



Railway infrastructure: Clearances



Infrastructure Standard

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Railway infrastructure: Clearances **AS 7633:2019**

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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:

Arc Infrastructure

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Public Transport Victoria

Metro Trains Melbourne

Queensland Rail

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 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.

Paul Daly

Chief Executive Officer

Rail Industry Safety and Standards Board

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Contents

1	Introduction.....	6
1.1	Purpose	6
1.2	Scope	6
1.3	Compliance.....	6
1.4	Referenced documents.....	7
1.4.1	Normative references.....	7
1.4.2	Informative references	7
1.5	Definitions.....	7
2	Philosophy and Methodology.....	8
2.1	Philosophy	8
2.2	Deemed to comply requirements	8
2.3	Methodology	8
2.3.1	General.....	8
2.3.2	Rolling stock static outline.....	9
2.3.3	Kinematic profile	9
2.3.4	Clearance	9
3	Design and rating	10
3.1	General.....	10
3.2	Selection and specification.....	10
3.3	Kinematic envelope.....	10
3.3.1	Application of kinematic envelope	10
3.3.2	Determination of kinematic envelope	11
3.3.3	Clearance to structures and between vehicles	12
3.3.4	Reduction of minimum contingency	12
3.3.5	Infringements of the minimum contingency	12
3.4	Historical structure gauge	12
4	Passenger and freight platforms.....	13
4.1	Lateral clearances.....	13
4.2	Platform height.....	13
4.3	Platform clearance	13
4.4	Structure gauge within tunnels.....	13
4.5	Structure gauge	14
5	Near rail clearances.....	14
6	Physical interface requirements.....	15
7	Electrical clearances.....	15
8	General inspection – frequency and tasks	15
9	Out-of-gauge loading	16
10	Decommissioned infrastructure	16

Appendix Contents

Appendix A	Tables.....	17
A.1	Table 1 – Deemed to comply clearances	17
A.2	Table 2 – Representative track tolerances for standard gauge track.....	22
Appendix B	Clearances hazards	23

AS 7633:2019
Railway Infrastructure Clearances
Draft of Public Comment

1 Introduction

1.1 Purpose

This Standard specifies clearance requirements for the various track classifications in Australia as defined in AS 7630 Track classification.

This Standard describes requirements in design, construction, commissioning, inspection, monitoring, maintenance, modification and decommissioning for clearances between rolling stock, fixed trackside structures and passing clearances between rolling stock on adjacent tracks.

This Standard does not cover temporary structures such as formwork and scaffolding covered by special operating conditions or vegetation control.

1.2 Scope

The scope of this document is to set 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.

No additional clearance allowances have been made for access and egress (emergency or otherwise), rolling stock clearances to people, plant and equipment, projection from rolling stock, or other OH&S reasons.

This Standard covers rail networks classified in AS 7630.

Tram tracks, cane railways and monorail networks are not included.

Treatment of expendable items such as mirrors, warning lights, speakers, periscopes, antennae, roof gutters are covered in AS 7507.

1.3 Compliance

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

- (a) Requirements.
- (b) 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 cannot be applied, or other controls could be appropriate / 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 as included in an appendix.

1.4 Referenced documents

1.4.1 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 1428.2 Design for access and mobility - Enhanced and additional requirements - Buildings and facilities.
- (b) AS 4292.1 Railway safety management - General requirements.
- (c) AS 7507 Rolling stock outlines.
- (d) AS 7630 Railway infrastructure - Track classification.

1.4.2 Informative references

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

- (a) Disability Standards for Accessible Public Transport 2002.
- (b) National Code of Practice - Accessible Rail.
- (c) National Guideline - Glossary of Railway Terminology.
- (d) RISSB Code of Practice for Loading of Rail Freight.
- (e) Commonwealth Disability Discrimination Act 1992 (DDA).
- (f) Disability Standards for Accessible Public Transport 2002 (DSAPT)

1.5 Definitions

Definitions of general railway technical terms can be found in the National Guideline - Glossary of Railway Terminology.

