

TO	Network Wide
FROM	Corporate Services & Safety, General Manager Technical Standards
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SUBJECT	Track and Civil Code of Practice – Section 7 Clearances – Technical Note ETD-07-01
TITLE	Technical Note - Track Centre Guidance – Double Stack Corridors v3.1

Clarification – Inland Rail Clearance Reference Profiles

For all greenfield sites the design references profile shall be Plate F which will encompass all other current ARTC reference profiles.

For existing corridor works the objective will be to meet the clearance requirements for the following rollingstock outlines.

- Plate D
- Plate H
- Plate F2

The combination of these templates are colloquially referred to as F2M (F2 Modified), however due to the variations in cross-section dimensions, lengths and bogie pivot positions no single template will apply to all possible track alignments (in curvature and cross-level). Clearances must be designed for the most adverse swept path from the reference plates, in each location.

1.0 References

ARTC CoP Section 7 Clearances

ARTC 2011 Clearance Policy V3

2.0 Reference Profiles

ARTC Code of Practice Section 7 Clearances

- Fig 7.5 Rollingstock Outline D (also Appendix E)
- Fig 7.7 Rollingstock Outline F
- Fig 7.17 Structure Outline for Plate F; Tangent track
- Fig 7.18 Structure Outline for Plate F; Curves > 300m Rad
- Fig 7.19 Structure Outline for Plate F; Curves < 300m Rad
- Appendix C Rollingstock Outline F2
- Appendix D Rollingstock Outline H

3.0 Background

Inland Rail will be designed for Plate F double stack operations. The existing tracks clearances were constructed for historic single stack profiles so clearances will need to be redesigned.

4.0 Objective

This document provides for the reassessment of clearances of existing tracks impacted by the introduction of double stack operations.

5.0 Scope

This Technical Note has been prepared for the Inland Rail Project to address the impact of introducing Plate F.

The following situations shall be addressed:

- Parallel running lines – Main line to main line (running lines)
- Main line to crossing loop (running lines)
- Running line to “cripple/refuge” siding
- Running line to active loading siding
- Running line to “Engineer’s/Maintenance” siding

6.0 Definitions

Running Line

- A line (other than a siding) that is used for the through movement of trains. (SA/WA/Western VIC) (RISSB)
- A line (other than a siding) which is used for through movement of trains (NSW)
- Includes any track on which trains run between stations or crossing loops and shall include No. 1 and No. 2 (and other running tracks specially classified) within station limits. (VIC)

Main Line

- The line normally used for running trains through and between locations. (SA/WA/Western VIC) (RISSB)
- The running line normally used for running rail traffic through and between locations. (NSW)

Crossing Loop (Includes Passing Lanes, Refuge Loop NSW, etc.)

- A length of track connected to the main line by switches at both ends to provide a facility that permits trains to both cross and pass each other. (RISSB)
- A running line, secondary to the main line, provided primarily for crossing or passing trains. (SA/WA/Western VIC)
- A running line in single-line territory, with entry and exit ends connected to a main line that is used to hold a train or track vehicle to allow other rail traffic to cross or pass. (NSW)

Passing Loop

- A passing loop is a section of track that runs parallel and connected at both ends to the main line. This allows, for example, two trains in opposite directions to cross each other, or a faster train to pass and overtake a slower one that is waiting in the loop. Passing loops are generally used on lines with only one track, and allows for increased running capabilities and minimalised running times. (RISSB)

Refuge Loop

- A running line in double-line territory, with entry and exit ends connected to a main line, that is used to hold a train or track vehicle to allow other rail traffic to cross or pass. (NSW) (RISSB)

Balloon Loop

- A portion of line that allows rail traffic to change direction of travel without change to the leading end. (NSW)

- A circular portion of line that allows trains to reverse their direction of travel (RISSB).

Siding

- A section of railway track, connected by points to a running line or another siding, on which rolling stock can be placed clear of the running line and normally used for purposes such as stabling, loading, rollingstock maintenance or passing of trains. (RISSB)
- A portion of line connected by points to a main line or loop where vehicles can be placed or stored. (SA/WA/Western VIC)
- A portion of track where vehicles can be placed clear of the running lines. (NSW)

Dead End Siding

- A portion of line connected to a running line or other siding, with points at one end only. (NSW),

Intermediate Siding

- A siding in a section provided for purposes other than crossing or passing of trains. (SA/WA/Western VIC) (RISSB)
- A siding located within a section, generally used for purposes other than crossing or passing of trains. (NSW)

“Cripple/Refuge” Siding

A siding provided primarily for the storage of defective rolling stock which is unfit to continue its operations. Rolling stock are placed and removed by a train movement which has an authority to occupy the adjoining track for shunting. If rolling stock repair work is required a track occupancy for the adjacent running line will normally be required. Also referred to as a Refuge siding.

