UGL REGIONAL LINX

Overbridges and Footbridges

CRN-STD-CVL-713026361-2296

CRN CS 320

LINKING COMMUNITIES. CONNECTING CUSTOMERS.

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Document Control

Function	Position	Name	Date
Approver	A&E Manager	Lucio Favotto	30.01.2022

Revision	Issue Date	Revision Description
1.2	30.01.2022	UGLRL Operational Standards Template applied
2.0	30.01.2022	First approved and issued UGLRL version for issue to website

Summary of changes made from previous version

Section	Summary of change
All	This document is based on the previous rail infrastructure maintainer (RIM). Full revision history is available on request from UGLRL.

1 Purpose, scope and application

This Standard details design requirements for overbridges and footbridges on the Country Regional Network (CRN).

This Standard does not cover the load rating of overbridges and footbridges, which shall be undertaken in accordance with AS 5100.7 “Load rating of existing structures”.

Overbridges are defined as bridges over the track, carrying road vehicles or livestock, and may include provision for pedestrians. Footbridges are bridges over the track carrying pedestrian traffic only, and may be freestanding or combined with an overhead booking office and/or retail outlets.

2 References

2.1 Australian and international standards

AS 1085.1 - Railway Track Material Part 1: Steel Rails

AS 5100 - Bridge Design

Unless otherwise specified, all references relate to the latest standard versions, including amendments and relevant superseding standards.

2.2 CRN documents

CRN CS 100 Civil Technical Maintenance Plan

CRN CS 215 Transit Space

CRN CM 302 – Structures Examination

CRN CP 213 Trackside Signs

CRN CS 310 Underbridges”

CRN CP 301 Structures Construction

2.3 Other references

RTA Technical Direction TD 2002/RS02 “Policy for Safety Screening of Bridges”

3 Engineering authority

Design and selection of infrastructure detailed in this standard for use on the CRN may only be undertaken by persons who have been granted appropriate Engineering Authority by the Principal Track and Civil Engineer.

4 General requirements

4.1 Design standards

All overbridges and footbridges shall be designed to Australian Standard AS 5100 “Bridge design” and the requirements specified in this standard.

4.2 Existing structures

When renewing the substructure or superstructure on an existing overbridge or footbridge, the design shall comply with Section 4.1 and shall provide for the current and proposed future line usage and business requirements.

This includes widening or extending existing bridges, or infilling the median.

The stability, capacity and serviceability of an existing structure may be impacted when modifying an existing bridge. This may arise from changes to the load paths and load magnitudes and is to be taken into account during the design process.

Disabled access legislation and policies may require the retrofitting of easy access to existing bridges. The new work shall be integrated into the existing structure taking into consideration aesthetics, material types and thermal movements etc. of the structure as a whole.

Other modifications or improvements to an existing bridge must also take into account any repair work that should be undertaken that would be otherwise impeded by the new work.

4.3 Integrated designs

The design of each overbridge and footbridge shall be integrated taking into account all associated requirements such as service routes, signalling infrastructure, drainage and architectural treatments. Aesthetics shall be taken into account including proportions, details and finishes.

In locations that are vulnerable to vandalism and graffiti, appropriate measures shall be taken to prevent access to the adjoining rail infrastructure. Anti-graffiti paints should be specified in areas where there is a high risk of graffiti.

Overbridges and footbridges shall not be painted in safeworking colours of red, orange and green.

4.4 Approved materials

Approved construction materials for main structural elements are steel and concrete. Timber materials shall not be used as structural elements in the design of new overbridges and footbridges.

Masonry is approved for existing structures and for cladding of new structures where this is required in special circumstances such as for heritage reasons.

Specially engineered or laminated timber products may be used as structural elements in the repair of existing bridges, subject to the approval of the Principal Track and Civil Engineer.

4.5 Clearances

Horizontal and vertical clearances for new overbridges and footbridges and renewal of substructure or superstructure in existing bridges shall comply with CRN Engineering Standard CRN CS 215 “Transit Space”.

The design of overbridges and footbridges shall also provide clearances for safe places as detailed in Section 9 of this standard.

4.6 Earthworks

Earthworks associated with the approaches to overbridges and footbridges shall be designed in accordance with RTA specifications.

4.7 Provision for services

Provision may be required when designing overbridges or footbridges for accommodating services owned by CRN (e.g. low voltage, signalling, communications) or services owned by other authorities and utilities (e.g. telephone, water supply, sewer lines, power and gas).

