Railway infrastructure: Clearances

RISSB RAIL INDUSTRY SAFETY AND STANDARDS BOARD

Infrastructure Standard

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This Australian Standard® AS 7633 Railway infrastructure: Clearances was prepared by a Rail Industry Safety and Standards Board (RISSB) Development Group consisting of representatives from the following organisations:

TBA

The Standard was approved by the Development Group and the Infrastructure Standing Committee in Select SC approval date. On Select Board approval date the RISSB Board approved the Standard for release.

This Standard was issued for public consultation and was subject to a stakeholder workshop. It was also independently validated before being approved.

Development of the Standard was undertaken in accordance with RISSB's accredited process. As part of the approval process, the Standing Committee verified that proper process was followed in developing the Standard

RISSB wishes to acknowledge the positive contribution of subject matter experts in the development of this Standard. Their efforts ranged from membership of the Development Group through to individuals providing comment on a draft of the Standard during the open review.

I commend this Standard to the Australasian rail industry as it represents industry good practice and has been developed through a rigorous process.

Deb Spring
Exec. Chair / CEO
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This Standard was prepared by the Rail Industry Safety and Standards Board (RISSB) Development Group AS 7633 Railway infrastructure: Clearances. Membership of this Development Group consisted of representatives from the organisations listed on the inside cover of this document

This Standard has been reviewed and supersedes the previous version in whole.

Objective

The objective of this Standard is to manage the risks to safety arising from the interface between rail infrastructure and rolling stock during railway operations. It achieves this by setting out the minimum clearance standards for safe operation between:

(a) rolling stock (including loads) and trackside structures and equipment; and

(b) rolling stock (including loads) on adjacent tracks.

This Standard uses key inputs from AS 7507.

Compliance

There are two types of control contained within Australian Standards developed by RISSB:

1. Requirements.
2. Recommendations.

Requirements – it is mandatory to follow all requirements to claim full compliance with the Standard. Requirements are identified within the text by the term 'shall'.

Recommendations – do not mention or exclude other possibilities but do offer the one that is preferred. Recommendations are identified within the text by the term 'should'.

Recommendations recognise that there could be limitations to the universal application of the control, i.e. the identified control is not able to be applied or other controls are more appropriate or better.

For compliance purposes, where a recommended control is not applied as written in the standard it could be incumbent on the adopter of the standard to demonstrate their actual method of controlling the risk as part of their WHS or Rail Safety National Law obligations. Similarly, it could also be incumbent on an adopter of the standard to demonstrate their method of controlling the risk to contracting entities, or interfacing organisations where the risk may be shared.

Controls in RISSB standards address known railway hazards are addressed in Appendix C.

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1 Scope and general

1.1 Scope

This Standard establishes general principles for railway infrastructure clearances throughout the asset lifecycle, specifies a system for calculating appropriate clearances, and provides recommended dimensions.

This Standard excludes:

(a) temporary structures such as formwork and scaffolding covered by special operating conditions, or vegetation control;

(b) expendable rolling stock items covered in AS 7507; and

(c) tram tracks, cane railways, and monorail networks.

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document:

(a) AS 7507 Rolling stock outlines.

(b) AS 7630 Railway infrastructure - Track classification

NOTE: Documents for informative purposes are listed in Appendix D.

1.3 Terms and definitions

For the purposes of this document, the terms and definitions given in RISSB Glossary: https://www.rissb.com.au/products/glossary/, and the following apply:

(a) ***contingency gap***
the gap between the kinematic envelope and a structure, or between kinematic envelopes on adjacent tracks

(b) ***kinematic envelope***
the kinematic outline generated by moving rolling stock, taking into account rolling stock and track tolerances

NOTE: the kinematic envelope changes in dimensions as it moves along the track due to track geometry, taking into consideration the kinematic outline and the swept outline.

(c) ***kinematic outline***
a two-dimensional shape that consists of the static outline plus the maximum permitted allowance for vertical bounce upwards plus lateral translation and body roll in response to a steady-state cant deficiency force at maximum permitted cant deficiency (or the maximum installed cant) and dynamic movements in response to track irregularity.

