### Document Information

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### Document Amendment History

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1.0 Introduction

This Technical Requirement details the criteria which must be met for pedestrian footbridges spanning the rail corridor.

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.

2.0 Definitions

Footbridge: A bridge designed solely for pedestrian traffic, and may be accessed either by lifts, stairs, ramps or escalators.

Pedestrians: These people may either be customers of Queensland Rail, or other non-commuter users of the footbridge, including cyclists.

Non-Frangible: A non-frangible ramp at the end of the platform could either be a concrete or earth ramp that would assist in train carriage or wagon sliding up onto the platform. Example: A steel frame set of stairs at the end of the platform would be classed as frangible.

3.0 Scope

This Technical Requirement 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 those matters which will affect or are affected by the presence of the railway. For example, the aesthetics of the footbridge are not considered.

4.0 Design

4.1 General

The design of footbridges is to comply with:

- relevant Australian Standards and National Construction Code (BCA),
- AS 5100 Bridge Design for collision protection and collision loads,
- CIVIL-SR-008 Protection screen, and
- this Technical Requirement.

Queensland Rail’s Station Design Manual is to be used as a reference document.

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

The design of the footbridge must also consider 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,
- 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 must be designed to suit Queensland Rails Standard Level Entry Platform Drawing QR-C-S2896.

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.

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 not practical and 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.

Typical Minimum Design Requirements:

- Minimum distance between handrails of the footbridge is to be 2.4m for Station Footbridges
- Minimum distance between handrails of the footbridge is to be 1.8m for Non-Station Footbridges
- Minimum dimension of 2.4m to any display
screens from finished walkway level
- Minimum dimension of 2.9m to any ceiling or roof structure from finished walkway level
- Minimum distance of 1.8m between handrails for stairs

For footbridges that are less than the minimum dimensions listed above, permission is to be obtained from Queensland Rail to allow relaxation of the particular design clause.

Typical Maximum Design Requirements:
- Maximum overall height (soffit to top of structure) of the footbridge overpass is to be 3.7m
- Maximum overall width of the footbridge overpass is to be 3.4m

Footbridges that exceed the maximum dimensions listed above are to be designed to all Clauses of AS5100.2, unless permission is obtained from Queensland Rail to allow relaxation of the particular design clause.

Flooring to the footbridge overpass must be designed using lightweight components (not concrete).

Roof structures are only required to the entry / exit waiting areas of the lifts and not to the footbridge overpass or stairs, unless otherwise advised by Queensland Rail.

The design of the footbridge overpass and primary support structures is to consider future rectifications if the footbridge structure is damaged.

### 4.2 Clearances

Clearances to railway tracks are to satisfy the following minimum requirements, unless otherwise approved by Queensland Rail:
- Station Footbridges – minimum horizontal clearance 4.55m from the nearest track centerline to the face of the primary footbridge support (1550mm high level platform + 1200mm Platform cope + 1800mm Clear pathway), minimum vertical clearance 6.4m from top of rail level to underside of the superstructure
- OHLE Clearances for Station Footbridges as per Drawing No 2760
- Non Station Footbridges – clearances are as per Queensland Rail Standard Drawing No 2754.

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

For footbridges across existing and future electrified lines, the footbridge’s primary support structure is, where possible, 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.

### 4.3 Earthquake Protection

Footbridges are to be classified as “importance level 2 structures” for the purposes of AS 1170.4 Structural design actions: Part 4 Earthquake actions in Australia and in accordance with AS 5100. The minimum lateral restraint force between the pedestrian footbridge overpass and its primary support structure/s shall be 500kN in accordance with AS5100.2 and applied in any direction at the connection/s. This lateral restraint force is not required to be transferred to the foundations of the footbridge. This will ensure there is a robust connection between the footbridge overpass and its supporting structure.

Footbridges are to be designed to minimise the risk of collapse during earthquakes, with particular attention being given to:
- bearing arrangements,
- widths of bearing shelves, and
- reinforcing steel in columns.

### 4.4 Durability

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

### 4.5 Maintenance

Footbridges are to 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.

### 4.6 Demolition

A footbridge is to 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 as required by Clause 13.

### 5.0 Substructure - Foundations

Foundations are to 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 is to be submitted to Queensland Rail for review before construction commences.
Provision is to 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 are to be designed to allow free drainage along the formation and are not to cause ponding.

6.0 Collision Protection

6.1 General
Collision protection and collision loads are to be designed in accordance with AS 5100 Bridge Design and this Technical Requirement.

The Collision loads imparted on the footbridge overpass primary support structures can be shared between other structural elements and their foundations (e.g. Lifts and Stairs).

6.2 Footbridges at Station Platforms

For footbridges at stations, design parameters for the purposes of collision load protection for the primary structural supports are to be in accordance with the following:

Supports must be a minimum 4.55m clear of the nearest track centerline to the face of the support.

If the supports are within a railway platform:

a) Supports must be contained within an earth filled or energy absorption granular material from the face of the support to the platform face, and for a minimum distance of 3.0m parallel with the track from the support. Supports must be located in excess of 20m from the end of a non-frangible ramped platform, or 3.0m from the end of a vertical (non-ramped) platform.

b) The supports must be designed:
   (i). to comply with AS5100.2 Clause 10.4.2; or
   (ii). the 500 kN collision load at a height of 5 metres above top of rail must be applied in any direction;

If the supports are within a railway platform and located less than 4.55m from the nearest track centerline:

a) then the supports must be designed in accordance with AS5100.2 – Clause 10.4, and

b) Approval must be obtained from Queensland Rail for the reduction of the 4.55m offset from the nearest track centerline.

