Specification

Civil – Design of Footbridges

MD-18-322

QUEENSLAND RAIL OFFICIAL

Version: 2.3
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Policy: Safety Policy

QueenslandRail

Table of Contents

1 Purpose

This Specification details the criteria which shall be met for the design of pedestrian footbridges spanning the rail corridor.

1.1 Business or technical need

This document defines the railway specific requirements that supplement AS 5100 for the design of footbridges in the Queensland Rail network.

This specification replaces Civil-SR-006 Design of Footbridges.

1.2 Scope

This Specification applies to the;

- design of new footbridges, and
- upgrading of existing footbridges.

It covers the design criteria for footbridges which pass over Queensland Rail property and covers only those matters which will affect or are affected by the presence of the railway. For example, the aesthetics of the footbridge are not considered, however this may be impacted by the structural solutions and / or maintenance requirements.

For the purposes of this document if the footbridge overpass structure has a ticket office, toilet facilities or retail outlets then this document does not apply.

2 Requirements of this Specification

2.1 Design

2.1.1 General

The design of footbridges shall comply with;

- relevant Australian Standards and National Construction Code (NCC),
- AS 5100 Bridge Design (2017) for collision protection and collision loads, except where alternative requirements are specified herein,
- CIVIL-SR-008 Protection screens, and
- this Specification.

Queensland Rail's Station Design Manual Guideline MD-13-339 is to be used as a reference document.

If there are any discrepancies between the above documents, then this Specification shall take precedence.

The design of the footbridge shall also include the integration of other railway infrastructure, such as but not limited to;

- rail track structure,
- rail maintenance access roads,
- railway formation drainage,
- sighting requirements for railway signals and level crossings,
- special items of overhead traction wiring equipment, e.g. switches, transformers, wiring at turnouts,
- the proximity of rail geometry / infrastructure features such as curved track, turnouts, points, diamonds, etc,
- passenger platform requirements, and
- access to clean and maintain the footbridge.

The design of any new footbridge and associated infrastructure (lifts, stairs and ramps) on a station platform shall be designed to suit existing features and not preclude future high-level platform upgrades.

Refer to Queensland Rail standard drawings for details of other railway infrastructure requirements.

It is preferred that all footbridges have as light as possible superstructure across the rail tracks.

It is preferred that all footbridges have a single clear span over existing and future railway tracks. Piers and columns will only be permitted between tracks when located on a platform, unless otherwise agreed by Queensland Rail.

Designers are to liaise with Queensland Rail to minimise the effect of construction on train services and to determine whether Queensland Rail will accommodate any speed restrictions, track closures and/or isolations of the overhead line equipment (OHLE) anticipated during construction.

The design of the footbridge is to take into account the available access to the site and the need to minimise interference with train operations, passengers and railway activities during construction, maintenance and demolition e.g. utilising existing planned corridor shutdowns.

Design is to 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.

Overhead wiring fittings shall not be attached to a footbridge, unless this is the only practical solution and is approved by Queensland Rail.

Designs shall provide for earthing and bonding of metallic components on the bridge to mitigate touch potential hazards and corrosion of steel.

The minimum and maximum limits for the design of footbridges are shown in Table 1 and Table 2.

Table 1

Parameter		Minimum dimension
Distance between handrails	Station Footbridges	2.4 m
	Mid-Section Footbridges	1.8 m
	Stairs	1.8 m
Vertical distance from finished walkway level	To display screens	2.4 m
	To ceiling or roof structure	2.7 m

Footbridges that are proposed to be less than the minimum dimensions listed in Table 1 require a derogation to be approved by the Discipline Head Track and Structures.

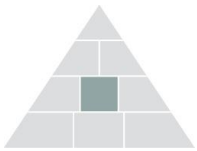
Table 2

Parameter	Maximum dimension
overall height (soffit to top of structure)	4.0 m
overall width	4.0 m
span	25.0 m

Footbridges that exceed the maximum dimensions listed in Table 2 shall be designed to all Clauses of AS 5100, unless a derogation has been approved by the Discipline Head Track and Structures.

Footbridge flooring should be designed using lightweight components/ construction.

The design of the footbridge overpass and primary support structures shall include and document (refer Section 2.10) future rectifications if the footbridge structure is damaged and needs to be repaired / replaced.



2.1.2 Clearances

Clearances to railway tracks shall satisfy the minimum requirements defined in Table 3 and Table 4.

Table 3. Minimum horizontal clearances from track centreline to bridge structure.