For the purposes of this document, the following terms and definitions apply:

Clearance: The minimum distance between rolling stock and trackside structures or between rolling stock on adjacent tracks.

Contingency: The gap between the kinematic envelope and a structure, or between kinematic envelopes on adjacent tracks.

Kinematic envelope: The outline generated by a moving vehicle, taking into account vehicle and track tolerances. (NB: This is different from kinematic outline in AS 7507).

Platform height: The nominal vertical distance between the top of rail and the platform edge.

Rail infrastructure manager (RIM): The person who has effective control and management of the rail infrastructure, whether or not the person —

- (a) owns the rail infrastructure; or
- (b) has a statutory or contractual right to use the rail infrastructure or to control, or provide, access to it.

Reference vehicle: A vehicle whose rolling stock outline has been accepted by the rail infrastructure manager as being clear to operate over a defined route.

Roll centre: The point of rotation of a vehicle above rail level as shown in AS 7507.

Rolling stock operator (RSO): The person who has effective control and management of the operation or movement of rolling stock on rail infrastructure for a railway but does not include a person by reason only that the person drives the rolling stock or controls the network or the network signals.

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.

Structures: Include retaining walls, rock faced cuttings, bridge members, tunnel walls, overhead wiring masts and signals.

Structure gauge: Cross sectional outline which track side structures shall not encroach.

Track centres: The distance between the design centrelines of adjacent tracks.

2 Philosophy and Methodology

2.1 Philosophy

Clearances between a rolling stock vehicle and a structure or other rolling stock vehicle are determined by establishing the rolling stock static outline, applying the kinematic envelope and contingency.

This establishes a minimum clearance that can be adopted for the safe operation and passage of rail vehicles, but can not consider other requirements such as provision for maintenance activities, walking routes, future modifications, etc.

Alternatively, a structure gauge may be adopted that accommodates all applicable rolling stock with sufficient contingency and allowances for other requirements nominated by the rail infrastructure manager (RIM). All structures shall then be located outside of this structure gauge in order to comply.

2.2 Deemed to comply requirements

The provision of the clearances shown in Appendix A – Tables shall be deemed to comply with the safe operation and passage of rail vehicles for the various track classifications.

The deemed to comply clearances and track centres for each track classification are shown in Appendix A – Tables, A.1 Table 1 – Deemed to comply clearances

The lateral clearances and track centres in Table 1 take into account kinematic effects, curve effects for 26 m long vehicles on curves of 150 m radius and normal track tolerances.

2.3 Methodology

2.3.1 General

All structure gauge clearances shall be in accordance with the requirements of the relevant structure gauge as required by the rail infrastructure manager (RIM).

There should be safe positive passing clearances between trains, as well as train to adjacent structures and, where maintenance access is permitted, safe clearances for staff while trains are running.

Adequate arrangement should be provided for emergency access depending upon emergency services requirement.

The provision of a place of safety and emergency egress shall be made for staff who access the corridor when trains are running and for access by emergency crews.

The following general requirements apply to railway clearances:

- (a) All clearances to determine structure gauges should ensure the safety of the trains, people on-board and any staff permitted on the trackside.
- (b) Corridor clearances shall be designed and maintained based on the kinematic envelope and swept path analyses of maximum permissible standard rolling stock static outline.
- (c) The rolling stock static outline shall be the maximum cross sectional dimension of the maximum permissible rolling stock static outline at rest on straight and level track.
- (d) Where any structure adjacent to an existing railway is replaced or significantly modified, the new or reconstructed structural works shall conform to this standard.

2.3.2 Rolling stock static outline

The rolling stock operator (RSO) shall ensure only trains compliant with the static envelope defined in this standard are operated within a network and across networks. Where facilities owned and operated by third parties are involved, the clearance requirement of rolling stock operator and those of the third party shall be compared and the larger dimension be used.