Customer (Active loading) siding e.g. silo, container or bulk loading/discharge facility

A siding provided for loading or unloading rolling stock. Activity may involve movement of wagons past a fixed loader (silo chute) or placing loading on or into stationary wagons. These activities may require personnel and/or motor vehicles to work between the rolling stock and the adjacent “active” running line. Protection will usually be provided by spatial separation.

Engineer’s / Maintenance Sidings

A siding primarily provided for the storage of rail bound track maintenance machines. These tracks will be generally utilised for stabling, maintenance, and repair activities both during track clearances between work occupations and during other non-working periods. These activities may require personnel and/or motor vehicles to work between the rolling stock and the adjacent “active” running line. Protection will usually be provided by spatial separation.

Both the Customer and engineer’s / maintenance sidings would benefit from the provision of a delineation or barrier at the boundary of the 3m Danger zone from the adjacent running line.

7.0 Lateral Displacement Calculations

Table 1: For tangent track lateral displacement of Plate F outline

		Limits from COP 7 (mm)	Width of Plate F opposite top of adjacent Rolling Stock	
			6500 top Plate F (mm)	3580 top Plate D (mm)
Track	Lateral position	+/- 50	50	50
	Rail wear	+/- 5	5	5
	Gauge	+/-20	20	20
	Cross level	+/-30	130	72
			205	147
Rolling Stock	Lateral Translation	+/-40	40	40
	Wheel wear	+/- 20	20	20
	Roll	2.5deg at 440mm above TOR	264	137
			324	197
Total lateral at top corner			529	344
Max Kinematic from CL			2130	1945

Table 2: For tangent track lateral displacement of Plate D outline

		Limits from COP 7 (mm)	At 3580 top Plate D (mm)
Track	Lateral position	+/- 50	50
	Rail wear	+/- 5	5
	Gauge	+/-20	20
	Cross level	+/-30	72
			147
Rolling Stock	Lateral Translation	+/-40	40
	Wheel wear	+/- 20	20
	Roll	2.0deg at 610mm above TOR	103
			163
Total lateral at top corner			310
Max Kinematic from CL			1835

8.0 Track Centres

Running Lines

Running lines require clearance to permit full kinematic profile of Plate F rolling stock to pass. For parallel lines the clearance should be a minimum 4500mm between centres if the tracks are coplanar. Non tangent tracks require an additional clearance to be calculated based on track geometry layout.

Using maximum kinematic of 2130mm gives $2 \times 2130 + 200 = 4460\text{mm}$ for tangent track. New construction is to be 4500mm per standard.

For “stationary” rolling stock on one track the width could be reduced by part of the rolling stock lateral and rotational tolerance, but with no reduction in track tolerance allowance. The case for stationary rolling stock may be on a siding adjacent to a running line. Note for running lines it cannot be assumed that rolling stock will be stationary as crossed rolling stock may commence moving before the passing train has cleared.

For stationary rolling stock, reduce the allowance for rolling stock translation and wheel wear from 60mm to 30mm and reduce body roll from 2.5 to 1.5 deg or 115mm.

Track centres can be reduced to $2 \times 2130 + 200 - 145 = 4315\text{mm}$, say 4320mm, but only where it can be guaranteed that one rolling stock is stationary and the rolling stock kinematic is reduced.

Allowance is required for widening on non tangent track and at turnouts for centre and end throw

Restricted access siding (Single Stack Only)

Where a Siding is limited to current single stack rolling stock use Plate B/D profile with width 3050mm at 3580mm above rail.

Min track centres with both rolling stock moving $1945 + 1835 + 200 = 3970\text{mm}$. New construction is 4000mm.

Reduction for stationary rolling stock by 70mm → 3900mm (Note: one track has static and one track has moving rolling stock). This would typical include Sidings where personnel or motor vehicle access is NOT required between the tracks.

Table 3: Allowable track centres

Track configuration	Rolling Stock Profiles		Comments
	F / F (mm)	F / D (mm)	
Parallel running lines	4500 tangent 4500 + allowance for curves #	4000	F/D cases only applicable to restricted access sidings (single stack Only) parallel tracks and subject to individual infringement approval and controls. Assumes tracks are co planar. (see note #)

Running line to restricted access siding (Assumes one Rolling Stock stationary)	4320	3900	
Controlled min running lines (Slab track or similar)			Consider on a case-by-case assessment with controls managed under the Transit Space Infringement process

Note: # # Additional allowance required for curved tracks or where relative track levels could affect clearance. The Transit Space Infringement process is to be used for any location where track tolerances are controlled at less than those indicated in the above tables or CoP 7.

