



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Track & Civil)

Category: Standard

Management of Clearances

ETM-07-01

Applicability

| | | | |
|-----------------|---|----------------|--|
| New South Wales | ✓ | CRIA (NSW CRN) | |
|-----------------|---|----------------|--|

Primary Source

ARTC Standards BDS 09, BDS 11, BDS 12, BDS 13, BDS 14, BDS 15, BDS 16, BDS 17, BDS 19 and BOP 01

Document Status

| Version | Date Reviewed | Prepared by | Reviewed by | Endorsed | Approved |
|---------|---------------|-------------|-------------------|---------------------------------|----------|
| 1.2 | 18 Jun 10 | Standards | Manager Standards | Exec Manager SS&P 21/06/2010 | CEO |

Amendment Record

| Version | Date Reviewed | Clause | Description of Amendment |
|---------|---------------|--------|---|
| 1.0 | 01 Dec 09 | | Implementation draft. Supersedes NSW Standards BDS 11 v1.2 in part, BDS 12 v1.2, BDS 14 v1.2 in part, BDS 15 v1.3, BDS 16 v1.2, BDS 17 v1.2, BDS 19 v1.1 and BOP v1.2 |
| 1.1 | 25 Mar 10 | 4 | Implementation draft update. Track centre and clearance requirements for structures adjacent to sidings changed from should to shall |
| 1.2 | 18 Jun 10 | | Banner added regarding mandatory requirements in other documents and alternative interpretations. |

© Australian Rail Track Corporation Limited 2011

Disclaimer:

This document has been prepared by ARTC for internal use and may not be relied on by any other party without ARTC's prior written consent. Use of this document shall be subject to the terms of the relevant contract with ARTC.

ARTC and its employees shall have no liability to unauthorised users of the information for any loss, damage, cost or expense incurred or arising by reason of an unauthorised user using or relying upon the information in this document, whether caused by error, negligence, omission or misrepresentation in this document.

This document is uncontrolled when printed.

Authorised users of this document should visit ARTC's intranet or extranet (www.artc.com.au) to access the latest version of this document.

Contents

| | | |
|-----------|--|-----------|
| 1 | Introduction | 3 |
| 2 | Symbols | 3 |
| 3 | Transit Space Standards | 3 |
| 3.1 | Rolling Stock and Loading Outlines | 4 |
| 3.2 | Infrastructure standards | 4 |
| 4 | Normal Structure Gauge 1994 | 4 |
| 5 | Kinematic Envelope Outline | 9 |
| 6 | Clearances at Platforms | 10 |
| 6.1 | General | 10 |
| 6.2 | Standard and Level Access Platforms | 10 |
| 6.3 | Standard Access Platform..... | 10 |
| 6.4 | Curved Track..... | 11 |
| 6.5 | Transitioned Track | 11 |
| 6.6 | Tolerances at Platforms..... | 12 |
| 6.7 | Documentation | 12 |
| 7 | Base Operating Standards for Clearances | 13 |
| 7.1 | Reduced Clearances | 13 |
| 7.2 | Approval of Reduced Clearance | 13 |
| 7.3 | Track and Structures Design Infringements..... | 13 |
| 7.4 | Infringement Notification and Records..... | 14 |
| 8 | Transit of Special and Out-of-Gauge Loads | 15 |
| 8.1 | General | 15 |
| 8.2 | Platform Clearances | 15 |
| 9 | Track Centre Clearance Warning Signs for Yards | 16 |
| 9.1 | Purpose | 16 |
| 9.2 | Warning Signs | 16 |
| 9.3 | Position of Signs | 16 |
| 9.4 | Inspection..... | 16 |
| 10 | Appendix 1: Rolling Stock Cross-sections | 17 |
| 11 | Appendix 2: Centre and End Throw at Transitions | 25 |
| 12 | Appendix 3: Definitions of Terms | 31 |
| 13 | Appendix 4: Forms (examples only) | 32 |
| 13.1 | ETM0701F-01 Transit Space Operational Infringement Approval..... | 33 |
| 13.2 | ETM0701F-02 Transit Space Operational Infringement Approval Register | 34 |

Mandatory requirements also exist in other documents.

Where alternative interpretations occur, the Manager Standards shall be informed so the ambiguity can be removed. Pending removal of the ambiguity the interpretation with the safest outcome shall be adopted.

1 Introduction

This specification contains procedures and strategies for the maintenance of approved envelopes through which operators may convey passengers and freight in a safe and commercial environment. It is applicable to the existing non-electrified lines in NSW for which ARTC has management responsibility.

Any proposal that impacts on transit space must be considered in accordance with the requirements of Section 7 of the ARTC T&C CoP and this specification.

The design of all new structures is to comply with the provisions of the ARTC T&C CoP and this specification as is the maintenance of existing assets.

Variations to the details given in the ARTC T&C CoP and this specification must not be made without specific approval of the relevant authority

Definition of terms used in this specification is shown in Appendix 3.

2 Symbols

Symbols used in this specification are shown below.

| Symbol | Description | Units |
|----------|--|--------|
| E_a | Applied super-elevation at the point in the track being analysed | mm |
| E_{ae} | Effective super-elevation for the point in the track being analysed | mm |
| E_d | Design super-elevation at the point in the track being analysed | mm |
| R | Radius of the track at the point in the track being analysed | metres |
| R_e | Effective radius of the track for the point in the track being analysed | metres |
| K | Co-efficient for determining horizontal displacement due to centre throw $\frac{B_c^2}{8}$ | |
| k | Co-efficient for determining horizontal displacement due to super-elevation $\frac{V}{1435}$ | |
| B_c | Vehicle bogie centres | mm |
| L | Vehicle length | mm |
| V | Platform height | mm |
| H | Platform horizontal position | mm |

3 Transit Space Standards

Transit Space Standards provide for the safe passage of approved trains on new and existing lines by providing:

- a Kinematic envelope comprising:
 - approved rolling stock and loading profiles;
 - track and vehicle tolerances;
 - allowances for curvature including end and centre throws and superelevation;

- a safety clearance margin;
- agreed infrastructure service requirements including drainage, mechanised maintenance, service access and increased track centre requirements

3.1 Rolling Stock and Loading Outlines

Maximum outline for authorised rolling stock static gauge is shown in Appendix 1 for:

- Narrow non-electric;
- Narrow square;
- Narrow container;
- Intersystem;
- Narrow hopper;
- Double stack;
- Out of gauge load; and
- NZZA wagon.

3.2 Infrastructure standards

Structure Gauge is to be applied in accordance with approved Corridor Strategies Detailed.

Structure Gauge is detailed in section 4. Infringement of the approved Transit Space Standards shall occur only in accordance with procedures set out in section 7.

4 Normal Structure Gauge 1994

Normal Structure Gauge 1994 applies to existing infrastructure.

Normal Structure Gauge 1994 is shown as Figure 1A.

Permanent infringements to Structure Gauge 1994 are shown in Figure 1B

The maximum Transit Space to be derived from Figure 1A is shown in Figure 1C.

Applicable to all ARTC NSW tracks where clearance is available. It provides for ease of use under most circumstances and includes appropriate infrastructure service requirements as detailed in Section 6. No restrictions are placed on rolling stock operation on corridors carrying any authorised rolling stock outline. It does not require determination of kinematic envelopes.

Infringement of the Nominal Structure Gauge 1994 will be permitted only in accordance with the provisions of Clauses 7 and 8.

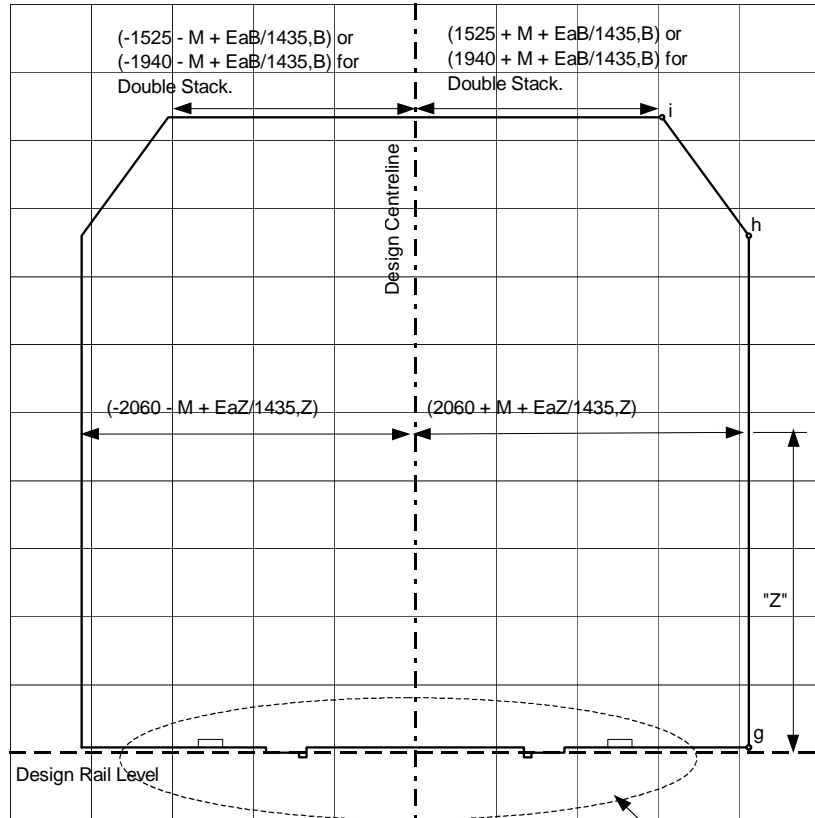
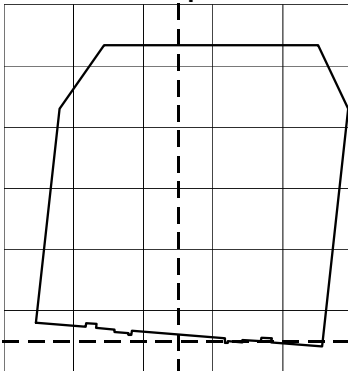
Where structures are located on a transition or a straight within 22 metres of a tangent point and the lateral clearance is less than 3.0 metres the 'M' allowance must include the allowance specified in Appendix 2.

Normal Structure Gauge, 1994

Coordinates

| Point | Lateral | Vertical |
|-------|-----------|----------|
| a | 673 | 38 |
| b | 673 | -32 |
| c | 718 | -32 |
| d | 718 | 0 |
| e | 921 | 0 |
| f | 921 | 38 |
| g | See Diag. | 38 |
| h | See Diag. | 3800 |
| i | See Diag. | B |

Superelevated Track Example



For Dimensions, see Detail.

Where:

"Ea" is the Applied Superelevation (right rail in diagram is the low rail).

"B" is the vertical clearance required.

"Z" is the vertical height above the design low rail level.

"M" is the Centre Throw and End Throw component in curves.

For dimensions "B" & "M", see text.

Physical Interface for trip arm in trip position only.