2.3.3 Kinematic profile

The kinematic envelope should include but not be limited to following factors:

- (a) Static rolling stock profile.
- (b) Track and vehicle tolerances.
- (c) Allowances for curvature and superelevation.
- (d) Vehicle roll and bounce.
- (e) Dynamic effects.
- (f) Rail wear (vertical and lateral).
- (g) Lateral track movement (separately for straight track and curved track).
- (h) Track maintenance tolerances.
- (i) Deviation due to wind loading.
- (j) Unequal loading of vehicles.

2.3.4 Clearance

Track survey datum marks shall be provided at all platforms and at other structures where reduced clearances have been permitted.

The structure clearance should be calculated and measured from the centre of the nearest track and station platform and canopies, signals, electrification and other operational equipment which could encroach within the typical structure gauges.

The actual clearance required between rolling stock and structures should be calculated considering for train speed, track irregularity, and the maintenance condition of rolling stock.

Where different types of rolling stock operate over a section of track, separate analyses of the kinematic envelope shall be carried out in order to determine critical clearances.

Where a place of safety is provided between two running lines or between a running line and a siding, its width should allow for the possible effects of staff disorientation and the aerodynamic effects of adjacent passing trains.

Where staff are permitted to be near the railway tracks while trains are running, additional passing clearances between trains and structures shall be provided.

Space provision shall be provided for a trackside walkway or place of safety where staff are permitted in the corridor when trains are running.

Where a sidings track is adjacent to running lines and staff are permitted to walk along siding track, wider track spacing shall be provided for between the running lines and the sidings track.

Trackside equipment which staff need to gain access to while trains are running should be located at a safe clearance from the passing trains. Where practicable, access doors should not open towards the track.

3 Design and rating

3.1 General

The following procedures shall be used for the determination of clearance standards when considering new or existing combinations of structures and rolling stock.

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

The static outline for rolling stock operating on a line section shall be determined by the rail infrastructure manager.

3.2 Selection and specification

Clearances shall be determined by the rail infrastructure manager in accordance with this Standard.

The clearance requirements should be determined by adopting a tiered approach:

- (a) Deemed to comply requirements.
- (b) Kinematic based calculation as shown in AS 7507 Section 2: Principals of rolling stock outlines.
- (c) Historical structure gauge.

3.3 Kinematic envelope

3.3.1 Application of kinematic envelope

The kinematic envelope is the outline generated by a moving vehicle, taking into account vehicle and track tolerances.

The vehicle tolerances should include the following:

- (a) Vehicle lateral movement between body and wheelset, wheel/rail free play allowing for rail and wheel wear.
- (b) Vehicle bounce.
- (c) Vehicle body roll.

The recommended vehicle tolerances for the RISSB reference vehicles are provided in AS 7507.

The track tolerances should include the following:

- (a) Rail wear.
- (b) Lateral track misalignment (straight or curve).
- (c) Variation in cant.
- (d) Allowance of 75 mm above design rail level for resurfacing except at fixed points.

The suggested track tolerances are shown in Appendix A – Tables, Table 2.

The suggested track tolerances are representative figures and may be varied depending on the rail infrastructure manager's maintenance regime.

Centre and end throw of vehicles can be calculated using the formulae in AS 7507.

A different kinematic envelope will apply for each vehicle outline at each specific location.

Where different types of rolling stock operate over a section of track, separate analyses of kinematic envelope will be necessary in order to determine critical clearances.

3.3.2 Determination of kinematic envelope

The track and rolling stock tolerances shall be applied to the static vehicle outline relative to the reference plane specified.

Lateral rolling stock tolerance shall be applied in the plane of the rails.

Rotational rolling stock tolerance shall be applied about the roll centre of the displaced vehicle.

Vertical rolling stock tolerance shall be applied perpendicular to the plane of the rails.

Lateral alignment track tolerance shall be applied in the horizontal plane.

Lateral track tolerance caused by variation in the rail shall be applied in the plane of the rails.

Vertical track tolerance shall be applied in the vertical plane.

Cross level tolerance shall be applied perpendicular to the plane of the rails.