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General Manager Technical Standards

Appendix A: Additional allowance for other activities on siding

Customer (Active loading) siding

Where access is required between siding and running line by loading personnel either on foot or by motor vehicle, sufficient space for a safe working area is required clear of the "Danger zone" of the active running line.

Danger zone is beyond 3.0m from the outside of the running rail or 3.80m from CL.

For on-foot activities at least 1.5m required plus ½ rolling stock width and tolerance allowance. Allow 1/3 of rolling stock kinematic tolerance ($324/3 = 108\text{mm}$)

Safety zone + work space + ½ rolling stock + track tolerance + 1/3 rolling stock tolerance

$3800 + 1500 + 1600 + 0.205 + 0.108 = 7213\text{mm}$, say 7.2m

Where provision is made for motor vehicle movements at least 3.5m work space is required (9.2m).

Minimum track CL spacing

No Motor vehicle Access = 7.2m

Motor Vehicular access = 9.2m,

With the desirable >10.0m

Note: The above is based on the ultimate 3200mm wide rollingstock.

Engineer's / Maintenance sidings

The same access principals will apply to Engineer's / Maintenance sidings as for Customer sidings.

Allow >9.2m where possible but min 7.2m.

Appendix B: Future proofing. Provision for AAR Wagon and Loco Profiles

The ARTC 2011 Clearance Strategy includes making provision for “off-the-shelf” AAR Profile Locomotives and Wagons, particularly for Heavy Haul operations. This appendix reviews clearance requirements for AAR Interchange locomotive Plate L and Wagon Plate B (Unlimited interchange).

Table B1: For tangent track lateral displacement of AAR Loco Plate L outline

Static width from CL = 1625mm

		Limits from COP 7 (mm)	At 4467 top of loco (mm)
Track	Lateral position	+/- 50	50
	Rail wear	+/- 5	5
	Gauge	+/-20	20
	Cross level	+/-30	89
			164
Rolling Stock	Translation	+/-40	40
	Wheel wear	+/- 20	20
	Roll	2.0deg at 610mm	135
			195
Total lateral at top corner			359
Max Kinematic from CL			1984

Table B2: For tangent track lateral displacement of AAR Plate B outline

Static width from CL = 1625mm

		Limits from COP 7 (mm)	At 4191 top of Rolling Stock (mm)
Track	Lateral position	+/- 50	50
	Rail wear	+/- 5	5
	Gauge	+/-20	20
	Cross level	+/-30	84
			159
Rolling Stock	Translation	+/-40	40
	Wheel wear	+/- 20	20
	Roll	2.0deg at 610mm	125
			185
Total lateral at top corner			344
Max Kinematic from CL			1969

Table B3: For tangent track lateral displacement of Plate F outline

Static width from CL = 1600mm

		Limits from COP 7 (mm)	Width of Plate F at top of AAR Rolling Stock	
			At 4500 top AAR "L" (mm)	At 4200 top AAR "B" (mm)
Track	Lateral position	+/- 50	50	50
	Rail wear	+/- 5	5	5
	Gauge	+/-20	20	20
	Cross level	+/-30	90	84
			165	159
Rolling Stock	Translation	+/-40	40	40
	Wheel wear	+/- 20	20	20
	Roll	2.5deg at 440mm	177	164
			237	224
Total lateral at top corner			402	383
Max Kinematic from CL			2002	1983

Track centre clearance for tangent with AAR Locos allowing full kinematic.

$2 \times 1984 + 200 = 4168$, Say 4200mm

Plate F and AAR Loco

$1984 + 2002 + 200 = 4186$, Say 4200mm

Allowance is required for widening on non-tangent alignment.

To future proof for use of AAR rolling stock in single stack sidings, track centres of 4200mm is required.

For stationary single stack rolling stock on one track width could be reduced by part of the rolling stock lateral and rotational tolerance, but no reduction in track tolerance allowance. (unless controls for reduced track tolerances are managed under the Transit Space Infringement process).

Reduce rolling stock translation and wheel wear from 60mm to 30mm and reduce body roll from 2.0 to 1.0 degree or 67mm.

So track centres can be reduced to:

$2002 + (1984 - 97) + 200 = 4089$ mm, say 4100mm, but only where it can be guaranteed that the single stack rolling stock is stationary and rolling stock kinematic movement is reduced.

Allowance required for widening on curved alignment.

