



TS 00180.3:1.0

Specification

Transit Space

Part 3: Network Specification for Sydney Metro Northwest and Southwest Line

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Preface

This specification is a first issue as TS 00180.3 *Transit Space – Part 3: Network Specification for Sydney Metro Northwest and Southwest*.

This specification forms part of the TS 00180 suite of standards related to transit space.

This specification defines the transit space requirements for all tracks that form the Sydney Metro Northwest and Southwest network.

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1 Scope

This specification specifies the specific parameters, outlines and design criteria for Sydney Metro Northwest and Southwest including the approved static outlines to be used as the basis for calculation of transit space and associated clearances.

2 Application

This specification is only applicable to Sydney Metro Northwest and Southwest and its operation and is not intended for use on any other network.

This specification should be read in conjunction with TS 00180.1.

This document is intended for use by designers, operators, maintainers and regulators of Sydney Metro Northwest and Southwest.

3 Referenced documents

The following documents are cited in the text. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document applies.

Transport for NSW standards

TS 00003.1 *Concessions to Transport Standards Part 1 – Concessions Process*

TS 00180.1 *Transit Space – Part 1: General Requirements*

TS 03805 (T HR EL 08012 ST) *Overhead Wiring Standards for Design and Construction*

Other referenced documents

Northwest Rapid Transit, *Design Standards Manual in Technical Library for Sydney Metro Northwest Operations, Trains and Systems* (This document is not publicly available. To obtain access email standards@transport.nsw.gov.au)

Sydney Metro, *Sydney Metro Concessions Process* (This document is not publicly available. To obtain access email standards@transport.nsw.gov.au)

4 Terms, definitions and abbreviations

The following terms, definitions and abbreviations apply in this document.

ARL above rail level; vertical offset above the top of the low rail

CM contingency margin; specific additional clearance required from the KE to fixed infrastructure or other vehicles to account for other factors not mandated in the KE calculation and provide a buffer for network maintainability

KE kinematic envelope

line a continuous section of railway track

MGF mechanical gap filler; extendable surface to reduce boarding gaps. Mostly used in curved platforms

network Sydney Metro Northwest and Southwest metro line operating between Tallawong and Chatswood including the line to Bankstown via Central and Sydenham under construction at the time of publication

OHW overhead wiring system; the wiring system located above the track that provides a nominal 1500 V dc power supply to the train

OLE overhead line electrical equipment; collective term for all types of traction supply systems including overhead rigid conductor system and overhead wiring system configurations

ORCS overhead rigid conductor system; rigid bar conductor 1500 V systems, primarily used in tunnel sections

PEB platform edge barrier; half height platform screen and door systems used on outdoor platforms

POR plane of rail; the plane formed by connecting the top of the two rails in their design level and alignment position. This plane will rotate with applied superelevation. This plane is used as the vertical origin for transit space calculations

PSD platform screen doors; platform screens and door systems used on metro platforms

PSR permanent speed restriction; the speed at which the train will automatically apply emergency breaks

rail level the plane formed by joining the top contact surface of the two rails of a track

RIM rail infrastructure manager; In relation to rail infrastructure of a railway, means 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.

RRSO reference rolling stock outline; the standard outline used for calculation of kinematic envelopes

SAD safe approach distance; the minimum clearance required to electrical infrastructure for electrical safety

SG structure gauge

SMTF Sydney Metro Train Facility

space proofing the strategic reservation of space around the operating lines to support access and management of railway assets while retaining flexibility to support future operations

UTO unattended train operation

5 Authorised outlines

The RRSO and special outlines listed in Table 1 and Table 2 have been authorised to operate on the Northwest and Southwest network.

Only unrestricted outlines shall be considered when undertaking transit space assessment for fixed infrastructure.

Table 1 – Authorised rolling stock outlines (RRSO)

Outline name	Usage	Pantograph	Reference	Special requirements
Metro – narrow	Unrestricted	Metro 1500 V pantograph	See Appendix A.1	Nil
Narrow non-electric	Restricted	None	See Appendix A.3	May only be used under power isolation where electrical SAD cannot be maintained. Maximum network speed of 40 km/h

Table 2 – Special outlines

Outline name	Type	Reference	Usage
Metro 1500 V pantograph	Pantograph	See Appendix A.2	The pantograph outline shall be considered at the top of outlines nominated in Table 1

6 Dynamic parameters

6.1 General

Sections 6.2 to 6.5 set out the parameters and equations to be used in conjunction with the methodologies in TS 00180.1 for determination of kinematic envelope and acceptance for the network. Section 6.7 identifies the track geometry design limits to which these tolerances are applicable.

6.2 Rolling stock dynamic allowances

Table 3 lists rolling stock dynamic factors used as the basis for KE calculation. Consultation with the RIM is required to manage application of tolerances for rolling stock acceptance.

Table 3 – Rolling stock dynamic factors

Direction	Relative to	Description	Value
Lateral	Relative to POR (with any superelevation variation applied)	The sum of the following: <ul style="list-style-type: none"> body to wheelset wheel wear wheel to rail free play. 	±44 mm total
Vertical	Relative to the displaced vehicle centreline	Bounce upwards (body only)	+50 mm to –0 mm
Vertical	Relative to the displaced vehicle centreline	Bounce down (Bogie only)	0 mm
Rotational	Roll about the displaced roll centre of the rolling stock outline (body only)	Note: the roll centre moves laterally and vertically with the rolling stock outline	±2°

6.3 Track dynamic allowances

6.3.1 Slab track allowances

Table 4, Table 5 and Table 6 set out the parameters for slab track that shall be used in conjunction with the methodologies in TS 00180.1 for determination of KE on slab track areas of the network.

Table 4 – Slab track lateral allowances

Parameter	Description	Value
Rail variation	Rail wear	15 mm
Alignment (horizontal difference from design)	Curves > 2000 m radius and tangent	±10 mm
Alignment (horizontal difference from design)	Curves ≤ 2000 m radius	±20 mm

Table 5 – Slab track vertical allowance

Parameter	Description	Value
Level	Vertical difference from design	±20 mm

Table 6 – Slab track rotational allowance

Parameter	Description	Value
Superelevation	Superelevation difference from design	±8 mm

6.3.2 Ballast track allowances

Table 7, Table 8, and Table 9 set out the parameters for ballast track that shall be used in conjunction with the methodologies in TS 00180.1 for determination of KE for ballasted areas of the network.