Centre and end throws shall be applied in the horizontal plane.

The kinematic envelope shall be the cumulative effects of the above translational and rotational tolerances on the static vehicle outline.

The kinematic envelope as determined shall assume the maximum vehicle speed on typical track condition.

The effect of stationary vehicles and those at low speed shall be included.

Vehicle effects for roll and for bounce are dependent upon vehicle/track interaction and should be reduced by limiting vehicle speed.

This calculated kinematic envelope provides no minimum contingency to structures or to passing trains.

3.3.3 Clearance to structures and between vehicles

A minimum contingency of 200 mm is the recommended minimum for all new works.

3.3.4 Reduction of minimum contingency

Where new works interface with existing work, every effort should be made to satisfy the minimum contingency.

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

A risk assessment process shall be used to determine the reduced safety margin. The risk assessment process should include, and address all identified operational risks.

3.3.5 Infringements of the minimum contingency

Infringements of the minimum contingency can be caused by, amongst other things:

- (a) rolling stock;
- (b) loads;
- (c) structures;
- (d) track centres; and
- (e) exceedence of track or vehicle tolerances.

Reduction in the minimum contingency may be permitted under special conditions approved by the rail infrastructure manager.

Management of infringements could include:

- (a) operating restrictions;
- (b) improved track and vehicle tolerances;
- (c) appropriate alterations to maintenance procedures; and
- (d) an action plan to correct infringement.

The management of reduction in safety clearance margin shall comply with the requirements of AS 4292.1.

3.4 Historical structure gauge

All infrastructure, as an absolute minimum, shall comply with the structure gauges for the relevant jurisdiction and also with other requirements that can apply as determined by the rail infrastructure manager.

Clearances to some existing items of infrastructure should not be altered without substantial changes to the Infrastructure and additional control measures can be required including:

- (a) operational restrictions;
- (b) track stability improvement; and
- (c) increased maintenance and inspection.

The management of these control measures shall comply with the requirements of AS 4292.1.

4 Passenger and freight platforms

4.1 Lateral clearances

Lateral clearances shall be provided at platforms to permit the safe passage of all rolling stock.

On tangent track, the gap between the platform edge and the vehicle should not be more than 100 mm.

On curved track, the gap between the platform edge and the vehicle will vary depending on track curvature and subsequent centre throw of the rolling stock and should not be more than 300 mm.

Other methods or engineering devices should be used to reduce the platform gap.

4.2 Platform height

The platform height should be set at approximately the same level as the vehicle floor.

If level access is not achievable, the platform height should be set with a step up into the train.

Any step up into the train should satisfy the requirements of AS 1428.2.

Where compliance with the relevant access requirements is not practicable, the rolling stock operator can seek guidance from the National Code of Practice - Accessible Rail.

Allowances shall be made for applied cant, track level variations and vertical movements of rolling stock in the determination of platform height.

The recommended platform height is nominally 1080 mm above top of rail.

4.3 Platform clearance

The rail infrastructure manager shall set out the requirements for the design and maintenance of track offset through station platforms. Station platforms are a special case of structures that are designed to come into close proximity to trains.

The relationship between platforms and rolling stock shall provide safe clearance for all passing trains (passenger and freight) and a suitable and safe stepping gap for passengers.

The platform height should be determined taking into account all rolling stock using the line.

The railway systems shall meet the requirements of the Commonwealth Disability Discrimination Act 1992 (DDA) and the Disability Standards for Accessible Public Transport 2002 (DSAPT) for the general public within the stations and tunnel.

4.4 Structure gauge within tunnels

Underground structure and tunnels shall have adequate space provision for the following but not limited to:

- (a) worst case rolling stock kinematic envelope, including centre throw and end throw of the rolling stock;
- (b) An agreed safety clearance margin not less than 200 mm beyond the worst case kinematic envelope to tunnel structure;
- (c) utilities and services;
- (d) emergency egress;
- (e) maintenance requirements.

The minimum structure gauge envelope shall be established for underground structures and tunnels based on the static outline and rollingstock configuration permitted to use on the line.