Detail

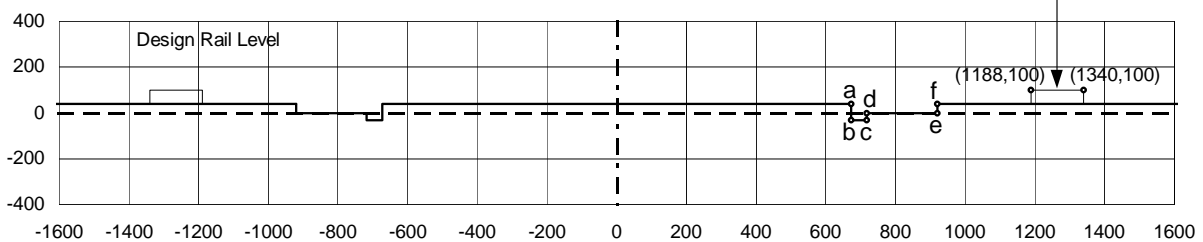


Figure 1A - Normal Structure Gauge 1994

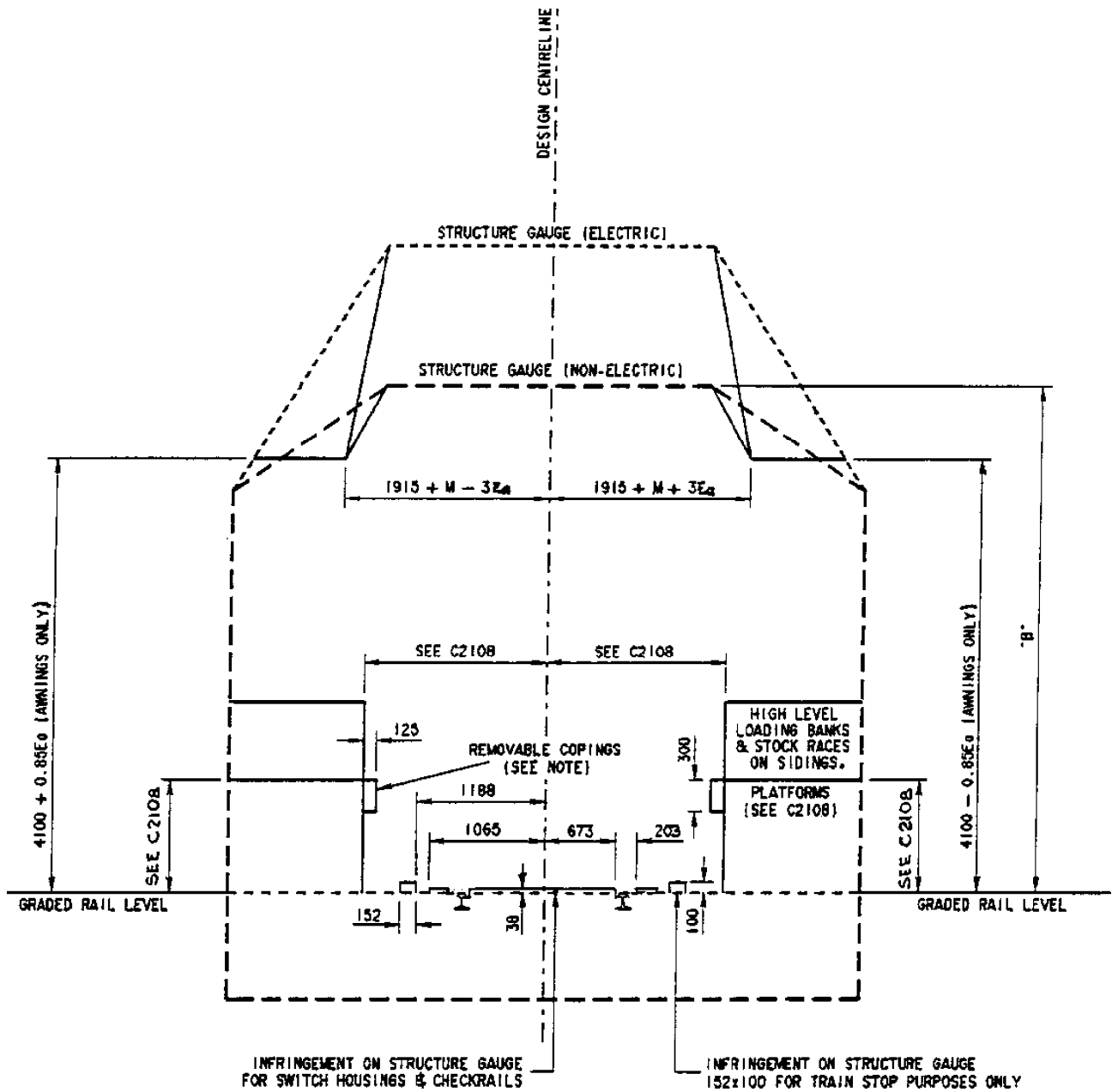


Figure 1B - Permanent Infringements

Note: Removable copings are an approved infringement where only narrow or non-electric vehicles operate.

Legend

M = maximum displacement of centre line of vehicle from the design centreline of curved track (ie the centre or end throw of a vehicle).

Ea = Superelevation of track in mm.

Z = height above graded rail level in mm.

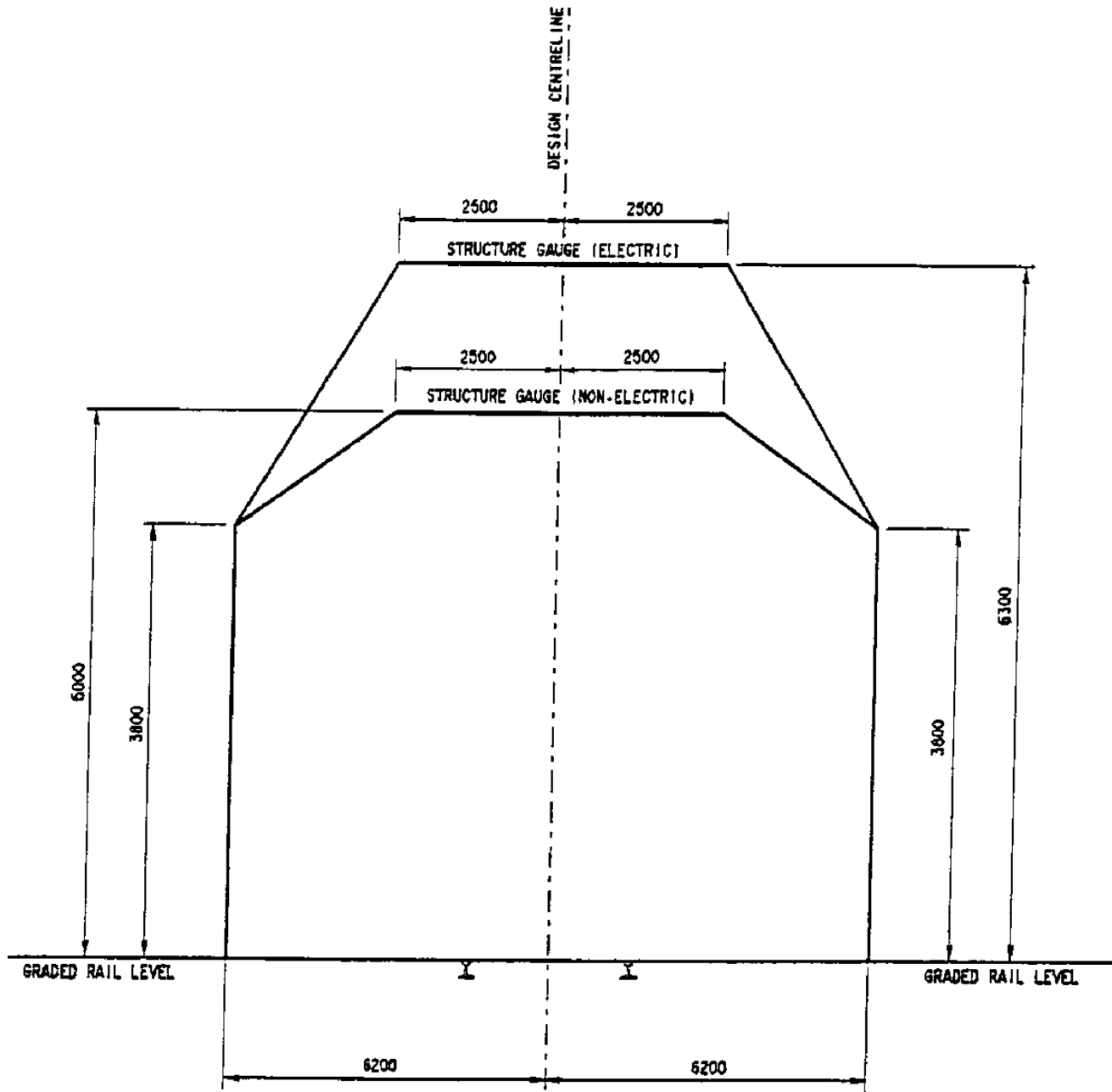


Figure 1C - Maximum Transit Space Envelope

Horizontal Clearance

The minimum clearance of 2060mm from track centre provides safe clearance for the passage of all rolling stock on straight track. This dimension should be altered to cater for curve effects as follows:

$$\text{Outside (high leg) of curve} = 2060 + M - \frac{EaZ}{1435} \text{ mm}$$

$$\text{Inside (low leg) of curve} = 2060 + M + \frac{EaZ}{1435} \text{ mm}$$

The altered horizontal dimensions should be rounded up to the nearest 20mm.

Where:

$$M = \text{the allowance for centre and end throws} = \frac{42000}{R} \text{ mm}$$

Z = height above rail level mm

Where structures are located in transitions or straights (including turnouts) within 22m of a tangent point the altered dimension (based on the full radius of the curve) must extend 20m beyond the tangent point along the straight (see Appendix 2).

To provide for main line crossing loop service requirements as listed below, the 2060 mm dimension from track centre may be varied to the values in Table 1. An allowance for track curvature and superelevation has been included in these clearances

| Structure | Dimension mm |
|--|--------------|
| Signal bridge masts; temporary construction works adjacent to a track. | 3000 |
| Vertical piers, columns, deflection walls between tracks | 3500 |
| Bridge substructures and deflection walls (except between tracks); cuttings without road access; station buildings; columns, footbridges, and signal bridge supporting structures on platforms; other structures located adjacent to non-electrified tracks and where road access is not required. | 4300 |
| Other structures and cuttings where road access is required. | 6000 |

Table 1

For structures adjacent to sidings the dimension from the track centre shall be as shown in Table 2 to allow for worksite access and operating safety requirements. These clearances shall be increased to allow for track curvature effects when structures are located at, or within 22 metres of curves or turnouts

| Structure | Dimension mm |
|--|--------------|
| Non-continuous structures e.g. isolated columns, doorways and gateways. | 2500 |
| Continuous structures, e.g. walls, material stacks and unbroken fencing. | 3000 |
| Where vehicle doors may open opposite a structure. | 3700 |

Table 2

Vertical clearances

In non-electrified areas, Dimension 'B' is the vertical distance from the underside of a structure to the design height of the low rail.

The minimum design value of Dimension 'B' for specified rolling stock outlines in non-electrified areas shall be as detailed in Table 3.

| Dimension B | Rollingstock Outline |
|---------------------------|---|
| 4670 + 1.2E _a | Narrow Non-Electric Narrow Square Narrow Container Intersystem Narrow Hopper Out of Gauge Load NZZA Wagon |
| 6250 + 1.5 E _a | Double Stack |

Table 3 – Vertical Clearance at Dimension B

This provides for the safe passage of approved Rolling Stock and loading outlines and includes a minimum vertical clearance of 400mm above the approved outline. The 400mm margin includes a design allowance of 150mm for track resurfacing.

Track Centres

Minimum design track centres for new works are shown in Table 4:

| | |
|--|--|
| Main line to Main line, Main line to Crossing Loop | 4500 (5500 where signals/lighting posts are located between tracks). |
| Main line to Refuge Loop Siding or Siding (non-examination) | 4500 (5500 where signals/lighting posts are located between track)s. |
| Main line to Siding, Crossing Loop to Siding or Examination Siding | 5500 for straight and curved tracks. |

Table 4

5 Kinematic Envelope Outline

The Kinematic Envelope represents the maximum dynamic displacement of a vehicle outline from track centreline and from rail level.

A different Kinematic Envelope will apply for each Rolling Stock Gauge. Where different types of rolling stock operate over a section of track, separate analyses of Envelope will be necessary in order to determine critical clearances.

A method for the determination of the Kinematic Envelope is shown in the ARTC T&C CoP Section 7.

The envelope assumes maximum vehicle speed on typical track condition. Vehicle effects for roll and for bounce are dependent upon vehicle/track interaction and may reduce by limiting vehicle speed.

6 Clearances at Platforms

6.1 General

A platform wall adjacent to a track is a critical clearance location and is to be specially managed under the provisions of ETE-07-01.

The clearances between platforms and rolling stock are designed to provide the minimum gap when allowance is made for vehicle dynamics and acceptable maintenance tolerances for track and vehicle.

ARTC is responsible for the maintenance of the clearance between the track and the platform. Others are responsible for maintaining the structural integrity of the platform surface, face and coping.

Special Load Gauge vehicles overhang standard platforms and cannot pass Level Access (see clause 6.2) platforms.

Special Load Gauge vehicle vertical clearance to standard access platforms is critical and tolerances must be maintained as specified below.

Some corridors have paths that are designated "Special Load Gauge paths" through the corridor. It is not permitted to construct Level Access platforms adjacent to tracks on these paths.

During track upgrading or construction works, changes in the approved design configurations may exceed acceptable tolerances and as a result special management procedures may need to be prescribed by the authorised ARTC representative.

6.2 Standard and Level Access Platforms

Platforms may be designated as Standard Access or Level Access.

Standard Access platforms provide a step down of approximately 150mm from car floor to platform coping.

Level Access platforms are at approximately the same level as the car floor. There are no Level Access platforms on the ARTC Network.

6.3 Standard Access Platform

The height V_s to a platform coping above Graded Rail Level on straight track is shown in Table 5.