Table 7 – Ballast track lateral allowances

Parameter	Description	Value
Rail variation	Rail wear	15 mm
Alignment (horizontal difference from design)	Curves > 2000 m radius and tangent	±15 mm
Alignment (horizontal difference from design)	Curves ≤ 2000 m radius	±25 mm

Table 8 – Ballast track vertical allowance

Parameter	Description	Value
Level	Vertical difference from design	±50 mm

Table 9 – Ballast track rotational allowance

Parameter	Description	Value
Superelevation	Superelevation difference from design	±10 mm

6.3.3 Maintenance facility and yard allowances

Table 10, Table 11 and Table 12 set out the parameters for maintenance facilities and yards that shall be used in conjunction with the methodologies in TS 00180.1 for determination of KE within maintenance yards in the network.

Table 10 – Maintenance facility and yard lateral allowances

Parameter	Description	Value
Rail variation	Rail wear	15 mm
Alignment (horizontal difference from design)	All areas	±30 mm

Table 11 – Maintenance facility and yard vertical allowance

Parameter	Description	Value
Level	Vertical difference from design	±50 mm

Table 12 – Maintenance facility and yard rotational allowance

Parameter	Description	Value
Superelevation	Superelevation difference from design	±10 mm

6.4 OLE parameters

Table 13 defines the uplift parameters that shall be used for the OLE configurations on the network when calculating pantograph KE.

Table 13 – OLE dynamic allowances

Parameter	Value
Uplift, OHW	+75 mm
Uplift, ORCS	0 mm

6.5 Contingency margins

Table 14 and Table 15 set out rolling stock contingency margins that shall be used for review and acceptance of transit space clearances on the network in accordance with TS 00180.1. When applied to the KE the CM parameters shall only result in a more conservative outline. For example the vertical clearance is only applied to the top points of the outline extending it vertically, but is not applied to the bottom points which would result in a shorter outline.

Table 14 – Body and bogie contingency margins (CM)

Direction	Additional clearance required
Lateral	+200 mm
Vertical	+100 mm

Table 15 – Pantograph contingency margins (CM)

Direction	Additional clearance required
Lateral	+100 mm
Vertical	+100 mm

6.6 Legacy platform tolerances

When assessing vehicles for operation in the network areas from Tallawong to Sydenham rolling stock parameters in Table 16 shall be used for determination of the DVO for operation due to restricted platform areas.

Table 16 – Northwest legacy dynamic factors for rolling stock compliance

Direction	Relative to	Description	Value
Lateral	Relative to the plane of the superelevation (with any superelevation variation applied)	the sum of all of the following: <ul style="list-style-type: none"> • Body to wheelset • Wheel wear • Wheel to rail free play 	±44 mm total
Vertical	Relative to the displaced vehicle centreline	Bounce upwards	+50 mm
Vertical	Relative to the displaced vehicle centreline	Bounce down (bogie only)	0 mm
Rotational	Roll about the displaced roll centre of the rolling stock outline (body only)	Note: the roll centre moves laterally and vertically with the rolling stock outline	±0.5°

6.7 Track geometry limits

Governing limits for horizontal, vertical curvatures and superelevation on the Northwest and Southwest network are defined in *Design Standards Manual in Technical Library for Sydney Metro Northwest Operations*.

7 Infrastructure design requirements

Sections 7.1 to 7.3 set out specific requirements that shall be accounted for in designs when constructing new infrastructure in the corridor that encompasses the Sydney Metro Northwest and Southwest rail network.

Specific requirements for clearances and gauging at rail level, applicable to all sections of the rail corridor are set out in Section 7.3.

7.1 Infrastructure service requirements

The infrastructure service requirements set out in Section 7.1 to 7.1.4 for the positioning of permanent trackside and overhead structures, and for track centres between adjacent tracks, shall be applied in the absence of specific requirements.

All positioning dimensions are given relative to the design track centreline horizontal position and height relative to the low rail.

7.1.1 Horizontal service requirements

For sections of main line or crossing loops outside of tunnel areas the minimum horizontal dimension between the face of the structure closest to the track and design track centreline shall be as detailed in Table 17.

Note: An allowance for track curvature and superelevation has been included in the clearances listed in Table 17.

Table 17 – Horizontal minimum infrastructure service requirements

Structure	At grade
Minimum horizontal clearance to structures and structure footings to one metre below design rail level to allow for operation of ballast cleaners.	2450 mm
Signals and associated equipment to enable visibility of signals	2550 mm
OLE masts adjacent to a track	2550 mm
Unattended operation segregation fence	3000 mm
Temporary construction works adjacent to a track	3000 mm
Piers, columns, deflection walls between tracks	4300 mm
Bridge substructures and deflection walls (except between tracks) Cuttings with no road access at track level Station buildings Columns, foot bridges	4300 mm
Other structures and cuttings located adjacent to electrified tracks where road access is required between the infrastructure and the track Bridges or air-space developments where an overhead wiring or signal mast is required within the structure limits	6200 mm

The type of vehicle and the intended use of the access roads shall be considered in establishing clearances.

If roads are used for maintenance access, sufficient clearance shall be provided in consultation with the RIM taking into account the vehicles using the roads, the maintenance activities intended and intended arrangements for track possession.

7.1.2 Vertical service requirements

For all track in electrified areas the minimum vertical dimension between the design minimum height of the overhead conductor that contacts the pantograph (including maximum sag conditions at worst operating temperatures) above the design maximum height of the low rail shall be as detailed in Table 18.

Table 18 – Vertical minimum service requirements to OLE equipment

Structure	Dimension
Tunnel sections using ORCS	4310 mm
At grade sections	4750 mm
At high rail pads or road crossings	5000 mm
SMTF (maintenance centre)	5000 mm

The design OLE height is determined from the lowest OLE position by considering worst-case conditions including maximum sag conditions at worst operating temperatures (not applicable for ORCS areas).

The highest OLE position is determined from the design OLE height, and shall be derived by removing all allowance for sag, using operating temperatures that result in the maximum wire height and maximum uplift of the wire caused by the maximum upwards thrust imposed by a pantograph.

For all track in electrified areas the minimum vertical dimension between the underside face of non-energised equipment and the design maximum height of the low rail shall be as detailed in Table 19.

Table 19 – Vertical minimum service requirements to over track structures

Structure	Dimension
OLE attached	5500 mm
OLE not attached (main line)	5950 mm
OLE not attached – elevated access required (SMTF)	7000 mm

7.1.3 Track centres

Minimum design track centres for new works shall be in accordance with Table 20 and are governed by the track geometry at the section being assessed. The governing track shall be whichever results in the larger track centre dimension.