AAR Rolling stock dimensions

Table B4: AAR Rolling Stock Dimensions: AAR Loco – Static

Point on Profile	Left side		Right side	
	Lateral (X)	Vertical (Y)	Lateral (X)	Vertical (Y)
A	0	63.5	0	63.5
B	-1198	63.5	1198	63.5
C	-1352	222	1352	222
D	-1581	222	1581	222
E	-1581	546	1581	546
F	-1626	940	1626	940
G	-1626	4467	1626	4467
H	-1067	4775	1067	4775
I	-1067	4953	1067	4953
J	0	4953	0	4953

Bogie centres 15.691

Length over headstocks 22.2

As rolling stock length increases then width reduces

Table B5: AAR Rolling Stock Dimensions – AAR Plate B

Point on Profile	Left side		Right side	
	Lateral (X)	Vertical (Y)	Lateral (X)	Vertical (Y)
A	0	69	0	69
B	-1118	69	1118	69
C	-1219	229	1219	229
D	-1372	381	1372	381
E	-1422	381	1422	381
F	-1626	1016	1626	1016
G	-1626	4191	1626	4191
H	-1524	4343	1524	4343
I	-1067	4597	1067	4597
J	0	4597	0	4597

Bogie centres 12.573

Length over headstocks 17.78

As rolling stock length increases then width reduces

Diagrams on following pages

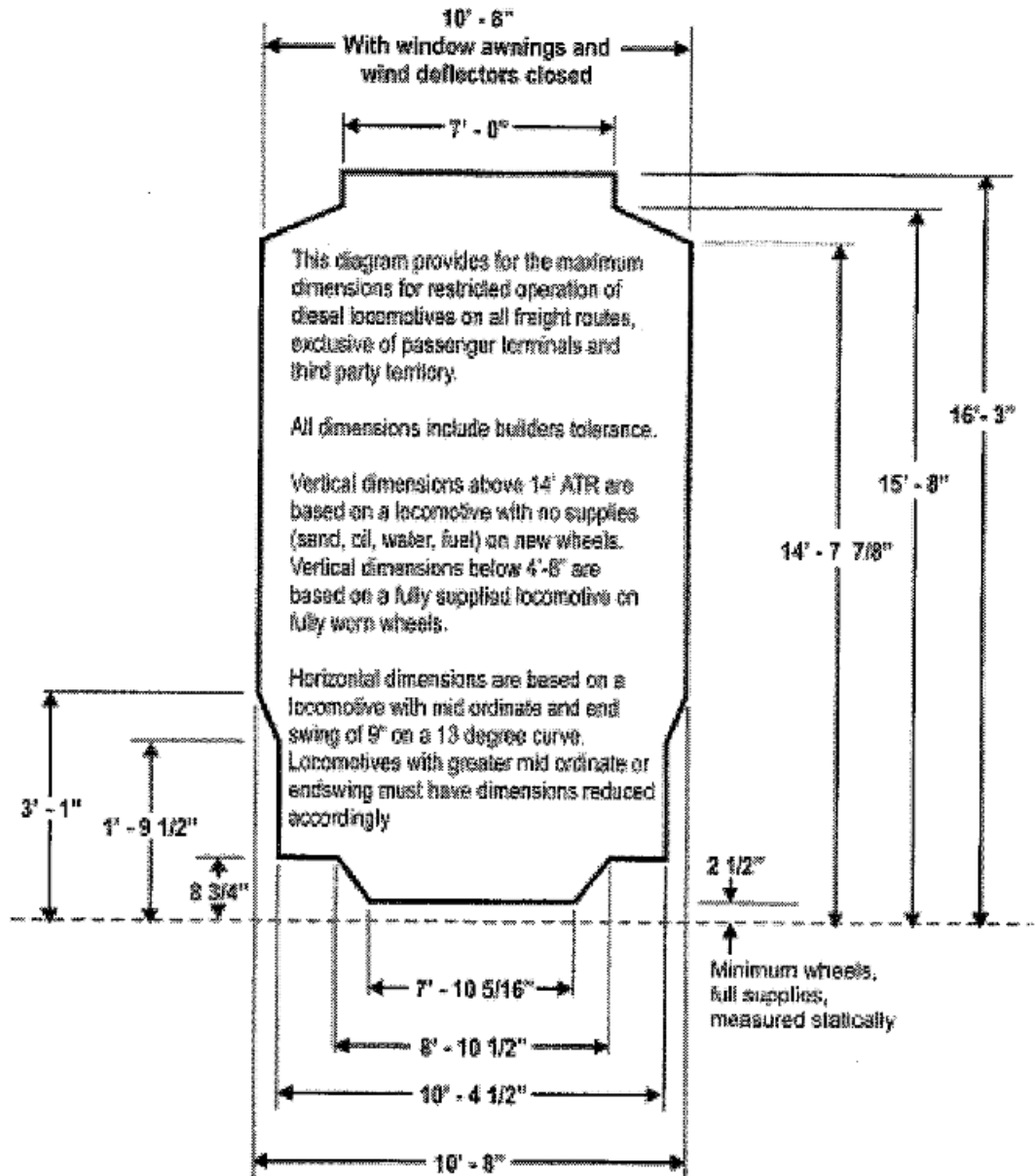


Fig. 2.1 Freight locomotive Plate L

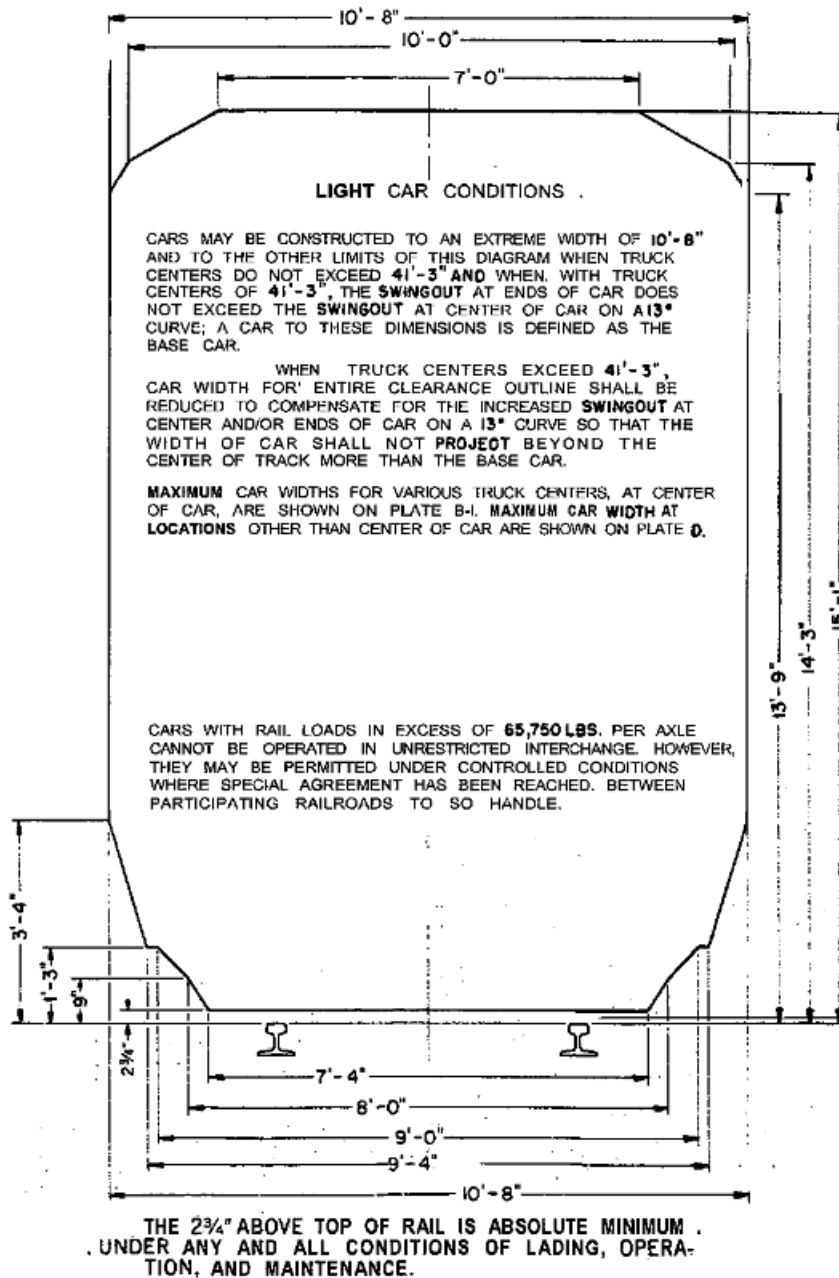
From Association of American Railroads Manual of Standards and Recommended Practices