Footbridge	Minimum horizontal clearance	Components of minimum clearance		Requirements
		Dimension	Component	
Station Footbridges	4.55 m	1550 mm	track centreline to cope	
		600 mm	width of cope	
		600 mm	width of tactiles	
		1800 mm	clear pathway for wheelchair passing	
	3.95 m	1550 mm	track centreline to cope	subject to compliance with NCC and AS 1428 via appropriate access and passing areas
		600 mm	width of cope	
		600 mm	width of tactiles	
		1200 mm	clear pathway for wheelchair passing	
Mid-Section Footbridges	as per Queensland Rail Standard Drawing No QR-C-S3306			

Reduced clearances may be possible if the footbridge is placed at the end of the platform and its elements will not impede safe train crew and passenger movements.

NOTE: Any structural elements closer than 3.5 m do not meet the structure clearance requirements on QR-C-S3306 and would require a derogation approved by the Discipline Head Track and Structures.

Furthermore, structural supports closer than 3.5 m to the track centreline are not covered by the risk assessment discussed in Section 2.3 and would be subject to a site-specific risk assessment to manage safety risk ‘so far as is reasonably practicable’ (SFAIRP).

Table 4. Minimum vertical clearances from the top of rail to underside of the bridge superstructure.

Footbridge	Minimum vertical clearance	Requirements
Station Footbridges (Brisbane suburban area)	6.4 m	subject to OHLE requirements refer to Drawing No QR-C-S3306
Mid-Section Footbridges	as per Queensland Rail Standard Drawing No QR-C-S3306 and Section 2.3.2	

Queensland Rail will advise if clearances are required in excess of the minimum.

Drawing QR-C-S3306 is specific to electrified lines. New footbridges over non-electrified lines shall be designed to allow for future electrification unless approval is given by the Discipline Head Track and Structures.

For footbridges across existing and future electrified lines, the footbridge's primary support structure is to be located clear of the overhead wiring system unless otherwise approved by Queensland Rail.

Footbridge abutments adjacent to existing tracks are to be located sufficiently clear of the tracks to allow for their construction and maintenance to be carried out with minimal disruption to train or station operations.

2.1.3 Durability

The design life of footbridges shall to be a minimum of 100 years.

2.1.4 Maintenance

Footbridges shall be designed to minimise required maintenance activities (painting of steelwork and cleaning) and, where maintenance is required, that it can be carried out with minimal disruption to Queensland Rail's train or station operations.

2.1.5 Demolition

A footbridge shall be designed so that it can be demolished progressively with minimal disruption to train or station operations, passengers and any railway activities. A demolition scheme is to be included in the drawings and documentation to be submitted to Queensland Rail.

2.2 Substructure - Foundations

Foundations shall be designed such that their construction or installation can be done with minimal disruption to railway operations.

The design of temporary shoring systems for excavations adjacent to operating railway tracks shall be submitted to Queensland Rail for review before construction commences.

Provision shall be made for railway formation drainage. Drains are to be concrete lined where appropriate and are to be clear of the track. Footbridge piers and foundations shall be designed to allow free drainage along the formation and not cause ponding.

2.3 Design Loads

2.3.1 Collison Loads - Footbridges at Station Platforms

Collision protection and collision loads shall be designed in accordance with this Specification and AS 5100.

As a result of a comprehensive risk assessment process (refer Section 2.12), Queensland Rail, as the Rail Authority, (under AS 5100.2 (2017) Clause 11.4) have adopted the following design collision loads to be applied to any supports within 20 m from track centreline;

- 500 kN parallel to rails, and
- 500 kN normal to rails.

To be applied simultaneously at a height of 2 m above rail distributed over a length of 1 m along a structural member.

The minimum loads selected are intended to increase the reliability of the supports and footbridge in the case where there is a strike with operating plant during maintenance operations which otherwise may close the line for an extended period.

The reduced pier collision loads shall only be used when the footbridges are placed to achieve the minimum distances to level crossings, turnouts, diamond crossings, and other special trackwork provided in Table 5.

Table 5

Maximum Line Speed (km/h)	Minimum Distance
≤ 60	45 m
> 60 & ≤ 80	80 m
> 80 & ≤ 100	125 m
> 100 & ≤ 120	180 m
> 120 & ≤ 140	245 m
> 140 & ≤ 160	320 m

Note: The minimum distances listed in Table 5 are based on risk considerations and calculated using Equation 1. The absolute minimum distance is 45 m.