4.5 Structure gauge

All infrastructure should comply with the structure gauges for the relevant jurisdiction and also with other requirements that can apply as determined by the rail infrastructure manager.

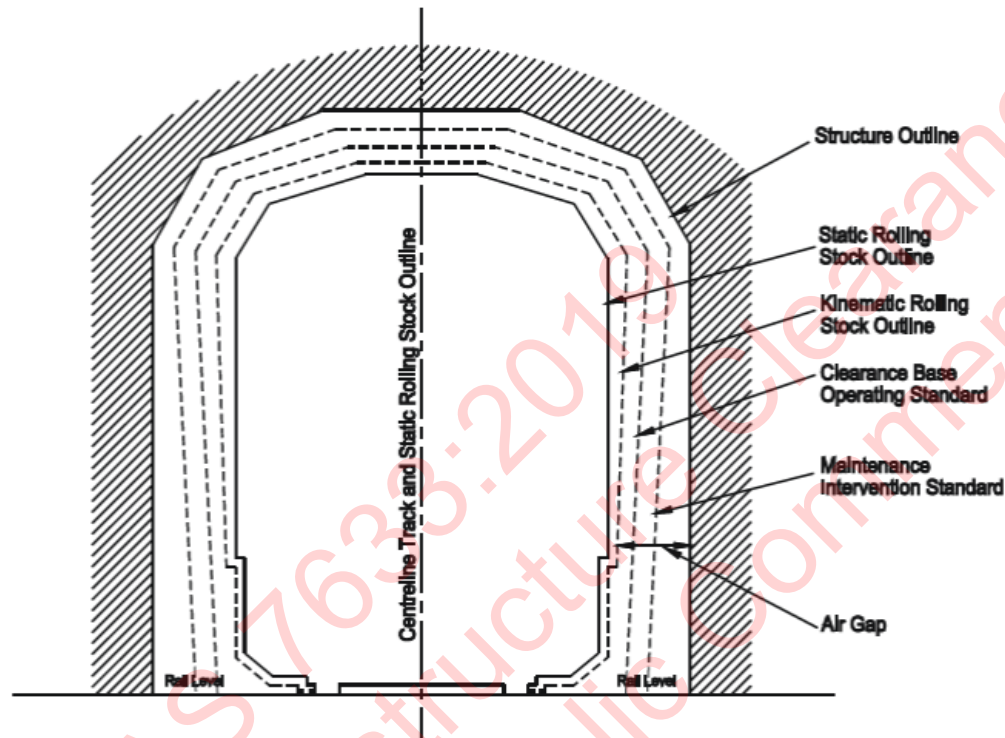


Figure 1: Schematic of clearance outlines

5 Near rail clearances

The near rail clearances define the areas reserved for items intended to come in close proximity to trains.

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

- (a) train warning/control equipment;
- (b) check rails;
- (c) guard rails;
- (d) level crossing surfaces and flangeway requirements; and
- (e) other lineside equipment such as signal trunking.

In general, except for the area designated for wheel flanges, locations below the plane of the rails are available for infrastructure installation.

The rail infrastructure manager shall determine the clearance requirements within the rail areas.

The management of near rail clearances shall comply with the requirements of AS 4292.1.

6 Physical interface requirements

The rail infrastructure manager should determine the clearance requirements for items of infrastructure that have a physical or operational interface with rollingstock.

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;
- (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.

The management of these physical interface requirements shall comply with the requirements of AS 4292.1.

7 Electrical clearances

Aerial lines and other cable systems shall maintain safety clearances to rail systems under the environmental and electrical service conditions determined for the line.

Low voltage aerial lines carrying alternating current (AC) shall not be located above direct current (DC) traction conductors.

The clearances between high voltage aerial lines and any part of the railway system shall satisfy the requirements of the electrical regulator in each jurisdiction.

8 General inspection – frequency and tasks

The rail infrastructure manager shall determine the frequency for general inspection of clearances.