Table 20 – Track centres

Horizontal design	Circumstance	Minimum track centre dimension (mm)
Straight track and curves ≥ 1000 m radius	Everywhere	4000
Curves < 1000 m radius	Where $(E_{a_o} - E_{a_i}) > 0$	$3973 + 2M + 2.5 (E_{a_o} - E_{a_i})$
Curves < 1000 m radius	Where $(E_{a_o} - E_{a_i}) \leq 0$	$3973 + 2M$

Note: In Table 20, new variables are defined as follows:

E_{a_o} = applied superelevation of the outside track

E_{a_i} = applied superelevation of the inside track

M = the curving effect parameter, defined in as part of the authorised outline listed in Appendix A

The track centre limits set out in Table 20 account for curved parallel tracks with different applied superelevation.

Where the applied superelevation would cause the gap between passing trains to reduce, that is $(Ea_o - Ea_i) > 0$ then the track centres shall be increased as per the method starting from the beginning of section 7.1.3 (this section). Where the applied superelevation results in a widening of the gap between passing trains, that is $(Ea_o - Ea_i) < 0$ no reduction in the track centres shall be applied.

7.1.4 Tunnel walkways

Walkways within the Sydney Metro Northwest and Southwest line tunnel system have been designed to align to the side of the train and enable, in emergency situations, side detrainment. To enable this, the walkways shall be designed to a horizontal offset from track centreline as specified in Table 21 or KE + 100 mm whichever is greater, in accordance with design interface defined in Section 10. The nominal position of the walkways on tangent level track is shown in Figure 1.

Table 21 – Nominal design parameters for tunnel walkways

Design feature	Parameter value
Horizontal offset on tangent track (nom)	1738 mm
Vertical	1150 mm

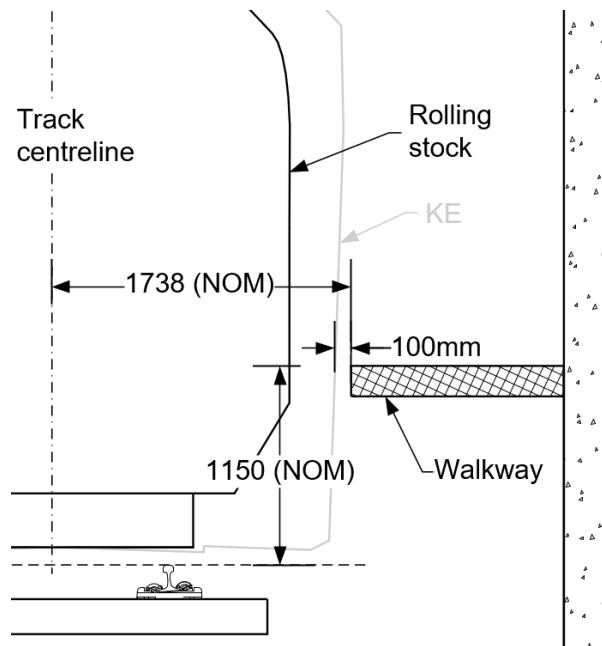


Figure 1 – Tunnel walkway representation

Where walkways are located on sections of curved track the horizontal and vertical offsets of the walkway shall be adjusted to maintain position relative to the rollingstock, while maintaining minimum clear space.

7.2 General structure gauge

General structure gauge is the base minimum distance required from the track centre line to new or modified infrastructure, in order to provide safe transit for all authorised outlines and space proofing for future network uses. General structure gauge is shown in Figure 2.

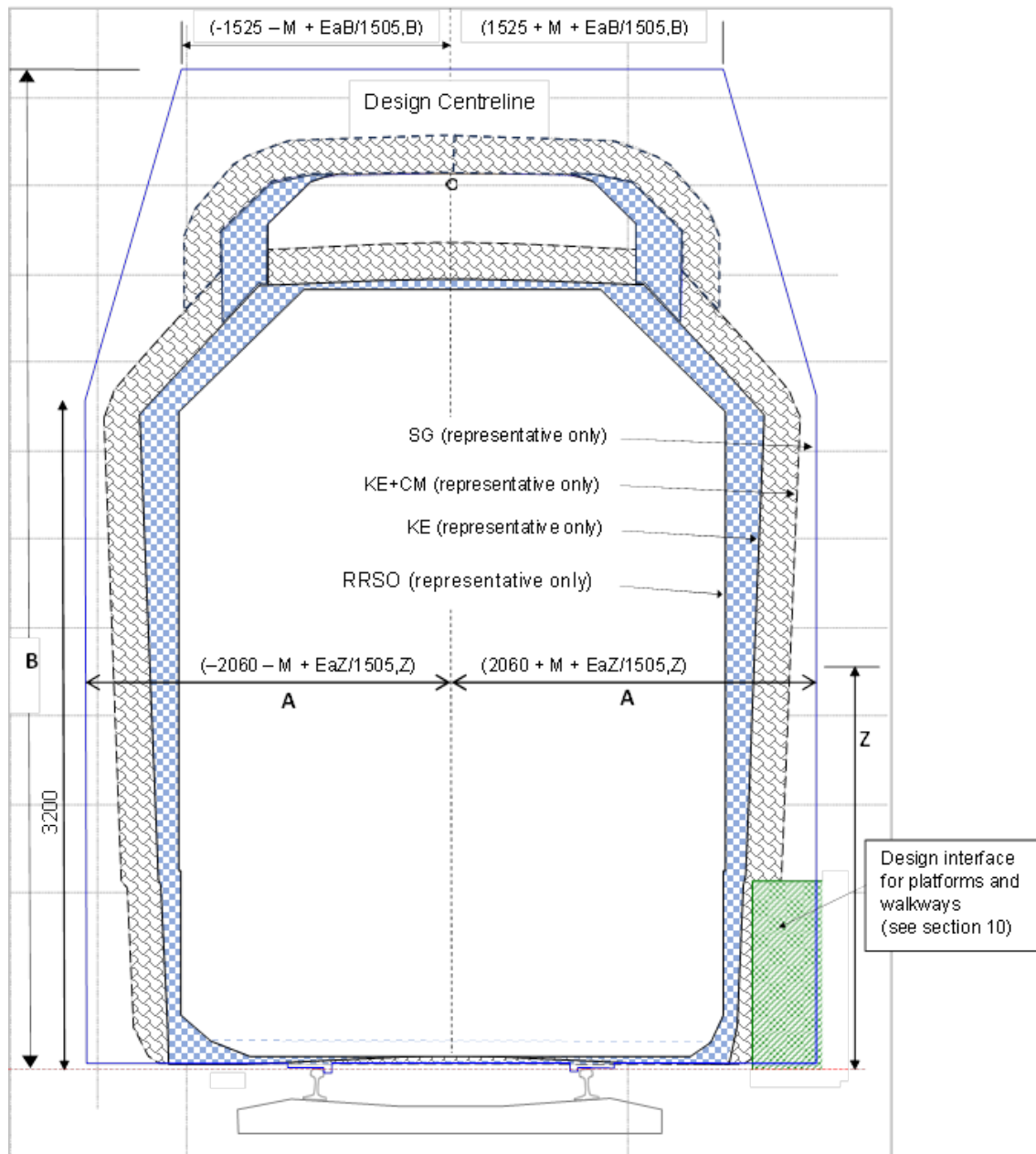


Figure 2 – General structure gauge (SG)

Parameters and dimensions depicted in Figure 2 are defined as follows:

- Ea is the applied superelevation (right rail in diagram is low rail)
- A is the horizontal clearance as per Table 22
- B is the vertical clearance to overhead structures, defined in Section 7.1.2

- Z is the vertical height above the design low rail where clearance is required
- M is the curving effect parameter, defined in the authorised outlines in Appendix A
- Design interfaces shown are indicative only.