Equation 1

$$D_{min} = {V^2}/{80}$$

Where:
D_{min} = Minimum distance (m)
V = Design train speed (km/h)

As part of the design process the designer shall also review the assumptions provided in Section 2.12 to ensure they apply to the specific bridge site. A site-specific SFAIRP risk assessment shall be undertaken to accompany an application for derogation if the standard risk assessment doesn't cover the particular bridge site. Alternatively, a design compliant with AS 5100 (2017) can be provided.

AS 5100 (2017) Clause 11.4.3 shall be followed, unchanged, with the following clarification;

- The 500 kN force shall be applied only to the major structural elements of the footbridge, for example;
  a) Truss bridges – all major members connecting nodes of the trusses i.e. bottom chords.
  b) Girder bridges – the main girders, and
  c) All bridge support piers/columns.

Consideration should be given to the method of replacement of damaged non-major elements which are not designed for the collision load.

Collision loads imparted on a footbridge structures can be shared between other structural elements and their foundations (e.g. Lifts and Stairs). However, if the designer takes this approach, they shall consider that a derailed train may damage the other elements before impacting the bridge. Conversely, consideration of how the stair/ramps/lift may also impart loads on the bridge shall also be addressed (refer Section 2.4 for further information).

Footbridges meeting the risk assessment assumptions do not require deflection walls.

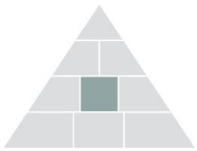
2.3.2 Collision Loads - Other Footbridges

Mid-section footbridges (I.e. footbridges away from station platforms) were also considered in the risk assessment mentioned in Section 2.3.1.

Mid-section footbridges may be designed in accordance with the same requirements as Section 2.3.1 provided;

- the risk assessment assumptions (refer Section 2.12) are met,
- there are no level crossings, turnouts, diamond crossings, or other special trackwork within the minimum distances provided in Table 5, and
- the supports are located a minimum clearance of 4.5 m from the nearest track centreline and it is not reasonably practicable to increase the clearance any further (refer below).

There is often more space available at mid-section footbridges to span across the entire rail corridor without intermediate supports, or at least offer an increased clearance to supports. The designer shall incorporate such safety benefits or demonstrate it is not reasonably practicable to do so. This shall be addressed within the concept design report (or within the tender offer for Design and Construct contracts). UIC 777-2 may offer a helpful framework to aid this process. A clearance reduction to 3.5 m may be considered if there are space constraints on the corridor at the proposed location of the footbridge, subject to a specific



SFAIRP risk assessment and associated application for derogation. Alternatively, a design compliant with CIVIL-SR-012 and AS 5100.2 is acceptable.

2.3.3 Earthquake

Footbridges shall be classified as “Importance Level 2 structures” for the purposes of AS 1170.4 and in accordance with AS 5100.2. Typically BEDC 2 is sufficient for most footbridges in the Queensland Rail network with special cases to be agreed with Queensland Rail.

Footbridges subject to earthquake forces shall be designed in accordance with AS5100.2 and to minimise the risk of collapse during earthquakes, with particular attention being given to;

- bearing arrangements,
- widths of bearing shelves, and
- ductility of supporting columns.

2.3.4 Wind

Wind loading shall be in accordance with AS 5100.2 with no reduction in ARI allowed for reduced design life unless agreed with Queensland Rail.

2.3.5 Minimum Restraint Loads

Minimum restraint loads, in accordance with AS 5100.2 (2017) Clause 10, shall be applied to all footbridges.

2.3.6 Pedestrian and Maintenance Traffic

Pedestrian traffic loads shall be in accordance with AS 5100.2 (2017) clause 8.

The following maintenance vehicles shall be used for design purposes on any ramps and within the footbridge span;

- two 7.5 kN axles with 1400 mm axle spacing, OR
- two 5 kN axles with 1000 mm axle spacing,

whichever is worse. Both vehicles shall have;

- 680 mm track (centre to centre tire spacing),
- 100 mm wide tyre with 40 mm contact length, and
- 1.1 dynamic factor added to static load.

If the footbridge has lifts, the overall dimensions and mass requirements within the lift for the preferred maintenance vehicle are to be confirmed by Queensland Rail.

2.4 Lift, Stair, and Ramp Structures

If a lift, ramp or stair structure also supports the footbridge, then it shall be designed in the same manner as a primary structural support (Section 2.3 and/or AS5100).

