
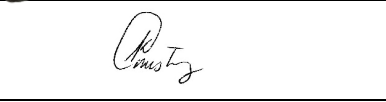





A Division of Transnet SOC Limited

TECHNOLOGY MANAGEMENT, track technology
SPECIFICATION
BBF9104 version 2

**TRANSNET FREIGHT RAIL USER REQUIREMENTS FOR
TURNOUTS**

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Date:			10 July 2014

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Document version

This document supersedes all previous versions of this document referred to as “user requirements for turnouts (crossings)”, dated before 10 July 2014.

1 Scope

This specification covers the requirements for the design of Tangential turnouts (new design) turnouts as well as Secant design (Transnet design turnouts) to be used on all Transnet Freight Rail lines.

2 Related documentation

The following documents are to be used in conjunction with this specification:

- Track structure technology structure 2014 (BBB5254 version 2)
- Manual for track maintenance (BBB0481v2)
- British standards: Railway applications– Switches and crossings (BS EN 13232; Part 1- Part 9)

3 Turnout definitions, terms and layouts

Turnouts, turnout sections and turnout components have been defined differently in various parts of the world. The various components are defined in this document with reference to the Manual for Track Maintenance (BBB0481v2 or latest) and the British standards: Railway applications – Switches and crossing (BS EN 13232-1:2003).

Definitions

Table 3.1

Term	Definition
General terms	
Contact area	Those parts of the rail ensuring the support and/or guidance, inside or outside, of a wheel
Running table	Upper surface of the head (A region)
Running surface	Curved surface defined by the longitudinal displacement of a straight line perpendicular to the centre-line of the track and tangential to both running tables
Running plane	Flat plane tangential to the running surface at the considered point
Rail inclination	Angle measured as a tangent between the normal to the running surface and the y-y axis of the rail
Inclined track	Where the axes of the two running surfaces are inclined inwards

	towards each other
Vertical track	Where the axes of the two running rails are parallel and thus have a rail inclination of zero
Rail twist	Change in inclination of the rail
Gauge reference plane	Plane parallel to and 14mm below the running surface of the rail
Running edge	Intersection of the gauge reference plane with the inside of the rail head
Track gauge	Distance between corresponding running edges of the two rails
Track centre-line	The line midway between running edges on straight track, and half normal gauge inside the running edge of the larger radius rail in curved track
High-side rail (high leg)	On curved track, the rail with the larger radius
Low-side rail	On curved track, the rail with the smaller radius
Gauge widening	Intended increase in gauge
Cant (superelevation)	Difference in height, relative to the horizontal, of the two rails of one track at a particular location, measured at the centrelines of the heads of the rails
Track twist	Change in cant
Turnout components	
Switch rail (points blade)	Moveable machined rail, often of special section, but fixed and/or joined at the heel end to a rail to provide continuity of wheel support.
Stock rail	Fixed machined rail, ensuring the continuity on the main or diverging track with the switch in the open position. The machined part of the stock rail supports its switch rail in the closed position, giving continuity of line through this switch rail.
Stock and switch	Reference to the combination of the stock rail and the switch rail

Heel block	Block ensuring the attachment of the stock and switch rails at the end of the switch rail
Wing rails	Outer parts of common crossing which support and guide the wheels across the flangeway gap
Guard rail (Check rail)	Special section bar ensuring the safe passage of the axle opposite the neck gap of the common crossing
Layout	
Secant turnout	Secant point turnout is defined as a switch point in which the arc of the radius of the switch rail or the turnout itself crosses the gauge line of the stock rail
Tangential turnout	Tangent point turnout is defined as a switch point in which the arc of the radius of the switch rail or the turnout itself matches the gauge line of the stock rail.
SRJ (Stock rail joint)	Joint between stock rail and machined stock rail at the toe of the turnout
EOS (End of set)	Point at the joint between the turnout rails and the stock rail
Switch panel	Imaginary panel that starts at the front of the turnout (tip of the switch rail) containing the stock and switch rails, and ending at the heel block
Closure panel	Imaginary panel that starts at the heel block, contains the lead and closure rails and ends at the crossing joint
Crossing panel	Imaginary panel that starts at the joint between the leads & closures and the crossing, contains the crossing and end at the joint between the end of the crossing and the stock rail
Main line	In basic design, the straight track
Branch line	In basic design the curved track, diverging track

4 Transnet Freight Rail technology plan on turnouts

As per document BBB5254version2 (Track Structure Technology Strategy 2014) the technology plan with regards to turnouts can be summarized as follows:

