reference Vehicle", of CRN overbridges shall be documented in the CRN overbridge database to determine the maximum service level that the bridge is designed to accommodate.

After selecting a suitable NRV according to the process shown in Figure 4, the load effects of NRV (hogging and sagging moments, shear forces, and support reactions) shall be calculated using a line model assessment method and load factors presented in section C5-2.3 to be ultimately documented in the CRN overbridge database.

NRV selection shall be done prior to assessing heavy vehicle applications and must be reviewed and endorsed by PBSE.

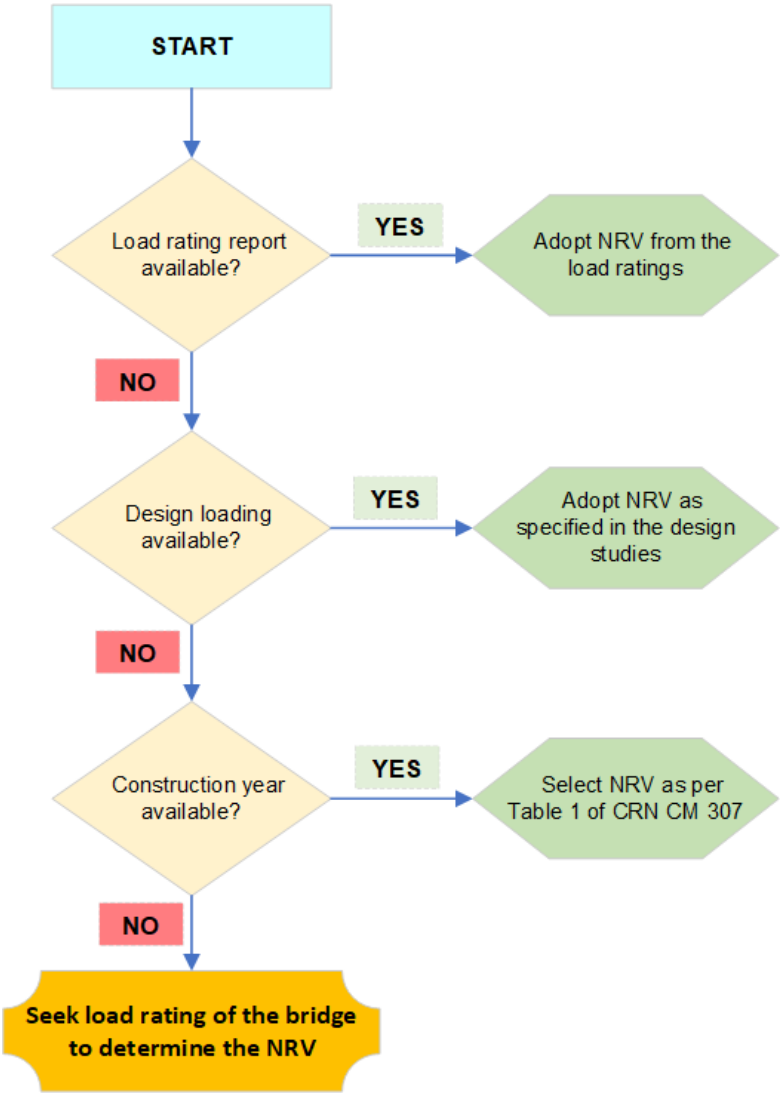


Figure 4- NRV selection process

Three different approaches are prioritised in Figure 4 to identify the most suitable Nominated Rating Vehicle, which are discussed in detail as follows.

Method 1: Selecting NRV Based on Load Rating Studies

The NRV shall be ideally determined based on the available load rating studies. Load rating studies shall be conducted in accordance with the requirements outlined in AS 5100 and CRN CM 308.

The rating of a structure is determined following ultimate limit state (ULS) design principles, which are then compared to the maximum factored loads applied to the bridge. The assessment process begins with compiling inventory data, including condition, material, and loading/traffic information, alongside confirmation of the current bridge condition and all geometric parameters.

The key outcome of the load rating study is the overbridge rating factor (RF) that is determined based on the following Equation (AS 5100 – Part 7):

$$RF = \frac{Available\ bridge\ capacity\ for\ traffic\ load\ effects}{Traffic\ load\ effects\ of\ nominated\ rating\ vehicle} = \frac{\phi R_u - (\gamma_g S_g^* + \gamma_{gs} S_{gs}^* + S_p^* + S_s^* + S_t^*)}{\gamma_Q (1+\alpha) W(S_Q^*)} \quad \textbf{(Equation 1)}$$

Notes to be considered:

i. Relevant NRVs and their associated rating factors, in either as-is or as-new condition, may be selected from the load rating study.
ii. NRV action forces should incorporate Live Load Factors (LLF), Dynamic Load Allowance (DLA), and Accompany Load Factors (ALF) as per the load rating report.
iii. A bridge is deemed to have insufficient capacity for the specified load if the rating factor is less than 1.
iv. To maintain a conservative approach, if the RF exceeds 1 for a specific vehicle, an RF of 1 shall be utilised for assessment purposes.

The bridge rating factor shall be documented for the selected NRV in the CRN overbridge database.

Method 2: Selecting NRV Based on design (or as built) drawings

The design loads determined by the bridge design codes are typically presented in the Issued For Construction (IFC) or as-built drawings. If the available IFC or as-built drawings transparently demonstrate the design loads and/or vehicles of CRN overbridges, NRV can be assumed to be the same as the design vehicle. The axial load and spacing of common design vehicles in Australia are presented in Appendix 1.

Method 3: Selecting NRV Based on Construction Year

In the absence of IFC or as-built drawings, NRV can be determined based on the construction era and corresponding design vehicle as shown in Table 1.

Table 1- Selecting NRV Based on Construction Year

Construction Period	Recommended NRV Loading	Reference Design Code
1948(1) – 76	MS18	NAASRA Highway Bridge Design Specification
1976 – 92	T44	NAASRA Bridge Design Specification
1992 – 2004	T44	Austroads Bridge Design Code(2)
2004 to present	SM1600	AS 5100 set

(1) MS18 or M18 can be selected as NRV for the CRN overbridges subject to the PBSE endorsement.
(2) Unlike NAASRA (1976), this code was developed based on limit states approach.

The recommended NRV loading in Table 1 is based on the Australian bridge design code that was applied during a certain period. More background information about the design loading of the past and current Australian bridge design codes is presented Appendix 3.

When using Method 3 for selecting NRV, it is highly recommended to review the relevant design factors associated within a certain era, including co-existing vehicles, load factors, lane factors, dynamic load allowances, and the structural analysis approach (e.g. limit states vs. allowable stress). Taking these factors into account can ensure that the selected NRV accurately reflects the operational requirements and structural capacity of an overbridge.

It should be noted that Method 3 is the least recommended method comparing to other 2 above mentioned methods. Therefore, it shall be applied if other methods cannot be used due to lack of information.

C5-2.3 Load and Lane Factors

Three following load factors shall be defined based on the Nominated Rating Vehicle (NRV) of any given CRN overbridge:

- Live Load Factor (LLF)
- Dynamic Load Allowance (DLA)
- Accompany Lane Factor (ALF)

AS 5100.2 and AS 5100.7 provide values for LLF, DLA and ALF for various vehicle loadings. The LLF and “1+DLA” factors that shall be employed in the assessment process are provided in Table 2 based on these guidelines. The Accompany Lane Factor (ALF) shall be used as per AS 5100.2 requirements.

Table 2- Load factors based on AS 5100

Vehicle Type	LLF	1 + DLA
T44, M18, MS18, Semitrailer, B-Double, Road Train	2.0	1.4
Crane	1.6	1.4
Volumetric (Livestock, liquid)	1.6	1.4
OSOM or Specific Vehicles	1.5	1.4

C5-3 Overbridge Assessment Process

C5-3.1 Heavy Vehicle Access Assessment

As it can be seen in Figure 5, the heavy vehicle access assessment (i.e. Tier 1 assessment) uses a line model (such as the one shown in Figure 6) to compare the maximum action forces generated by the applicant’s vehicle to the maximum action forces generated by NRV for sagging and hogging moments and shear forces.

It should be noted that no detailed structural assessment (such as grillage modelling) is undertaken by this process although it relies on past structural assessments, including load rating studies, to determine the acceptable rating factor of an overbridge. If an assessment fails, a higher tier assessment may be undertaken subject to the endorsement of PBSE.