(d) ***reference rolling stock outline***
greatest permissible kinematic envelope based on the summation of all rolling stock operating on a route

NOTE: This is determined using the widest and highest kinematic outline and consists of three specific parts:
1. the reference static outline,
2. reference kinematic outline, and
3. reference swept outline.

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(e) ***static outline***
a drawing or specification of a notional vehicle cross-section which prescribes maximum permissible rolling stock dimensions under specified conditions of load and suspension displacements in the vertical direction

(f) ***structures***
structures include retaining walls, rock faced cuttings, bridge members, tunnel walls, overhead wiring masts and signals

(g) ***structure outline***
the desired minimum outline for structures along a route

(h) ***track centres***
the distance between the design centrelines of adjacent tracks

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2 Calculating rail infrastructure clearances

2.1 General

Clearances are calculated by:

(a) establishing the rolling stock kinematic outline;

(b) applying the track kinematic parameters to create a kinematic envelope; and

(c) adding a contingency gap.

See figure 1 and figure 2 for the schematic representation of clearances on level tangent track.

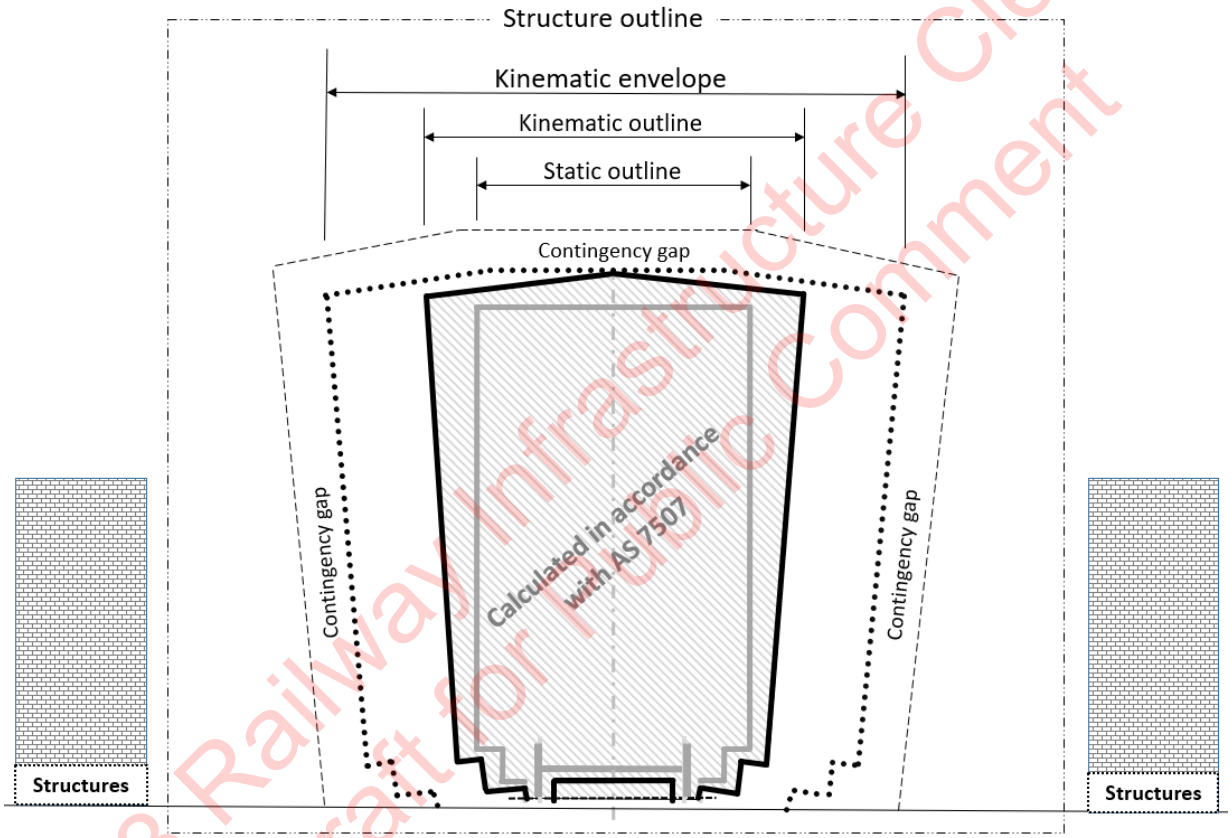

Figure 1 Schematic of clearance outlines between rolling stock and a structure

NOTE: The above schematic also shows the interrelationship between AS 7500 and this Standard.