4.1 Turnout range

- 4.1.1 All new manufacture of turnout with the purpose of installation on Transnet Freight Rail's S, N1, N2 and N3 lines have been limited to only 48kg/m and 60kg/m sets
- 4.1.2 The S lines are limited to the utilization of 60 kg/m sets including mainly the 1:20 Tangential turnout with the swingnose crossing. Other turnouts to be utilized on the S lines include the 60kg/m 1:12 tangential set and the 60kg/m sets.
- 4.1.3 N1 lines are currently utilizing a mixture of new and older generations of turnouts in 48kg/m, 57kg/m and 60kg/m sets. To standardize only 48kg/m and 60kg/m sets have been installed over the last 10 years. In future only 60kg/m sets will be newly installed to replace 48kg/m and 60kg/m sets and all reclaimed turnouts 48kg/m, 57kg/m and 60kg/m may be cascaded down to less important lines. Turnouts on N1 lines include mainly 1:12 tangential and 1:12 secant turnouts and in future the 1:9 tangential set.
- 4.1.4 N2 lines primarily utilize new 48kg/m 1:12 secant sets as these have low annual MGT.
- 4.1.5 The utilization of complex turnout designs including 1:4.5 diamonds, 1:6 equal split, 1:7 (single and double slip), and 1:8 is not recommended as production of these sets is to be discontinued. These complex turnout designs should be excluded from all new designs and track should be optimized to enable the use of standard turnouts.
- 4.1.6 All 30kg/m, 40kg/m sets and all wooden sets on N2 and N3 lines are to be replaced with either reclaimed sets cascaded down from S or N1 lines, or new sets.

4.2 Transitions and rail inclination

- 4.2.1 All turnouts to be designed to have zero (0) rail inclination and thus requires a transition area from a 1:20 rail inclination to a zero (0) inclination going into the turnout and when exiting the turnout. This transition from 1:20 inclined rail should be designed a distance from the start and end of the turnout.

5 Secant turnout (Spoornet) design

The design requirements of the existing Transnet Freight Rail (previously Spoor-net) turnouts are as described below.

5.1 General requirements

5.1.1 Turnout design	5.1.1.1	The turnouts are of secant design (refer to section 2.2)
	5.1.1.2	The turnout designs to be utilized as per TFR Technology plan (BBF5254) will be limited to 1:9 (6.34°), 1:12 (4.76°) and 1:20 (2.862°)
	5.1.1.3	The unit mass of the rails to be used is 48 kg/m and 60 kg/m
	5.1.1.4	The turnouts must be constructed according to existing Transnet drawings. In the absence of these drawings, the British or AREMA standards shall apply.
	5.1.1.5	The turnout must be able to withstand a lateral force of 80kN (≈8 ton).
5.1.2 Axle loading	5.1.2.1	The 48kg/m sets have to be designed to withstand a maximum load of 22 with occasional overloading factor of 1.2 (26 tons/axle) while the 60kg/m sets have to be designed to withstand a vertical force of 30 ton/axle with occasional overloading factor of 1.07 (32 tons/axle)
5.1.3 Operating speeds	5.1.3.1	The entry and exit speed into the straight track (main line) of a turnout is limited to 50km/h and should be designed for accordingly
	5.1.3.2	The entry and exit speed through the diverging track (branch line) of the turnout is limited to 30km/h and should be designed for accordingly
5.1.4 Turnout gauge	5.1.4.1	The gauge of the straight leg is 1065mm (-0, +3) from SRJ to EOS
	5.1.4.2	The gauge of the turnout leg is 1065mm (-0, +3) with gauge widening to 1070mm (-0, +3) at the leads & closures of the turnout
5.1.5 Turnout cant	5.1.5.1	The cant must be zero (0) on all turnouts, on main and branch line and must be designed for accordingly
5.1.6 Rail inclination	5.1.6.1	The inclination of the rails between the SRJ and the EOS has to be flat (0°) for both main and branch lines
	5.1.6.2	No transition from 1:20 inclination to 0 (flat) is to be included

	at the start of the turnout and at the end of the turnout on both main and branch lines
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5.2 Turnout components

5.2.1 Rail profiles	5.2.1.1	Standard 48kg/m profiles for the manufacturing of turnouts is the SAR48 rail profile
	5.2.1.2	Standard 60kg/m profiles for the manufacturing of turnouts is the 60E1 rail profiles
5.2.2 Rail	5.2.2.1	Only TFR Rail suppliers to be used for the manufacturing of turnout and turnout components
	5.2.2.2	350LHT is the standard rail metallurgy to be used for the manufacturing of turnouts and turnout components
5.2.3 Design	5.2.3.1	To be designed as specified in TFR (Spoornet) drawings and related specifications
	5.2.3.2	Geometry of the turnout as a whole and its components to of Secant design
5.2.4 Rail to rail fasteners	5.2.4.1	Rail to rail fasteners to be done according to TFR (Spoornet) drawings
5.2.5 Turnout fastening system	5.2.5.1	Only Transnet Freight Rail approved fastenings systems are allowed to be used as fastening system for TFR (Spoornet) design secant turnouts
5.2.6 Turnout sleepers	5.2.6.1	The turnout design generally fits onto TFR designed Universal concrete sleepers but may also interchanged with dedicated concrete sleepers
	5.2.6.2	Only TFR approved suppliers may supply TFR design Universal concrete sleeper for use in TFR (Spoornet) design turnouts.
	5.2.6.3	Dimensions, quantities and spacing of sleepers are indicated on TFR (Spoornet) drawings and should be adhered to during manufacturing of turnouts
	5.2.6.4	No wooden sleepers are allowed to be used on any turnouts
	5.2.6.5	Only TFR approved bolting systems are to be used for the fastening of rail chairs to sleepers on TFR (Spoornet) design turnouts. These systems are preferably installed in factory