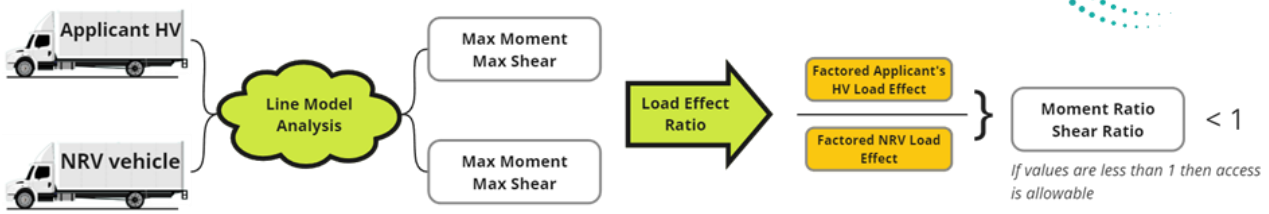


Figure 5- Applicant's and NRV vehicle ratio effect calculation by the line model

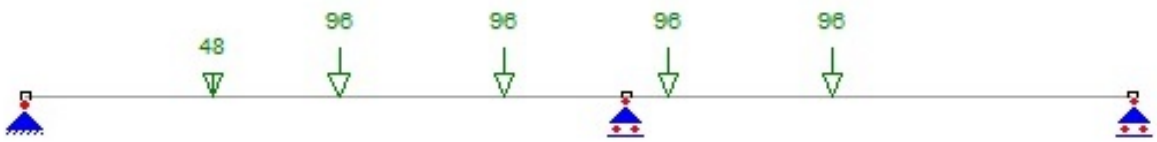


Figure 6- Example of one-dimensional line model analysis of a bridge and heavy vehicle (Each point load represents the total load of an axle)

The key steps of the heavy vehicle access assessment are as follows:

- **Step 0**: Prior to starting the assessment, the following data shall be documented in the CRN overbridge database for all CRN overbridges:
  - Type of Nominated Rating Vehicle (refer section C5-2.2)
  - LLF, DLA and ALF factors for the selected NRV (refer section C5-2.3)
  - Shear forces and bending moments (both hogging and sagging), which shall be calculated based on the line model analysis for NRV loading.
  - Overbridge Rating Factor for the selected NRV (if available), which shall be acquired through the load rating studies.
- **Step 1**: The axle load is applied as a moving point load along the line model of an overbridge, with the distance between these point loads replicating the axle spacing of the applicant's vehicle, as it is shown in Figure 7.

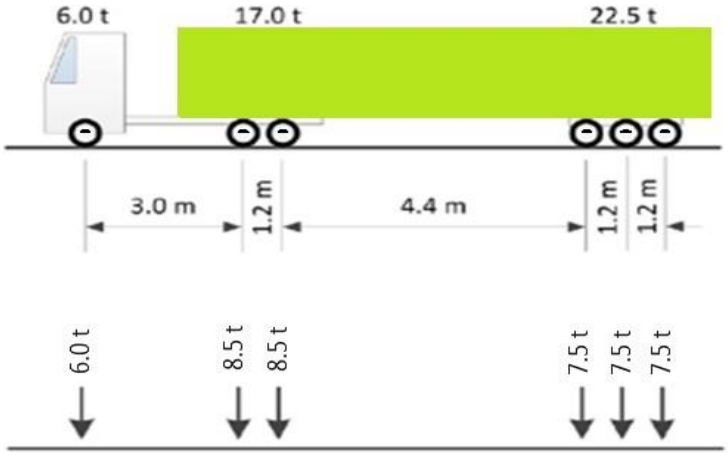


Figure 7- Conversion of axle weights to point loads

The maximum load actions, which depend on the heavy vehicle position along an overbridge, are calculated by incrementally positioning the applicant's vehicle along the one-dimensional

line model of the assessed CRN overbridge. The details of bridge sections and material properties are not required to be considered in the line model analysis.

The key outcome of this step is the maximum shear forces and hogging and sagging moments. To achieve this, Excel macros or other computer-based methods can be used to evaluate the bending moments and shear forces generated in the line model by the application vehicles. The output includes the calculated moments and shears for each span within the defined range.

- **Step 2**: LLF, DLA and ALF factors shall be determined based on the applicant's vehicle.
- **Step 3:** Factored load actions (shear forces and hogging and sagging moments) for the applicant's vehicle (**AV**) shall be calculated based on the outcomes of Step 1 and the factors determined in Step 2 as follows:

Factored Load Action $_{\text{Applicant's Vehicle}}$ = LLF_{AV} x DLA_{AV} x ALF_{AV} x "Calculated Load Action" $_{AV}$

Factored load actions for the selected NRV shall be calculated based on the parameters defined in Step 0:

Factored Load Action $_{NRV}$ = LLF_{NRV} x DLA_{NRV} x ALF_{NRV} x RF_{NRV} x "Calculated Load Action" $_{NRV}$

- **Step 4:** The heavy vehicle application is "Passed" (i.e. 'Approved') if the following ratio is true:

$$\frac{\textbf{Factored Load Action}_{\text{Applicant's Vehicle}}}{\textbf{Factored Load Action}_{NRV}} < 1.00 \qquad \textbf{(Equation 2)}$$

- **Step 5**: If equation 2 is not satisfied, the Assessor (subject to the approval of Principal Bridge and Structures Engineer) may decide to impose restrictions on the applicant's heavy vehicles in order to reduce Live Load Factors (LLF), Dynamic Load Allowance (DLA), and Accompany Lane Factors (ALF) - Refer to section C5-4 for further information.

C5-3.2 Carriageway Width Assessment

In addition to assessing the heavy vehicle access, the Assessor shall also check the bridge's width to ensure sufficient horizontal clearance is available for heavy vehicles to safely pass the CRN overbridge without the risk of a collision with the parapets or traffic barriers.

If the vehicle width is wider than the outer width of the applicant's vehicle, the assessor shall review the alignment of the road and impose appropriate restrictions (e.g. an applicant shall apply appropriate measures and/or adjustments to "*ensure loads pass over guardrails or kerbs*") to eliminate the risk of a collision with the overbridge parapets or traffic barriers.

It should be highlighted that more sophisticated analytical methods and experimental tests, which are beyond the scope of this manual, may be required to study lateral dynamics in the vehicle and heavy vehicle rollover in order to assess the safety and adequacy of the carriageway width.

C5-4 Conditional Adjustment for Load and Lane Factors

If the heavy vehicle fails to pass the assessment, Live Load Factors (LLF), Dynamic Load Allowance (DLA), and Accompany Lane Factors (ALF) can be adjusted by imposing restrictions on the applicant's heavy vehicle. Table 4 summarises the viable restrictions and corresponding reduced LLF and DLA factors that the assessor can apply to "conditionally approve" the heavy vehicle application. It should be noted that the recommended conditions and reduced factors shall be reviewed and endorsed by the Reviewer and the Approver.

The conditions presented in Table 4 have been determined based the following information:

- AS 5100.2 and AS 5100.7 recommendations,
- Type of Heavy Vehicle load,
- Type of monitoring equipment (installed on a Heavy Vehicle and/or a bridge),
- Availability of Heavy Vehicle Safety Stations, and
- Other site factors (e.g. traffic volume, bridge location, lane occupancy, etc.)

However, other factors can be considered by the Assessor while adjusting the load factors, including:

- Heavy Vehicle Load Cases (e.g. HML, CML, GML); If the HML load case is not satisfactory for the adjusted LLF, the Assessor may need to check CML and GML load cases to conditionally approve an application.
- Load rating report recommendations,
- History of defects, in particular the current condition of an overbridge,
- Multiple heavy vehicles travelling on an overbridge simultaneously.

Four different categories of heavy vehicles are presented in **Table 4** as follows:

- **Category A – General Heavy Vehicle**; which mainly includes Class 2 and Class 3 heavy vehicles, such as Freight Carrying Vehicles (Semi-trailer, B-Double, B-Triple, etc.), Performance Based Standards Vehicles (Prime Mover and Quad Axle Semitrailer, etc.), Controlled Access Bus, Rigid Truck and Dog, Prime Mover and Semitrailer.
- **Category B – Volumetric**; which mainly includes livestock carriers, tankers, or similar.
- **Category C – Crane**; which includes various types cranes such as All Terrain Crane, Pick and Carry Crane, etc.
- **Category D – OSOM, Heavy Load Platform, or Special Purpose Vehicle (SPV)**; which includes Oversize Overmass Vehicles (Prime Mover and Low Loader, etc.), Heavy Load Platform, and Special Purpose Vehicle excluding cranes (Fire truck, Prime Mover Towing Drill Rig Trailer, Concrete pump, etc.). Agricultural Vehicles (Tractor, Combine Harvester, etc.) can also be considered as part of this category.