7.2.1 Horizontal clearances

The requirements in Section 7.2.1 specify the minimum horizontal dimension for various track geometries from design track centreline to a structure (dimension A in Table 22).

Up to a height above design rail level of 3400 mm, the minimum horizontal dimension A shall be in accordance with Table 22.

Table 22 – Horizontal clearance dimension A

Location	Dimension A (mm)
Straight track	2060
On the inside of curves	$2060 + M + \frac{EaZ}{1505}$
On the outside of curves	$2060 + M - \frac{EaZ}{1505}$

7.2.2 Vertical clearances

In electrified areas, the vertical distance from the rail to an item of infrastructure is governed by the height of the OLE. The OLE and associated energised equipment are a designed physical interface. Refer to TS 03805 for further guidance on OHW design and construction.

The minimum vertical height (dimension B in Figure 2) of non-energised equipment and other infrastructure above the track shall be 200mm above the highest OLE position.

The minimum vertical clearance between the lowest OLE position and the maximum height of the low rail shall be in accordance with Section 7.1.2.

7.3 Rail level structure gauge

Figure 3 outlines the SG that applies at rail level on all lines of the network. The SG line at rail level provides space proofing for track and related infrastructure to be installed under the path of travelling rolling stock.

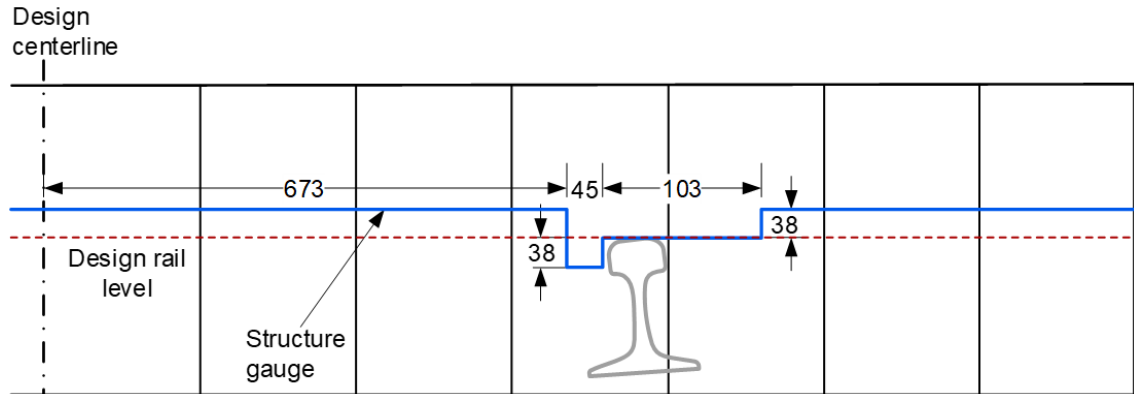


Figure 3 – Under train structure gauge (SG)

Structure gauge coordinates are in Table 23.

Table 23 – Structure gauge coordinates at rail level

Horizontal (mm)	Vertical (mm)
0	38
673	38
673	-38
718	-0.38
718	0
821	0
821	38
2100	38

8 Rolling stock

Section 8 sets out requirements that ensure that any rolling stock operating on the network fits within the provisioned space available.

Rolling stock shall be assessed in accordance with the process outlined TS 00180.1.

These assessments shall be completed using the dynamic parameters defined in Section 6 and the rolling stock compared with chosen authorised RRSO or combinations of authorised RRSOs selected from Section 5.

Type testing may be demonstrated through either the use of computer simulation and modelling and or physical measurement.

Where desktop techniques are used they shall be supplemented by physical measurements completed on a minimum of one example of each type of rolling stock being considered representative of the fleet being assessed.

Testing shall consider all degraded modes of operation and consider operation up to the maximum operational speed for the network in consultation with the RIM.

Additional checks and re-validation shall be completed in accordance with the rolling stock maintenance manuals.

8.1 Elements exceeding the reference rolling stock outline

Any equipment affixed to the rolling stock that does not comply with the authorised RRSO shall:

- be frangible in nature and deform or detach in a safe manner on contact with surrounding infrastructure
- be identified as either of the following:
 - a design interface specified in Section 10
 - managed as a concession in accordance with TS 00003.1 and the *Sydney Metro Concessions Process*.

All exceeding items shall be identified on the rolling stock certification.

8.2 Restricted operations

Where a vehicle is to be operated under restricted conditions, dynamic testing may be reduced by agreement with the RIM. The reduced dynamic testing shall be documented on the rolling stock approval, along with the associated operational restrictions.

The restrictions shall be recorded on the approved rolling stock register.

9 Platforms

Platform design offsets are set out in Table 24 and define the required offsets and frangible elements required for platforms on the Sydney Metro Northwest and Southwest line and covers passenger platforms and access platforms for maintenance staff.

Construction limits for the platform area are set out in Section 12.

Table 24 – Platform design offsets – passenger platforms

Platform type	H (mm)	V (mm)	Horizontal frangible edge (mm)
Straight track underground ¹	1555	1200	13
Straight track on slab ¹	1565	1200	23
Curved platforms ^{2, 3} (nominal) on slab	1615	1200	73

Notes

In addition to the platform offsets listed in Table 24:

1. This offset only applies to existing platforms constructed to this offset and shall not be used for new platforms. Platforms constructed to this offset shall have a maximum speed of 75 km/h and special rolling stock assessment.
2. The offsets shall apply to all configurations of platforms with horizontal curvature within the platform zone.
3. Nominal offsets shall be modified to compensate for curving and superelevation effects.

9.1 New platform design

New platforms shall be designed in accordance with design conditions as follows:

- track through platforms shall be straight and level with no applied superelevation or vertical curvature
- the straight track section shall extend for at least 20 m beyond the platform
- vertical curves shall not start until at least 10 m beyond the platform
- track form shall be slab track or equivalent system
- trackform transitions shall not be located within the platform area nor within 20 m beyond their start or end.