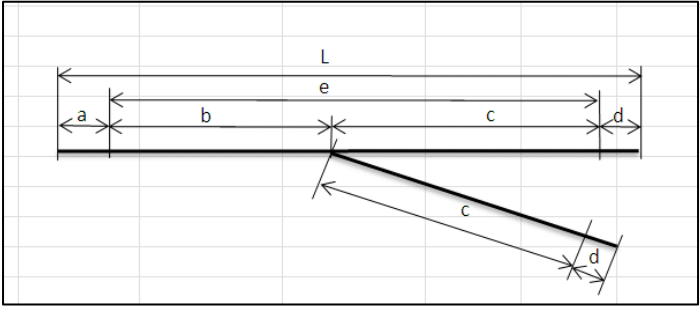
	conditions but may also be installed in the field
5.2.7 Points blade (Switch rail)	<p>5.2.7.1 To be designed as specified in TFR (Spoornet) drawings</p> <p>5.2.7.2 No jockey-type blades are permitted for use on TFR (Spoornet) design secant turnouts</p>
5.2.8 Frog	5.2.8.1 The frogs used in the TFR (Spoornet) design may be rail-manufactured, Rail-bound Manganese Crossings, or Manganese Monoblock as per TFR (Spoornet) design
5.2.9 Stock and guard rail	5.2.9.1 Stock and guard rail as specified in TRANSNET drawing
5.2.10 Positioning of rail joints	<p>5.2.10.1 The positioning of rail joints must be done as per TFR (Spoornet) drawings</p> <p>5.2.10.2 The positioning of rail joints should allow for the easy replacement of components, including switch rails and frogs</p>

5.3 Switches and signalling

5.3.1 General	<p>5.3.1.1 Switches must be able to accommodate existing signalling systems</p> <p>5.3.1.2 Switches as per TRANSET specification</p>
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6 Tangential design turnouts (New generation)

6.1 General

<p>6.1.1 Turnout design</p>	<p>6.1.1.1 The turnout is to be designed as per European Standards</p> <p>6.1.1.2 The turnout is to be a Tangential design turnout (other designs will be considered)</p> <p>6.1.1.3 Standard turnouts include turnouts with diverging angles of 1:9 (6.34°), 1:12 (4.76°) and 1:20 (2.862°)</p> <p>6.1.1.4 The unit mass of the rail to be used is to be 60kg/m</p> <p>6.1.1.5 The turnout must be able to withstand a lateral force of 80 kN (≈8 ton) on at any point along the turnout</p> <p>6.1.1.6 The turnout must be insulated</p> <p>6.1.1.7 Welding on the turnout should be kept to a minimum</p> <p>6.1.1.8 Components should be easily replaceable and readily available</p> <p>6.1.1.9 Turnouts should be designed in such a manner to enable machine tamping</p> <p>6.1.1.10 Uncompensated acceleration: Maximum of 0.658m/s²</p>
<p>6.1.2 Setting out diagram</p>	<p>6.1.2.1 Supplier to submit proposal</p> <p>6.1.2.2 Turnouts must be able to be installed in existing track and thus geometric limits will be applicable</p> <p>6.1.2.3 Maximum lengths of 1:9, 1:12 and 1:20 tangential turnouts are specified below</p> <ul style="list-style-type: none"> • 1:9 tangential – 34,896 meter • 1:12 tangential – 44,037 meter • 1:20 tangential – 62,191 meter <p>6.1.2.4 Turnout intersection point and angle of 1:9, 1:12 and 1:20 as shown in table</p>  <p>The diagram illustrates the geometry of a tangential turnout. It shows a horizontal main track and a diverging branch track. The main track has a total length L, which is divided into segments a, b, c, and d. The diverging track has a length c and a width d at its end. The diverging angle is indicated by a dashed line. The diagram is set against a grid background.</p>

		a (mm)*	b (mm)	c (mm)	d (mm)*	e (mm)	L (mm)
	1:9 (6.34°)	3900.00	9614.50	16281.90	5100.00	25896.40	34896.40
	1:12 (4.76°)	3300.00	12478.30	21358.70	6900.00	33837.00	44037.00
	1:20 (2.862°)	2700.00	14991.00	42700.00	1800.00	57691.00	62191.00
<p>*Transition lengths at SRJ and EOS (column a & d) only required for turnouts with 0 (zero) rail inclination</p> <p>6.1.2.5 The total length of the turnout, as provided above, must include the rail inclination transition at in front and at the end of the turnout if included in the design</p> <p>6.1.2.6 Turnouts must be designed to accommodate overhead cables, mass poles and other permanent structures</p> <p>6.1.2.7 The turnout Radius must be selected based on desired train speeds, lateral forces, track gauge and geometric layouts and should is not permitted to be less than 170,00 meter for the 1:9, 300 meter for 1:12 and 600 meter for 1:20 tangential</p> <p>6.1.2.8 The turnout geometry may be of tangential design, semi-tangential, compound curves. Design geometry will be evaluated upon submission of proposal</p> <p>6.1.2.9 Provision is to be made for thermit-weld areas (replacement purposes)</p>							
6.1.3	Maximum axle load	6.1.3.1	An axle loading of 32 ton per axle has to be designed for with occasional incidents of overloading to 36 ton per axle				
6.1.4	Gauge. (Measured 14mm below top of crown)	6.1.4.1	Straight leg (Main line): 1 065mm (–0, +3)				
		6.1.4.2	Turnout leg (Branch line):1 065mm (–0, +3), 1065mm (-0, +3) at leads and closures				
6.1.5	Turnout design speed	6.1.5.1	1:20 Turnout				
		6.1.5.1.1	Main line: 100km/h (facing and trailing)				
		6.1.5.1.2	Branch line: 75km/h (facing and trailing)				
		6.1.5.2	1:12 Turnout				
		6.1.5.2.1	Main line: 100km/h (facing and trailing)				
		6.1.5.2.2	Branch line: 50km/h (facing and trailing)				