It should be noted that Category C and D vehicles fall under "Class 1 Heavy Vehicles".

Table 4 also presents the acceptable LLF and DLA factors for each above category where the Heavy Vehicle is permitted without the need for imposing any restrictions on an applicant (i.e. the Heavy Vehicle application is "Approved").

C5-4.1 Adjustment of Dynamic Load Allowance (DLA)

AS 5100.7 allows the reduction of Dynamic Load Allowance for Heavy Load Platforms and invisible load where the maximum travel speed is 10 km/h. However, some references and manuals (such

as the Waka Kotahi NZ Transport Agency manual) have provided guidance for estimating DLA where the travel speed is higher than 10 km/h, which can be used as a reasonable approximation in special cases. Applying equations other than the recommendations of AS 5100 to reduce DLA shall be reviewed and approved by PBSE.

C5-4.1 Adjustment of Accompanying Lane Factor (ALF)

If, after applying reduced Live Load Factor (LLF) and Dynamic Load Allowance (DLA) as per Table 4, the heavy vehicle application fails to pass the access assessment, an alternative assessment of the overbridge's capacity may be considered to adjust ALF under the following conditions:

i. The CRN overbridge must have two or more lanes.

ii. The vehicle must travel in the centre of the CRN overbridge .

iii. The vehicle must be escorted when traveling over two lanes.

iv. The vehicle must remain in the centre of the lanes in the direction of travel.

v. No other vehicles are allowed on the CRN overbridge during the crossing.

If above conditions are all satisfied, the overbridge's capacity can be assessed for two lanes instead of a single lane, as two lanes are assumed to be loaded under a heavy vehicle. In this case, the **Factored Load Action** $_{NRV}$ in Equation 2 is re-calculated based on the updated **ALF**$_{NRV}$. The adjusted **ALF**$_{NRV}$ is determined as "the sum of the load effects of each loaded lane with the relevant ALF $(i.e. \sum ALF)$", using ALF values outlined in Table 3 based on AS 5100.2.

Table 3- Accompanying lane factors

Number of loaded lanes	Accompanying lane factor (ALF_i)
1 lane loaded	1.0
2 lanes loaded	1.0 for first lane; and 0.8 for second lane
3 or more lanes loaded	1.0 for first lane; and 0.8 for second lane; and 0.4 for third and subsequent lanes

The ALF adjustment is primarily recommended for Class 1 applications that can be assured to meet the above conditions. For Class 2 or Class 3 applications, the ALF adjustment is usually recommended for emergency vehicles, such as ambulances.

The ALF adjustment shall be reviewed and approved by PBSE.

Table 4- Adjusted LLF, DLA, and ALF factors and corresponding access conditions

Requested Vehicle	LLF	"1 + DLA"	ALF	Conditions
Category A: General Heavy Vehicle	$2.00 \leq LLF$	1.40	-	**HV is permitted without condition.**
	$1.80 \leq LLF < 2.00$	1.40	-	i. Vehicle to enrol in IAP or TMA.
	$1.60 \leq LLF < 1.80$	1.40	-	*i.* Vehicle to enrol in IAP or TMA. *ii.* Vehicle is to be fitted with an OBM system or use a weighbridge.
	$1.60 \leq LLF < 2.00$	1.10 (A1)	-	i. Vehicle to travel along the bridge at a maximum of 10km/h with no sudden braking or acceleration. ii. Vehicle to enrol in IAP or TMA. iii. Vehicle to be fitted with an OBM system or use a weighbridge.
	$1.60 \leq LLF < 2.00$	1.10 (A1)	1.8 (A2)	i. Vehicle to travel along the bridge at a maximum of 10km/h with no sudden braking or acceleration. ii. Vehicle to enrol in IAP or TMA. iii. Vehicle to be fitted with an OBM system or use a weighbridge. iv. Vehicle to travel over two lanes. v. Vehicle to travel in centre of lanes in direction of travel. vi. No other vehicles to be permitted on the bridge.
	$LLF < 1.60$	-	-	**HV is not permitted.**
Notes and Considerations for Category A: A1) DLA reduction, in other words limiting maximum speed to 10 km/h, is only recommended for emergency vehicles and school buses in rural low-volume traffic roads. A2) This is strictly for exceptional circumstances, which shall be considered for vehicle passage on roads with very low traffic, subject to the approval of PBSE.				
Category B: Volumetric	$1.60 \leq LLF$	1.40	-	**HV is permitted without condition.**
	$1.60 \leq LLF$	1.1 (B1)	-	i. Vehicle to travel along the bridge at a maximum of 10km/h with no sudden braking or acceleration. ii. Vehicle to enrol in IAP or TMA. iii. Vehicle to be fitted with an OBM system or use a weighbridge.
	$1.60 \leq LLF$	1.1 (B2)	1.8 (B2)	i. Vehicle to travel along the bridge at a maximum of 10km/h with no sudden braking or acceleration. ii. Vehicle to enrol in IAP or TMA. iii. Vehicle to be fitted with an OBM system or use a weighbridge. iv. Vehicle to travel over two lanes. v. Vehicle to travel in centre of lanes in direction of travel. vi. No other vehicles to be permitted on the bridge.
	$LLF < 1.60$	-	-	**HV is not permitted.**
Notes and Considerations for Category B: B1) DLA reduction, in other words limiting maximum speed to 10 km/h, is only recommended for emergency cases in rural low-volume traffic roads. B2) This is strictly for exceptional circumstances, which shall be considered for vehicle passage on roads with very low traffic, subject to the approval of PBSE.				

Requested Vehicle	LLF	"1 + DLA"	ALF	Conditions
Category C: Crane (C1)	$1.60 \leq LLF$	1.40	-	**HV is permitted without condition.**
	$1.50 \leq LLF < 1.60$	1.4	-	i. Crane to enrol in IAP or TMA. ii. Crane is to be equipped with OBM system.
	$1.50 \leq LLF < 1.60$	1.1	-	i. Crane to enrol in IAP or TMA. ii. Crane is to be equipped with OBM system. iii. Crane to travel along the bridge at a maximum of 10km/h with no sudden braking or acceleration.
	$LLF = 1.50$	1.1	1.8	i. Crane to enrol in IAP or TMA. ii. Crane is to be equipped with OBM system. iii. Crane to travel along the bridge at a maximum of 10km/h with no sudden braking or acceleration. iv. Crane to travel in the centre of the bridge. v. Crane is to be escorted to traveling over two lanes. vi. Crane to travel in the centre of lanes in the direction of travel. vii. No other vehicles to be permitted on bridge. ***Note**: It is highly recommended to engage traffic control and/or police escort to meet above conditions.*
	$LLF < 1.50$	-	-	**Crane is not permitted.**
Notes and Considerations for Category C: C1) Consideration should be given to Crane assessment as wheel-concentrated load is significantly high, which requires a proper assessment of the deck system punching shear.				
Category D: OSOM, Heavy Load Platform, Or Special Purpose Vehicle (SPV)(D1)	$1.50 \leq LLF$	1.40	-	**HV is permitted without condition.**
	$LLF = 1.50$	1.1	1.8	i. Vehicle to enrol in IAP or TMA. ii. Vehicle to travel along the bridge at a maximum of 10km/h with no sudden braking or acceleration. iii. Vehicle is to be escorted for traveling over two lanes. iv. Vehicle to travel in centre of lanes in direction of travel. v. No other vehicles to be allowed on bridge. ***Note**: It is highly recommended to engage traffic control and/or police escort to meet above conditions.*
	$LLF < 1.50$	-	-	**HV is not permitted.**
Notes and Considerations for Category D: D1) As per definition provided in NHVR portal, a Special Purpose Vehicle (SPV) means: • a motor vehicle or trailer, other than an agricultural vehicle or a tow truck, built for a purpose other than transporting goods by road; or • a concrete pump or fire truck.				

Chapter 6 Level Crossing Assessment

C6-1 Introduction

Level crossings represent one of the highest safety risks due to the direct interaction between rail vehicles, road vehicles and the potential for serious injury or fatalities in the event of an incident.

Currently there are more than 2,090 existing level crossings across the operational and non-operational CRN network that are classified to provide access to road vehicles.