The height to a platform coping above Graded Rail Level (low rail) on curved, track is to be:

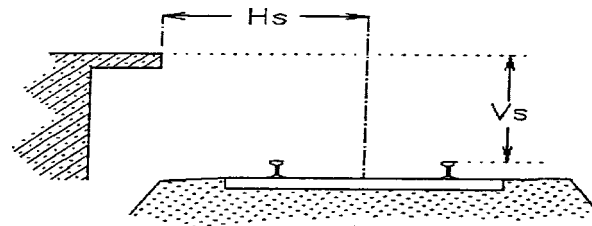
$$V_c = V_s + 1.7 E_d \text{ for a concave platform}$$

$$V_v = V_s - 0.7 E_d \text{ for a convex platform}$$

The horizontal and vertical clearance between a straight Standard Access platform coping edge and the design centreline of the adjacent track is shown in Table 5.

| Rolling stock type | Sleeper type | Hs (mm) | K | k | Vs (mm) |
|---------------------|--------------|---------|-------|------|---------|
| Narrow/Non Electric | All | 1575 | 32600 | 0.67 | 1065 |
| ANZR | All | 1700 | 42000 | 0.75 | 1065 |

Table 5



FIG

Figure 2

6.4 Curved Track

The horizontal clearance to concave and convex Standard Access platforms is shown in figure 3 by H_c and H_v respectively as follows:

$$H_c = H_s + \frac{K}{R} - kE_d \quad \text{for concave platform}$$

$$H_v = H_s + \frac{K}{R} + kE_d \quad \text{for convex platform}$$

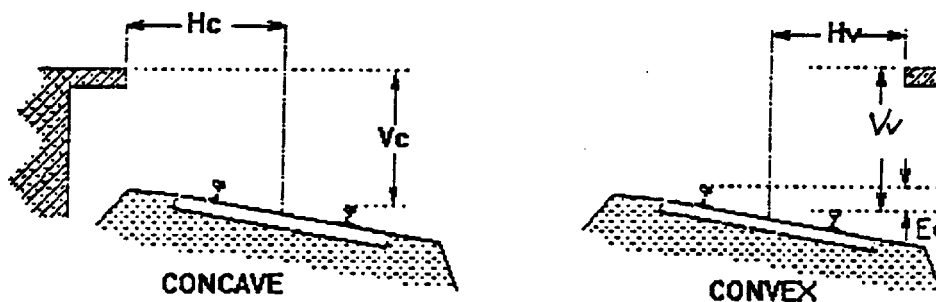


Figure 3

6.5 Transitioned Track

The clearances to platforms adjacent to transition curves, or within a vehicle length of a transition curve, are determined from modified forms of the above formulae. The radius used is the effective radius at the point in the track being analysed, and the super-elevation used is the effective super-elevation at the point in the track being analysed.

$$H_c = H_s + \frac{K}{R_e} - kE_{ae} \quad \text{for concave platform}$$

$$H_v = H_s + \frac{K}{R_e} + kE_{ae} \quad \text{for convex platform}$$

The effective super-elevation (E_{ae}) for a **concave** platform is the average super-elevation of two points on the track, which are a distance of $\frac{L+Bc}{2}$ and $\frac{L-Bc}{2}$, in the direction of increasing super-elevation, from the point in the track being analysed.

The effective super-elevation (E_{ae}) for a **convex** platform is the average super-elevation of two points on the track, which are a distance of $\frac{Bc}{2}$, in each direction, from the point in the track being analysed.

The effective radius (Re) for a **concave** platform is the average radius of two points on the track, which are a distance of $\frac{L+Bc}{2}$ and $\frac{L-Bc}{2}$, in the direction of tightening radius, from the point in the track being analysed.

The effective radius (Re) for a **convex** platform is the average radius of two points on the track, which are a distance of $\frac{Bc}{2}$, in each direction, from the point in the track being analysed.

The average radius of two points can be determined using the following formula:

$$Re = \frac{2}{\left(\frac{1}{R_1} + \frac{1}{R_2}\right)}$$

Where R1 and R2 are the radii at each of the two points.

Ea and R at any point in a transition can be determined from formulae provided in ARTC Specification ETD-00-03.

6.6 Tolerances at Platforms

6.6.1 Tolerances on height

Construction/reconstruction (Platforms)

| | | |
|-----------------|-------------|--------------------------------|
| Standard Access | -0mm + 25mm | Relative to Graded Rail Level. |
|-----------------|-------------|--------------------------------|

(i.e. Standard Access platforms height as constructed may vary between 1065mm and 1090mm above graded rail level).

Maintenance/reconstruction (track)

| | |
|--------------|--|
| ARTC Network | -0mm + 50mm relative to actual rail level. |
|--------------|--|

Height of existing platforms above actual rail level may vary between 1065mm and 1115mm.

6.6.2 Tolerances on lateral clearance

Construction tolerance on lateral clearance for Standard Access Platforms is to be:

| | |
|------------|--|
| +5mm – 0mm | For both straight and curved track relative to design track alignment. |
|------------|--|

Maintenance tolerance on lateral clearance for Standard Access Platforms is to be:

| | |
|--------------|---|
| +15mm – 15mm | For both straight and curved track (see Clause 8 for base operating tolerances) relative to actual track alignment. |
|--------------|---|

Through platforms, super-elevation is to be maintained within 10mm of design.

6.7 Documentation

The following details any new platform design must be provided to ARTC:

- Line and track;
- Kilometrage;
- Station name and platform number
- Design details consisting of track width class, rolling stock outlines considered, height category (standard or level access);
- Standard followed.

7 Base Operating Standards for Clearances

7.1 Reduced Clearances

The required transit space can be infringed by rolling stock, loads, structures, track centrelines and the exceedence of track and vehicle tolerances.

Normal Structure Gauge 1994 provides for a safety margin of 200mm between the kinematic envelope and an adjacent structure (excluding a platform) or a vehicle on an adjacent track.

For a limited period the clearance other than at platforms may be reduced down to the Base Operating Standard of 100mm without restricting operating conditions. However, inspection and maintenance systems should be reviewed and modified where specified by the authorised ARTC representative.

Where the clearance is reduced below the Base Operating Standard for clearances of 100mm, action is to be taken to restore clearances.

At platform copings the usual design safety margin of 200mm is not achieved and special lateral and vertical clearances are authorised in clause 6.

The base operating tolerance on platform height is 100mm (i.e. 1165mm for standard access platforms on straight track). The base operating tolerance on platform lateral clearance is -20mm of the design value.

Permanent reduction in the clearances detailed above may be permitted only under special operating conditions and registered in accordance with clause 7.4.

To determine the safety margin at a structure or between adjacent trains, the kinematic envelope should be derived.

No structure should be designed, or have a change in configuration, which will result in a safety margin less than 200mm.

7.2 Approval of Reduced Clearance

Reduction in safety margins to those listed in Clause 7.1 may be approved by the authorised ARTC representative.

Management of temporary infringements should include:

- Action plan to correct infringement;
- Appropriate alterations to maintenance procedures and operating restrictions;
- Consultation with the authorised ARTC representative;
- Appropriate records of the infringements.

Reduction in a service clearance may be approved by the authorised ARTC representative.

Reduction of designated safety margins to structures and between rolling stock should be temporary only and managed by the authorised ARTC representative.

7.3 Track and Structures Design Infringements

When existing tracks or structures are scheduled for renewal or major upgrading and for new structures, the design must include clearances not less than those specified in the Normal Structure Gauge 1994. Where this is unattainable, reduced clearances may be approved in accordance with clause 7.1.

Prior to approval, evidence of the inability to comply will need to be submitted to the authorised ARTC representative together with appropriate technical and financial supportive documentation. Where approval is given, the appropriate infringement approval form will need to be completed, specifying any special conditions.

7.4 Infringement Notification and Records

Structure Gauge Infringement Approval Forms are to be held by authorised ARTC representative. See Appendix 4.

A register is to be maintained for each Corridor with a current copy of the register issued to the authorised ARTC representative and relevant Maintenance Staff.

8 Transit of Special and Out-of-Gauge Loads

8.1 General

The Maximum Load Diagram for Out-of-Gauge Loads is shown in Appendix 1 "Out of Gauge rollingstock".

The authorisation of various vehicle loads and speeds is published in the appropriate working timetable. Authority for the running of heavy loads is to be established by ARTC Operations.

The objective is to initiate consultation where clearances cannot be maintained within the specified tolerances. In particular, platform heights are identified as critical to the operation of special and out-of-gauge loads.

The authorised ARTC representative is to regularly monitor and fully document all locations where special and out-of-gauge loads will infringe existing structures. Any intended variation, or variations from previous monitoring should also be nominated.

Any infringements of structure gauge standards adopted for various lines at any time are to be regarded as temporary only and are to be corrected as a priority.

The ARTC Operations will use the information from the authorised ARTC representatives to determine what out-of-gauge loads can run, and will liaise directly with ARTC Operations Standards Manager to arrange any special corrective measures required for the safe transit of these loads.

Operators will liaise directly with the ARTC Operations Standards Manager to determine whether particular trains can run, and arrange for the running of these trains.

8.2 Platform Clearances

For the running of special and out-of-gauge loads, the platform height needs to be maintained within tolerance, particularly on curves. Lateral clearances to platforms are at an absolute minimum for passenger services when vehicle allowances of 2° roll and 75mm bogie displacement are included.

The standards for platform clearances are detailed in the Section 7. Any reduction in these clearances is to be treated as potential infringement and reported accordingly.

9 Track Centre Clearance Warning Signs for Yards

9.1 Purpose

Warning signs are to be provided where track centres within yard limits are less than 4000 mm. This applies to ARTC tracks or between an ARTC track and an adjacent track.

The purpose of the sign is to warn train operations personnel of the existence of track centres narrower than 4000 mm. The required response to the signs by operators is specified in the Safe Working regulations.

9.2 Warning Signs

Warning Signs should contain the words *“Danger Narrow Track Clearances”* and be laid out as shown in Figure 4. All signs are to be reflectorised and of metal construction.



Figure 4

Where signs are provided at entry points to yards/sidings, they are to be 600 x 400mm. The minimum height of the centre of the sign is to be 2.2m above rail level. Where signs are provided at point levers or main frame levers, they are to be 400 x 300mm.

9.3 Position of Signs

The number and location of signs within a yard is to be determined during a joint risk assessment with the operator/s. The minimum requirement is 2 signs, one at each end of the yard. The position of all Warning Signs is to be documented on the applicable track layout diagram. Signs are to be positioned:

- Clear of structure gauge and clearly visible to train operations personnel;
- So as not to be associated with any signals;
- So as not to restrict the operator's normal field of vision or operation of levers;
- So they will not present a tripping hazard, or a head or body collision hazard to personnel.
- The position of all signs is to be documented on the applicable track layout diagram.

9.4 Inspection

Signs are to be inspected as specified in the ARTC T&C CoP.

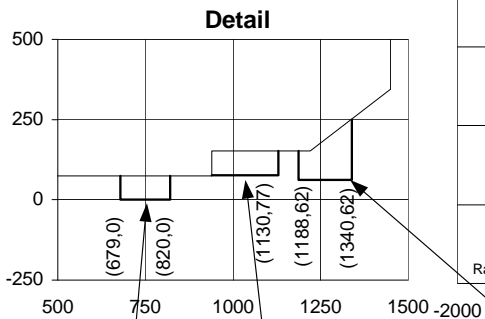
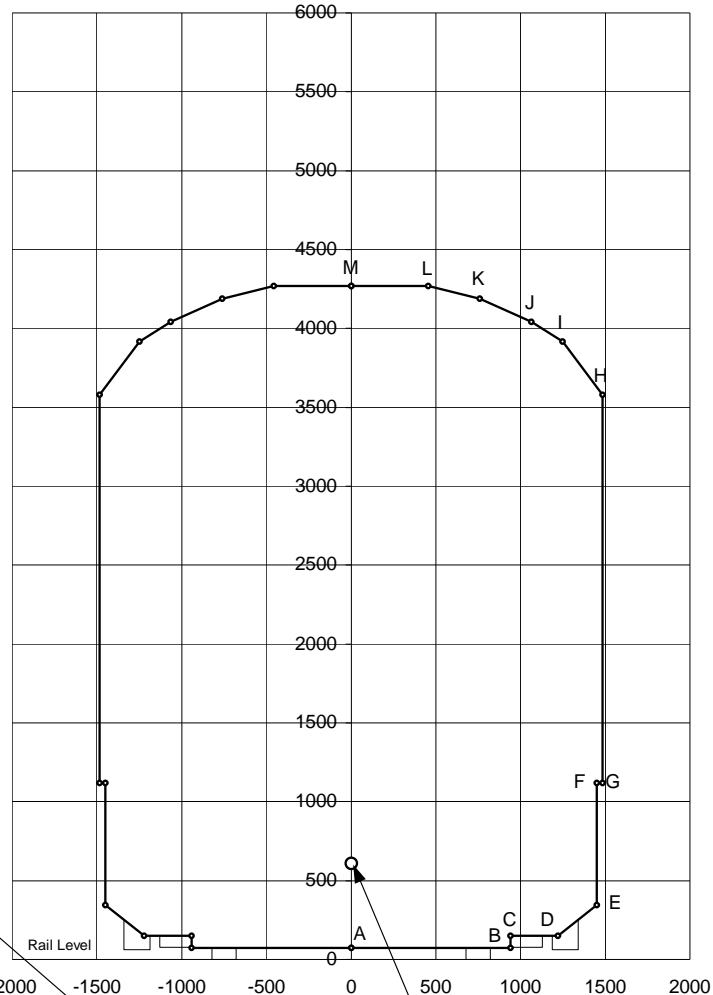
10 Appendix 1: Rolling Stock Cross-sections