	<p>6.1.5.3 1:9 Turnout</p> <p>6.1.5.3.1 Main line: 100km/h (facing and trailing)</p> <p>6.1.5.3.2 Branch line: 35km/h (facing and trailing)</p>
6.1.6 Turnout cant	6.1.6.1 The cant must be zero (0) on all turnouts on main and branch line
6.1.7 Rail inclination	<p>6.1.7.1 The inclination of the rails of the turnout may be flat (zero) or 1:20, and will be left to the discretion of the turnout designer which will be evaluated upon submission of proposal.</p> <p>6.1.7.2 If transitions from 1:20 to 0 (zero) and <i>vice versa</i> are included in the design it must be included at both the front and end of the turnout</p> <p>6.1.7.3 Supplier to make recommendations on the transition length at front and end of turnout to optimize wheel-rail interaction</p>
6.1.8 Performance criteria	<p>6.1.8.1 The design lifespan for turnouts should be 800 million gross tons (MGT) under normal operating and maintenance conditions</p> <p>6.1.8.2 Expected life cycle cost and suggested maintenance practices to be submitted with design, including assumptions/prescriptions regarding:</p> <ul style="list-style-type: none"> • Welding on cast components / assemblies • Rail grinding • Destressing • Tamping • Ballast condition and replacement • Formation standards
6.1.9 Rail profiles	<p>6.1.9.1 Standard 60kg/m profiles for the manufacturing of turnouts is the 60E1 rail profile</p> <p>6.1.9.2 Only TFR approved rail suppliers to be used for the manufacturing of turnout and turnout components</p>
6.1.10 Rail Metallurgy	<p>6.1.10.1 R350LHT is the standard rail metallurgy to be used for the manufacturing of turnouts and turnout components</p> <p>6.1.10.2 Head hardened</p> <p>6.1.10.3 Maximum of 0.3% Chromium content</p>

6.1.11 Holing in rails	<p>6.1.11.1 All drilled holes to be positioned on the neutral axis of the rail</p> <p>6.1.11.2 All drilled holes are to be chamfered to eliminate stress rising points</p>
6.1.12 Other consideration	<p>6.1.12.1 Maximum protrusion above nominal running surface is 12mm</p> <p>6.1.12.2 Side and crown wear limits to all rails fabricated and cast steel components and/or assemblies</p> <p>6.1.12.3 Shear forces designed for in sub-assemblies</p> <p>6.1.12.4 Allowable gauge limits at each sleeper</p> <p>6.1.12.5 Minimum protrusion below nominal running surface in flangeway areas is 50mm</p> <p>6.1.12.6 The maximum crown rail wear limit is 15mm</p>

6.2 Turnout panels (set of points, crossing, leads & closures)

6.2.1 Set of points: Switch panel	Rail profiles	<p>6.2.1.1 UIC ZU-1-60 asymmetrical profile (or similar)</p> <p>6.2.1.2 Refer to section 6.1.9</p>
	Design	<p>6.2.1.3 Undercut stock rail</p> <p>6.2.1.4 Tangential radius</p> <p>6.2.1.5 Transfer of longitudinal (thermal) forces: 600kN (≈60 ton) per rail in tension and compression</p> <p>6.2.1.6 Holing for extension plates and clamp locks to be supplied</p> <p>6.2.1.7 Flangeway opening between points blade and points stock rail at double full crown to be 65mm minimum Crown of points blade may be machined to achieve minimum opening</p> <p>6.2.1.8 Ø13.5mm Holes to be supplied for electrical and signal bonding (points blades and points stock rails)</p>
	Material	<p>6.2.1.9 UIC Zu-1-60 asymmetrical profile forged at end to corresponding 60E1</p> <p>6.2.1.10 60E1 rail profile butt-welded to forged end of</p>

		switch rail
		6.2.1.11 Refer to section 6.1.10 for rail metallurgy
		6.2.1.12 Welding area to be heat-treated to a hardness of HB 340 (minimum) to avoid soft spots
		6.2.1.13 Maximum width of spheroidized zone at HB 320 to be 5mm
		6.2.1.14 Minimum hardness in spheroidized zone to be HB 300
		6.2.1.15 No Martensite is permitted during the forging or hardening process
		6.2.1.16 Hardness of forged and butt-welded areas must be restored to hardness of head hardened parent metals
		6.2.1.17 Supplier to submit detail on the hardening process used to restore hardness after forging and butt-welding of rails
		6.2.1.18 Supplier to confirm hardness penetration through complete head of UIC Zu-1-60 rail used
6.2.2 Crossing (Crossing panel)	Rail profiles	6.2.2.1 Refer to section 6.1.9
	Rail material	6.2.2.2 Refer to section 6.1.10
	Frog & Wing rail assembly: Rail manufactured , rail bound or monoblock	6.2.2.3 The frog may be rail manufactured, rail bound, monoblock or moveable vee in design. Interchange-ability is preferable
		6.2.2.4 Welded on closure rails (with “Intermediate profile welding” process)
		6.2.2.5 Manufactured steel frame welded to wheel transfer area.
		6.2.2.6 Machining of transfer areas to suit wheel profiles
		6.2.2.7 Ramping to suit wheel profiles to be included
		6.2.2.8 Transfer of longitudinal (thermal) forces: 600kN (≈60 ton) per rail in tension and compression
		6.2.2.9 Ø13.5mm Holes to be supplied for electrical