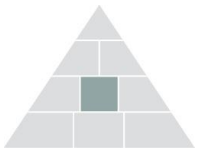
If ramp or stair structure does not support the footbridge, then stair and ramp structure supports shall be designed to;

- meet the collision loads as per Section 2.3., or
- be of “lightweight” and redundant construction.

Alternatively, a site-specific SFAIRP risk assessment may be undertaken by the designer to determine level of protection for stairs/ramps.

For straight staircases and ramps parallel to the track it is preferred to have columns that are designed to the minimum design loads as per Section 2.3. This is to provide some robustness against minor derailments or accidental impact during platform maintenance. This is of particular importance for long trackside ramps which can carry similar risk profiles to bridges themselves but can also be subject to progressive column collapse. Such ramp structures shall have minimum design loads as per Section 2.3 or shall be designed to AS5100 in its entirety if the assumptions of the standard bridge risk assessment are not met.

The allowance for “lightweight” and redundant construction is intended for use on the likes of switch-back stairs or other situations where larger columns are obtrusive. “Lightweight” structures are considered to be structures that are not expected to significantly escalate a derailment event. For the purposes of this clause, steel post-and-beam type construction that is not specifically designed for collision loads is considered “lightweight”. Redundancy in the design shall be provided such that staircase itself doesn’t become unusable due to minor accidental impact during platform/track maintenance (i.e. removal/damage of an individual post doesn’t result in collapse). Redundancy is also deemed to be met if the stair/ramp can be used by the public if a readily available temporary prop can be safely installed in the event of removal of an individual post. The SWL of the prop is to be included in the Operations and Maintenance manual and design drawings. The designer can also omit the requirement for redundancy where it can be demonstrated that stair/ramp supports that are very close to ground/platform and/or positioned in such that it is not possible for a train or platform maintenance vehicle to impact the support without otherwise hitting the stairs/ramp or other structures.



Care shall be taken by the designer to ensure that the connection of secondary structures to bridge are designed in such a manner to as not result in bridge collapse prior to connection failure (i.e. design the bridge and supports to take the capacity of such connections) unless they are specifically intended to transfer collision loads. Refer Section 2.3.1 for further information.

2.5 Superstructure

2.5.1 General

Footbridge superstructures over existing tracks shall be designed to minimise the time needed for erection, e.g. precast / prefabricated components. The aim is to minimise any disruption to train services during construction resulting from speed restrictions, track closures and/or isolations of the overhead traction wiring equipment.

2.5.2 Deck Drainage

Footbridge deck drainage shall be designed to discharge in a manner which does not adversely affect;

- neighbouring properties,
- railway tracks and infrastructure, and
- associated railway facilities or property.

In particular, the drainage shall be designed is to prevent sheet or continuous stream water flows off the superstructure onto the OHLE.

Deck drainage discharge via scuppers shall not be permitted from spans over existing and future railway tracks. Deck drainage pipes shall comply with the requirements for services in Section 2.7.

2.6 Protection Barriers

Protection screens, walls, and glass panels on footbridges shall be designed to protect the railway by preventing;

- public access to overhead traction wiring equipment and the track, and / or
- the throwing of objects at trains, stations and staff / public on the railway corridor.

The minimum requirements for footbridge protection screens are provided in Queensland Rail CIVIL-SR-008 Protection Screens.

2.7 Services

Footbridges shall be designed to minimize impacts on Queensland Rail services (signal, telecommunications, and OHLE) and privately owned services. Existing underground services that are to remain in place are to be protected from loads during construction and operation of the footbridge. Design details are to be submitted to Queensland Rail for review.

Services shall not be attached to the sides or underside of the footbridge over, or adjacent to, the railway.

The design of the services shall allow for them to be accessed for maintenance from the footway of the overpass and not from the rail track. All concealed services are to be located under the footway of the structure, within ceiling space, or within the balustrade, but readily and safely accessible from the footway.

Services and their attachment to the footbridge shall have a minimum 50 year design life and shall be designed for replacement with minimal disruption to railway operations. Design and material selection shall be subject to review by Queensland Rail.

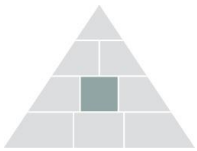
2.8 Advertising Signs

Advertising signs and other hoardings shall not be placed on footbridges.