"Narrow Non-Electric" Rollingstock Outline Dimensions

Bogie Centres: 16155 mm
Body Overhang: 3353 mm

Coordinates

| Point | Lateral | Vertical |
|-------|---------|----------|
| A | 0 | 75 |
| B | 940 | 75 |
| C | 940 | 152 |
| D | 1220 | 152 |
| E | 1450 | 345 |
| F | 1450 | 1120 |
| G | 1485 | 1120 |
| H | 1485 | 3580 |
| I | 1250 | 3916 |
| J | 1065 | 4040 |
| K | 760 | 4190 |
| L | 455 | 4270 |
| M | 0 | 4270 |

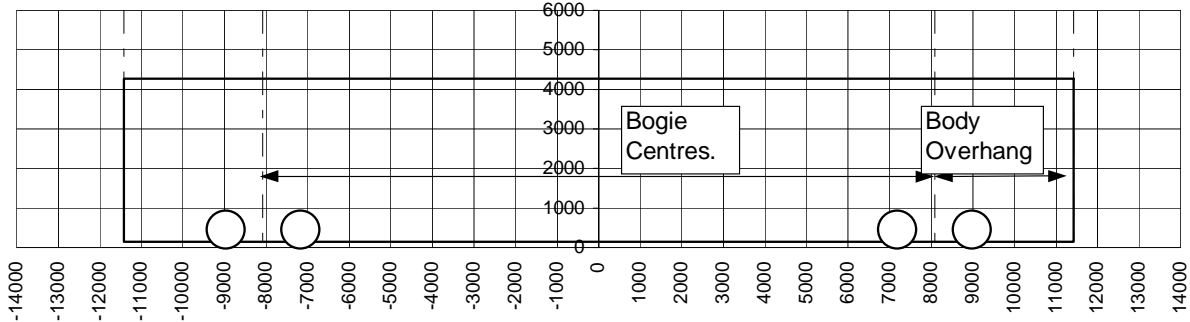


Physical Interface for wheels only.

Outline Extension for bogie components only.

Physical Interface for trip valve arm only.

Roll Centre at 610 mm.



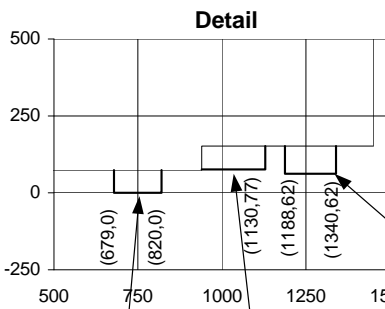
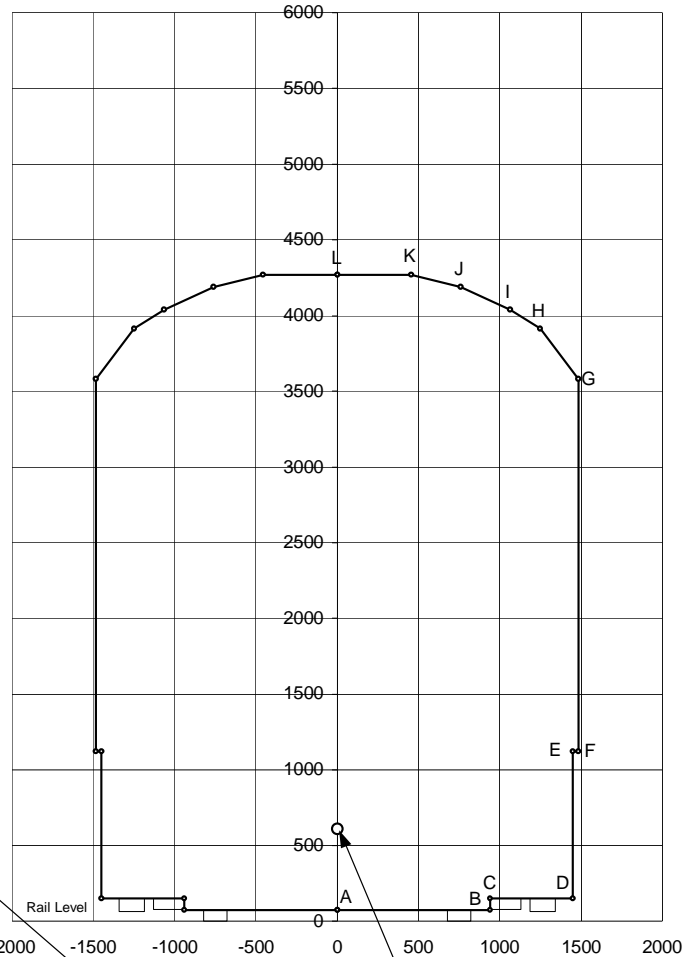
- All cross-section dimensions are symmetrical about the vehicle centreline.
- The origin for all horizontal coordinates is the vehicle centreline.
- The origin for all cross-section vertical coordinates is the rail level.
- All dimensions are in millimetres.

"Narrow Square" Rollingstock Outline Dimensions

Bogie Centres: 16155 mm
Body Overhang: 3353 mm

Coordinates

| Point | Lateral | Vertical |
|-------|---------|----------|
| A | 0 | 75 |
| B | 940 | 75 |
| C | 940 | 152 |
| D | 1450 | 152 |
| E | 1450 | 1120 |
| F | 1485 | 1120 |
| G | 1485 | 3580 |
| H | 1250 | 3916 |
| I | 1065 | 4040 |
| J | 760 | 4190 |
| K | 455 | 4270 |
| L | 0 | 4270 |

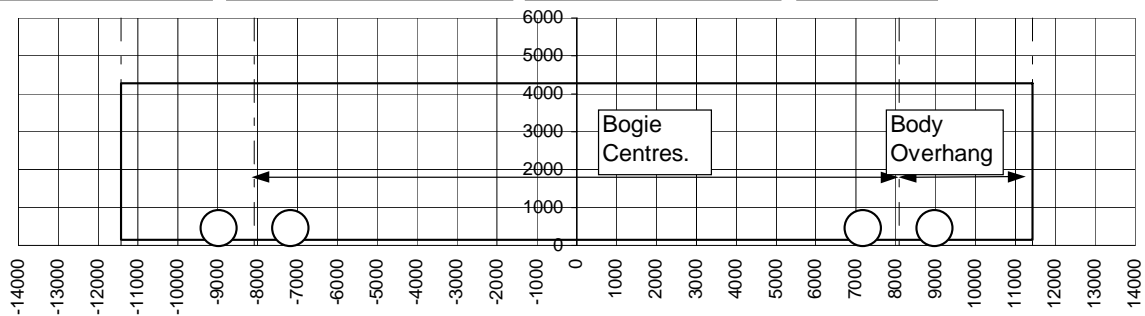


Physical Interface for wheels only.

Outline Extension for bogie components only.

Physical Interface for trip valve arm only.

Roll Centre at 610 mm.



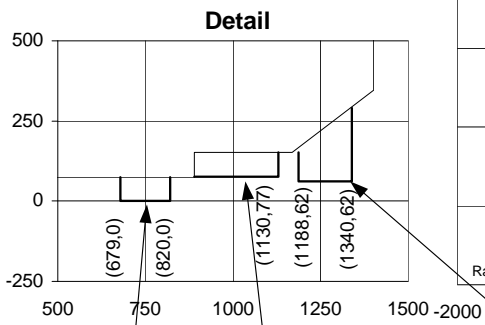
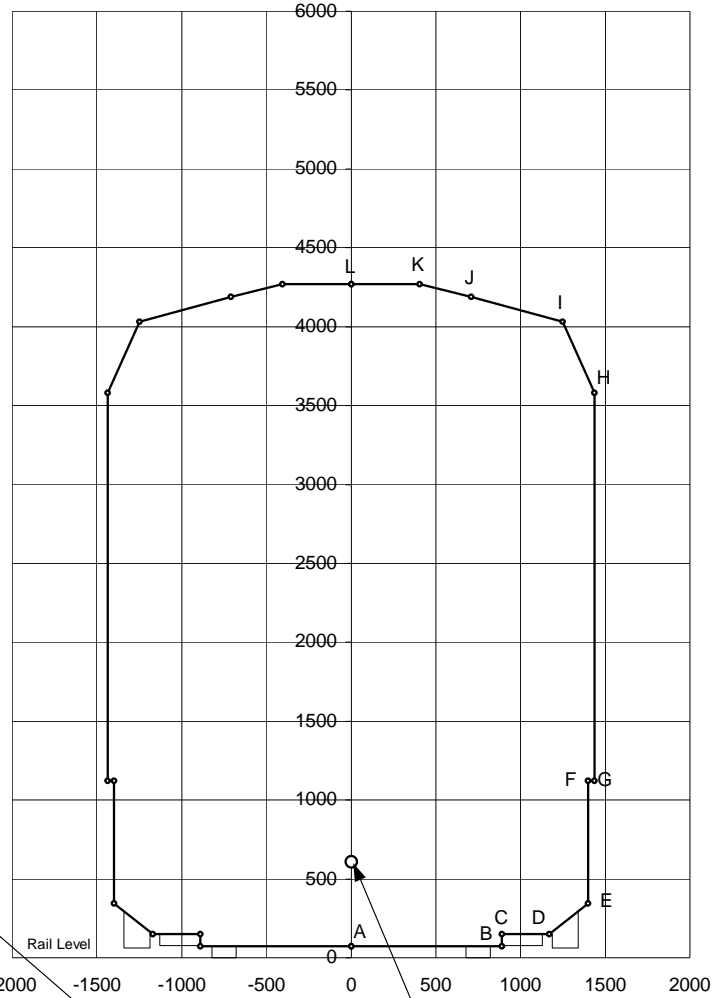
- All cross-section dimensions are symmetrical about the vehicle centreline.
- The origin for all horizontal coordinates is the vehicle centreline.
- The origin for all cross-section vertical coordinates is the rail level.
- All dimensions are in millimetres.

"Narrow Container" Rollingstock Outline Dimensions

Bogie Centres: 17300 mm
Body Overhang: 3603 mm

Coordinates

| Point | Lateral | Vertical |
|-------|---------|----------|
| A | 0 | 75 |
| B | 890 | 75 |
| C | 890 | 152 |
| D | 1170 | 152 |
| E | 1400 | 345 |
| F | 1400 | 1120 |
| G | 1435 | 1120 |
| H | 1435 | 3580 |
| I | 1250 | 4030 |
| J | 710 | 4190 |
| K | 405 | 4270 |
| L | 0 | 4270 |

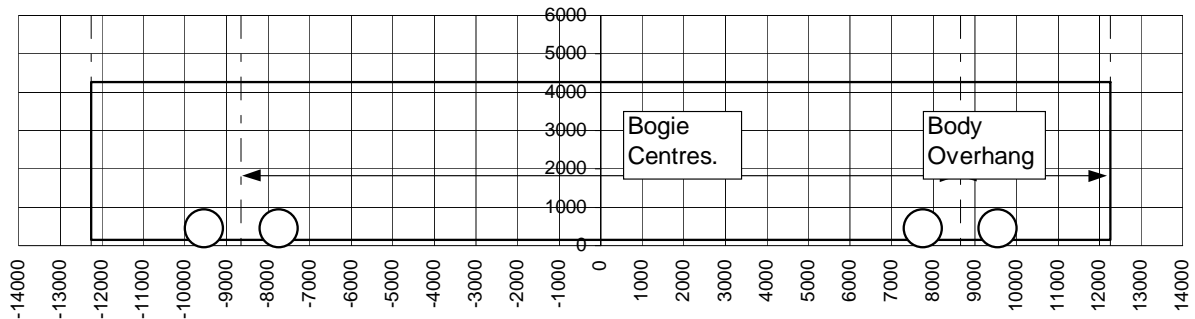


Physical Interface for wheels only.

Outline Extension for bogie components only.

Physical Interface for trip valve arm only.

Roll Centre at 610 mm.