		and signal bonding
		6.2.2.10 Supplier to specify best technical solution for MGT per annum and axle loads with reference to type of frog used
	Frog & Wing rail assembly: Moveable vee	6.2.2.11 Swingnose crossing to be included in design of turnouts with special consideration to 1:20 tangential design
		6.2.2.12 Welded on closure rails (with “Intermediate profile welding” process)
		6.2.2.13 Manufactured steel frame welded to wheel transfer area.
		6.2.2.14 Machining of transfer areas to suit wheel profiles
		6.2.2.15 Ramping to suit wheel profiles to be included
		6.2.2.16 Transfer of longitudinal (thermal) forces: 600kN (≈60 ton) per rail in tension and compression
		6.2.2.17 Ø13.5mm Holes to be supplied for electrical and signal bonding
		6.2.2.18 Supplier to advice on best technical solution for MGT per annum and axle loads with reference to type of frog used
	Material	6.2.2.19 14% Manganese steel casting in wheel transfer area.
		6.2.2.20 Supplier to propose welding between casting and closure rail sections
		6.2.2.21 Casting to be explosive hardened.
		6.2.2.22 Welding area to be heat-treated to a hardness of HB 340 (minimum) to avoid soft spots
		6.2.2.23 Welding Tolerances (geometric): 0.2mm over the running surface (crown) and gauge side of the crown and 0.5mm on the field side of the crown head measured over 1000mm.
		6.2.2.24 Maximum width of spheroidized zone at HB 320 to be 5mm
		6.2.2.25 Minimum hardness in spheroidized zone to

		<p>be HB 300</p> <p>6.2.2.26 No Martensite is permitted</p> <p>6.2.2.27 Hardness of forged and butt-welded areas must be restored to hardness of head hardened parent metals</p> <p>6.2.2.28 Supplier to submit detail on the hardening process used to restore hardness after forging and butt-welding of rails</p>
	Stock & Guard	<p>6.2.2.29 Guard rail profile to be UIC33 or similar</p> <p>6.2.2.30 Guard rail and buttress assembly must be able to withstand lateral forces of up to 60kN (≈6 ton)</p> <p>6.2.2.31 Guard rail must be replaceable and adjustable during routine maintenance</p> <p>6.2.2.32 42mm Minimum flangeway permitted at crossing nose</p> <p>6.2.2.33 Guard rail must allow for smooth lateral shift of the wheel</p> <p>6.2.2.34 Maximum protrusion above nominal running surface is 12mm</p>
6.2.3 Leads & closures (closure panel)	Rail profiles	6.2.3.1 Refer to section 6.1.9
	Rail metallurgy	6.2.3.2 Refer to section 6.1.10
	Design	<p>6.2.3.3 Tangent design</p> <p>6.2.3.4 Closure rails must be able to withstand lateral forces of up to 80 kN (≈8ton)</p>

6.3 Other turnout components (excluding components already mentioned)

6.3.1 Concrete turnout sleepers	<p>6.3.1.1 Geometrical design to be conducted by turnout supplier/manufacturer</p> <p>6.3.1.2 Width of concrete sleeper bearing area = 250mm.</p> <p>6.3.1.3 Provision to be made for mounting of Signal equipment (points machines and escapement cranks) on both sides of the turnout.</p> <p>6.3.1.4 Structural design of concrete sleeper to be approved by Transnet Freight Rail</p> <p>6.3.1.5 Electrical resistance of 1 250 ohm (minimum) over two sleepers under very wet conditions</p> <p>6.3.1.6 The same set of sleepers to be used on both Left hand (LH) and right hand (RH) turnouts</p> <p>6.3.1.7 If a transition area is included in the turnout design, concrete sleepers facilitating the transition from zero (0) rail inclination to 1:20 rail inclination to be included as part of sleepers supplied</p> <p>6.3.1.8 Lengths of standard sleepers are 2200mm for 60kg track (and 2050mm for 48kg track)</p> <p>6.3.1.9 Minimum length of sleeper allowed in turnout to be 1765mm (-0; +10)</p> <p>6.3.1.10 Maximum length of sleeper allowed in turnout to be 3860mm (-0; +10)</p> <p>6.3.1.11 Maximum sleeper spacing to be 600mm (+/- 10)</p> <p>6.3.1.12 Dedicated sleepers are required for the entire turnout with the inclusion of a numbering and identification system</p> <p>6.3.1.13 Hollow sleepers to accommodate signalling equipment are preferable and must be designed for</p> <p>6.3.1.14 The dimensions of hollow steel sleepers to be compatible with signalling equipment. These requirements are to be provided by TFR signalling department</p>
6.3.2 Rail to chair /sleeper fastening	<p>6.3.2.1 Must be Transnet approved fastening system</p> <p>6.3.2.2 The minimum clamping force of the fastening system is 25kN per fastening</p> <p>6.3.2.3 Minimised chair / plate concept</p>