The designer shall consider requests that may be received from other authorities for new services to be attached to a bridge. Special ducts shall be provided for both current and future services, where appropriate. Services shall be segregated where necessary, e.g. power and signalling.

The location and fixing of such service ducts shall be designed so that future access to the services for maintenance is facilitated, and access to the main structure for inspection and maintenance is not impeded.

Service ducts shall be provided within the structure (e.g. under footways), in preference to exposed service lines.

4.8 Safety

The design of overbridges and footbridges including the design of substructure or superstructure renewals shall take into account safety considerations for construction and maintenance personnel, and the future users of the structure.

Designs for overbridges and footbridges shall provide safe access for inspection and maintenance. This may include access steps, ladders, cages, walkways and fixing points.

4.9 Protection of the environment

The design of overbridges and footbridges including the replacement of components in existing structures shall take into account environmental impacts during construction and maintenance activities, with a view to minimising any impacts.

4.10 Heritage

Heritage considerations and classifications shall be observed in all overbridge and footbridge designs. This may have particular application in circumstances where an existing structure is being replaced or modified, or where a new structure is being proposed in the vicinity of existing heritage items.

4.11 Design procedure – new or infrequently used products

If any products specified in the design documentation can reasonably be deemed to be new or infrequently used, these must be identified by the designer and referred to the Principal Track and Civil Engineer for approval. The designer must be satisfied that the manufacturer/constructor/maintainer understands any special requirements/practices relating to the product prior to release of the design documentation.

4.12 Drawings

Construction drawings shall comply with UGLRL CRN standard procedures and formats, and shall detail the design loadings, horizontal and vertical clearances, and any other information that is relevant to ensuring that the new structure is constructed and maintained in accordance with the design.

4.13 Construction

Design documentation shall identify standards for construction, including construction methods, processes and materials.

CRN has a suite of technical specifications for construction of structures. The specifications are detailed in CRN Engineering Specification CRN CP 301 “Structures Construction” and shall be incorporated in the design and construction documentation of overbridges and footbridges.

Design documentation shall include relevant references for material testing and testing of welds.

The design of new overbridges and footbridges and the design of superstructure or substructure renewals shall take into account construction constraints, particularly under live operating conditions and track possession constraints.

4.14 Maintenance

The design of overbridges and footbridges including the design of superstructure or substructure renewals shall take into account the ability to access components for inspection and maintenance purposes.

Components, materials and finishes should be chosen to minimise future maintenance.

Maintenance requirements shall be specified in all design documentation for structures. Requirements shall include examination tasks and frequencies, damage limits, and repair standards. In most cases, the requirements of CRN Engineering Standard CRN CS 100 “Civil

Technical Maintenance Plan" and CRN Engineering Manual CRN CM 302 "Structures Examination" will apply. However site specific maintenance requirements may need to be provided.

4.15 Advertising signs

Design loadings for advertising signs shall be in accordance with relevant Australian Standards.

The bridge shall be assessed for the structural capacity to withstand the advertising sign design loadings.

Fixing details shall be in accordance with design codes and practices. They shall not impact on the structural integrity of the bridge. They shall only be made into existing structural members with the approval of the Principal Track and Civil Engineer. They shall not create an obstruction that causes water to pond or debris to accumulate on the bridge structure.

Fixings and ladders for the sign shall not impinge on the clear walking space of footbridges and pedestrian walkways.

Signs and fixings shall not prevent access for inspection and maintenance of the bridge, including the structure immediately behind the sign.

5 Design criteria

5.1 Overbridges

Designs shall comply with AS 5100. The relevant road authority and other involved parties shall be consulted in order to ascertain the proposed usage and loading requirements for the structure.

5.2 Footbridges

Designs including ramps and stepways shall comply with AS 5100 and other relevant Australian and CRN Standards.

Designs shall take into account dynamics associated with crowd loading from rail patrons and the general public at stations and at other locations, where required, based on usage.

5.3 Widening or extending existing bridges

Design loads for widening or extending existing bridges shall be as above, unless waivers have been approved by the Principal Track and Civil Engineer.

It may be permissible to design the extensions for a reduced traffic loading than that prescribed in AS 5100 if the live load design of the existing bridge structure is below AS 5100. However, overbridge extensions shall be designed for a minimum loading of T44. Designs for loading less than AS 5100 shall be approved by the road authority and the Principal Track and Civil Engineer.