PLATE B EQUIPMENT DIAGRAM FOR UNRESTRICTED INTERCHANGE SERVICE

Standard

S-2026-88

Adopted, 1948; Revised, 1963, 1966, 1967, 1972, 1983, 1988

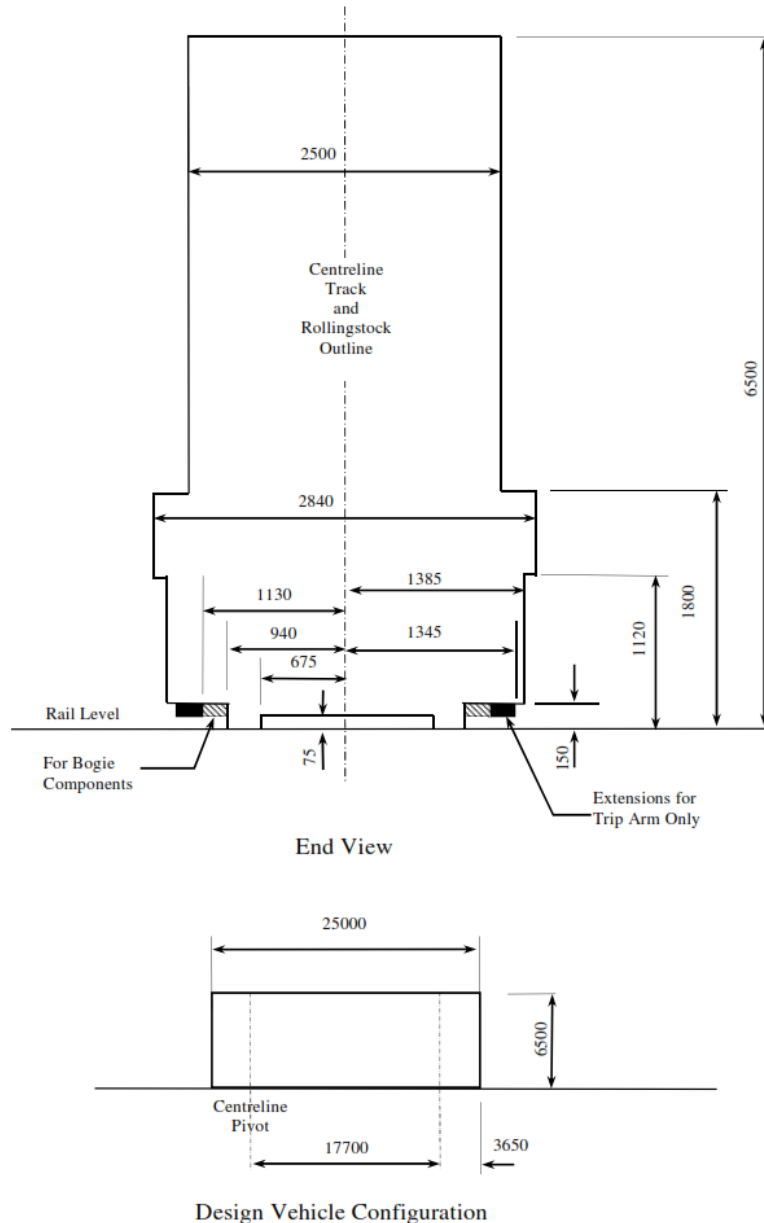


From Association of American Railroads Manual of Standards and Recommended Practices

Appendix C: ARTC F2 Profile

The ARTC Route Access Standard refers in Fig 5.1 to an F2 profile being 2500mm wide x 6500mm high. No other dimensions are defined. The profile described below is the double stack outline of Wagons to be applied to the Crystal Brook – Goobang Junction route. The base vehicle has the same swept path as Plate C on a 100m radius curve.

Figure 7.X – Rollingstock Outline F2



Notes:

- [1] The dimensions between bogie pivots and from bogie pivot to end of body should not be increased unless allowance is made by a reduction in width to compensate for increased centre and end throw on a curve of 100 m radius.
- [2] The clearances above rail should be preserved under all conditions of operation, loading and maintenance of a vehicle on level track.

Allowable Track Centres using F2 Profile

Critical points on profile for clearances F2 to F2 is the top corner 1250 from CL at 6500 above TOR.

F2 to Plate D clearance at 3580 above rail

Table C2: For tangent track lateral displacement of Plate F2 outline

		Limits from COP 7 (mm)	6500 on Plate F2 (mm)	3580 on Plate F2 Top Plate D (mm)	5300 on Plate F2 Top H (mm)
Track	Lateral position	+/- 50	50	50	50
	Rail Wear	+/- 5	5	5	5
	Gauge	+/-20	20	20	20
	Cross Level	+/-30	130	72	106
			205	147	181
Rolling Stock	Lateral Translation	+/-40	40	40	40
	Wheel wear	+/- 20	20	20	20
	Roll	2.5deg at 440mm above TOR	264	137	212
			324	197	272
Total lateral at outer corner			529	344	453
Static profile from CL			1250	1250	1250
Max Kinematic from CL			1779	1594	1703

Table C3: Allowable track centres Using F2 Profile

Track configuration	Rolling Stock Profiles		Comments
	F2 / F2 (mm)	F2 / D (mm)	
Parallel running lines	3757	3629 (D/D 3870)	Single stack Plate D will govern track centres on tangent track.