The risk profile at each of these crossings is variable and dependant on a number of key factors which must be considered during the assessment of heavy vehicle applications, including but not limited to:

- Level Crossing configuration and control/s (i.e. active, passive, service)
- Rail Traffic (i.e. type, expected frequency and volume)
- Road Classification (i.e. State highway, main road, secondary road, local road)
- Road Traffic (i.e. vehicle type, volume, speed, road classification)
- Road/Rail Interface (i.e. road/rail geometry, potential for 'short-stacking')
- Sighting Distance standards compliance (i.e. AS1742-2016, CRN CS 520, CRN CM 521)
- Sighting Distance constraints (i.e. topography, structures, vegetation)

With a significant increase in freight demand in NSW, heavy vehicle access requests have significantly increased and is projected to increase further into the future. In addition, many of the existing level crossings were designed and constructed adopting a 'design vehicle' which was deemed appropriate at that particular time. However, due to the implementation of larger and heavier vehicles across the NSW road network heavy vehicle configurations can often exceed the applicable 'design vehicle' and therefore require assessment.

UGLRL has developed this level crossing assessment procedure to manage and authorise heavy vehicle access over CRN level crossings to further mitigate the associated safety risks.

C6-2 Responsibilities

The Assessor is responsible for the assessment of third-party heavy vehicle access requests. When required the Assessor also liaises with various stakeholders to obtain information and technical advice to inform the assessment, including but not limited to the following:

- Heavy Vehicle Coordinator
- Principal Signalling Engineer (i.e. active level crossings)
- Risk and Assurance Manager (i.e. level crossing history and risk data, ALCAM)
- TfNSW (i.e. Road Access Freight Branch)
- NHVR
- Third-party Heavy Vehicle applicants and operators

C6-3 Level Crossing Assessment Process

C6-3.1 Pre-Assessment Requirements

The Heavy Vehicle Coordinator refers applications via the CRN Heavy Vehicle Portal to the Assessor when level crossings are applicable. Applications for assessment may include passive level crossings only, active level crossings only or a combination of both passive and active level crossings.

Following referral from the Heavy Vehicle Coordinator, the Assessor shall review the level crossing information (i.e. Asset ID, Road Name/Suburb and Asset type) is correct and in accordance with the AR174 report and HxGN data.

The Assessor should, for all applicable level crossings, source and review the following documents and related information which is utilised in the assessment phase:

- CRN Heavy Vehicle Portal (i.e. application documents, NHVR permit, traffic management plan)
- AR174 - Level Crossing Sighting Assessment Summary
- NHVR National Network Map (i.e. NSW)
- Aerial Imagery (i.e. Google Maps, Six Maps, CRN Xerra LIDAR)
- CRN Level Crossing Sighting Distance calculator
- HxGN (UGLRL asset management database)

C6-3.2 Passive and Active Level Crossings Assessment

The assessment methodology for passive and active level crossings differs due to inherent variability in the implemented controls, available sighting distances, site specific conditions, existing constraints and risk profile.

The assessment of passive and active level crossings is to be undertaken by the Assessor in accordance with the following procedure:

- Review the status and class of the application (i.e. Class 1, Class 2, Class 3).

  As per the Heavy Vehicle National Law (HVNL):

  'Restricted Access Vehicles (RAV) include Class 1, 2 or 3 vehicles that operate under a notice or permit and vehicles operating under higher mass limits (HML) that have restrictions on the parts of the road network they can access'.

- Review and confirm the authorised heavy vehicle types permitted as outlined in the NHVR National Network Map (i.e. refer specifically the NSW Restricted Access Vehicles and Road Trains Maps)

  (https://maps.nhvr.gov.au/?networkLayerContext=NATIONAL_MAP&view=Category&exemptionSetId=-2)

- Review the AR174 report for the 'design vehicle', current sighting distances, 'design vehicle' calculation parameters and related level crossing compliance information.
- If the subject heavy vehicle, based on key parameters, including but not limited to heavy vehicle's class, configuration, type and length, is deemed:

(a) equivalent to or less than the approved vehicles outlined in the NHVR National Network Maps AND also the 'design vehicle' specified in the AR 174 report.

or alternatively,

(b) is not an approved vehicle as specified in the NHVR National Network Maps BUT is equivalent to or less than 'design vehicle' specified in the AR 174 report.

AND the uniform rate of vehicle acceleration and rate of deceleration/coefficient of deceleration are not less than the adopted values for the 'design vehicle' and/or AS1742.7 Appendix D.

Passive and Active Level Crossings – as outlined in Table 5 the Assessor, may conditionally approve heavy vehicle access in accordance with the minimum standard conditions as outlined in Table 6.

Alternatively, if the uniform rate of vehicle acceleration and rate of deceleration/coefficient of deceleration are less than the adopted values for the current 'design vehicle' calculations and/or the minimum values outlined in AS1742.7 Appendix D.

Passive and Active Level Crossings – as outlined in Table 5 the Assessor shall undertake a new sighting distance compliance assessment using the applicable CRN Level Crossing calculator and the relevant heavy vehicle parameters (i.e. vehicle type, length, acceleration/deceleration). The Assessor, subject to the outcomes of this assessment, may:

- "Conditionally Approve" heavy vehicle access in accordance with Table 5 and subject to the minimum standard conditions as outlined in Table 6, or
- "Conditionally Approve" heavy vehicle access in accordance with Table 5 subject to the minimum standard conditions as outlined in Table 6 and include any additional controls and conditions (if required), or
- **Reject** heavy vehicle access if the risk cannot be satisfactorily be managed using all available controls.

- If the subject heavy vehicle, based on key parameters, including but not limited to heavy vehicle's class, configuration, type and length, is deemed:

(a) equivalent to or less than the approved vehicles as specified in the NHVR National Network Maps AND/OR exceeds the 'design vehicle' specified in the AR 174 report.

or alternatively,

(b) is not an approved vehicle as specified in the NHVR National Network Maps AND exceeds the 'design vehicle' specified in the AR174 report.

Passive Level Crossings – as outlined in Table 5 the Assessor shall undertake a new sighting distance compliance assessment using the applicable CRN Level Crossing calculator and the relevant heavy vehicle parameters (i.e. vehicle type, length, acceleration/deceleration). The Assessor, subject to the outcomes of this assessment, may:

- "Conditionally Approve" heavy vehicle access in accordance with Table 5 and subject to the minimum standard conditions as outlined in Table 6, or

- "Conditionally Approve" heavy vehicle access in accordance with Table 5 subject to the minimum standard conditions as outlined in Table 6 and include any additional controls and conditions (if required), or
- **Reject** heavy vehicle access if the risk cannot be satisfactorily be managed using all available controls.

Active Level Crossings - the Assessor shall consult with the Principal Signalling Engineer to review and assess the existing signalling configuration and jointly determine suitable controls and conditions to facilitate conditionally approved access (where possible).

Table 5- Heavy Vehicle Level Crossing Assessment

Heavy Vehicle length in comparison to the AR174 level crossing 'design vehicle' or maximum NHVR approved vehicle length	Acceleration Rate comparing to AR174 'design vehicle' rate	Deceleration Rate in comparison with the AR174 'design vehicle' rate	Level Crossing Control Type	Action to be undertaken by the Assessor	Approval Conditions and Restrictions
Shorter	Equivalent or greater acceleration rate	Equivalent or greater deceleration rate/coefficient of deceleration	Stop	Conditionally approve access and apply the **Standard Conditional Approval;** (including ***Emergency Only*** approval conditions)	> Refer Table 6 for further details
			Give Way		
		Lower deceleration rate/coefficient of deceleration	Stop		
			Give Way	Undertake new sighting distance assessment. If insufficient sighting distances are available, reject heavy vehicle access **or** alternatively where acceptable to do so conditionally approve access and apply the "**Standard Conditional Approval"** (including ***Emergency Only*** approval conditions) **and** additional controls and restrictions as required.	> Consider the feasibility and safety risks of reducing the speed of the heavy vehicle on approach to the level crossing. > Refer Table 6 for further details
Shorter	Slower acceleration rate	Equivalent or greater deceleration rate/coefficient of deceleration	Stop	Undertake new sighting distance assessment. If insufficient sighting distances are available, reject heavy vehicle access **or** alternatively where acceptable to do so conditionally approve access and apply either the "**Standard Conditional Approval"** (including ***Emergency Only*** approval conditions **and** additional controls and restrictions as required , or **Standard Conditional Approval** (including ***Stop and Report*** approval conditions **and** additional controls and restrictions as required	> Consider implementing Heavy Vehicle Stop and Report procedure. > (Note: typically applicable to short term higher risk Class 1 OSOM and Class 3 applications) > Consider the feasibility of traffic control and/or a rail protection officer to manage rail traffic (Note: typically applicable to short term higher risk Class 1 OSOM and Class 3 applications) > Refer Table 6 for further details
			Give Way		
		Lower deceleration rate/coefficient of deceleration	Stop		
			Give Way		