The design platform offsets to be adopted for new platforms are depicted in Figure 4.

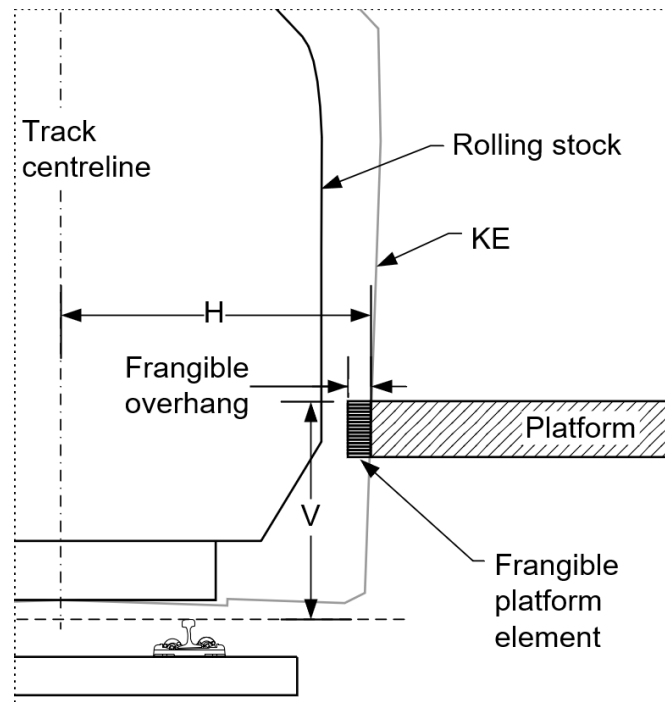


Figure 4 – Platform dimensions

9.2 Platform screens and doors

PSDs shall be installed on all passenger platforms in the network to protect the boundary of the UTO zone.

PSDs shall be designed to minimise the gap between the doors and rolling stock in order to reduce entrapment risk.

The terms PSD and PEB are used on the network operators documentation to distinguish between two types of barriers at the platform edge. PSD are full height barriers, supported from the roof used in underground platforms. PEB are bottom supported systems used in outdoor platforms. In this document, these combined PSD and PEB systems are collectively nominated as PSDs and shall be treated together as one system.

A typical configuration is shown in Figure 5.

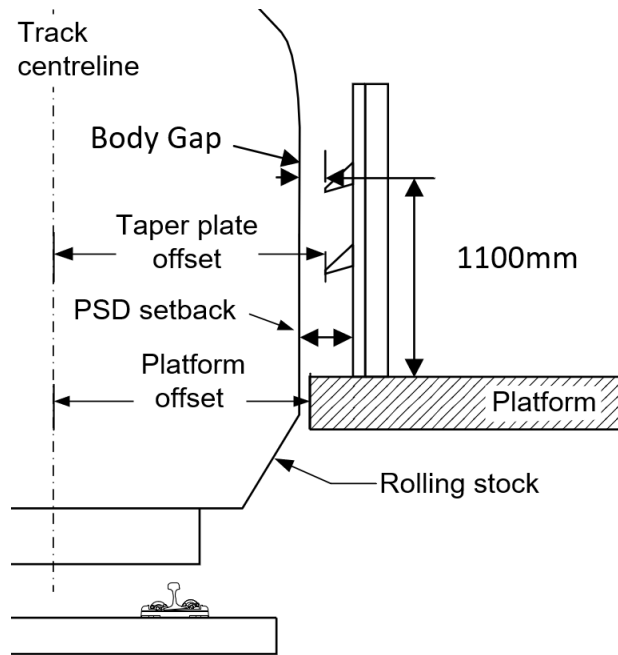


Figure 5 – Typical platform screen and door configuration

Platform screen and door systems shall be designed with a setback from the hard platform edge sufficient to achieve minimum clearance required by the design interface in Section 10.

Body gap is the gap between the edge of the taper plates and the extremity of the train bodyside and is a critical dimension for assessing the risk of entrapment between the rolling stock and the PSD. Body gap is assessed at a vertical offset of 1100 mm above the platform standing surface.

Taper plates may be installed to the track side face of the doors to reduce the risk of entrapment. The extension of the taper plate towards the track is governed by the design infringement specified in Section 10.

9.3 Mechanical gap fillers

MGF systems shall extend into the KE in order to function. To ensure safe operation of the network, the MGF shall fully retract back to the nominal platform offset when trains are operating. This shall be safeguarded by a control in the train control system that prevents extension of the unit while rolling stock is not stationary at the platform.

When a train is stationary at the platform the MGF may extend to the side of the stationary rolling stock. A gap between the extended MGF and the train side shall be maintained to minimise contact.

Figure 6 depicts MGF location and operational configurations.

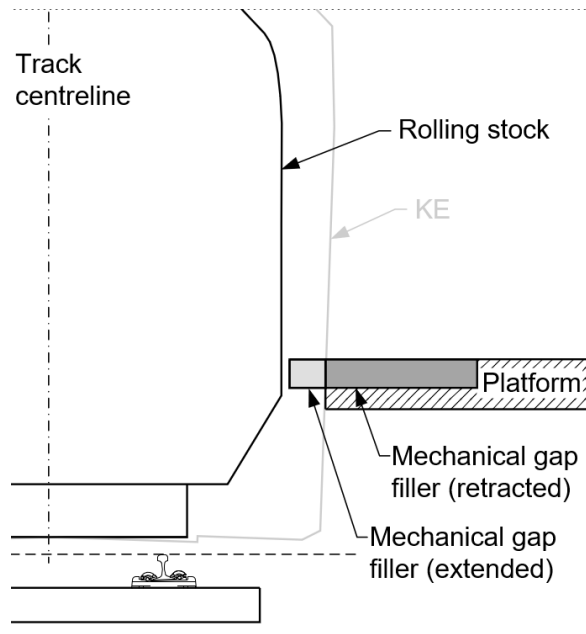


Figure 6 – Platform mechanical gap filler (MGF) systems

9.4 Maintenance and service platforms

Where maintenance and service platforms are required for network operations they shall be installed to the offsets in Table 25 and modified if required for non-tangent geometry.

Table 25 – Platform design offsets – other platforms

Platform type	H (mm)	V (mm)	Horizontal frangible edge (mm)
Cleaner platform level access	1627	1200	50
Maintenance road level access	1555	1200	0
Elevated access platform	1555	3400	80

Edge infills shall also be designed to manage the risk to operation and maintenance staff within the design interface allowed for in Section 10.