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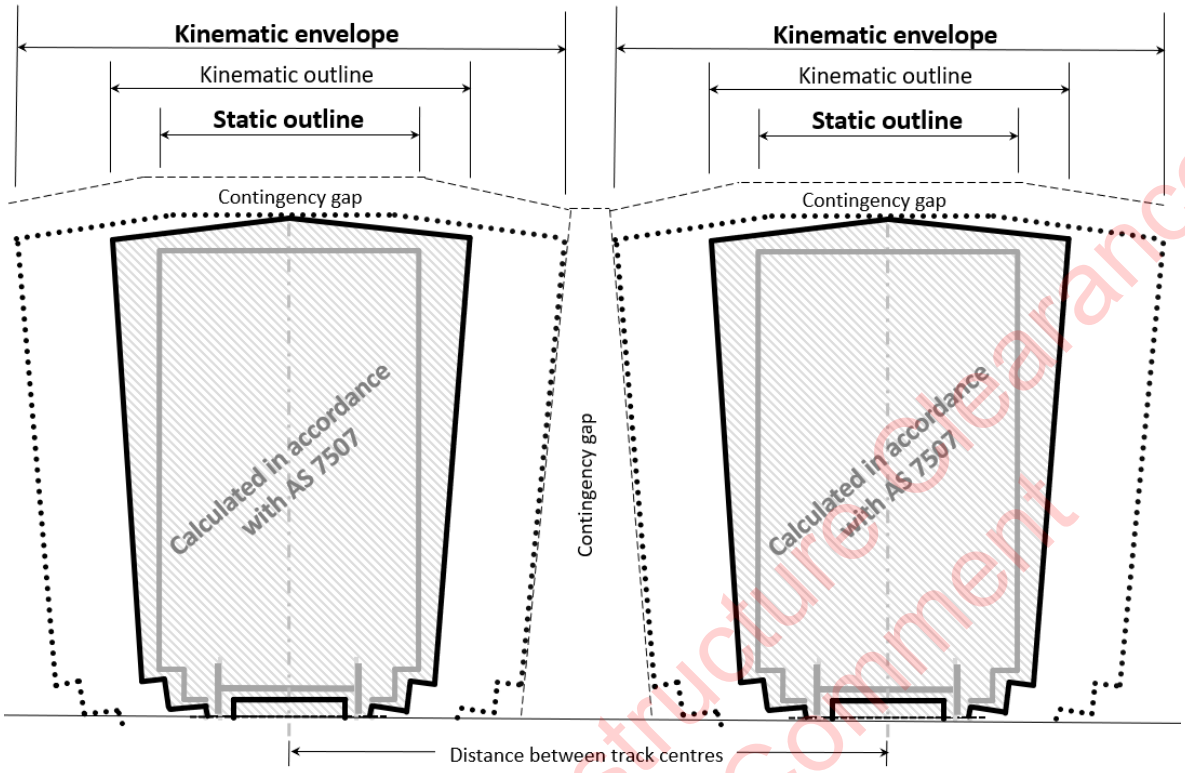

Figure 2 Schematic of clearance outlines between rolling stock on adjacent tracks

A structure outline may be adopted that accommodates all applicable rolling stock with sufficient contingency gap and allowances for other requirements nominated by the rail infrastructure manager.

Rail infrastructure managers complying with the clearances given in Appendix A are deemed to satisfy the requirements of this Standard.

2.2 Rolling stock kinematic outlines

Rolling stock kinematic outlines calculated in accordance with AS 7507 shall be used when calculating the kinematic envelope.

2.3 Kinematic envelope

The kinematic envelope for a rolling stock vehicle shall be calculated, inclusive of:

(a) rolling stock kinematic outlines specified in Section 2.2;

(b) rolling stock kinematic parameters:

i. all lateral rolling stock tolerances and centre and end throw are applied relative to the coordinate system of the wheelset, which follows the plane of the cant (including cant tolerances);

ii. all rotational rolling stock tolerances are applied about the roll centre, which is fixed to the coordinate system of the rolling stock static outline, which shifts laterally relative to the wheelset;

iii. all vertical rolling stock tolerances are applied relative to the coordinate system of the rolling stock static outline, which rolls and shifts laterally relative to the wheelset.