Comment: For Plate F2 the vertical clearance requirement is comparable to Plate F with full kinematic allowance.

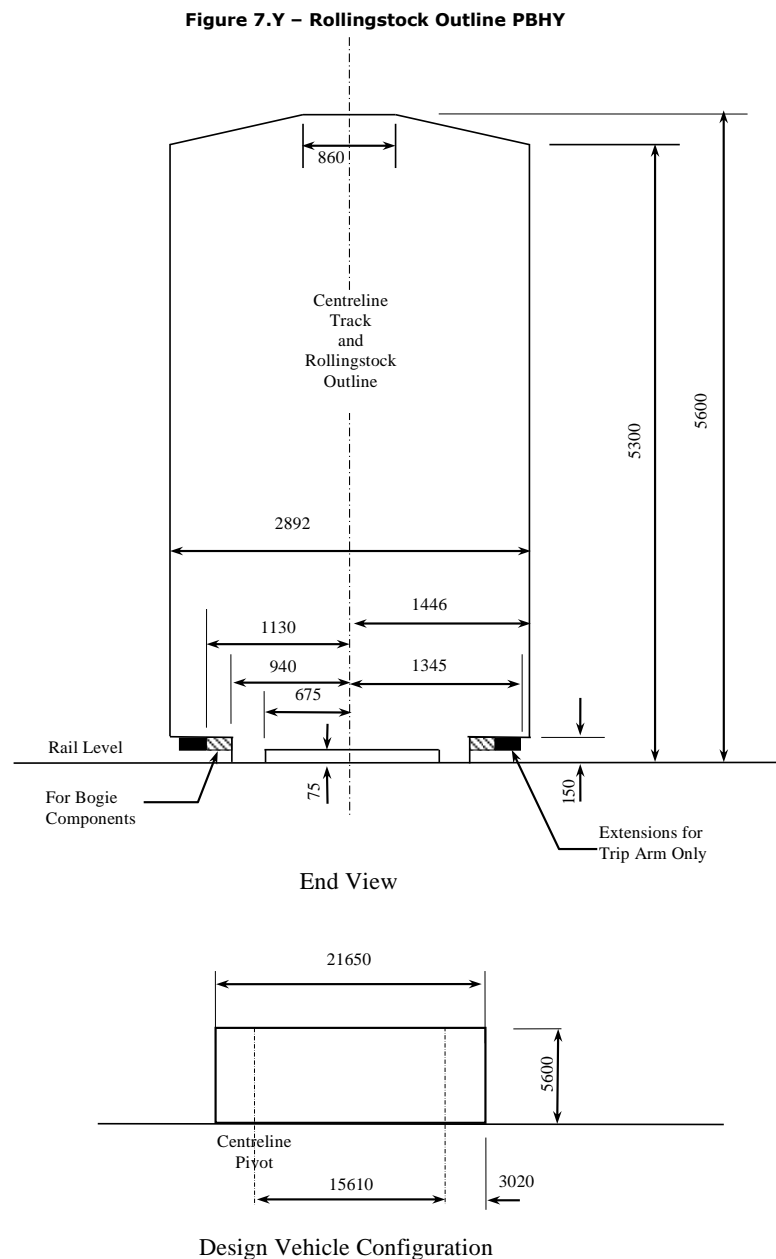
For lateral clearance on tangent track, the track centre dimension for Plate D/D is wider than for Plate F2/F2 and Plate F2/D. For curved track alignments the swept path must be calculated for both rolling stock profiles.

Appendix D: ARTC H (previously referred to as PBHY “high cube” vans)

The H vans operated by SCT have been approved to operate on the Crystal Brook –Goobang Jct route since 2006.

These vans fall outside both the Plate D and plate F2 profiles so must be given special consideration.

Basic dimensions are shown on the diagram below.



Notes:

- [1] The clearances above rail should be preserved under all conditions of operation, loading and maintenance of a vehicle on level track.
 - [2] At heights above rail to 3580mm the swept path is inside the C profile swept path.
- * Different end and centre dimension due to doors.

Allowable Track Centres using H Profile

Critical points on profile for clearances H to H is the top corner 1428 from CL at 5300 above rail.