2.9 Drawings

In addition to information otherwise required to document the construction of the bridge the drawings shall include the following;

- the railway clearance outline and, at platforms, the structure outline superimposed on an elevation of the footbridge in relation to the track alignment (90 degrees to track centreline),
- design loads,
- any special provisions, e.g. structural redundancy and use of precast or prefabricated elements,
- railway centrelines in the vicinity of the proposed footbridge,
- distances from footbridge to track centreline and OHLE,
- railway kilometrage at the intersection of railway and footbridge centrelines,
- details of all existing railway infrastructure, including maintenance and emergency access, under and in the vicinity of the proposed footbridge,
- Queensland Rail services and non-Queensland Rail services, and
- Platform, ramps, stairs, platform canopies, station furniture, station building, lifts, etc.



All structural drawings, including temporary works such as falsework and formwork shall be certified by a Registered Professional Engineer of Queensland as having been designed in compliance with the Professional Engineers Act.

Prior to construction, copies of the drawings and a design report consisting of;

- overall scope of design and construction works,
- maintenance activities,
- future demolition scheme,
- collision protection measures, and
- details of work within / over / adjacent to Queensland Rail property

shall be submitted to Queensland Rail for review and a compliance check against Queensland Rail's Technical Requirements and Standards.

Construction shall not commence until permission has been received from Queensland Rail and a design approval issued.

2.10 Certification of Design and Construction

The footbridge design shall be carried out in compliance with the Professional Engineers Act and the designer shall hold current, Queensland Rail specific Rail Industry Worker (RIW) accreditation. The designer shall list all the relevant parameters, functional requirements and the standards used for the design.

Design shall be reviewed by a competent professional engineer not directly involved in the design and verified that the design complies with the specified functional requirements and related standards. A Form 15 Compliance Certificate for building design shall also be provided by the designer as part of the footbridge design certification. The designer shall provide formal certification to Queensland Rail that the footbridge design and verification requirements have been met. The certification shall include a summary of the specified functional requirements and related standards.

The completed footbridge shall also be certified by a Registered Professional Engineer of Qld as having been constructed in accordance with the drawings and any approved variations. A Form 16 Inspection Certificate for building certification shall also be provided by the contractor as part of the footbridge construction completion.

2.11 As Constructed Documentation

As-constructed documentation shall be supplied in accordance with the Contract for practical completion of construction. As a minimum the Contractor shall provide Queensland Rail with;

- as constructed drawings (plan and section) and documents for the footbridge showing the relationship to;
  - the railway tracks,
  - all adjacent railway infrastructure, and
  - any collision protection elements for the footbridge,
- a design report listing key design assumptions and decisions including any additional risk assessment regarding collision protection,
- any required or applicable maintenance manuals for any materials or products used in the footbridge in accordance with Track, Civil & Structural Design Engineering MD-15-151, and
- a bridge components list in a format suitable form for entering into the Queensland Rail assets register.

Drawings shall be in electronic pdf and an approved CAD format – refer to Track, Civil & Structural Design Engineering MD-15-160 and associated attachments.

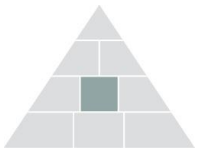
2.12 Footbridge Risk Assessment Commentary

AS 5100 does not differentiate between small and large pedestrian bridges or other type of bridges. Also, for small / simply supported footbridges, it is not practicable to achieve any level of pier redundancy.

On platforms, large footbridge supports can introduce more frequent, lower consequence risks associated with restricted passenger circulation. Consequently, Queensland Rail undertook a comprehensive risk assessment process as per AS 5100 to determine the most appropriate controls (eg collision loads, etc).

Mid-section footbridges were also considered in the risk assessment process. Mid-section footbridges are often located on plain track (i.e. no points/crossings) and often have more opportunity to place supports further away from the track. Data shows, there is a significant reduction in probability of derailments occurring on plain track which outweighs the level of protection provided by platforms.

In both cases, any derailment of a passenger train impacting the supports of a footbridge is likely to cause multiple fatalities, either by the abrupt stop of the travelling train (striking one of its supports), or by the collapse of the footbridge over the train. The risk profile will change (increase) with the train speed at the time of derailment and with the reduction in ductility of the supports.



As a result of the risk assessment, it was identified that the risk of a derailed train striking the supports of a footbridge was extremely low and the cost to construct rigid supporting piers (as per AS 5100) was found to be grossly disproportional to the benefit they can offer.