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(c) track kinematic parameters:

i. all lateral alignment track tolerances are applied relative to horizontal,

ii. lateral track tolerances caused by variation in the rail are applied relative to the plane of the cant,

iii. all vertical track tolerances are applied relative to horizontal,

iv. all rotational track tolerances and the design cant are applied relative to horizontal.

NOTE: Representative track tolerances are provided in Appendix B.

A different kinematic envelope will apply for each type of rolling stock at each specific location.

The kinematic envelope shall be the cumulative effects of the above translational and rotational tolerances on the rolling stock kinematic outlines.

2.4 Contingencies

A 200 mm horizontal contingency gap and 200 mm vertical contingency gap should be applied to all new works.

2.5 Rail infrastructure clearances

The actual clearance required between rolling stock and structures should be calculated considering all the factors identified in Sections 2.3 and 2.4.

Where different types of rolling stock operate over a section of track, separate analysis shall be carried out in order to determine minimum clearances.

Although detailed requirements are not provided in this Standard, consideration should also be given to the following:

(a) restricted or confined spaces;

(b) authorised access to areas, including walking paths;

(c) detraining; and

(d) emergency response.

Provision should be made for additional clearance over and above that stated within this Standard for service and maintenance requirements as determined by the rail infrastructure manager.

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3 Authorised reference rolling stock outlines

A reference rolling stock outline for each route shall be determined by the rail infrastructure manager, based on calculations using the worst-case kinematic envelope for rolling stock permitted on the track section, and relevant track conditions.

A register of rolling stock outlines authorised for each track section shall be established and maintained.

NOTES:

1. The reference rolling stock outline could be restricted due to the historical structure outline.
2. AS 7507 includes reference vehicles that have been accepted by rail infrastructure managers.

4 Structure outline

The desired minimum outline for structures along a route shall be determined by the rail infrastructure manager.

Track side structures should not encroach on the structure outline. The infringement of track side structures is discussed in Section 5.

5 Structure outline infringements

5.1 General

Rail infrastructure managers shall develop and implement a documented risk-based process for managing infringements.

Where meeting the recommended contingency gap is impractical, a reduced contingency gap may be adopted provided the risk-based assessment process has been completed and any mitigation measures implemented.

Risk management systems and procedures should follow the principles described in AS ISO 31000 and be carried out by competent persons.

5.2 Platforms

Platforms are structures that are designed with minimal clearances to manage train-platform-interface risks.

The rail infrastructure manager shall set out the requirements for the design and maintenance of track offset through station platforms.

The clearance between platforms and rolling stock shall provide safe clearance for all passing rolling stock.

In the case of passenger rolling stock, the gap between the platform edge and rolling stock should be minimised by additional engineering devices for passenger access and egress, where possible.

NOTE: On curved track, the gap between the platform edge and the vehicle will vary depending on track curvature and subsequent centre throw and end throw of the rolling stock.

Allowances shall be made for applied cant, track level variations and vertical movements of rolling stock in determining the vertical distance between the top of the low rail and the platform edge.

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The vertical distance between the top of the low rail and the platform edge should be determined taking into account all rolling stock using the line, the track offset and:

(a) set at approximately the same level as the rolling stock floor; or

(b) set with a step up into the train, considering:

i. rolling stock functionality, such as door operations;

ii. demographics and patronage; and

iii. access / egress assistance.

5.3 Tunnels

Tunnels can encroach on the structure outline due to construction parameters or geographical limitations. Tunnels should provide adequate clearance to accommodate:

(a) The worst-case rolling stock reference outline for that section of track;

(b) the contingency gap outlined in Section 2.4;

(c) utilities and services;

(d) service and maintenance requirements;

(e) emergency egress.

NOTE: Consideration should be given to derailment containment and protection.

5.4 Low-lying infrastructure

Clearance requirements for low lying infrastructure within the immediate vicinity of the rail shall be determined by the rail infrastructure manager.