Maintenance requirements shall be developed in consultation with the RIM where maintenance and service platforms are installed within yard limit requirements for additional inspection.

9.5 Platforms on non-tangent geometry

Where the track geometry through the platform is not straight additional clearance is required to manage dynamic effects and the impact of body throw.

To compensate for geometry impacts the nominal offset shall be modified as detailed in TS 00180.1 and by the factors in Table 26 and Table 27.

Table 26 – Platform offsets for concave platforms

Offset orientation	Offset modification factor
Vertical	$V + 1.7 \times E_a$
Horizontal	$H + 27565/R - 0.75E_a$

Table 27 – Platform offsets for convex platforms

Offset orientation	Offset modification factor
Vertical	$V - 0.7E_a$
Horizontal	$H + 27565/R + 0.75E_a$

Additional KE allowance shall also be made to compensate for increased body roll and track effects such as rail wear. The proposed horizontal offsets and revised KE shall be included in the design report.

10 Design interfaces

The design interfaces specified in Table 28 have a physical or operational interface with rolling stock that requires them to be within the SG. The maximum infringement and any specific controls are listed with the item.

Table 28 – Designed infringements and applicable conditions

ID	Item	Acceptable infringement	Details
1	OLE and associated energised electrical equipment	Clearances in accordance with Section 7.1.2	Design of OLE system shall be in compliance with <i>Design Standards Manual in Technical Library for Sydney Metro Northwest Operations</i> .
2	Buffer stops	Block end of line	Design and construction in accordance with <i>Design Standards Manual in Technical Library for Sydney Metro Northwest Operations</i> .
3	Rolling stock Frangible Door steps	Not considered as part of the vehicle for clearance assessment and may extend beyond the RRSO to a maximum of +20mm	These elements installed at the doors of the train to improve stepping gap are sacrificial and not considered as part of the vehicle outline when assessing compliance.
4	Platform edge	May approach to the kinematic outline down to KE + 0 mm	Platforms are a design interface with special installation and maintenance tolerances as detailed in Sections 9 and 12.2.

ID	Item	Acceptable infringement	Details
5	Platform edge frangible elements	May infringe into the kinematic outline to KE – 20 mm	Deformable lengths of frangible elements may extend into the KE to a maximum infringement of KE –20 mm. Non-deformable length shall be compliant with KE +0.
6	PSD	May approach to the Kinematic outline down to KE + 0 mm	PSDs are established very close to the platform edge to reduce entrapment risk. As they are part of the pedestrian platform they may infringe as described. PSD system elements including header boxes, but excluding frangible elements of taper plates, shall be clear of the kinematic gauge including under all combinations of pressure loadings due to train aerodynamics and tunnel ventilation effects.
7	PSD frangible taper plates	May approach to the Kinematic outline down to KE – 20 mm	Taper plates are used to reduce the entrapment risk at platform doors. If these elements are made from a frangible or deformable material they may infringe as described. Non frangible components shall maintain clearance of KE + 0 mm.
8	Axle counters	May be set to interact with the wheel in accordance with OEM design	Design to be set against top of rail, with an appropriate maintenance program.
9	Lineside friction modifier applicators	May be set to interact with the wheel in accordance with OEM design	Installation tolerances to be defined in maintenance manual.
10	MGFs	Extended MGF may infringe to RRSO while rolling stock is stationary	MGF systems shall be designed to be fully retracted into the platform face when trains are clear to operate.
11	Tunnel walkways	Design clearance of KE+100mm	Tunnel walkways are designed to align with the train and provide for side detrainment. As such reduced clearance is required. Walkways shall not be used alongside ballasted track. Technical maintenance plan shall include examination of clearances between track and the walkway.

11 Approval of clearances

Any infrastructure that does not comply with the minimum infrastructure limits or structure gauge requirements specified in this document shall be approved prior to entering operations.

Any deviations shall be approved in accordance with TS 00003.1 and the *Sydney Metro Concessions Process*.

11.1 Narrow clearances management

Any infrastructure that does not achieve the minimum infrastructure limits and structure gauge requirements shall be recorded in the narrow clearances register maintained by the RIM.

The narrow clearances register shall form part of the technical maintenance plan for the network and identify any additional maintenance or inspection requirements for these sections.

12 Acceptance limits

12.1 Construction tolerances at structures (other than platforms)

Physical construction of structures adjacent to track infrastructure shall not reduce the transit space safety margins. Design of structures shall consider construction tolerances when establishing clearance requirements.

12.2 Tolerances at platforms

Platform measurement conventions are shown in Figure 7. Horizontal measurements with a positive number mean a larger gap between train and platform, while a negative number is a reduced gap. For vertical measurements a positive value means an increase in the distance between the platform surface and the design rail level, or a larger step down into the carriage.

The tolerances set out in Table 29 apply to the construction or renewal of platforms and the construction, renewal or maintenance of track through platforms and for a distance of no less than 20 m to either side.

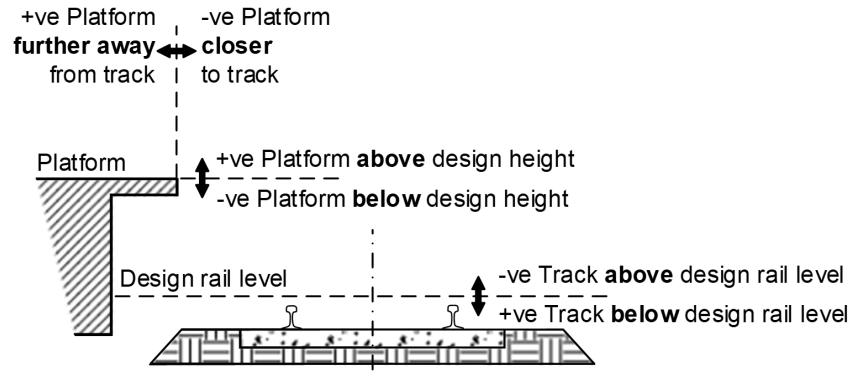


Figure 7 – Platform measurement conventions

Table 29 – Acceptance tolerances at platforms

Scenario	Vertical tolerance (mm)	Horizontal tolerance (mm)	Superelevation tolerance (mm)	Comments
Construction or renewal of platform	+0 to -5	-0 to +5	N/A	Relative to design hard coping edge position
Construction of track at platform	±5	±5	±2	Relative to design rail position
Maintenance of track at platform	±5	±5	±5	Relative to design rail position

Appendix A Authorised outlines

A.1 Metro narrow outline

Figure 8 shows the metro narrow outline and the following should be noted:

- 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
- points A – D and A' to D' are considered to define the bogie for tolerance application
- points E – J and E' to J' are considered to define the body for tolerance application.