Heavy Vehicle length in comparison to the AR174 level crossing 'design vehicle' or maximum NHVR approved vehicle length	Acceleration Rate comparing to AR174 'design vehicle' rate	Deceleration Rate in comparison with the AR174 'design vehicle' rate	Level Crossing Control Type	Action to be undertaken by the Assessor	Approval Conditions and Restrictions
Longer	Equivalent or greater acceleration rate	Equivalent or greater deceleration rate/coefficient of deceleration	Stop	Undertake new sighting distance assessment. If insufficient sighting distances are available, reject heavy vehicle access **or** alternatively where acceptable to do so conditionally approve access and apply either the **Standard Conditional Approval** (including ***Emergency Only*** approval conditions) **and** additional controls and restrictions as required, or **Standard Conditional Approval** (including ***Stop and Report*** approval conditions) **and** additional controls and restrictions as required	> Consider implementing Heavy Vehicle Stop and Report procedure. > (Note: typically applicable to short term higher risk Class 1 OSOM and Class 3 applications) > Consider the feasibility of traffic control and/or a rail protection officer to manage rail traffic (Note: typically more suitable to Class 1 OSOM and Class 3 applications) > Refer Table 6 for further details
			Give Way		
		Lower deceleration rate/coefficient of deceleration	Stop		
			Give Way		
	Slower acceleration rate	Equivalent or greater deceleration rate/coefficient of deceleration	Stop		
			Give Way		
		Lower deceleration rate/coefficient of deceleration	Stop		
			Give Way		

Table 6- Minimum Standard Approval Conditions – Level Crossing Assets

Heavy Vehicle NHVR Class	Level Crossing Asset Type/ Rail Line Classification	Approval Condition Classification	Central West Standard Condition (applied to each level crossing asset)	North West Standard Condition (applied to each level crossing asset)	South West Standard Condition (applied to each level crossing asset)
Class 1,2,3	Active Level Crossing/ Operational & Non-Operational lines	**Standard Conditional Approval** (including ***Emergency Only*** approval conditions)	• *Obey all signal warnings and advanced warning signs in relation to the actively protected level crossing.* • *Avoid stopping on approach to the crossing where possible.* • *When it ok to traverse the active crossing, do so at a constant speed and do not stop on the crossing.* • *Refer also **UGLRL Approval Conditions*** outlined below*: **Emergency Contact Details Only:** **UGLRL Network Control** **(Central West Network Control) Contact Numbers:** (02) 4028 9544 (Emergency Call-Central West Network Control) or 1800 547 276 (All Areas-Emergency Call)	• *Obey all signal warnings and advanced warning signs in relation to the actively protected level crossing.* • *Avoid stopping on approach to the crossing where possible.* • *When it ok to traverse the active crossing, do so at a constant speed and do not stop on the crossing.* • *Refer also **UGLRL Approval Conditions*** outlined below*: **Emergency Contact Details Only:** **UGLRL Network Control** **(North West) Contact Numbers:** (02) 4028 9541 (Emergency Call-North West Network Control) or 1800 547 276 (All Areas-Emergency Call)	• *Obey all signal warnings and advanced warning signs in relation to the actively protected level crossing.* • *Avoid stopping on approach to the crossing where possible.* • *When it ok to traverse the active crossing, do so at a constant speed and do not stop on the crossing.* • *Refer also **UGLRL Approval Conditions*** outlined below*: **Emergency Contact Details Only:** **UGLRL Network Control** **(South West) Contact Numbers:** (02) 4028 9542 (Emergency Call-South West Network Control) or 1800 547 276 (All Areas-Emergency Call)

Heavy Vehicle NHVR Class	Level Crossing Asset Type/ Rail Line Classification	Approval Condition Classification	Central West Standard Condition (applied to each level crossing asset)	North West Standard Condition (applied to each level crossing asset)	South West Standard Condition (applied to each level crossing asset)
Class 1,3	Active, Passive Stop and Passive Give Way Level Crossings / Operational Line	**Standard Conditional Approval** (including ***Stop and Report*** approval conditions)	• *Obey all signals, advanced warnings and signs in relation to the applicable active or passive level crossing.* • *After receiving clearance to proceed travel at a consistent low speed and do not stop on or across the crossing.* • *Refer also **UGLRL Approval Conditions* - Stop and Report procedure** outlined below:* **Stop and Report Contact Details (refer below approval conditions for further details):** UGLRL Network Control (Central West) Contact Numbers: (02) 4028 9504 (Normal Call) 1800 427 198 (Public Free Call) **Emergency Only Contact Details:** UGLRL Network Control (Central West) Contact Numbers: (02) 4028 9544 (Emergency Call-Central West Network Control) or 1800 547 276 (All Areas-Emergency Call)	• *Obey all signals, advanced warnings and signs in relation to the applicable active or passive level crossing.* • *After receiving clearance to proceed travel at a consistent low speed and do not stop on or across the crossing.* • *Refer also **UGLRL Approval Conditions* - Stop and Report procedure** outlined below:* **Stop and Report Contact Details (refer below approval conditions for further details):** UGLRL Network Control (North West) Contact Numbers: (02) 4028 9501 (Normal Call) 1800 643 373 (Public Free Call) **Emergency Only Contact Details:** UGLRL Network Control (North West) Contact Numbers: (02) 4028 9541 (Emergency Call-North West Network Control) or 1800 547 276 (All Areas-Emergency Call)	• *Obey all signals, advanced warnings and signs in relation to the applicable active or passive level crossing.* • *After receiving clearance to proceed travel at a consistent low speed and do not stop on or across the crossing.* • *Refer also **UGLRL Approval Conditions* - Stop and Report procedure** outlined below:* **Stop and Report Contact Details (refer below approval conditions for further details):** UGLRL Network Control (South West) Contact Numbers: (02) 4028 9502 (Normal Call) 1800 021 914 (Public Free Call) **Emergency Only Contact Details:** UGLRL Network Control (South West) Contact Numbers: (02) 4028 9542 (Emergency Call-South West Network Control) or 1800 547 276 (All Areas-Emergency Call)

Heavy Vehicle NHVR Class	Level Crossing Asset Type/ Rail Line Classification	Approval Condition Classification	Central West Standard Condition (applied to each level crossing asset)	North West Standard Condition (applied to each level crossing asset)	South West Standard Condition (applied to each level crossing asset)
Class 1,2,3	Passive Stop and Passive Give Way Level Crossing/ Operational Line	**Standard Conditional Approval** (including ***Emergency Only*** approval conditions)	• *Obey all advanced warnings and signs in relation to the passive level crossing.* • *Look for oncoming trains in both directions and only proceed to drive across the level crossing when safe to do so.* • *Do not stop on or across the level crossing.* • *Refer also **UGLRL Approval Conditions*** outlined below:* **Emergency Only Contact Details:** UGLRL Network Control (Central West) Contact Numbers: (02) 4028 9544 (Emergency Call-Central West Network Control) or 1800 547 276 (All Areas-Emergency Call)	• *Obey all advanced warnings and signs in relation to the passive level crossing.* • *Look for oncoming trains in both directions and only proceed to drive across the level crossing when safe to do so.* • *Do not stop on or across the level crossing.* • *Refer also **UGLRL Approval Conditions*** outlined below:* **Emergency Only Contact Details:** UGLRL Network Control (North West) Contact Numbers: (02) 4028 9541 (Emergency Call-North West Network Control) or 1800 547 276 (All Areas-Emergency Call)	• *Obey all advanced warnings and signs in relation to the passive level crossing.* • *Look for oncoming trains in both directions and only proceed to drive across the level crossing when safe to do so.* • *Do not stop on or across the level crossing.* • *Refer also **UGLRL Approval Conditions*** outlined below :* **Emergency Only Contact Details:** UGLRL Network Control (South West) Contact Numbers: (02) 4028 9542 (Emergency Call-North West Network Control) or 1800 547 276 (All Areas-Emergency Call)
Class 1,2,3	Passive Stop and Passive Give Way Level Crossing/ Non-Operational Line	**Standard Approval**	e.g. Non-operational W42 Tarana to Oberon line	e.g. Non-operational W50 Binnaway to Gwabegar line	e.g. Non-operational S84 Narrandera to Tocumwal line

Table 7- Additional Standard Approval Conditions – Heavy Vehicle Form

Heavy Vehicle NHVR Class	Level Crossing Asset Type/ Rail Line Classification	Approval Condition Classification	Standard Conditions (to be applied to Heavy Vehicle Form)
Class 1,2,3	Active, Passive Stop and Passive Give Way Level Crossings/ Operational Line	**Standard Conditional Approval** (including ***Emergency Only*** approval conditions)	**UGLRL Level Crossing Approval Conditions*** This level crossing access request for the abovementioned Class 2 vehicle has been assessed and will require the following **Emergency Only Report Procedure** to be followed in the event of an incident or damage to rail infrastructure at the level crossings denoted above: If for some reason the vehicle breaks down or becomes stranded on/adjacent to the level crossing and/or damage is caused to the level crossing or other UGLRL infrastructure, the first thing that must be done is to phone the relevant **UGLRL Network Control Emergency Only** contact number/s provided in the table above. When reporting an emergency to UGLRL Network Control the vehicle operator/supervisor **MUST** follow the correct protocols when communicating. They must: - identify themselves and their company. - provide the exact location (refer ***Level Crossing Asset Number/ID, Kilometrage KM and Road Name/Suburb as*** denoted in the table above), - advise the relevant ***application number*** shown in bold at the top of this letter. - provide a clear and concise description of the emergency.