Low lying items of infrastructure or equipment close to the plane of the rails include:

(a) train warning/control equipment;

(b) check rails;

(c) guard rails;

(d) wayside condition monitoring equipment;

(e) level crossing surfaces and flangeway requirements; and

(f) other lineside equipment such as signal trunking.

5.5 Train-to-infrastructure interfaces

Items of infrastructure that have a physical or operational interface with rollingstock shall be approved by the rail infrastructure manager to determine clearance requirements.

These items include:

(a) train stops in the trip position;

(b) rail lubricator actuators;

(c) overhead contact wires and associated equipment;

(d) automatic door openers in the active position;

(e) overhead wagon loading structures in the lowered position;

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(f) buffer stops;

(g) approved legacy infringements e.g. speed signs, platform awnings, ancillary equipment on tunnel walls; and

(h) provision for pantograph kinematic envelope.

5.6 Managing approved infringements

5.6.1 General

Where infringements have been approved, the actual in-field nominated clearance requirements shall be measured, monitored and maintained.

Track survey datum marks should be provided at all platforms and at other structures where reduced clearances have been permitted. Alternatively, other surveying methods may be used.

Additional risk controls should be implemented to reduce the consequence or likelihood of rolling stock colliding with infrastructure due to infringements, such as:

(a) improved track structure rigidity,

(b) operational restrictions,

(c) reduced track maintenance tolerances,

(d) more frequent track maintenance inspections,

(e) reduced rolling stock tolerances,

(f) more frequent rolling stock inspections,

(g) risk treatment action plan to correct infringement.

5.6.2 Infringement register

A register of permitted infringements should be kept. As a minimum the register should include:

(a) details of the infringing asset;

(b) the location (i.e. kilometrage);

(c) approved infringement details, including reference points and measurements;

(d) approving person;

(e) additional risk controls; and

(f) reference to supporting documentation.

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6 Managing rail infrastructure clearances

6.1 General

All clearances shall meet the requirements established by the rail infrastructure manager.

All new infrastructure shall be constructed outside of the structure outline, unless otherwise determined by the rail infrastructure manager.

6.2 Design

As a minimum the following items shall be taken into account when designing new infrastructure:

(a) Reference rolling stock outlines authorised to operate on a network.

(b) Construction and maintenance tolerances.

All track side structures shall be assessed to determine whether it infringes on the structure outline.

NOTE: Although outside the scope of this Standard, collision loads for structurally significant members given in AS 5100.2 should be considered when designing new structures close to the structure outline.

6.3 Monitoring and maintenance

Railway infrastructure clearances shall be monitored and maintained.

The method and frequency of inspections to monitor and maintain railway infrastructure clearances shall be determined by the rail infrastructure manager.

The inspection frequency regime should be risk-based and take into account the track classification, location, rates of deterioration and other local factors.

In addition, clearances should be inspected where there are suspected defects following events affecting the location of tracks or structures, or defects identified from walking inspections.

Clearance inspections should include:

(a) Lateral and vertical clearances at platforms.

(b) Lateral and vertical clearances to structures.

(c) Vertical clearances to overhead structures.

(d) Track centres between adjacent tracks.

(e) Track centres at turnout clearance points.

Action shall be taken to restore clearances when the clearance is reduced to 100 mm or less, except at platforms. Additional monitoring and more frequent inspections should be carried out until clearances can be restored.

6.4 Modification

Unless otherwise specified by the rail infrastructure manager, any new or reconstructed structural adjacent to an existing railway shall be outside the structure outline.

Any modifications should be risk assessed in accordance with ISO 31000 and additional risk control measures implemented where applicable.

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6.5 Decommissioning

Any de-commissioned items of infrastructure should be removed or have necessary clearances maintained to ensure safe passage of trains.

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7 Overhead traction power

Clearances between rolling stock and trackside overhead line equipment shall be determined by the rail infrastructure manager, making allowances for the type of traction power.

The minimum vertical distance from the top of rail to the underside of permanent structures shall include the electrical clearances determined by the rail infrastructure manager.

8 Out-of-gauge loading

Where any part of rolling stock falls outside the approved reference rolling stock outline for the corridor, it shall be treated as an out-of-gauge load.