5.4 Seismic loading

The class of bridge for seismic loading in accordance with AS 5100.2 Table 14.3.1 Bridge Earthquake Design Category is Type III, i.e. essential to post-earthquake recovery.

6 Bearings and deck joints

Bearings and deck joints shall be designed in accordance with AS 5100.4 "Bridge design, Part 4: Bearings and deck joints".

The design loads shall be in accordance with AS 5100.2 "Bridge design, Part 2: Design loads".

Bearings and joints shall be designed to provide sufficient access for the inspection, maintenance and replacement of the bearings and joints.

The minimum vertical distance between the underside of the main beams and the bearing shelf shall be 500mm.

Jacking points shall be provided on the bearing shelf.

7 Configuration requirements

Note: Approved non-standard configurations are documented in Appendix 1.

7.1 Stepways

Stepway riser and tread dimensions for footbridges shall be 150mm and 300mm respectively.

Stepway risers shall be closed in to prevent visibility from beneath the structure.

7.2 Barriers, safety screens and protection screens

7.2.1 Definitions

Barriers are defined as the fence or walls along the sides of overbridges and footbridges, installed to protect road vehicles, cyclists and pedestrians from falling over the edge of the bridge.

Protection screens are defined as screens installed on overbridges and footbridges to restrict objects from falling or being thrown onto the track below.

7.2.2 Barriers

Bridge barriers for new structures and where required as part of superstructure renewal shall be designed in accordance with AS 5100. The barriers provided above the rail corridor shall be at least medium performance level and should be subject to a risk assessment to determine whether a higher performance level is required.

The approach barriers to new, extended or refurbished overbridges and footbridges shall also comply with AS 5100.

Pedestrian barriers and balustrading for new structures, and where required as part of superstructure renewal shall be a minimum height of 1200mm.

Roll top mesh, chain wire mesh and wire strand parapets are not permitted on new bridges and shall be progressively replaced on existing structures.

7.2.3 Protection screens

Prevention of objects falling or being thrown from overbridges and footbridges shall be achieved by the provision of one of the protection measures listed in AS 5100, including full enclosure (footbridges), provision of solid opaque walls with a minimum height of 2.4 metres, or the provision of protection screens.

For the purposes of this section, the edge of the travelling lanes (refer to AS 5100) is Normal Structure Gauge as defined in CRN CS 215.

For new and existing overbridges and footbridges on the CRN network, the requirement for protection screens shall be assessed on the basis of a risk assessment. The assessment should include a review of incident data. Reference should be made to RTA Technical Direction TD 2002/RS02 “Policy for Safety Screening of Bridges” for guidance on the risk assessment.

Where required to be installed, protection screens shall be designed in accordance with AS 5100. The design should provide a balance between functionality, aesthetics, effectiveness and value for money, giving due consideration to the following factors:

- Safety for train users/operators: the ability of the screen to prevent objects from being thrown onto the track;
- General safety and train operation: the ability of the screen to prevent trespassers from climbing onto safety screens, thereby endangering their lives and impacting on train traffic;

- Pedestrian amenity: the ability of the screen material and design to provide adequate ventilation, suitable acoustics, light to the inside of the bridge, and views through the screen to the surrounding environment;
- Visual aesthetics: the likely visual impact of the screened bridge as viewed by people in the surrounding area;
- Sharp edges: the design shall minimise any exposed sharp edges on the pedestrian side;
- Modular construction: barrier screens should be designed to be modular, so that individual panels can be replaced;
- Costs: the likely construction and maintenance costs, including initial, ongoing, life span, vandal damage, and graffiti.

7.3 Drainage

A drainage system shall be provided on all overbridges and footbridges. The water shall be directed away from platforms and other CRN infrastructure and shall not discharge onto the rail corridor. The drainage system shall be cleanable. The minimum pipe size shall be 225mm diameter.

8 Miscellaneous design requirements

8.1 Clearances to electrical services and equipment

Electrical services within the rail corridor may include aerial lines and exposed low voltage equipment.

Bridges shall be designed and constructed to ensure that minimum clearances are observed to all electrical power lines and equipment, in accordance with Australian Standards and the regulations of the relevant electrical authorities.

Where high voltage aerial lines are located above the bridge, measures shall be taken to ensure that the risk of transferred potential associated with fallen conductors is mitigated.