Heavy Vehicle NHVR Class	Level Crossing Asset Type/ Rail Line Classification	Approval Condition Classification	Standard Conditions (to be applied to Heavy Vehicle Form)
Class 1,3	Active, Passive Stop and Passive Give Way Level Crossings/ Operational Line	**Standard Conditional Approval** (including ***Stop and Report*** approval conditions)	**UGLRL Level Crossing Approval Conditions*** The proposed vehicle journey and Class 1 application has been assessed and will require the following **Level Crossing - Stop and Report procedure** to be followed: - Stop and Report procedure involves stopping before the level crossing and reporting to UGLRL Network Control using the relevant priority contact number provided above, to obtain authority to traverse the level crossing. - When reporting to UGLRL Network Control the operator/supervisor **MUST** follow the correct protocols when communicating. They must identify themselves and their company, provide the exact location (refer ***Level Crossing Asset Number/ID, Kilometrage KM and Road Name/Suburb as*** denoted in the table above), and also advise the relevant ***application number*** shown in bold at the top of this letter. - A report must be made to UGLRL Network Control **immediately before entering and immediately after clearing** the level crossing. - Traverse UGLRL controlled level crossings on sealed roads at a constant speed and do not stop on the crossing. - If for some reason the vehicle breaks down or becomes stranded on/adjacent to the level crossing and/or damage is caused to the level crossing or other UGLRL infrastructure, the first thing that must be done is to phone the relevant **UGLRL Network Control Emergency Only** contact number/s provided in the table above or listed below. - When reporting an emergency to UGLRL Network Control the operator/supervisor **MUST** follow the correct protocols when communicating. They must identify themselves and their company, provide the exact location (refer ***Level Crossing Asset Number/ID, Kilometrage KM and Road Name/Suburb as*** denoted in the table above), advise the relevant ***application number*** shown in bold at the top of this letter and provide a clear and concise description of the emergency.

Where as a result of the abovementioned assessment process a passive level crossing is deemed to have sufficient sighting distance to safely accommodate a larger vehicle type/class than the current 'design vehicle', the Assessor may give consideration to updating the 'design vehicle' in HxGN via the UGLRL ACR process. It should be noted that in addition to the 'design vehicle' type and specifications the minimum sighting distances.

Chapter 7 Post - Assessment Procedure

C7-1 Permit Issue

After the completion of all assessments and reviews, i.e. the completion of all technical assessments explained in chapters 4 to 6, the following actions shall be taken to issue the Heavy Vehicle permit:

- The Assessors updates the Heavy Vehicle permit to provide the status of assessed assets (i.e. “Approved”; “Conditionally Approved”; “Rejected”) and corresponding recommendations and/or restrictions that is required to be followed and obeyed by the applicant.
- The Assessors uploads the completed permit into the CRN Heavy Vehicle portal, and notify the Approver to undertake the final review of the permit.
- The Approver undertakes the final review with the following considerations:
    - All the required fields in the permit are filled appropriately.
    - The expiry date of the permit is determined based on the NHVR Class and other risk factors (such as asset condition, loading configuration, imposed conditions, etc.).
    - The Structures Approver is responsible for the final review and approval of the applications that include bridges only or both level crossing and bridge assets.
    - The Level Crossings Approver is responsible for the final review and approval of the level crossing assessments for applications that include level crossings only.
- The Approver signs the Heavy Vehicle permit, uploads it into the CRN Heavy Vehicle Portal, and notifies the Heavy Vehicle Coordinator to submit the permit to the applicant.
- The Heavy Vehicle Coordinator issues the permit to the applicant.
- The Heavy Vehicle Coordinator opens the permit to check that no information is missing, including signature, expiry date and applicant information.
- The Heavy Vehicle Coordinator saves the PDF version of the ‘permit’ and emails to the applicant.
- The Heavy Vehicle Coordinator updates the status of the application in the CRN Heavy Vehicle Portal as follows:
    - Progress field should be changed from ‘Ready to Issue’ to ‘Completed’.
    - Completed Date field should be updated to the date the ‘permit’ is issued to the applicant; and
    - Approval Decision filed should be updated to ‘Approved, Conditionally Approved or Rejected’.

C7-2 Permit Renewal

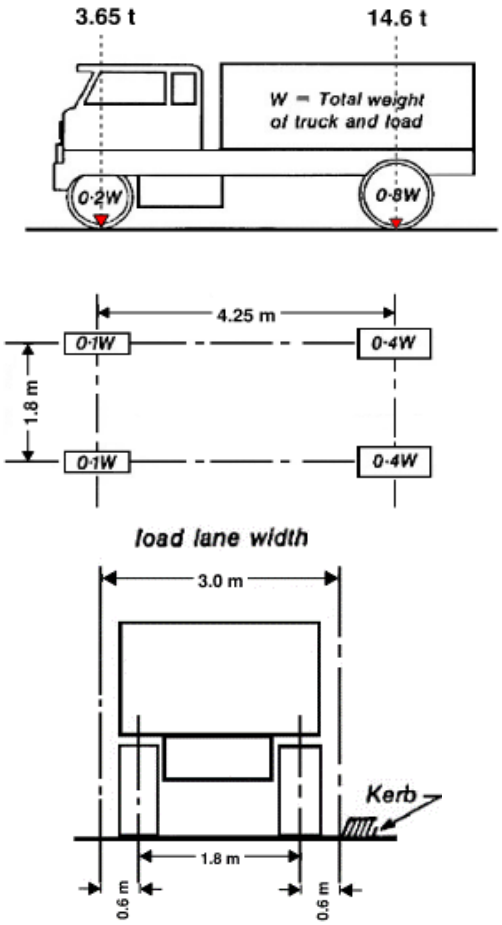
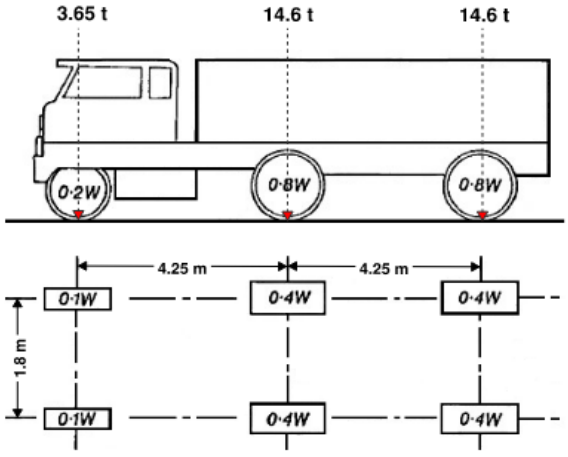
It is the responsibility of the applicant to reach out to UGLRL CRN and reapply for ‘Expiring soon’ or ‘Expired’ permits.

C7-3 Change in Condition

For active permits, which have not reached their expiry date, where UGLRL CRN are made aware of a condition that impacts the capacity of an asset and/or the public safety, which alters the approval or conditions of the approval, the Approver or delegate is to ensure a contact is made with the applicant through the Heavy Vehicle Coordinator to modify the condition(s) or rescind the permit.