H to Plate D clearance at 3580 above rail

Table D1: For tangent track lateral displacement of H outline

		Limits from COP 7 (mm)	5300 on H (mm)	3580 on H top D (mm)
Track	Lateral position	+/- 50	50	50
	Gauge	+/- 5	5	5
	Rail wear	+/-20	20	20
	Cross level	+/-30	106	72
			181	147
Rolling Stock	Translation	+/-40	40	40
	Wheel wear	+/- 20	20	20
	Roll	2.0deg at 610mm	164	104
			224	164
Total lateral at outer corner			405	311
Static profile from CL			1446	1446
Max Kinematic from CL			1851	1757

Table D2: Allowable track centres Using H Profile

Track configuration	Rolling Stock Profiles			Comments
	H / H (mm)	H / F2 (mm)	H / D (mm)	
Parallel running lines	3902	3754	3792 (D/D 3870)	H van will govern track centres on tangent track

Comment: For H the vertical clearance is not an issue.

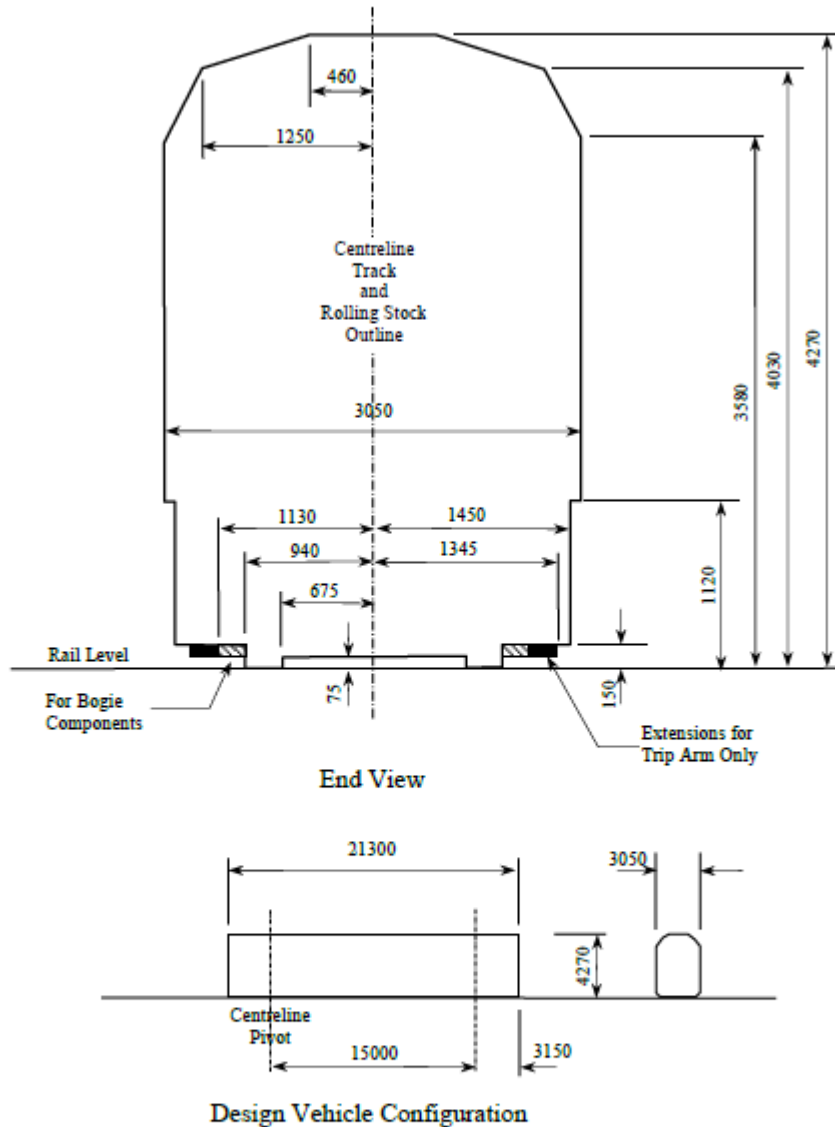
For lateral clearance on tangent track, the track centre dimension for Plate H/H is wider than for D/D, H/F2 and H/D. For curved track alignments the swept path must be calculated for all rolling stock profiles.

Appendix E: ARTC D

Clearances between D / F2 and D / H are covered in previous appendices.

Basic dimensions are shown on the diagram below.

Figure A1.4 – Rolling Stock Interstate Outline Plate D



Notes:

- [1] *The dimensions between bogie pivots and from bogie pivot to end of body should not be increased unless allowance is made by a reduction in width to compensate for increased centre and end throw on a curve of 100 m radius.*
- [2] *The clearances above rail should be preserved under all conditions of operation, loading and maintenance of a vehicle on level track.*
- [3] *The area outside the wheels, 80mm above rail and 1130mm from the vehicle centre line shall be occupied by bogie components only.*