8.2 Fire rating

As a minimum, the fire resistance level of footbridges (for life safety purposes and where not associated with a railway station) should be 30 minutes. An extra level of fire rating may be required for property protection, and this should be agreed with the Principal Track and Civil Engineer.

For footbridges providing access to railway stations, the minimum fire resistance level should be 2 hours.

The fire rating criteria apply to the structural elements of the bridge above the tracks excluding other spans, stairs and ramps not above the track.

8.3 Deck sheeting

Asbestos/fibrous cement deck sheeting is not permitted on new footbridges and shall be progressively replaced on existing structures.

8.4 Bird Nesting

Design features such as spikes may be required to prevent birds nesting on the bridge structure.

9 Collision protection

9.1 General

The design of piers or columns supporting overbridges or footbridges within the rail corridor shall comply with the provisions for collision protection and loading in AS 5100.

The prime requirement is to protect the piers and columns against damage from a derailed train, which in turn could result in collapse of the structure onto the train.

Similarly, piers and columns located next to roadways should be protected against impact from road vehicles.

If additional rail tracks are being installed that will involve an existing overbridge or footbridge being modified or extended and an existing support being converted to a common support, provision shall be made for collision loading from a derailed train on both sides of the bridge support.

The preference on single lines is for the new bridge to be designed with a clear span over the rail track (i.e. abutments only), eliminating any piers in close proximity to the line

9.2 Location of piers, columns and deflection walls

The minimum clearance to track centre line from any pier, column or deflection wall shall be as specified in CRN CS 215.

A pier or column shall not be located between tracks except on platforms. Variation to this may only be approved by the Principal Track and Civil Engineer.

The preferred option when designing replacement of piers, columns or superstructure or construction of a new structure, the superstructure shall have structural redundancy to prevent collapse of the structure under impact loads.

9.3 Design loading

All piers or columns supporting a new overbridge or footbridge within the rail corridor shall be designed in accordance with the provisions of AS 5100. The same requirements apply to alterations to the piers or columns, increases in loads on the structure or expansion of the structure.

Clause 10.4.3 of AS 5100.2 need not apply to piers and columns located on platforms provided all of the following conditions are satisfied:

- Platforms are earth-filled and designed in accordance with relevant CRN standards. Note that earth-filled platforms will provide full dispensation in Section 10.4.3 of AS 5100.2. Suspended platforms will require to be assessed by rigorous analysis to demonstrate that the platform can provide an adequate level of protection to the pier or column when the platform is subject to design loading;
- Pier or column transverse location (with respect to track) is in accordance with CRN CS 215 (e.g. in excess of 4.3m from centreline of track);
- Pier or column longitudinal location (with respect to track) is more than 20m from end of ramped platform, or is more than 2.6m from end of vertical (non-ramped) platform.

All piers and columns including those on platforms as described above, must satisfy Clause 10.4.4 of AS 5100.2 for the minimum design load. Platforms shall not be assumed to provide a degree of protection to permit reduction of the 500 kN collision load.

For temporary structures (less than 12 months) and for the renewal of piers or columns in existing structures, a risk assessment may be undertaken to determine whether any relaxation to the load requirements of AS 5100 can be made.

The risk assessment shall consider the following criteria:

- Site condition, cutting, embankment etc.
- Derailment history
- Type of structure, i.e. potential for collapse damage to trains
- Track geometry
- Track speed
- Type of rolling stock

- Future usage and growth in patronage.

The results of the risk analysis will determine the category of collision loading in AS 5100 that shall be applied to a support.

The use of lower order protection devices such as earth mounds, gabions or guard rails etc. may be used in the risk analysis to reduce the risk ranking if approval is obtained from the Principal Track and Civil Engineer.

9.4 Structural configuration

Piers or columns may be designed to withstand the load criteria stipulated in AS 5100 by configuring either as:

- individual units
- in combination with deflection walls, or
- solely reliant on deflection walls

Piers, columns and deflection walls shall comply with the structural configuration and geometric requirements of AS 5100.1. In addition, piers, deflection walls or the first column of a group shall have the leading faces rounded or vee-shaped.

In the case of retrofitting a deflection wall to an existing vulnerable pier or column, as well as infill walls, end walls shall extend parallel to the track, 3 metres on the approach side of the pier or column.