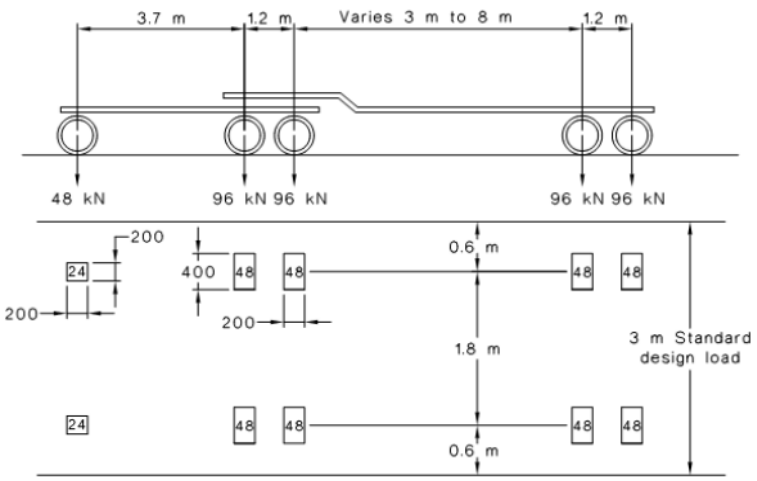
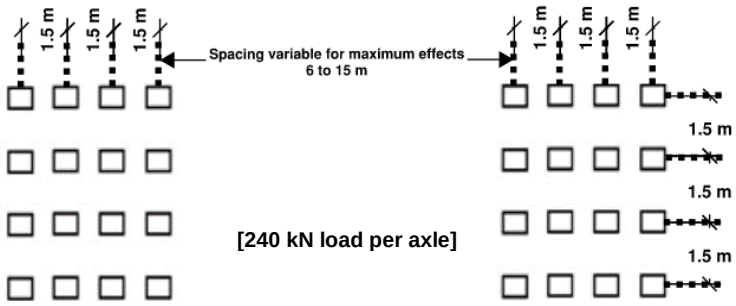
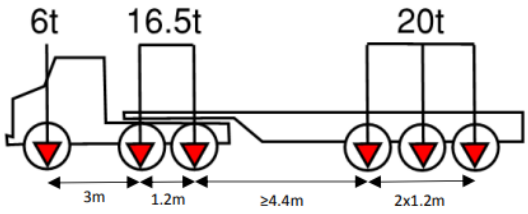
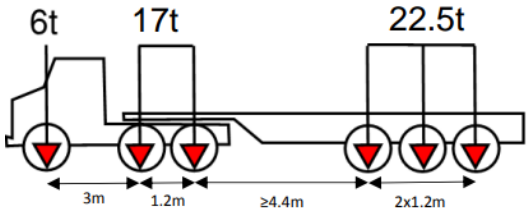
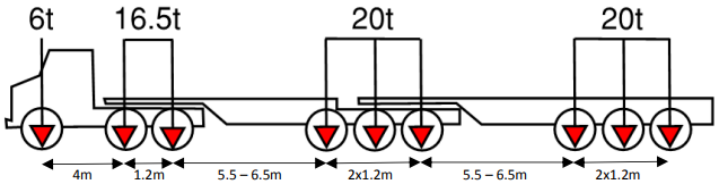
Appendix 1 Typical Load Configuration of Common Design Heavy Vehicles

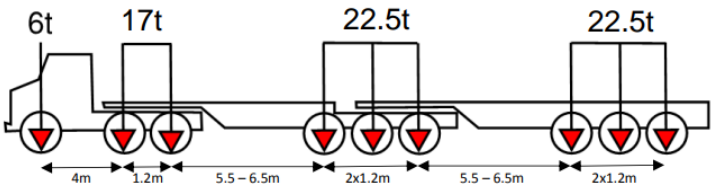
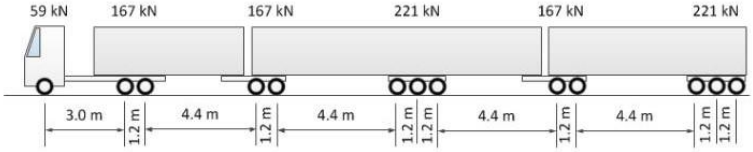
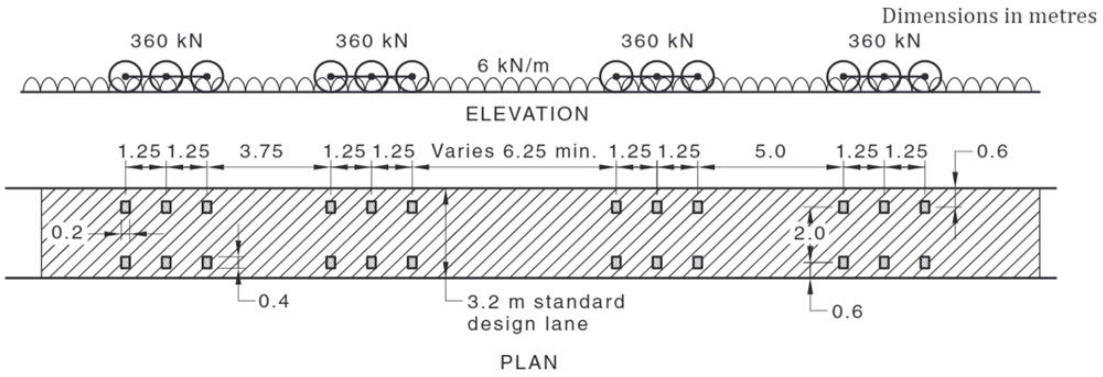
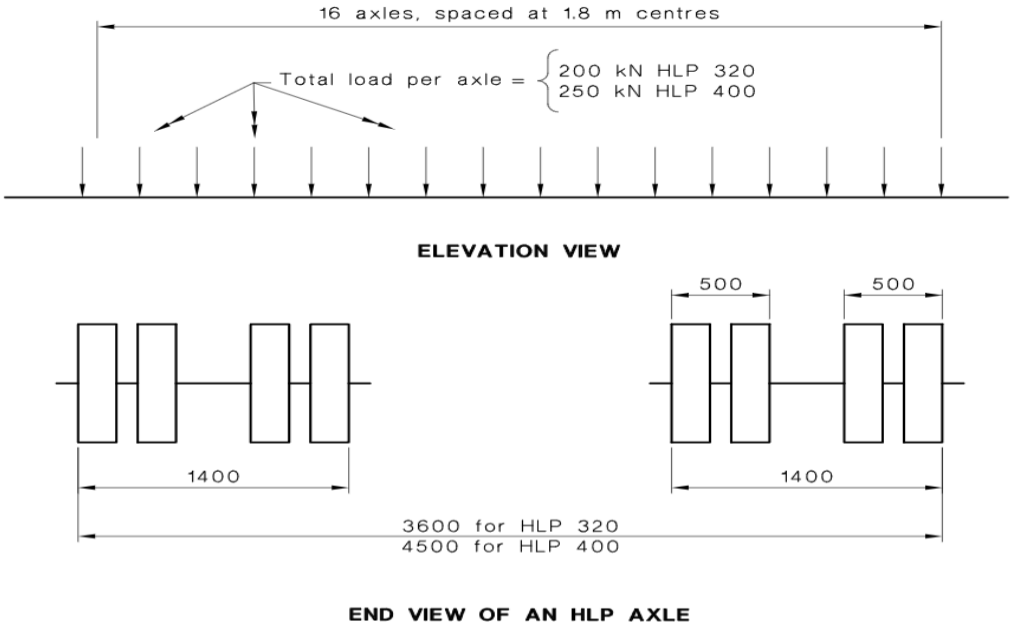
Typical axial loading and spacing of common design vehicles in Australia is presented in below table based on Australian and CRN standards as well as the industry best practices.

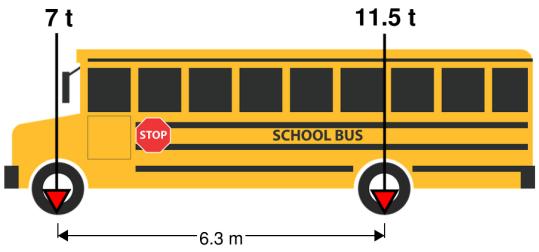
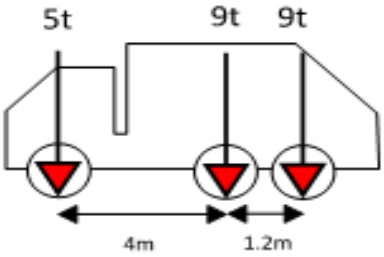
Design Vehicle	Axial Loading and Spacing	Reference
M18		NAASRA (1970)
MS18		NAASRA (1970)

Notes (for M18 and MS18):

1. Loading and dimensions presented above are converted from imperial units provided in the original reference document. Therefore, there are some slight differences between the metric and imperial values.
2. Refer to the Reference design code for details regarding front and rear wheels dimensions.
3. The cross section of both trucks is the same.