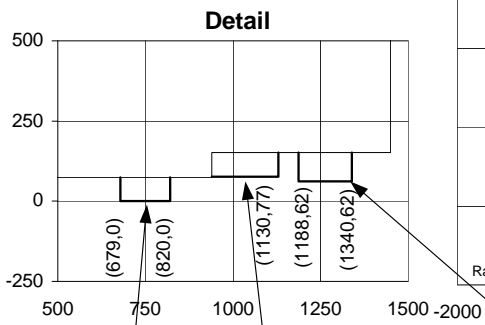
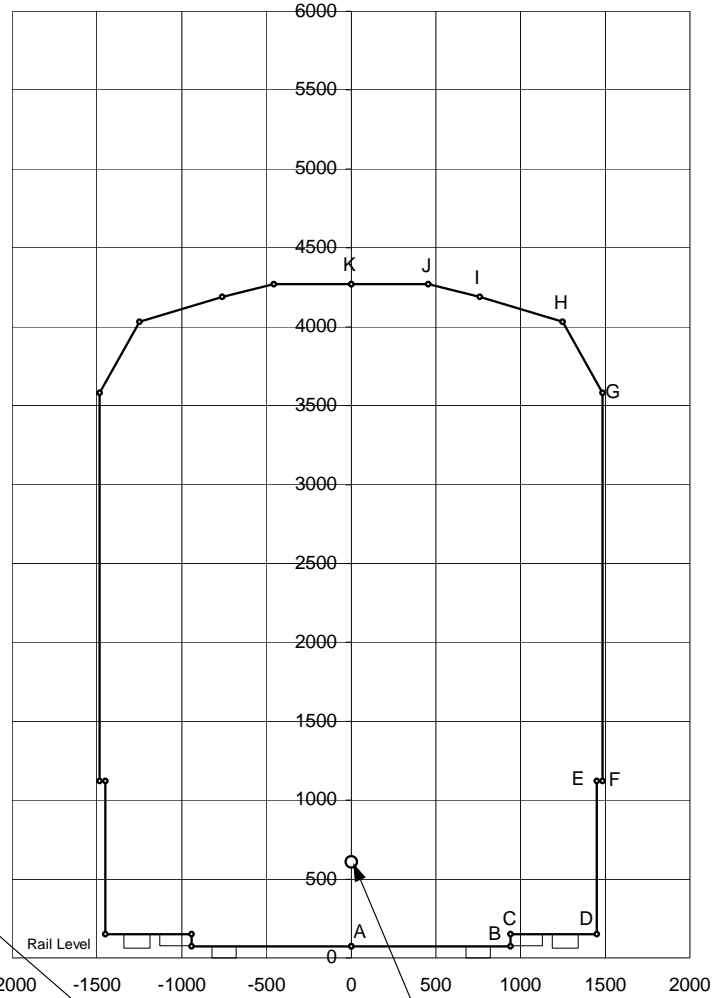
- All cross-section dimensions are symmetrical about the vehicle centreline.
- The origin for all horizontal coordinates is the vehicle centreline.
- The origin for all cross-section vertical coordinates is the rail level.
- All dimensions are in millimetres

"Intersystem" Rollingstock Outline Dimensions

Bogie Centres: 16155 mm
Body Overhang: 3353 mm

Coordinates

| Point | Lateral | Vertical |
|-------|---------|----------|
| A | 0 | 75 |
| B | 940 | 75 |
| C | 940 | 152 |
| D | 1450 | 152 |
| E | 1450 | 1120 |
| F | 1485 | 1120 |
| G | 1485 | 3580 |
| H | 1250 | 4030 |
| I | 760 | 4190 |
| J | 455 | 4270 |
| K | 0 | 4270 |

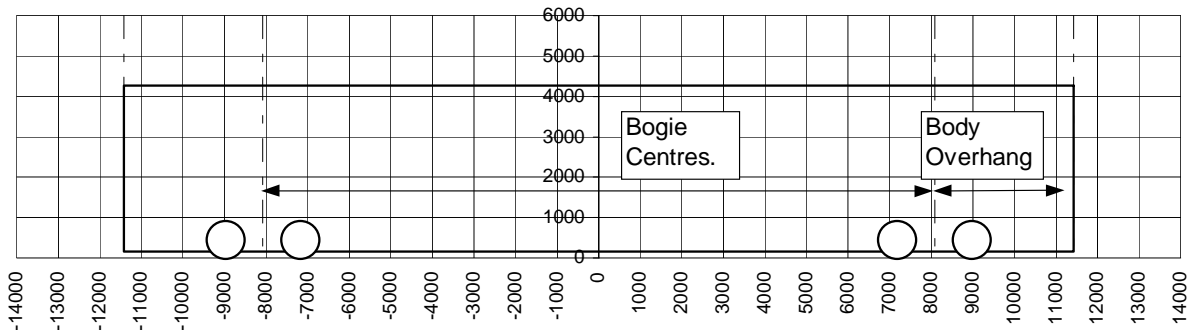


Physical Interface for wheels only.

Outline Extension for bogie components only.

Physical Interface for trip valve arm only.

Roll Centre at 610 mm.



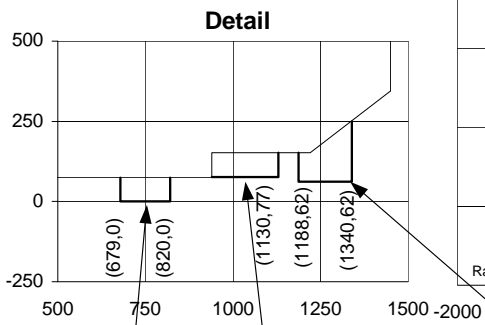
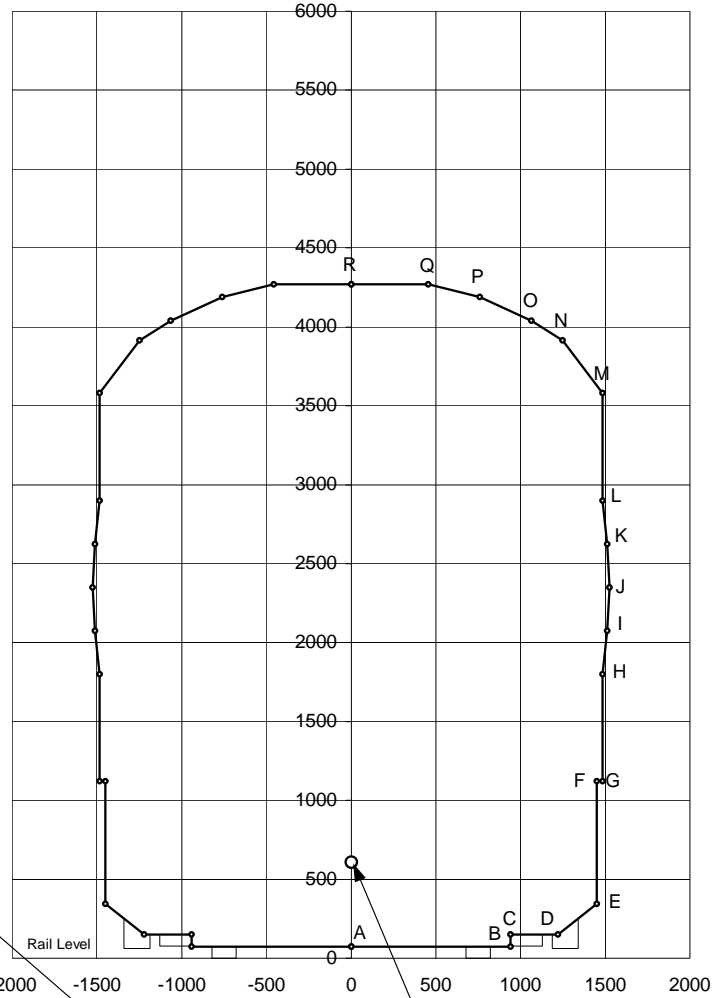
- All cross-section dimensions are symmetrical about the vehicle centreline.
- The origin for all horizontal coordinates is the vehicle centreline.
- The origin for all cross-section vertical coordinates is the rail level.
- All dimensions are in millimetres.

"Narrow Hopper" Rollingstock Outline Dimensions

Bogie Centres: 13000 mm
Body Overhang: 1500 mm

Coordinates

| Point | Lateral | Vertical |
|-------|---------|----------|
| A | 0 | 75 |
| B | 940 | 75 |
| C | 940 | 152 |
| D | 1220 | 152 |
| E | 1450 | 345 |
| F | 1450 | 1120 |
| G | 1485 | 1120 |
| H | 1485 | 1800 |
| I | 1510 | 2075 |
| J | 1525 | 2350 |
| K | 1510 | 2625 |
| L | 1485 | 2900 |
| M | 1485 | 3580 |
| N | 1250 | 3916 |
| O | 1065 | 4040 |
| P | 760 | 4190 |
| Q | 455 | 4270 |
| R | 0 | 4270 |

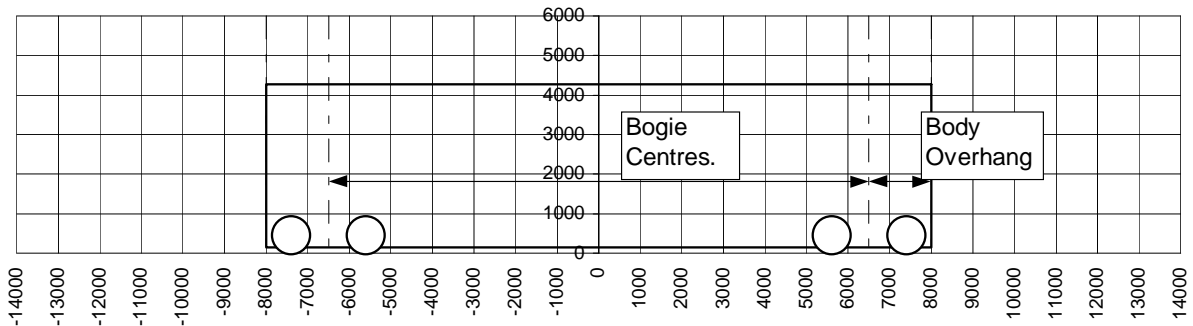


Physical Interface for wheels only.

Outline Extension for bogie components only.

Physical Interface for trip valve arm only.

Roll Centre at 610 mm.



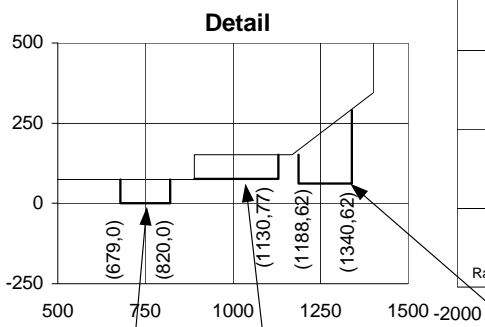
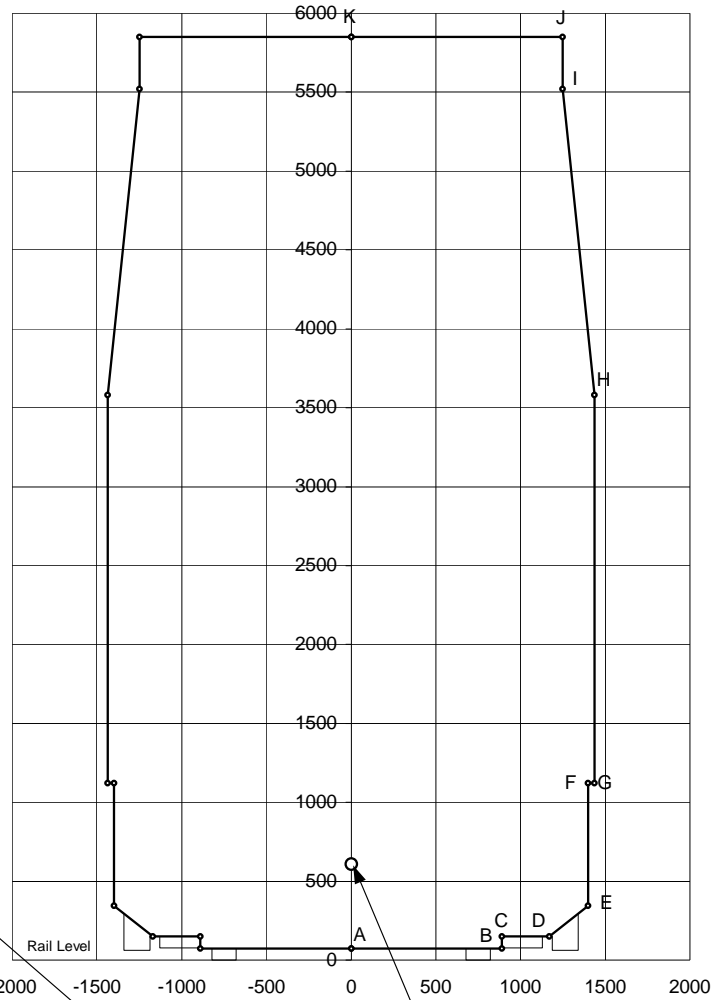
- All cross-section dimensions are symmetrical about the vehicle centreline.
- The origin for all horizontal coordinates is the vehicle centreline.
- The origin for all cross-section vertical coordinates is the rail level.
- All dimensions are in millimetres.