6.3.3 Rail to rail fasteners	6.3.3.1	Buttress must be able to withstand induced lateral forces of 60kN (≈6ton)
	6.3.3.2	Refer to section 8 with regards to buttress
	6.3.3.3	Supplier to make recommendation on fastening system (Bolts/ Huck-bolts, etc.)
6.3.4 Positioning of rail joints	6.3.4.1	Rail joints and the locations thereof must be included in the design of the turnout to allow for in situ exothermic welding.
6.3.5 Block joints	6.3.5.1	Refer to section 9 for information regarding block joints

6.4 Switching

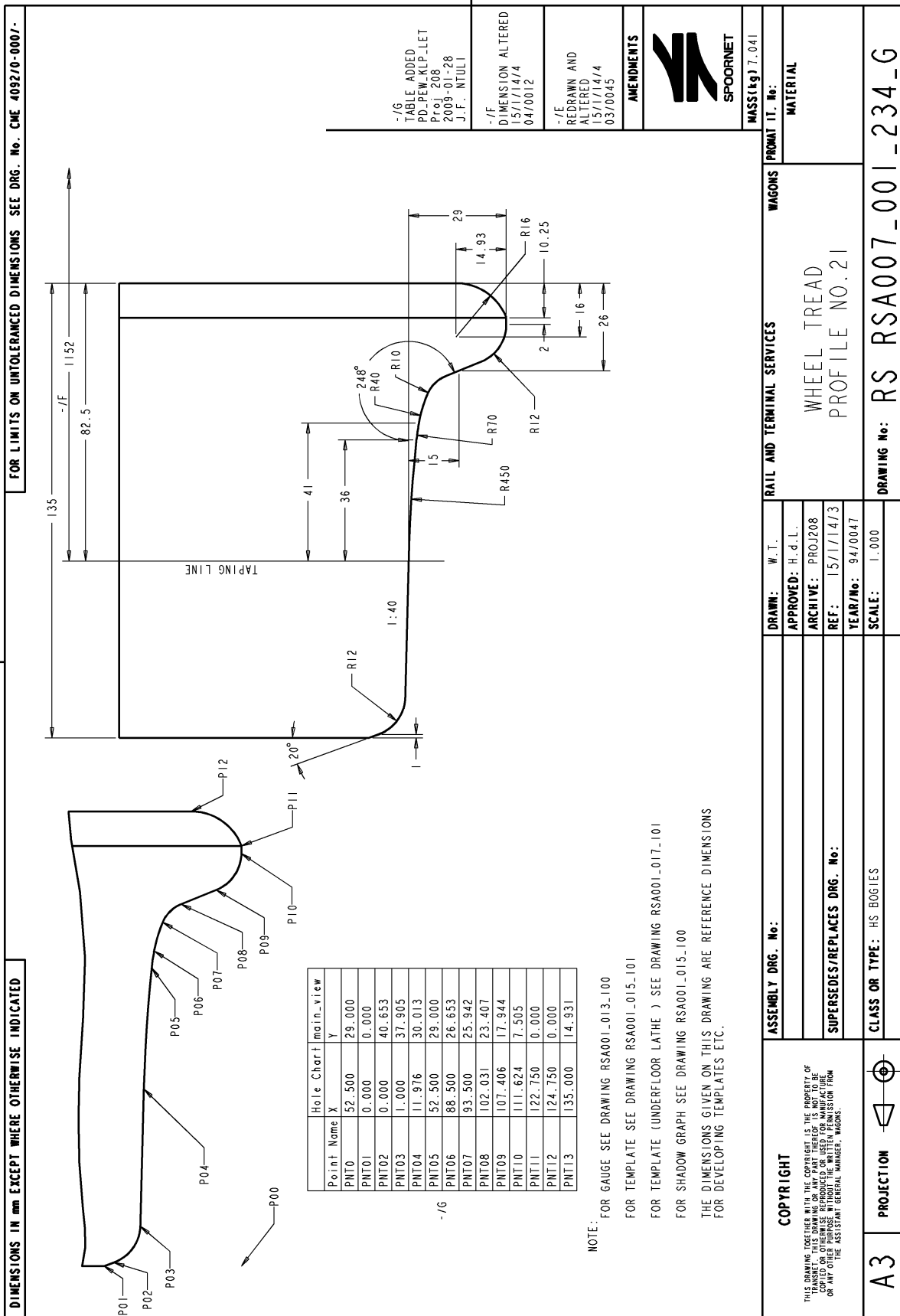
6.4.1 Switching	General	6.4.1.1	Switches must be able to accommodate existing signalling equipment
	Set of points	6.4.1.2	Connecting and drive rods (stretcher bars) to suit design as per Transnet Freight Rail Signal department
		6.4.1.3	Points machine: Westinghouse SWITCHMATIC, VAE-DLD, ALSTOM C1H or similar. Supplier to make recommendation
		6.4.1.4	Maximum of one drive rod and locking system point per points blade in the event of short blades typically on the 1:9 turnout
		6.4.1.5	Maximum of two drive and locking system points per points blade in the event of long blades (1:12 and 1:20)
		6.4.1.6	The utilization of one points machine to operate multiple driving points will be beneficial in the event of multiple driving positions
		6.4.1.7	Points Blades to fit flush against stock rails with a force < 0.5kN needed to keep closed under static conditions (no trains passing)
		6.4.1.8	Throw at point of points blades 110mm.