Design Vehicle	Axial Loading and Spacing	Reference
T44		NAASRA (1976)
Abnormal (196t)		NAASRA (1976)
Semi-Trailer GML (42.5t)		NHVR Vehicle Configuration Database
Semi-Trailer HML (45.5t)		NHVR Vehicle Configuration Database
B-Double GML (62.5t)		NHVR Vehicle Configuration Database

Design Vehicle	Axial Loading and Spacing	Reference
B-Double HML (68t)		NHVR Vehicle Configuration Database
Road Train		Austroads 2014
M1600	Refer below figure	AS5100.2:2017
		
HLP320 and HLP400	Refer below figure	AS5100.7:2004
		

Design Vehicle	Axial Loading and Spacing	Reference
School Bus		Refer Note (1)
Garbage Truck		Refer Note (1)

Notes:

(1) The axial loading and spacing of these vehicles are determined based on the experiences in past CRN projects. It is preferable to seek vehicle data from an applicant, and use these vehicle arrangements in the absence of vehicle data.

Appendix 2 Location and Vertical Clearances of CRN Underbridges Over Roads

Following table presents the location and vertical clearances of CRN Underbridges over roads. The vertical clearances dataset in this section is intended as a general reference source and provided for information purposes only. Information, data and advice here is provided on the basis that the heavy vehicle operators and drivers are responsible for assessing the relevance and accuracy of its content. UGLRL make no representations, express or implied, as to the accuracy, currency or usefulness of the presented information.

UGLRL accept no liability to any person for the information, data or advice (or the use of such information, data or advice) which is provided in this document.

It is the responsibility of the freight operator and heavy vehicle driver to know the exact height and clearances of their heavy vehicles abide by the clearance requirements.

Asset ID	Description	X Coordinate	Y Coordinate	Clearance (m)
UBN00438B	Road passing between Werris Creek Road and Warral Road	-31.199277	150.832767	2.2
UBN00453A.1	Passing over Carter St	-31.088935	150.918185	3.66
UBN00453A.2	Passing over Viaduct Way	-31.088935	150.918185	3.66
UBN00453A.3	Road passing over Ebsworth St	-31.088935	150.918185	5.3
UBN00454C	Passing over Peel St	-31.084752	150.923303	4.26
UBN00454D	Passing over Marius St/Macquarie St. existing sacrificial protection present	-31.084752	150.923303	3.3
UBN00454B	Passing over Solander St	-31.085073	150.922909	4.5
UBN00456A	Passing over Murray St	-31.096243	150.939191	4.5
UBN00467A	Passing over street off Chaffeys Ln	-31.089192	151.021416	2.2
UBN00468A	Passing over road connecting Acacia Rd and opposite road	-31.080304	151.027418	2
UBN00510C	Dirt road adjacent to river	-30.967945	151.347813	3.5
UBN00513A	Off road	-30.955021	151.373041	2.3
UBN00555A	Passing over Barleyfields Rd	-30.638698	151.507991	5.56
UBN80600B	Off road, along Kamilaroi Hwy	-30.225753	149.420618	TBC
UBS50286A	Off road	-35.217731	149.503589	5
UBS50304A	HQJOC Acc Rd	-35.333673	149.383566	4.6
UBS50311B	Gravelly road passing through Caulvert Burbong Ave	-35.337132	149.318629	4.5
UBS50319A	Passing over Yass Road	-35.336722	149.241801	5
UBS50320A	Passing over dirt road. Appears to be industrial use	-35.341932	149.232488	3.87
UBS54328A	Passing over dirt road adjacent to Jerrabomberra Creek	-35.323093	149.160057	5
UBS80506A	Passing over dirt road	-34.829028	147.378269	3.5
UBS80559A	Passing over Pamandi Siding Rd	-34.745913	146.815714	2.2
UBS80587A	Passing over dirt road	-34.722535	146.535207	3.1

Asset ID	Description	X Coordinate	Y Coordinate	Clearance (m)
UBW00158B	Passing over Cooerwull Rd	-33.473999	150.130437	4.5
UBW00166A	Passing over Springvale Ln	-33.411326	150.1107	2.97
UBW00167A	Passing over Millers Rd	-33.403721	150.101916	2.9
UBW00168A	Passing over Castlereagh Hwy	-33.402532	150.094552	5.3
UBW00168C	Road not in use	-33.402477	150.094724	5.3
UBW00169A	Passing over dirt roads. Industrial area	-33.405515	150.083786	3.9
UBW00198B	Passing over Diamond Swamp Road	-33.523999	149.909290	4.1
UBW00215B	Passing over Tarana Rd	-33.509637	149.771317	3.6
UBW00221A	Dirt roads shown	-33.499503	149.733049	2.9
UBW00239C	Passing over Russell St	-33.423992	149.584834	4
UBW00284A	Passing over Newbridge Rd	-33.542919	149.292166	3.9
UBW00302A	Passing over Forest Reefs Rd	-33.447248	149.18092	3.7
UBW00374A	Passing over dirt road	-32.84641	149.089199	4.3
UBW00452A	Passing over dirt road	-32.290738	148.696973	4.5
UBW20384A	Passing over road, industrial use	-33.186846	148.699389	4.2
UBW61475A	Passing over Sandy Creek	-32.135993	148.642584	3.9
UBS50255A	Passing next to Bongaralaby Creek, road adjacent	-35.011029	149.646857	2.8

Appendix 3 Design Vehicles of Australian Bridge Codes

The bridge design codes that have been published in Australia throughout 20 and 21 centuries provided different design vehicles as explained in "*Research Report AP-R466-14, Austroads 2014*":

1948–76 NAASRA Highway Bridge Design Specification

After 1947 the bridge design loading was unified across Australia based on the American Association of State Highway Officials (AASHO) design codes. This design code includes two main vehicles, the H20 and HS20 which also provided for overload conditions. These were converted to the metric system in 1970 and were then referred to as M18 and MS18 respectively.

1976 NAASRA Bridge Design Specification

In 1976 the Bridge Design Specifications was released, introducing three new loading vehicles, the A14, T44 and L44. They represented a 14-tonne axle, a 44-tonne truck, and a lane traffic simulator, respectively. Also included was the abnormal vehicle, a 196 tonne 8 axle vehicle that would likely occupy two lanes.

1992 Austroads Bridge Design Code

The 1992 Bridge Design Code focused on converting the 1976 Bridge Design Specification to the limit states approach. The code also removed the A14 load and the abnormal vehicle load from the 1976 code but introduced the W7 wheel load and the HLP320 and HLP400 load cases. Modifications to the L44 load also occurred.

2004 Australian Standard 5100 Bridge Design Set

The 2004 Australian Standard for Bridge Design introduced two new vehicle load cases, the S1600 and M1600 loadings, which both simulate trailing trucks. However, S1600 represents stationary traffic conditions, and M1600 simulates moving traffic conditions. The code also provided provisions for the specification of HLP320 and HLP400 load cases.

In summary, there are 12 historic design live load configurations for live load capacity assessment as listed below:

- *H20-44 (M18)*
- *HS20-44 (MS18)*
- *H20-44 overload*
- *HS20-44 overload*
- *T44 truck load*
- *1976 L44 lane load*
- *1976 abnormal vehicle*
- *1992 L44 lane load (Ultimate Limit States)*
- *1992 T44 truck load (Ultimate Limit States)*
- *HLP320 (Ultimate Limit States)*
- *HLP400 (Ultimate Limit States)*
- *S1600 (Ultimate Limit States)*
- *M1600 (Ultimate Limit States)*

Appendix 4 Bibliography

1) Review of Axle Spacing Mass Schedules and Future Framework for Assessment of Heavy Vehicle Access Applications, Research Report AP-R466-14, Austroads 2014.
2) Higher Order Bridge Assessment in Australia, Research Report AP-R582-18, Austroads 2018.
3) Bridge Assessment: A comparison of approaches by bridge engineers and the Performance Based Standards Scheme Research Report AP-C103-19, Austroads 2019.
4) Bridge manual SP/M/022, Waka Kotahi NZ Transport Agency, 2013.
5) TfNSW Risk Criteria for External Organisations, TS 04982:1.0, T MU MD 20002 ST, 23 August 2024.
6) UGL Regional Linx Risk Management Framework, CRN-FRA-RLS-459032646-317, 17 December 2021.
7) NHVR online portal: https://www.nhvr.gov.au/
8) TfNSW online portal: https://www.transport.nsw.gov.au/