"Double Stack" Rollingstock Outline Dimensions

Bogie Centres: 17300 mm
Body Overhang: 3603 mm

Coordinates

| Point | Lateral | Vertical |
|-------|---------|----------|
| A | 0 | 75 |
| B | 890 | 75 |
| C | 890 | 152 |
| D | 1170 | 152 |
| E | 1400 | 345 |
| F | 1400 | 1120 |
| G | 1435 | 1120 |
| H | 1435 | 3580 |
| I | 1250 | 5520 |
| J | 1250 | 5850 |
| K | 0 | 5850 |

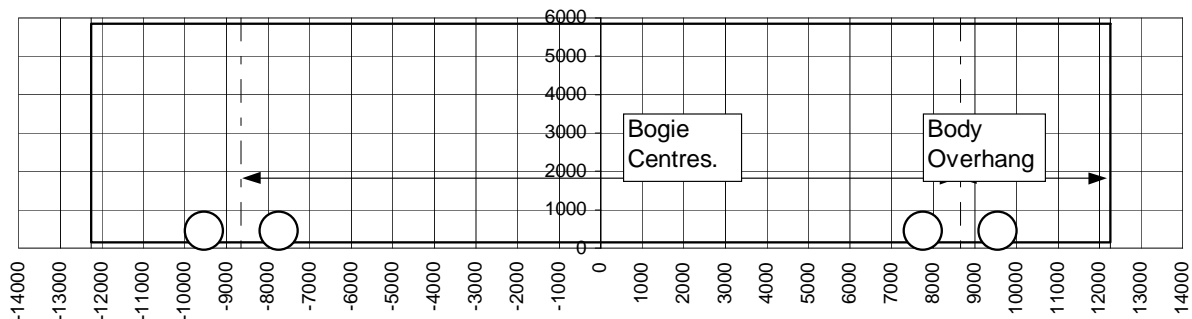


Physical Interface for wheels only.

Outline Extension for bogie components only.

Physical Interface for trip valve arm only.

Roll Centre at 610 mm.



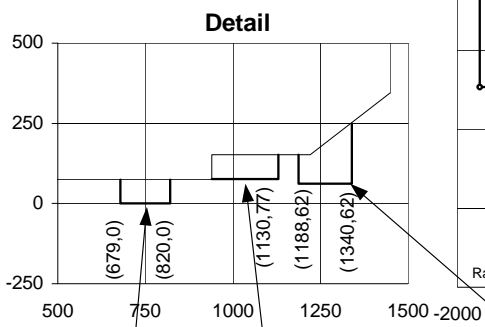
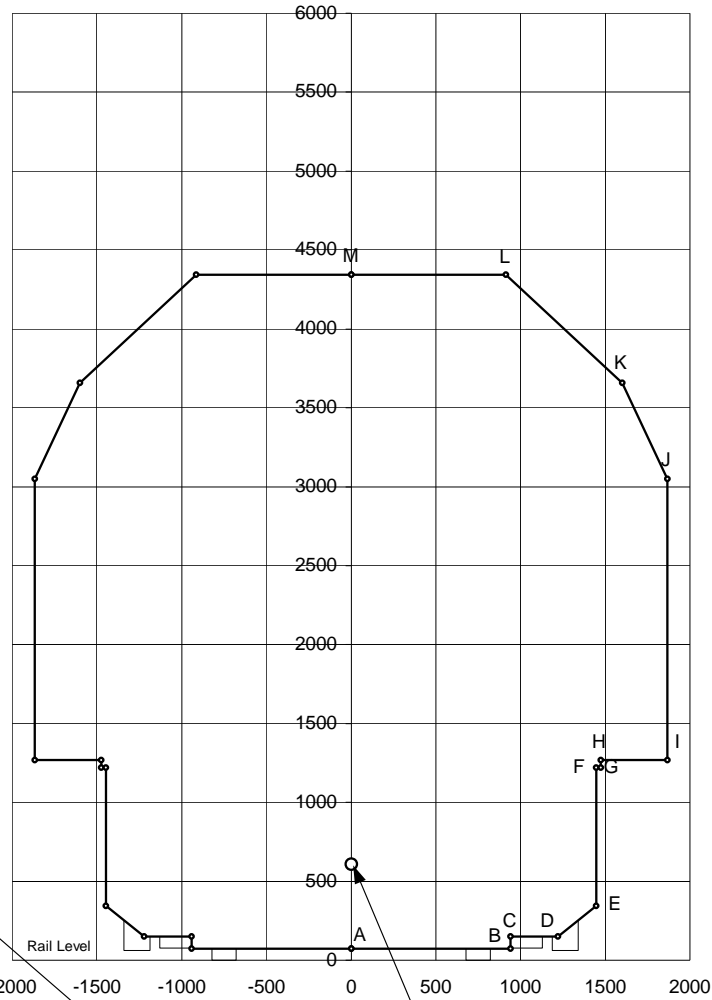
- All cross-section dimensions are symmetrical about the vehicle centreline.
- The origin for all horizontal coordinates is the vehicle centreline.
- The origin for all cross-section vertical coordinates is the rail level.
- All dimensions are in millimetres.

"Out of Gauge Load" Rollingstock Outline Dimensions

Bogie Centres: 15240 mm
Body Overhang: 1980 mm

Coordinates

| Point | Lateral | Vertical |
|-------|---------|----------|
| A | 0 | 75 |
| B | 940 | 75 |
| C | 940 | 152 |
| D | 1220 | 152 |
| E | 1448 | 345 |
| F | 1448 | 1219 |
| G | 1473 | 1219 |
| H | 1473 | 1270 |
| I | 1867 | 1270 |
| J | 1867 | 3048 |
| K | 1600 | 3658 |
| L | 914 | 4343 |
| M | 0 | 4343 |

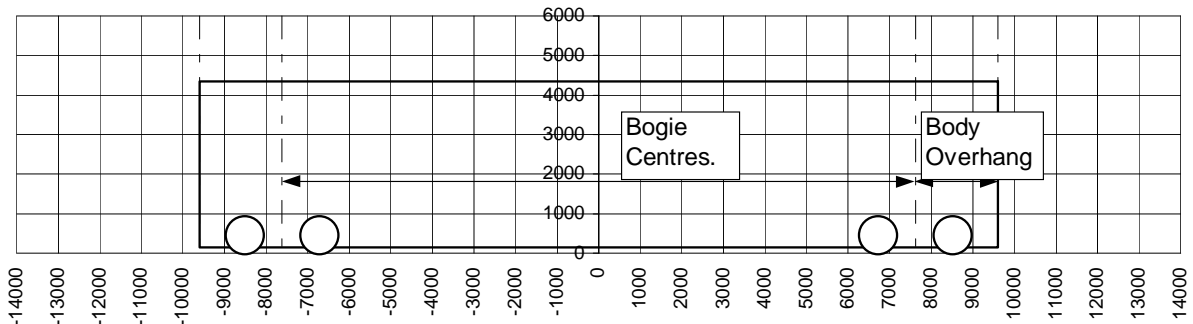


Physical Interface for wheels only.

Outline Extension for bogie components only.

Physical Interface for trip valve arm only.

Roll Centre at 610 mm.



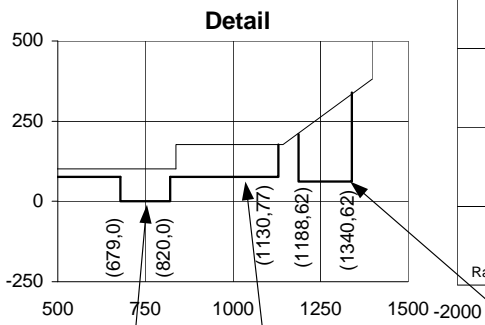
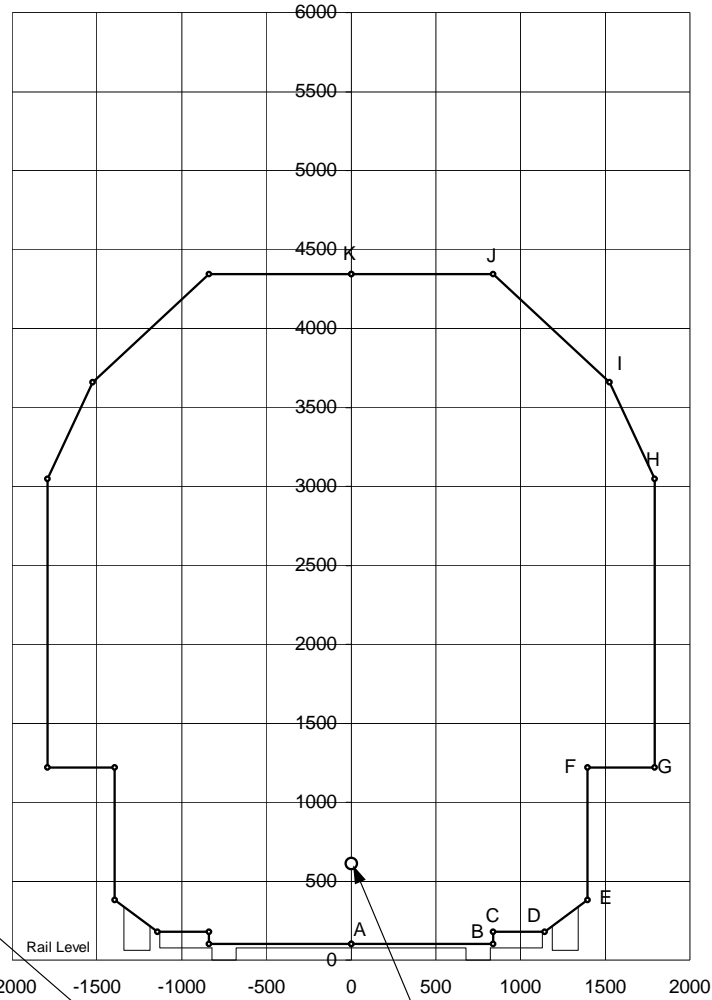
- All cross-section dimensions are symmetrical about the vehicle centreline.
- The origin for all horizontal coordinates is the vehicle centreline.
- The origin for all cross-section vertical coordinates is the rail level.
- All dimensions are in millimetres.

"NZZA Wagon" Rollingstock Outline Dimensions

Bogie Centres: 18300 mm
Body Overhang: 0 mm

Coordinates

| Point | Lateral | Vertical |
|-------|---------|----------|
| A | 0 | 102 |
| B | 838 | 102 |
| C | 838 | 178 |
| D | 1143 | 178 |
| E | 1397 | 381 |
| F | 1397 | 1220 |
| G | 1790 | 1220 |
| H | 1790 | 3048 |
| I | 1524 | 3658 |
| J | 838 | 4343 |
| K | 0 | 4343 |

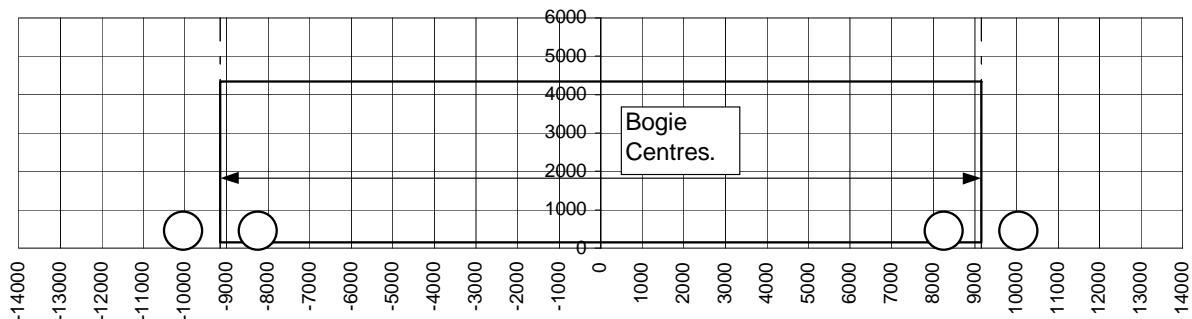


Physical Interface for wheels only.

Outline Extension for bogie components only.