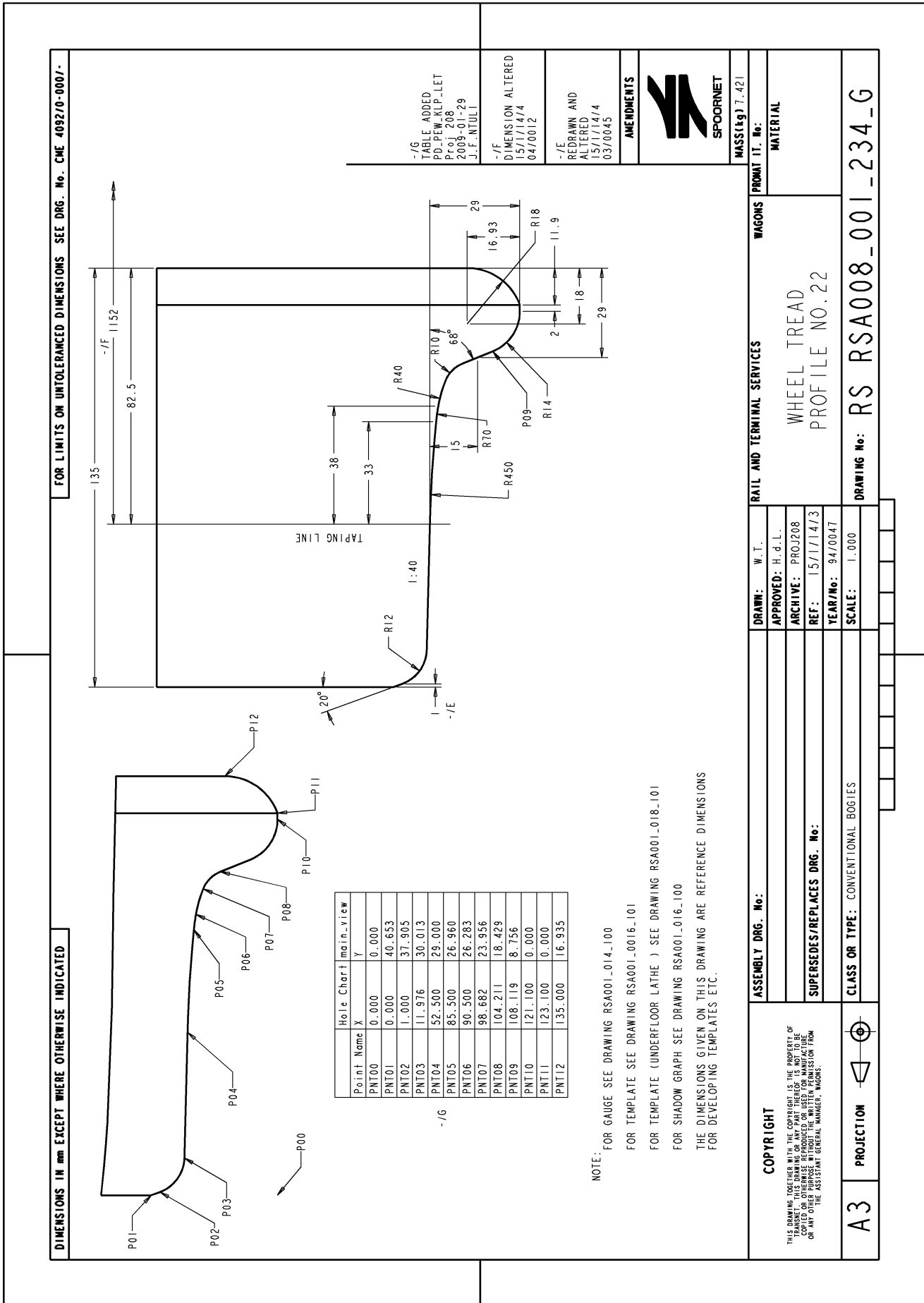
		minimum	
	Crossing (Movable vee)	6.4.1.9	Pull rods to suite design as per Transnet Freight Rail
		6.4.1.10	Signal department to advise
		6.4.1.11	Points machine: Westinghouse SWITCHMATIC, VAE-DLD, ALSTOM C1H or similar
		6.4.1.12	Maximum of two drive points on a single points machine for the blade on the moveable vee
		6.4.1.13	As only one machine is available from set to be replaced, Supplier to make recommendation with respect to machine, keeping in mind that it would be favourable to use similar machines on a turnout
		6.4.1.14	Throwing stroke to be submitted with design