The risk assessment undertaken was based on the following assumptions;

- Maximum 290 passenger trains / day (total all tracks and directions combined),
- Maximum 20 freight trains / day (total all tracks and directions combined),
- A base passenger train derailment rate of 2.5 x 10^{-8} / km travelled,
- A base freight train derailment rate of 1.1 x 10^{-6} / km travelled,
- A derailment is 10 times more likely to occur at turnouts, switches etc. (I.e. the base rates can be reduced by a factor of 10 for risk calculations),
- Maximum bridge dimensions (height, width span) in accordance with Section 2.5.1,
- Supports are located with a minimum clearance of 3.5 m from track centreline, and
- No level crossings, turnouts, diamond crossings, and other special trackwork within a distance of $V^2/80$ m, with a minimum distance of 45 m (see section 2.3.1), of the bridge supports.

3 Responsibilities

The following establishes the unique accountabilities and responsibilities of the key internal stakeholders for this Specification.

3.1 Who does what?

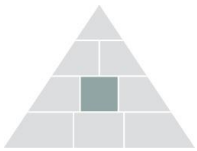
Who	What
Project Managers	Include this specification in all scopes for new footbridges or upgrade works for exiting footbridges.

4 Terms and definitions

The following key terms and definitions are unique to this Procedure. Please refer to the Business Glossary for other terms not included in this section.

Term	Definition	Source[1]
Diamond Crossing	The track structure where one track crosses another at the same grade.	Queensland Rail Corporate Glossary
Footbridge	A bridge designed for pedestrian traffic, and may be accessed either by lifts, stairs, ramps or escalators.	
Level Crossing	Any crossing of a railway at grade, providing for both vehicular traffic and other road users including pedestrians.	Queensland Rail Corporate Glossary
Mid-Section Footbridge	A footbridge that is structurally and functionally independent of a station.	
OHLE	Overhead line equipment	
Pedestrians	The people using the bridge who may be either customers of Queensland Rail, or other non-commuter users, including cyclists.	
Turnout	A track structure used for diverting trains from one track to another. Sometimes referred to as a Switch or Points	Queensland Rail Corporate Glossary
Station Footbridge	A footbridge that has elements (piers/stairs/ramps/lifts) connected to a station platform/s	
SFAIRP	So Far as is 'Reasonably Practicable"	MD-11-1339 Safety Risk Management & ONRSR Guideline A390705

[1] Where left blank, Source is not applicable.



5 Document history

Document Information

Current Version	2.3
First Released	10 December 2018
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Document Authoriser	Chief Executive Officer (CEO)
Functional Owner	Discipline Head Track and Structures
Document Owner / Approver	Discipline Head Track and Structures
Content Developer*	Discipline Head Track and Structures
Review Stakeholders	SEQ Assets, Project Safety
Audience	All employees, contractors and consultants

*Contact for further information

Document Amendment History

Version	Date	Section(s) Amended	Summary of Amendment
2.3	25/06/2020	2.3.1	Additional considerations for structure behaviours under collision loads.
		2.4	Clarification of collision load design intention and preferences
2.2	24/02/2020	2.1.1	Changed maximum height of bridge deck (Table 2) to 4.0 m.
2.1	09/08/2019	2.1.2	Risk to be managed So Far As Is Reasonably Practicable
		2.3.1	Collision loads to be applied to piers Condition for minimum collision loads related to proximity to infrastructure that increases risk likelihood
		2.4	Added requirements for stair and ramp structure supports
2.0	19/02/2019	Whole document	Document transferred to Core SEMS Template

6 Appendices

Appendix 1 – Related documents

Queensland Rail documents

Document type	Document title
Principle	N/A
Standard	N/A
Strategy / Plan	N/A
Specification / Framework	MD-15-151 Track, Civil & Structural Design Engineering MD-15-160 Production of Drawings by External Consultants
Procedure	MD-11-1339 Safety Risk Management
Instruction	N/A
Guideline	MD-13-339 Station Design Manual
Form / Template	N/A
Other	CIVIL-SR-008 Protection Screens CIVIL-SR-012 Collision Protection of Supporting Elements Adjacent to Railways
Drawings	QR-C-S3306 Structure Gauges Structure Clearance Electrified Lines Clearances Required To New Structures

External documents

Document type	Document title
Standard	AS 1170.4 Structural Design Actions: Part 4 Earthquake Actions in Australia AS 1428 Design for Access and Mobility AS 5100 Bridge Design UIC 777-2 Structures Built Over Railway Lines - Construction Requirements In The Track Zone
Specification / Framework	NCC National Construction Code
Guideline	ONRSR Guideline A390705. Meaning of duty to ensure safety so far a is reasonably practicable (SFAIRP)