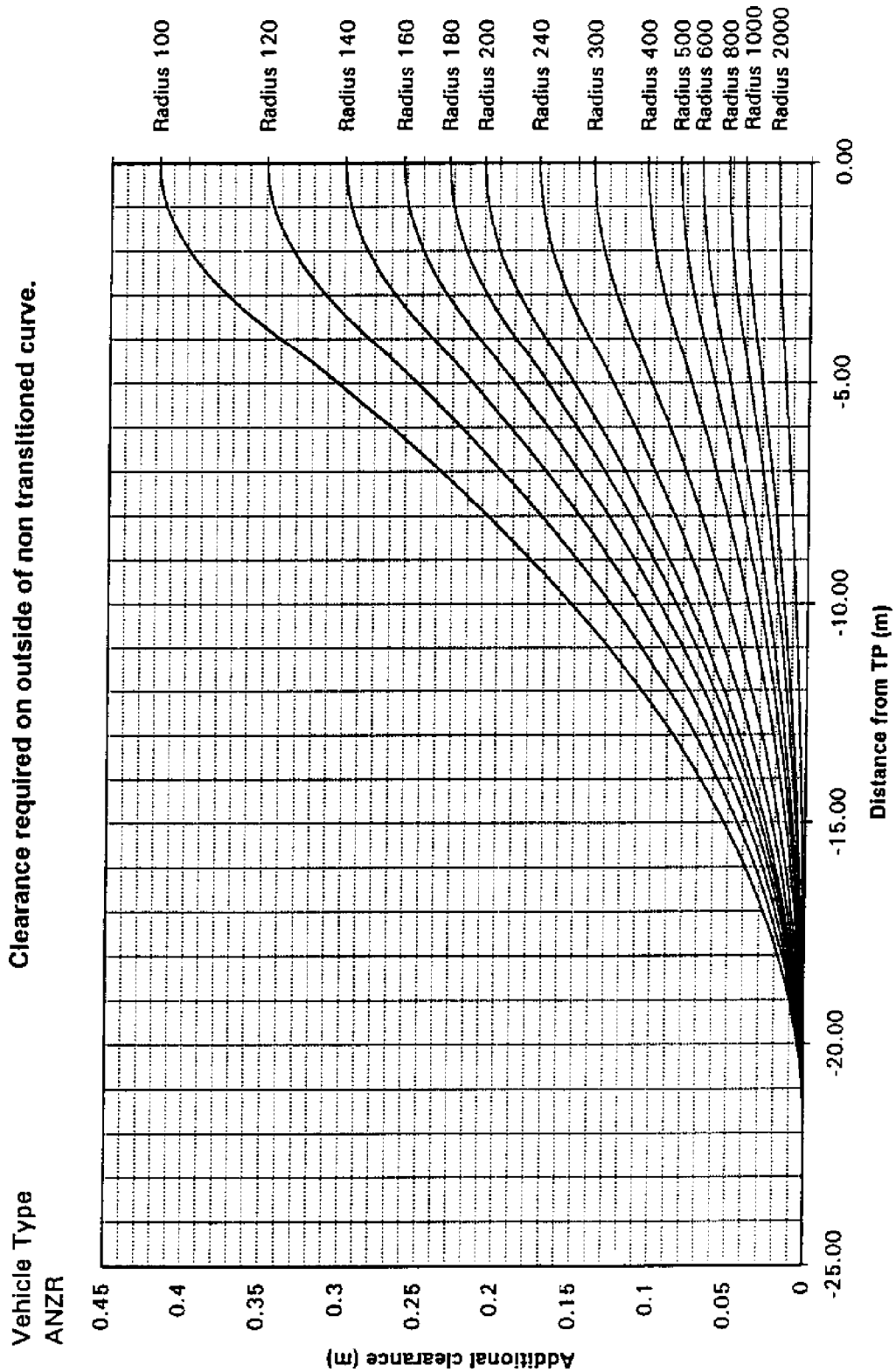
Physical Interface for trip valve arm only.

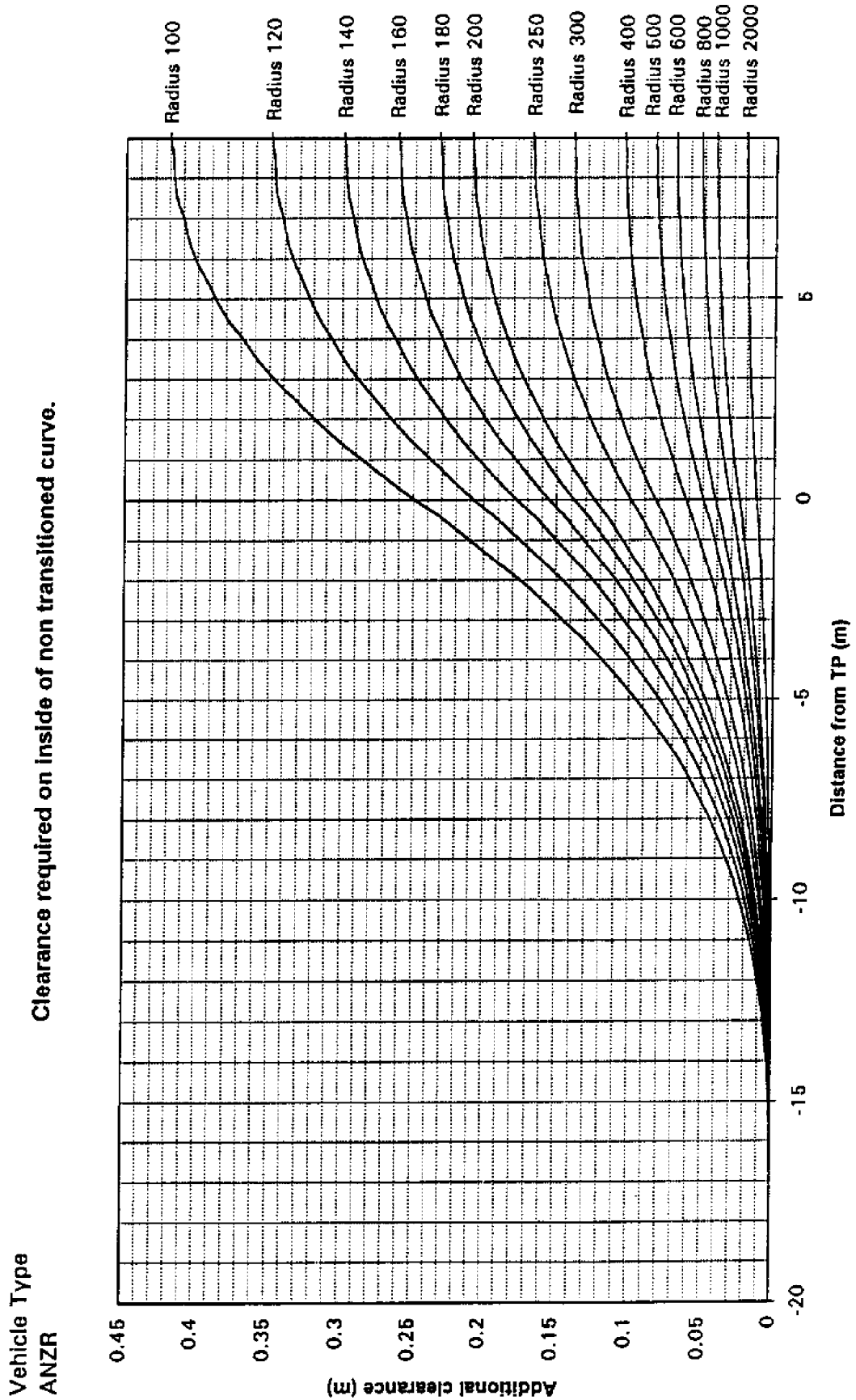
Roll Centre at 610 mm.

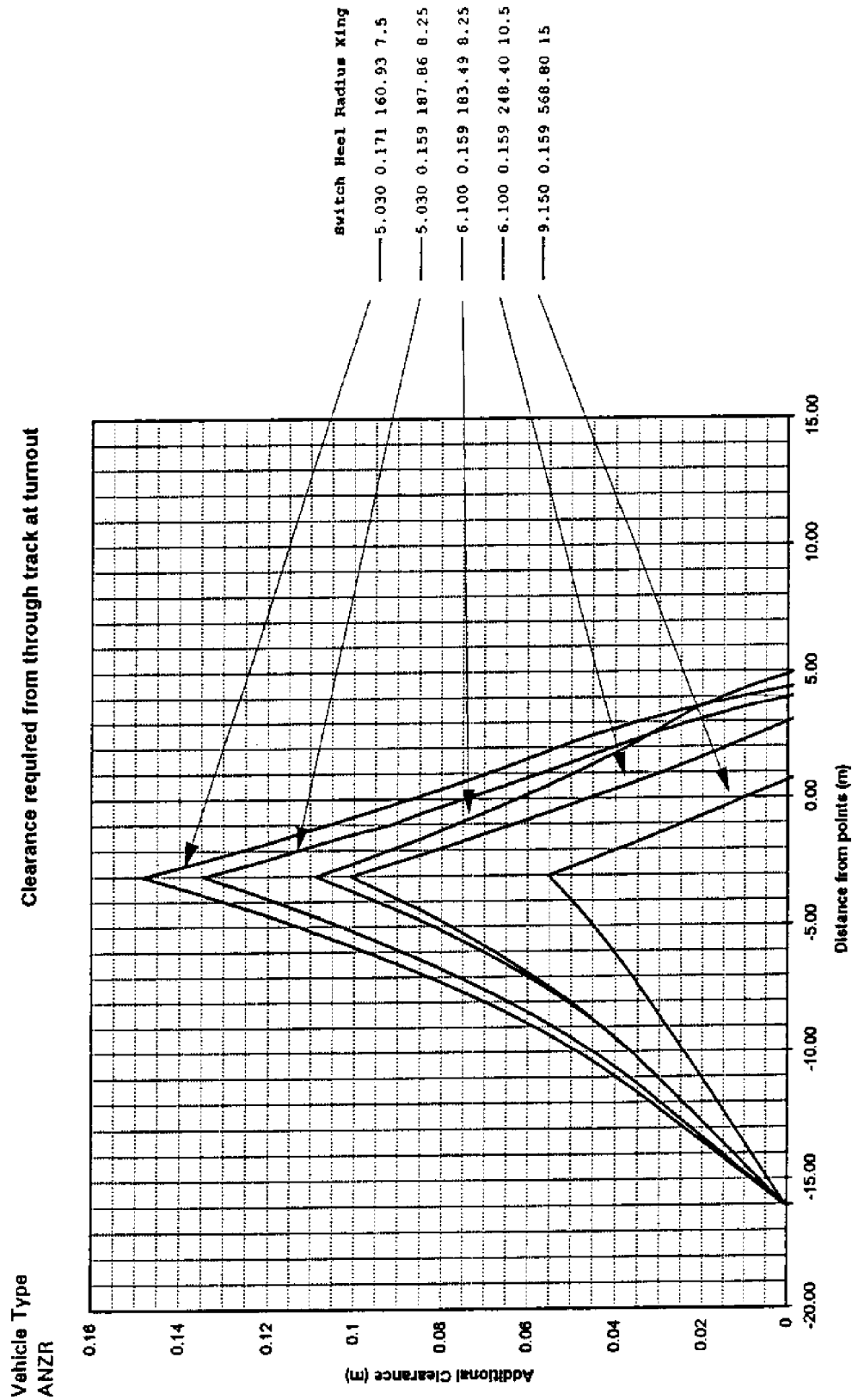


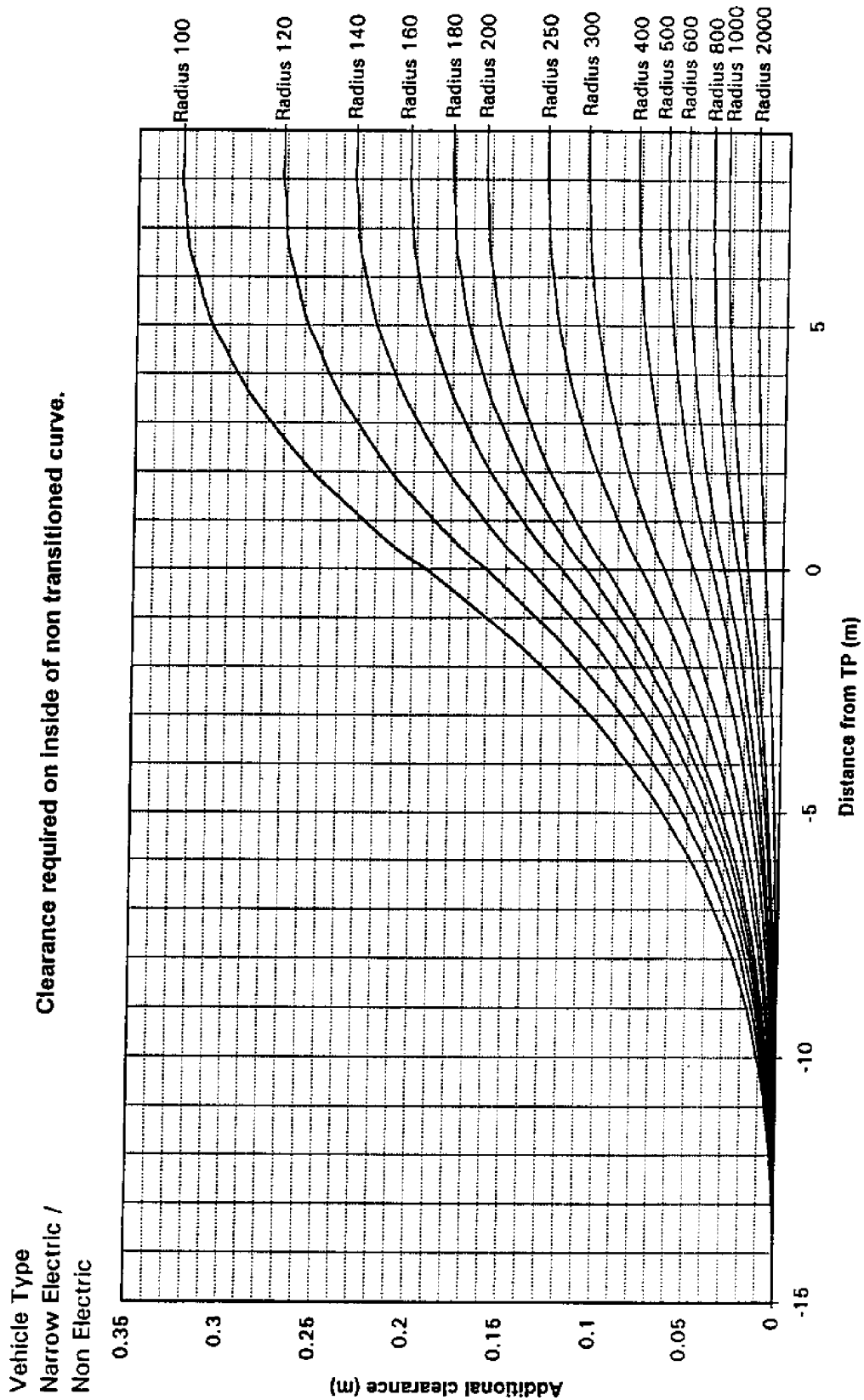
- All cross-section dimensions are symmetrical about the vehicle centreline.
- The origin for all horizontal coordinates is the vehicle centreline.
- The origin for all cross-section vertical coordinates is the rail level.
- All dimensions are in millimetres.