General inspection of clearances should be carried out in a manner and at an interval appropriate to the track classification, location, rates of deterioration and other local factors.

At locations where clearance is infringed, the frequency of general inspection should be increased as determined by the rail infrastructure manager.

A general inspection including determination of the available clearances should also be carried out where there are suspected defects following events affecting the location of tracks or structures, or defects identified from walking inspections.

The inspection frequency regime should take into account the associated level of risk at the clearance location.

Clearance inspection should include but not be limited to the following:

- (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 turn out clearance points.

Structures include retaining walls, rock faced cuttings, bridge members, overhead wiring masts and signals.

9 Out-of-gauge loading

Where any part of a vehicle falls outside the approved static vehicle outline of the corridor, it is to be treated as an out-of-gauge load.

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

Management of out-of-gauge loadings may include the following:

- (a) Any special route required to avoid fouling close structures.
- (b) Speed restrictions past close structures.
- (c) Piloting past close structures.
- (d) The need to stop the train and check the load for movement prior to passing a close structure.
- (e) Speed restrictions past passenger platforms if a load overhangs the platform.
- (f) Restricting passenger access to platforms during the period in which an overhanging load would pass through a platform area.
- (g) Timetabling of the movement.

10 Decommissioned infrastructure

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

Appendix A Tables

A.1 Table 1 – Deemed to comply clearances

AS 7633:2019
Railway Infrastructure Clearances
Draft of Public Comment

AS 7630 Track classification	Worse case rolling stock outline	Minimum horizontal distance from centreline of track to face of structures
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Medium speed passenger (MSP)	Determined by RIM	3 m	456- ... 760 r55 rr
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High speed passenger (HSP)	Determined by RIM	3 m	456- ... 760 r55 rr
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Branch line freight (BLF)	Determined by RIM	3 m	4--7 ... 7 1 r r
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Main line freight (MLF)	Determined by RIM	3 m	4--7 : 7 r
Heavy haul freight (HHF)	Determined by RIM	3 m	4--7 : 7 r

AS 7633:2019
Railway Infrastructure Clearances
Draft of Public Comment

AS 7633:2019
Railway Infrastructure Clearances
Draft of Public Comment

A.2 Table 2 – Representative track tolerances for standard gauge track

Description		Direction	Tolerance
Timber sleepersed ballasted track			
Alignment	Rail wear		15 mm
	Variation from design	Lateral	± 25 mm
			± 35 mm
Level	Variation from design	Vertical	± 75 mm, - 0 mm
Cant	Variation from design	Rotational	± 10 mm
Concrete sleepersed track			
Alignment	Rail wear		15 mm
	Variation from design	Lateral	± 15 mm
			± 25 mm
Level	Variation from design	Vertical	± 75 mm, - 0 mm
Cant	Variation from design	Rotational	± 10 mm
Slab track and transom top bridges			
Alignment	Rail wear		15 mm
	Variation from design	Lateral	± 10 mm
			± 20 mm
Level	Variation from design	Vertical	± 10 mm, - 0 mm
Cant	Variation from design	Rotational	± 10 mm

Appendix B Clearances hazards

Hazard No.	Hazard	Heading No.
5.2	Harm to infrastructure by rolling stock	2.1, 2.2, 2.3 3.1, 3.2, 3.3, 3.4 4.1, 4.2, 4.3, 4.4, 4.5 5, 6, 8, 9, 10
6.6	Harm to track & civil infrastructure by rolling stock	2.1, 2.2, 2.3 3.1, 3.2, 3.3, 3.4 4.1, 4.2, 4.3, 4.4, 4.5 5, 6, 8, 9, 10
6.9	Harm to Track & Civil infrastructure during operation and maintenance	2.1, 2.2, 2.3 3.1, 3.2, 3.3, 3.4 4.1, 4.2, 4.3, 4.4, 4.5 5, 6, 8, 9, 10

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Once agreed by the Development Groups, Standing Committees and Validator, the drafts are passed to the RISSB Board for approval.

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