9.5 Guard rails

9.5.1 Functional purpose

The prime purpose of guard rails on rail tracks is to keep derailed or derailing bogies/ wheels tracked parallel to and in close proximity to the running rails. In the case of an overbridge or footbridge, the guard rails afford a level of protection to an adjacent pier or abutment.

9.5.2 Configuration

Where guard rails are determined to be appropriate for providing protection to vulnerable supports of overbridges and footbridges, they shall be installed in accordance with the requirements specified in CRN Engineering Standard CRN CS 310 “Underbridges”:

10 Safety refuges and handhold devices

10.1 Provision of safe areas

The design of new overbridges and footbridges shall make provision for a safe area for infrastructure and other authorised staff to stand during the passage of a train.

A safe area shall be provided below an overbridge or footbridge where the abutment or pier wall is longer than 20 metres.

In lieu of calculating kinematic envelopes, the default clearances to the front of the safe area are:

- 2230mm on tangent track
- 2500mm on curved track.

10.2 Locations with limited clearances

10.2.1 Clearance less than kinematic + 600mm:

Where the clearance dimension from the track centreline to the wall structure of the overbridge or footbridge is less than kinematic plus 600mm, refuges shall be provided.

10.2.2 Clearance between kinematic + 600mm and kinematic + 1200mm

Where the clearance dimension from the track centreline to the wall structure of the overbridge or footbridge is between kinematic plus 600mm and kinematic plus 1200mm, handhold devices as specified in Section 10.6 shall be provided.

10.2.3 Limited clearance sign

Owing to physical constraints, it may not always be possible to provide refuges or handhold devices along new or existing overbridges or footbridges.

Where refuges or handhold devices are required but are not provided, overbridges and footbridges shall have warning signage attached (See Figure 1 below).

Warning signs should be considered for overbridges and footbridges less than 20 metres in length where clearance is less than kinematic plus 1200mm.

The sign is a warning that there is insufficient clearance to stand safely when trains are passing.

The sign specification is provided in CRN Engineering Specification CRN CP 213 “Trackside Signs”.

Figure 1 – Limited Clearance sign

Where earlier versions of limited clearance signage have been installed, they may remain until replaced, at which time the signage shown in Figure 1 shall be installed

Existing signage must be of the type shown in Figure 2

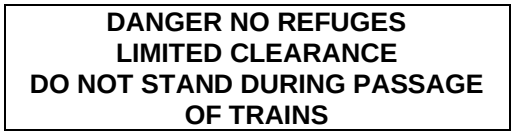

Figure 2 – Old Limited Clearance signage

10.3 Locations with adequate clearances

Where the clearance dimension from the track centreline to the wall structure of the overbridge or footbridge is greater than kinematic + 1200mm, no physical protection or signage is required.

10.4 Location of refuges, handhold devices and signs

The spacing of safe areas/ refuges/ handhold devices below an overbridge or footbridge shall not exceed 20 metres. The spacing at each location shall be determined by a risk assessment, taking account of factors such as train speed, available sighting distances, existence of warning light systems etc.

Refuges/ handhold devices shall be provided on one side only of a single track where there are structures closer than the clearances for safe places on both sides of the track.

Where clearances are restricted on only one side of a single track, refuges/ handhold devices are not required. Signage is required on the side of the obstruction as detailed in Section 10.2.3.

Where refuges/ handhold devices are required on multiple tracks, they shall be provided in a staggered pattern on both sides of the track group.

The limited clearance sign shall be attached to the wall structure so as to be clearly visible to personnel standing on or adjacent to the track. The sign is required at access points to the limited clearance area.

The sign shall be attached at each end of the wall structure and at locations along the structure wall where access is available to the track adjacent to the structure.

If access is only available from the end of the structure, no signs are required along the wall.

If access is continuously available, for instance the structure is on one side only, signs shall be installed at maximum 20 metre intervals along the structure.

10.5 Refuge details

The floor of the refuge shall be at cess level or with a maximum step up above the cess level of 200mm.

The minimum dimensions of refuges shall be:-

Height: 2000mm

Width: 1500mm

Depth: 700mm

If the refuge shall contain telephones, fire extinguishers or other essential items, the width shall be increased to provide the same clear floor area.

The floor of the refuge shall be level. The refuge shall be kept clear of cables, pipes or other obstructions.

Handrails shall be installed in all refuges to assist staff in keeping their balance during the passage of a train.