If the supports are not located on a railway platform:

a) but less than or equal to 7.5m from the nearest track centerline, then the supports must be designed in accordance with AS5100.2 – Clause 10.4.

b) and between 7.5m and 20m from the nearest track centerline, then a risk analysis is to be carried out to determine the required concentrated collision load, but which is to be no less than the minimum of 500kN applied at a height of 5 m above the top of the rail.

6.3 Non Station Footbridges
Footbridges located clear of station platforms are to be designed to have the lightest superstructure possible given the location and other design parameters.

Design collision loads for non-station footbridges are to be designed in accordance with AS5100.2 – Clause 10.4.

6.4 Vertical Uplift to Footbridges

The Vertical Uplift force applied to the footbridge overpass must be designed in accordance with AS5100.2 – Clause 10.4.4. For example a footbridge overpass with a clearance of 6.4m from the top of rail level to underside of the overpass is required to resist a 360kN uplift force at the soffit, and reduces to zero at 10m.

The Uplift force is to be only applied to the major structural elements of the footbridge. This includes for:

a) steel trusses – members connecting nodes of the trusses i.e. chords, verticals, diagonals and transverse members

b) steel girders – the main steel girders and cross girders/diaphragms which provide load sharing or restraint to the main girders

c) concrete girders – the main concrete girders and diaphragms

d) other superstructure types – to be approved by Queensland Rail Discipline Head Track and Structures prior to commencement of detailed design.

The Uplift force shall be applied at any location on the major structural elements, distributed over one square metre or one metre length to allow for roof crushing of the railway vehicle. The major structural element must be able to withstand the loads without deformation or over stressing. Consideration should be given to the method of replacement of damaged non-major elements which are not designed for the uplift loads.

Any major structural element protected on both sides and underneath by structural elements which have all been designed for the uplift load may be excluded from having the load applied directly to the element, e.g. the transverse member connecting nodes on the top chords of a truss.
6.5 Upgrading of Existing Footbridges
When upgrading existing footbridges, supports which do not satisfy the requirements of Clause 6.1 are to have deflection walls provided. Independent deflection walls are to be provided where space permits. Collision loads are to be in accordance with this Technical Requirement.

7.0 Lift Structures
If the lift structure supports the footbridge, then it shall be designed the same as a primary structural support and the requirements of this standard for clearance in Clause 4.2 and collision protection in Clause 6.0 shall apply.

8.0 Superstructure

8.1 General
Footbridge superstructures over existing tracks are to 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.

The connections between the deck and piers are to be designed to minimise the risk of collapse in the event of an earthquake or collision from railway traffic.

8.2 Deck Drainage
Footbridge deck drainage shall be designed to discharge in a manner which does not adversely affect neighboring properties, railway tracks and infrastructure, associated railway facilities or property occupied by Queensland Rail. In particular, the drainage is to be designed to prevent sheet or continuous stream water flows off the superstructure onto the OHLE.

Deck drainage discharge via scuppers is not permitted from spans over existing and future railway tracks. Deck drainage pipes are to comply with the requirements for services in Clause 10.

9.0 Protection Screens
Protection screens for footbridges are to 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 Technical Requirement CIVIL-SR-008 Protection Screens.

10.0 Services
Footbridges are to 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, including pipes for deck drainage, are not to be attached to the sides or underside of the footbridge over or adjacent to the railway.

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

Services and their attachment to the footbridge are to have a 100 year design life and are to be designed for replacement with minimal disruption to railway operations. Design and material selection is to be subject to review by Queensland Rail.

11.0 Advertising Signs
Advertising signs and other hoardings are not to be placed on footbridges, unless approved by Queensland Rail.

If the design of the footbridge requires existing advertising signs on Queensland Rail property to be removed or relocated because of the proposed works, Queensland Rail must be advised as early as possible. Failure to do so may cause delays in the start of work.

12.0 Drawings
The drawings are to show:
- 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 centerline),
- 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 centerline and OHLE,
- railway kilometreage at the intersection of railway and footbridge centrelines, and
- 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
• 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,
• future demolition scheme,
• collision protection measures, and
• details of work within / over / adjacent to Queensland Rail property
• maintenance activities
are to be submitted to Queensland Rail for review and a compliance check against Queensland Rail's Technical Requirements and Standards. Construction is not to commence until permission has been received from Queensland Rail.

13.0 Certification of Design and Construction

The footbridge design is to be carried out in compliance with the Professional Engineers Act. The designer is to specify the functional requirements and the standards used for the design.

Design is to be reviewed by competent professional engineers 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 must also be provided as part of the footbridge design certification. The designer is to provide formal certification to Queensland Rail that the footbridge design and verification requirements have been met. The certification is to include a summary of the specified functional requirements and related standards.

The completed footbridge must 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 must also be provided as part of the footbridge construction completion.

14.0 As Constructed Documentation

As-constructed documentation is to be supplied in accordance with the Contract for practical completion of construction. The Contractor is to provide Queensland Rail with:
• as constructed drawings (plan and section)

and documents for the footbridge, showing the relationship to the railway tracks and all adjacent railway infrastructure, and
• collision protection elements for the footbridge. Drawings are to be in electronic pdf and CAD format.

15.0 Associated Costs Incurred by Queensland Rail

All of Queensland Rail’s costs associated with the review, design and construction of the footbridge and the implementation of Queensland Rail’s Technical Requirements will be charged to the footbridge owner or its agent. This includes any remedial work necessary to Queensland Rail property as the result of this work and any accidental damage, as well as costs associated with train delays. Rates will be set by Queensland Rail.