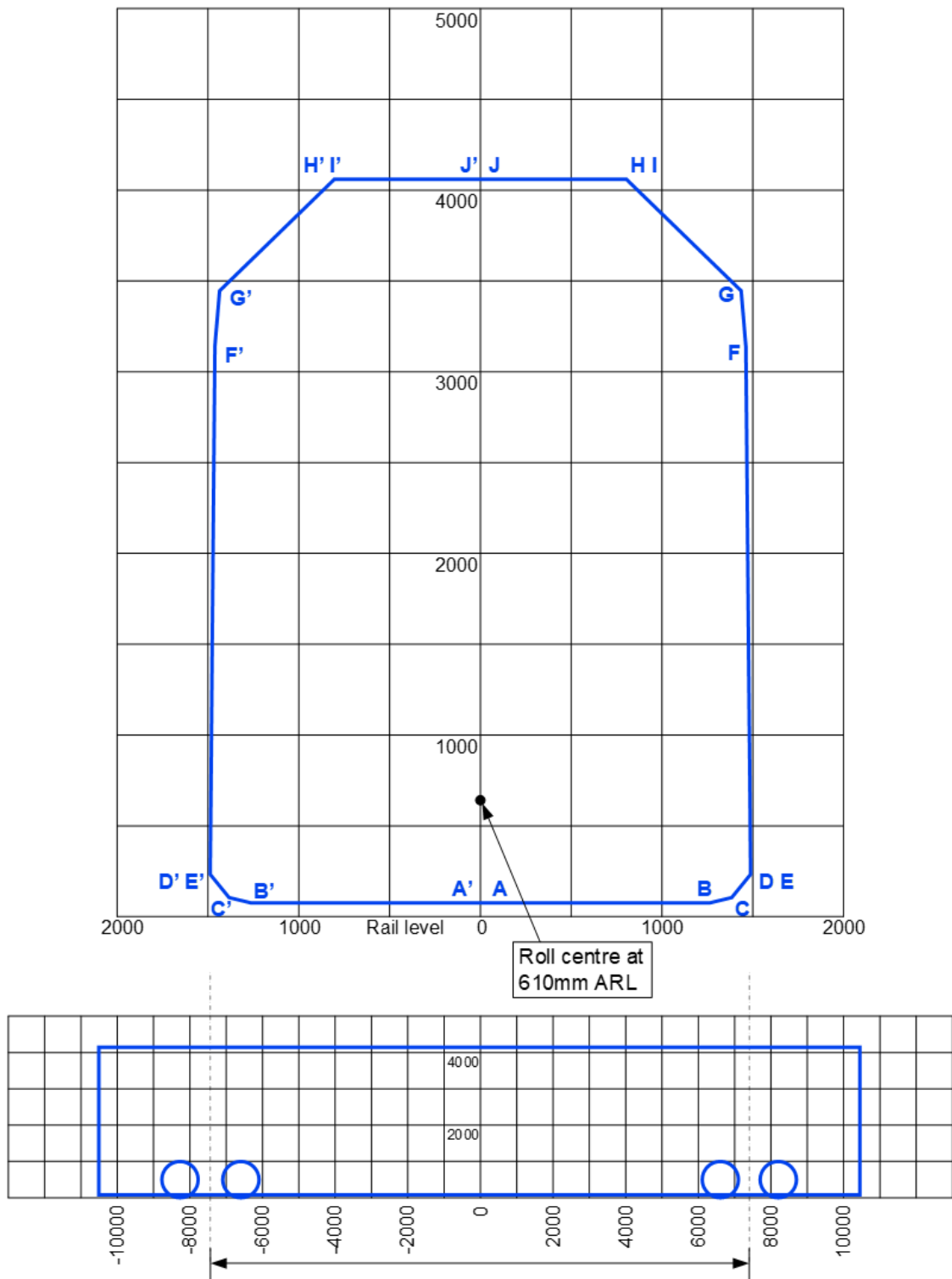


Figure 8 – Metro narrow outline

Table 30 sets out the coordinates of points in the metro narrow outline static profile shown in Figure 8.

Table 30 – Metro narrow static profile

Point	Lateral (mm)	Vertical (mm)
A	0	75
B	1260	75
C	1384	105
D	1488	233
E	1488	233
F	1462	3141
G	1436	3446
H	804	4060
I	804	4060
J	0	4060

Table 31 sets out the dimensions of vehicle features for the metro narrow outline static profile shown in Figure 8.

Table 31 – Metro narrow vehicle dimensions

Vehicle feature	Dimension (mm)
Bogie centres	14,850
Body overhang (symmetrical)	3040
Vehicle width	2976
Vehicle length	20,930
Roll centre ARL	610

Simplified curving effect coefficient M for metro narrow outline can be calculated as per Equation 1. Definitions for equations are detailed in TS 001180.1.

$$M = \frac{27565}{Rh}$$

Equation 1 – Simplified coefficient for curve effects, M

Where

R_h = horizontal curve radius

A.2 Metro 1500 V pantograph

Figure 9 depicts the metro 1500 V pantograph.