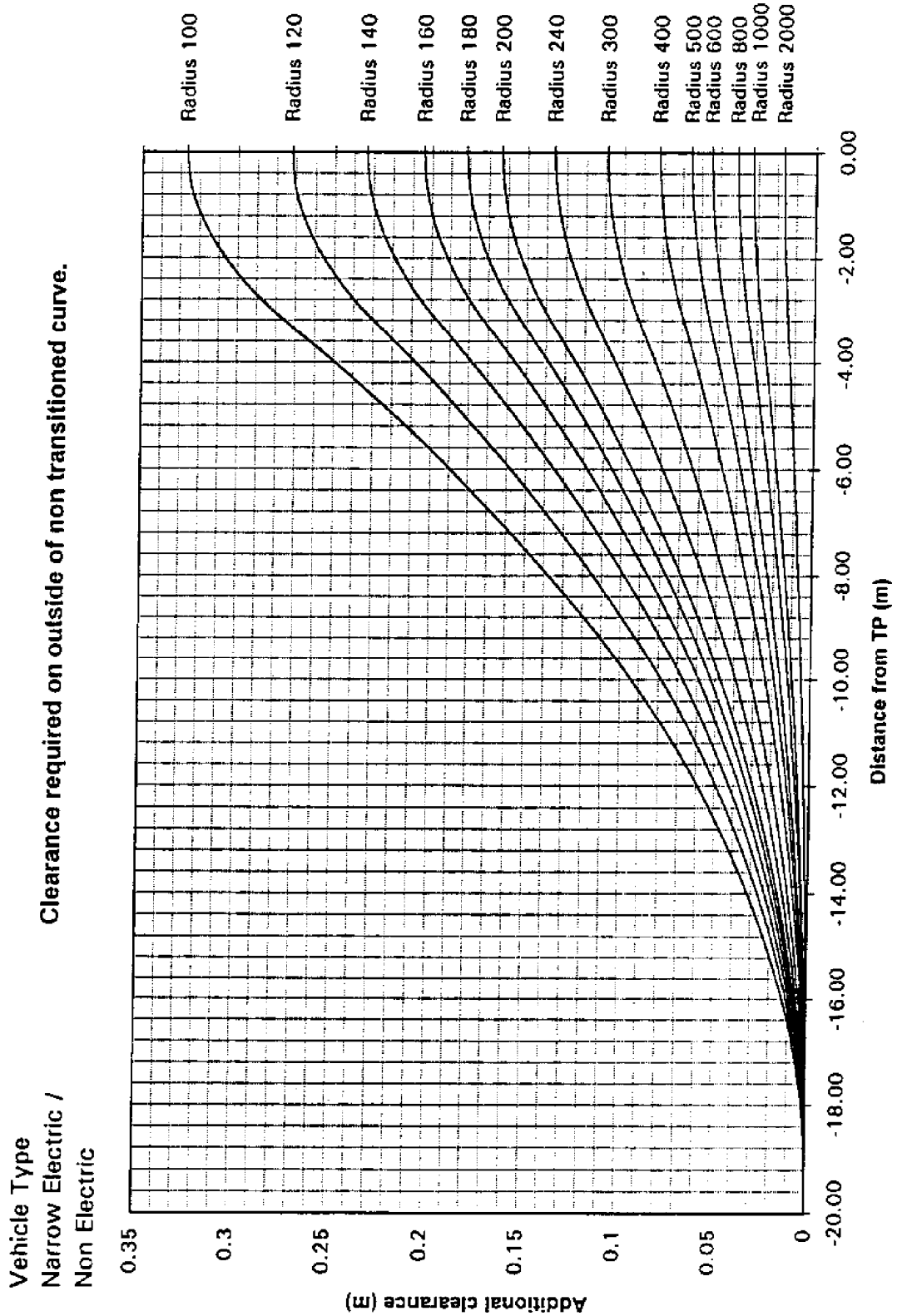
11 Appendix 2: Centre and End Throw at Transitions

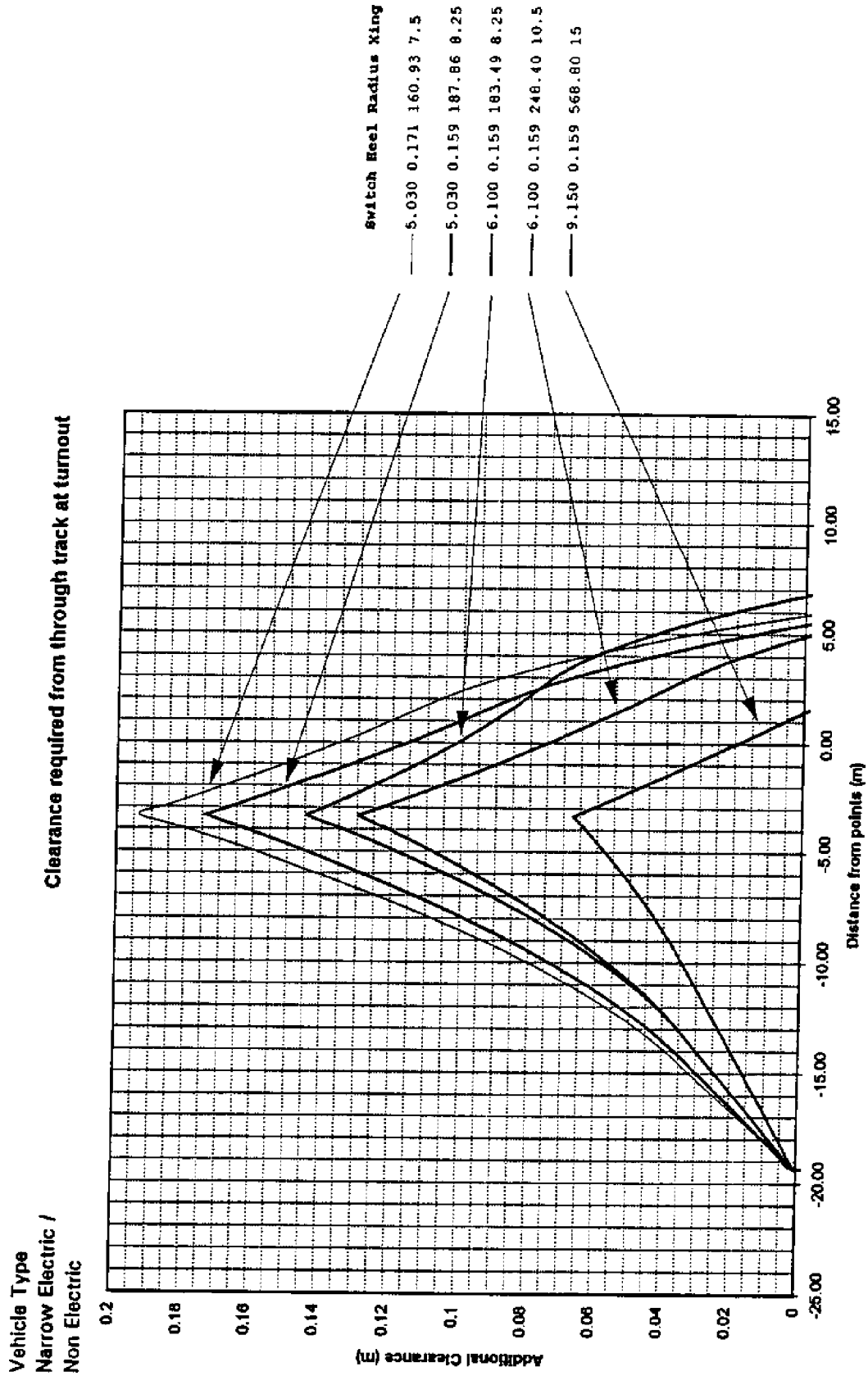












12 Appendix 3: Definitions of Terms

| | |
|--|---|
| Transit Space | A clearance envelope which provides for the safe passage of defined rolling stock and for infrastructure service requirements. The Envelope is defined by Transit Space outline referred to as 'Structure Gauge'. |
| Base Operating Limits | The limits of track or rolling stock maintenance outside which operating restrictions will apply. |
| Clearance | The space margin between the kinematic envelope of approved rolling stock and a structure, or between rolling stock on adjacent tracks. |
| Corridor Transit Space Strategy | Operating parameters for a specified line, incorporating business and infrastructure service requirements. |
| Graded Rail Level | The approved design rail level taking into account all service requirements. |
| Infringement | Incursion into the clearance between the Approved Corridor Transit Space outline and the relevant rolling stock outline and which can be approved only the authorised ARTC representative. |
| Kinetic Envelope | The swept envelope of any rail vehicle which incorporates specified track and rolling stock tolerances. |
| Maximum Rail Level | The highest approved rail level and is 150mm above graded rail level. |
| Rolling Stock Outlines and Load Profiles | Approved envelopes outside which no vehicle or load may be constructed without prior approval of the authorised ARTC representative. |
| Safety Clearance Margin | The defined clearance beyond the kinematic envelope necessary for safe operation using specified track and rolling stock tolerances. |
| Service Requirement | The clearance beyond the Safety Clearance Margin which enables defined service tasks to be undertaken. |
| Special Loads/Profiles | Vehicle/loading envelopes which infringe approved rolling stock outlines. Operating conditions must be approved by the authorised ARTC representative. |
| Structure Gauge | The transit space outline setting out the space parameters necessary for the construction and maintenance of structures adjacent to a rail |

13 Appendix 4: Forms (examples only)

13.1 ETM0701F-01 Transit Space Operational Infringement Approval



Engineering (Track & Civil) Code of Practice – General Appendix - Form
ETM-07-01 Management of Clearances

Form number: ETM0701F-01

TRANSIT SPACE OPERATIONAL INFRINGEMENT APPROVAL

| Location Details | | | |
|-------------------------------------|----------------------|---------------------------------------|----------------------|
| Approval No. | <input type="text"/> | Track: | <input type="text"/> |
| Line Code: | <input type="text"/> | Tracks: | <input type="text"/> |
| Line: | <input type="text"/> | Km from: | <input type="text"/> |
| Section from: | <input type="text"/> | Km to: | <input type="text"/> |
| Section to: | <input type="text"/> | Nearest station: | <input type="text"/> |
| Infringement Details | | | |
| Lateral | | Up Side | |
| Height From | | <input type="text"/> | |
| Height To | | <input type="text"/> | |
| Max Infringement to Structure Gauge | | <input type="text"/> | |
| Min Clearance to Kinematic Envelope | | <input type="text"/> | |
| Lateral | | Down Side | |
| Height From | | <input type="text"/> | |
| Height To | | <input type="text"/> | |
| Max Infringement to Structure Gauge | | <input type="text"/> | |
| Min Clearance to Kinematic Envelope | | <input type="text"/> | |
| Vertical | | * Down side of centreline is positive | |
| Horizontal From * | | <input type="text"/> | |
| Horizontal To * | | <input type="text"/> | |
| Max Infringement to Structure Gauge | | <input type="text"/> | |
| Min Clearance to Kinematic Envelope | | <input type="text"/> | |
| Track Centres | | | |
| Max Infringement to Structure Gauge | | <input type="text"/> | |
| Min Clearance to Kinematic Envelope | | <input type="text"/> | |
| Approval Details | | | |
| Infringement Structure | | <input type="text"/> | |
| Requesting Authority | | <input type="text"/> | |
| Reason for Infringement | | <input type="text"/> | |
| Condition of Approval | | | |
| Structure Gauge Reference | | <input type="text"/> | |
| Structure Gauge Drawing | | <input type="text"/> | |
| Recommended | | <input type="text"/> | |
| Approved | | <input type="text"/> | |
| Title | | Date | <input type="text"/> |

Note: Form layout may change to suit a particular infringement