10.6 Handhold device details

A handrail unit comprises two vertical pipe handrails of 40mm diameter, located 1000mm apart and each protruding 400mm from the fixing point on the structure.

The pipes shall to be manufactured from galvanised steel.

Each handrail extends vertically from 900mm above cess level to 1800mm above cess level.

The horizontal and vertical elements of each handrail are connected by a bend of 200mm radius.

A level standing area at cess level shall be provided between the handhold devices.

A schematic layout for a handhold device is shown in Figure 3 below.

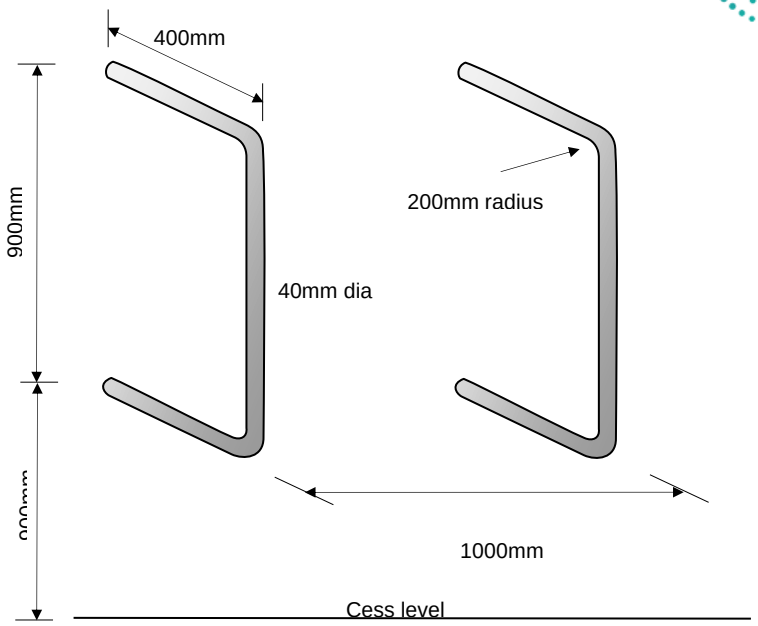

Figure 3 – Handrail units

Appendix 1 Approved special configurations

The following configurations are approved variations from standard configurations. They are applicable to the nominated locations only. When due for replacement they shall be replaced by standard configurations.

Configuration Type	Approved variation	Location	Controls	Original Waiver
Throw protection screens	Throw protection screens are not required	Bourke Street footbridge Tamworth 455.045	- Track speed in Up and Down direction maximum 25 kph. - Clear line of site of bridge deck area to be maintained for maintenance staff. - Review of risks if ~ Regular train movements increase. ~ Vandalism increases in the vicinity.	CCW 12/029 6/11/2012
Throw protection screens	Throw protection screens are not required	Kootingal overbridge 489.324km	- Clear line of site of bridge deck area to be maintained for maintenance staff - Review of risks if ~ Regular train movements increase. ~ Vandalism increases in the vicinity ~ Track speed increases	CCW 13/004 4/3/2013
Throw protection screens	Throw protection screens are not required	Danglemah overbridge 496.019km		
Throw protection screens	Throw protection screens are not required	Glen Innes overbridge & 681.074 km	- Review of risks if line at location brought back to rail operations	
Throw protection screens	Throw protection screens are not required	Bonville overbridge 595.278km OBN51595A	- Clear line of sight of bridge deck area to be maintained for maintenance staff - Review of risks if ~ Increase in regular train movements. ~ Increase in acts of vandalism in the vicinity ~ Increase in track speed. ~ If footways installed on the bridge	CCW 13/019 24/09/2013
Throw protection screens	Throw protection screens are not required	Frampton overbridge 445.031km OBS00445A		
Bearing and Deck Joints	500mm vertical clearance between underside of the main girders & bearing shelf is not required	Frampton overbridge 445.031 km	- Nil required	CCW 13/017 14/08/2013
Barriers	Permit design of replacement overbridge barriers to 'Regular' performance level	Bundanoon overbridge 160.153 km Bundanoon overbridge 162.466 km Gunning overbridge 278.333 km Yass Junction overbridge 313.855 km	- Nil required	CCW 15/02a 20/01/2015

		Binalong overbridge 347.583 km Galong overbridge 363.604 km Wallenbeen overbridge 407.912km		