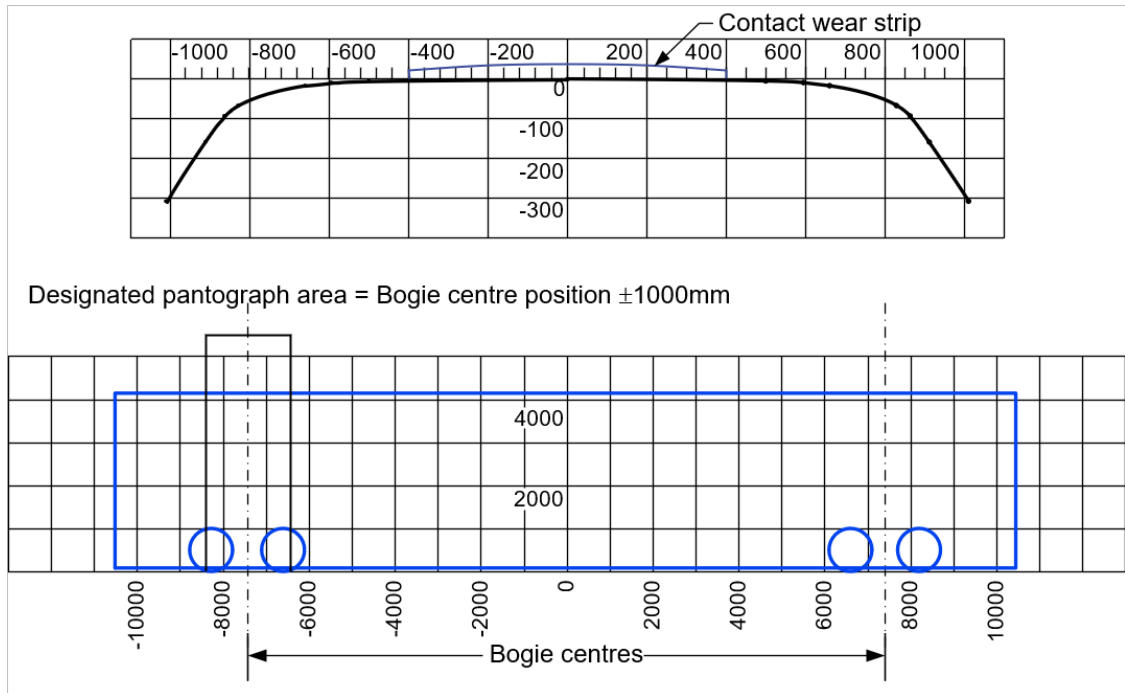


Figure 9 – Metro 1500 V pantograph

In Figure 9, the following should be noted:

- all cross-section dimensions are symmetrical about the vehicle centreline
- the origin for all horizontal coordinates is the vehicle centreline
- the origin for all pantograph vertical coordinates is the contact position with fully worn contact brushes
- all dimensions are in millimetres.

Table 32 sets out the coordinates for points on the metro narrow 1500 V pantograph shown in Figure 9.

Table 32 – Metro narrow 1500 V pantograph

Horizontal (mm)	Vertical (mm)
0	0
634	0
748	-14
839	-44
916	-101
947	-148
1062	-322

A.3 Narrow non-electric outline

Figure 10 shows the narrow non-electric outline.

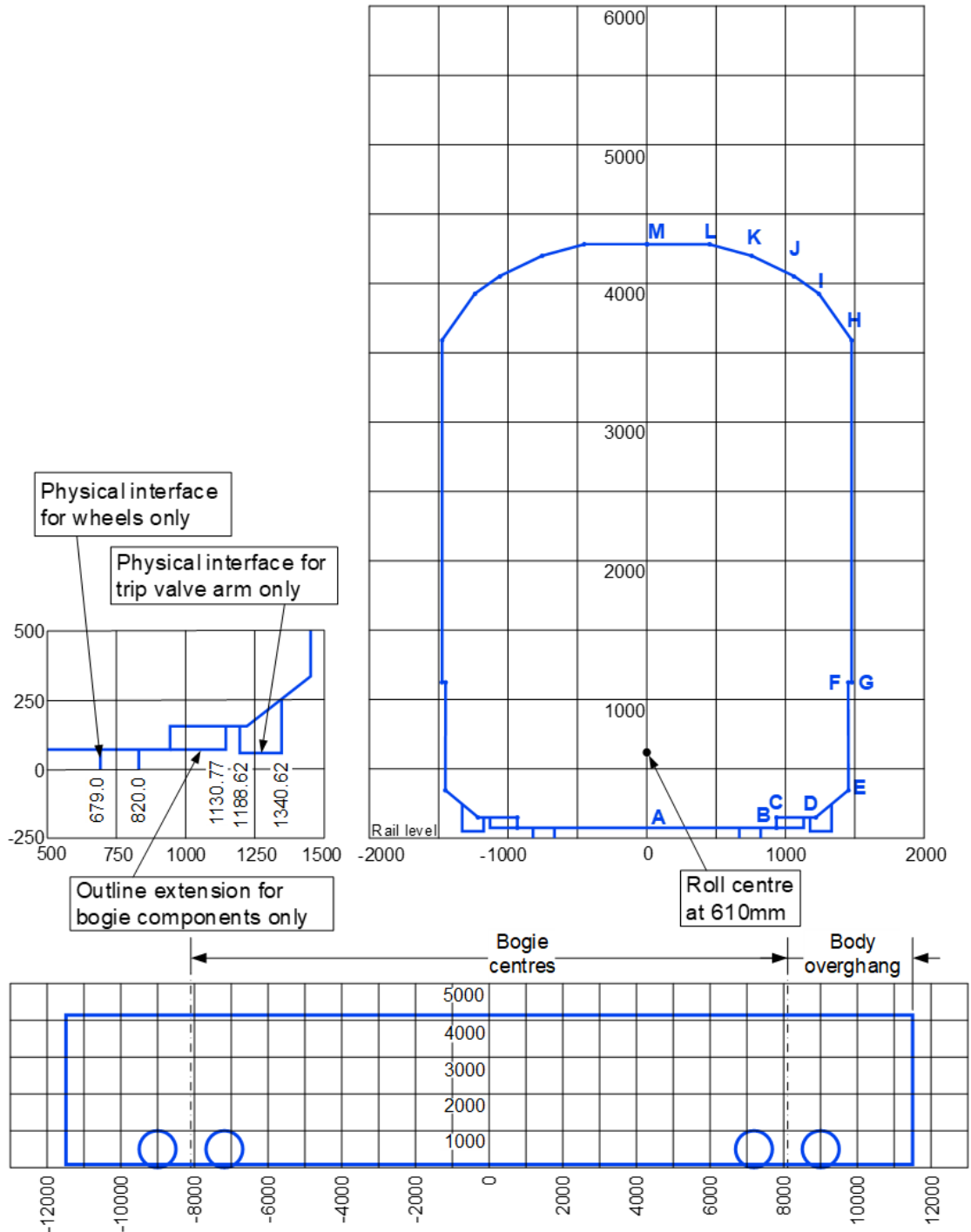


Figure 10 – Narrow non-electric outline

In Figure 10 the following should be noted:

- 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
- the origin for all pantograph vertical coordinates is the contact position with fully worn contact brushes
- all dimensions are in millimetres.

Table 33 sets out the coordinates for points on the narrow non electric static profile shown in Figure 10.

Table 33 – Narrow non electric static profile

Point	Lateral (mm)	Vertical (mm)
A	0	75
B	1260	75
C	1384	105
D	1488	233
E	1488	233
F	1462	3141
G	1436	3446
H	804	4060
I	804	4060
J	0	4060

Table 34 sets out the dimensions of vehicle features for the metro narrow outline static profile shown in Figure 10.

Table 34 – Narrow non electric vehicle dimensions

Vehicle feature	Dimension (mm)
Bogie centres	16,155
Body overhang (symmetrical)	3353
Vehicle width	2976
Vehicle length	22,861
Roll centre ARL	610

Simplified curving effect coefficient M for metro narrow outline can be calculated as per Equation 2. Definitions for equations are detailed in TS 001180.1.

$$M = \frac{32600}{Rh}$$

Equation 2 – Simplified coefficient for curve effects, M

Where

Rh = horizontal curve radius