Prior to running of out-of-gauge loads, the critical dimensions to structures or adjacent tracks should be inspected and measured, particularly on curves.

Where out-of-gauge loads have been approved by a rail infrastructure manager, the special conditions listed below should be considered:

(a) Limiting the rolling stock to a specific route, or section of track, to avoid fouling close structures.

(b) Restricting the speed at which the rolling stock passes:

  i. close structures to, and

  ii. passenger platforms if a load overhangs the platform.

(c) Confirming that the load is secured, and has not moved, immediately prior to passing a close structure.

(d) Restricting passenger access to platforms during the period in which an overhanging load would pass through a platform area.

(e) Piloting past close structures.

(f) Timetabling of the movement,

(g) Swept path analysis.

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Appendix A Deemed to comply clearances

Clearances required to accommodate rolling stock with the worst-case foreseeable kinematic envelope shall be calculated in accordance with table A-1 (See Note 1).

Table A.1 Structure outline

AS 7630 Track classification	Minimum horizontal Distance from centreline of track to face of structures	Track centres	Minimum vertical distance from top of rail to the underside of permanent structures		
			Electrified tracks		Non-electrified tracks
			DC	AC	
Passenger (HSP, MSP, LSP) Note 2	3 m	4 m	5.65 m	6.05 m	5.65 m
Branch line freight (BLF) Note 3	3 m	4 m	-	-	4.67 m
Heavy Haul Freight (HHF) Note 3	3 m	4.572 m	-	-	5.131 m
Mainline freight (MLF) Note 4	3 m	4.5 m	-	-	7.1 m

NOTES:
1. The lateral clearances and track centres in Table A-1 take into account kinematic effects, curve effects for 26 m long vehicles on curves of 150 m radius and normal track tolerances.
2. Passenger traffic type includes high speed passenger (HSP), moderate speed passenger (MSP) and low speed passenger (LSP).
3. The minimum vertical distance from top of rail to the underside of permanent structure for branch line freight and heavy haul freight considers single stack freight wagons only.
4. Measurements provided for mainline freight will permit RISSB Reference Vehicle 6 (Interstate Plate F).
5. UIC 777-2 gives additional information explaining the benefit of a minimum 3 m clearance from the centreline of the track to the face of a structure.

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Appendix B Representative track tolerances for standard gauge track

The track tolerances provided in Table B.1 are representative figures and may be varied depending on the rail infrastructure manager's maintenance regime.

Table B.1

Description			Direction	Tolerance
Timber sleepered ballasted track				
Alignment	Rail wear		Lateral	15 mm
	Variation from design	Tangents and curves > 2000 m radius		± 25 mm
		Curves < 2000 m radius		± 35 mm
Level	Variation from design		Vertical	± 75 mm
Cant	Variation from design		Rotational	± 10 mm
Concrete sleepered track				
Alignment	Rail wear		Lateral	15 mm
	Variation from design	Tangents and curves > 2000 m radius		± 15 mm
		Curves < 2000 m radius		± 25 mm
Level	Variation from design		Vertical	± 75 mm
Cant	Variation from design		Rotational	± 10 mm
Slab track and transom top bridges				
Alignment	Rail wear		Lateral	15 mm
	Variation from design	Tangents and curves > 2000 m radius		± 10 mm
		Curves < 2000 m radius		± 20 mm
Level	Variation from design		Vertical	+ 10 mm
Cant	Variation from design		Rotational	± 10 mm

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Appendix C Hazard register

Hazard No.	Hazard
5.2	Harm to infrastructure by rolling stock
6.6	Harm to track & civil infrastructure by rolling stock
6.9	Harm to Track & Civil infrastructure during operation and maintenance

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Appendix D Bibliography

The following referenced documents are used by this Standard for information only:

(a) AS 5100.2 Bridge design, Part 2: Design loads.

(b) AS ISO 31000:2018 Risk management - Guidelines

(c) RISSB Code of Practice for Loading of Rail Freight.

(d) UIC 777-2:2ED 2002 Structures built over railway lines – Construction requirements in the track zone

(e) Commonwealth Disability Discrimination Act 1992 (DDA).

(f) Disability Standards for Accessible Public Transport 2002 (DSAPT)

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