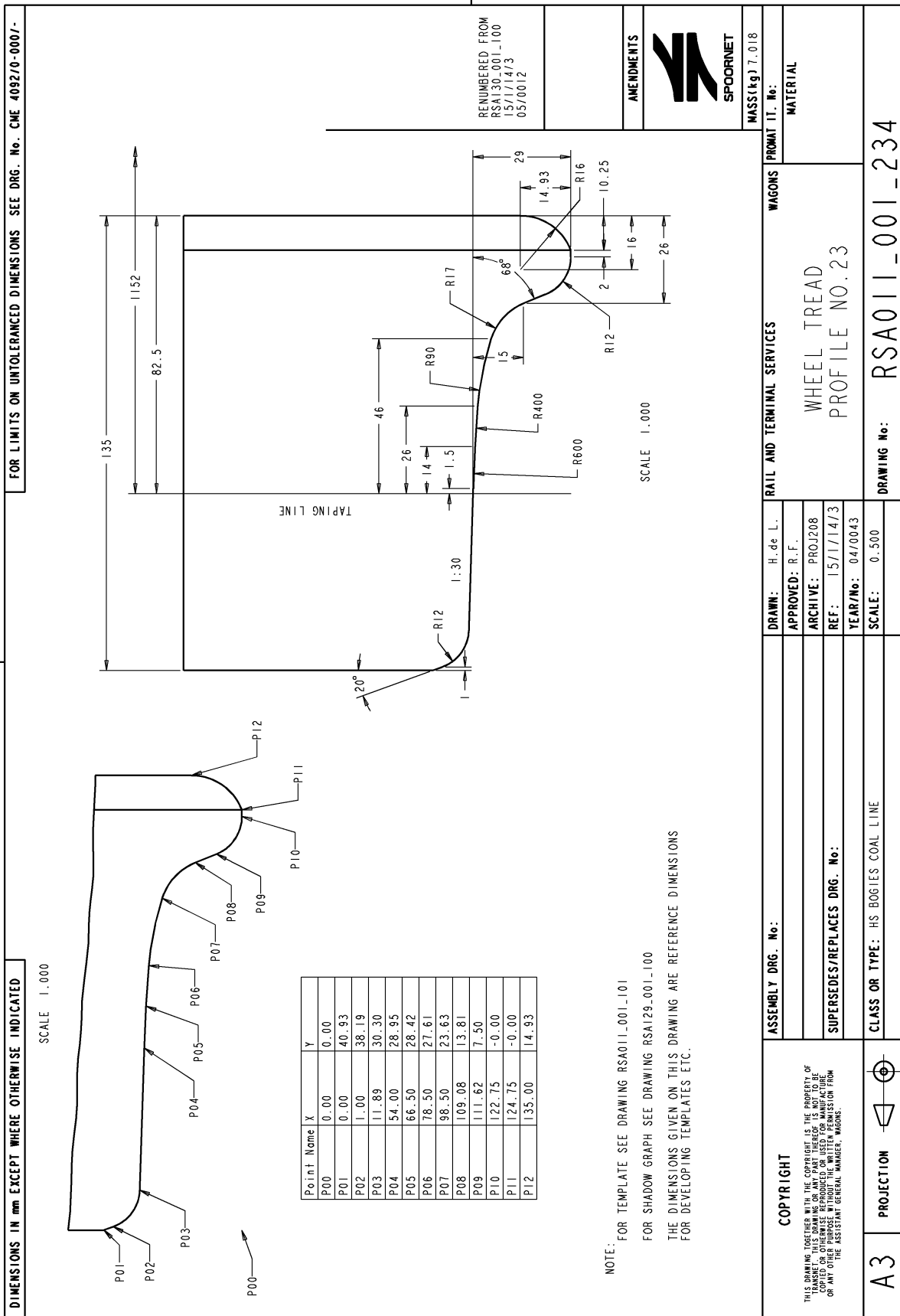
7 Wheel set and bogie information

7.1.1 Back to back dimension	7.1.1.1	Locomotives (wheel set): 986mm
	7.1.1.2	Wagons: 986mm
7.1.2 Wheel tread profiles	7.1.2.1	Locomotives: No 22 (Spoornet drawing RS A008_001_234_A).
	7.1.2.2	Wagons: No 21 (Spoornet drawing RS A007_001_234_A).
	7.1.2.3	Wagons: No 23 (Spoornet drawing RS A011_001_234_A)
7.1.3 Wheel diameter	7.1.3.1	Locomotives: Ø 1 250mm- Ø 920mm.
	7.1.3.2	Wagons: Ø 915 to 867mm (30 ton/axle) and 863 to 811mm (20ton/axle)
7.1.4 Wheel centres on bogie	7.1.4.1	Locomotives: 3 Axle bogies <ul style="list-style-type: none"> • 1 970mm (minimum) • 2 200mm (maximum)
	7.1.4.2	Locomotives: 2 Axle bogies <ul style="list-style-type: none"> • 1041mm (minimum) • 1715mm (maximum)
	7.1.4.3	Wagons: 2 Axle bogies <ul style="list-style-type: none"> • 1 753mm (minimum) • 1 830mm (maximum)
	7.1.5.1	Locomotives: 100kN (maximum)
	7.1.5.2	Wagons: 60kN (maximum)
7.1.6 Hollow wear on wheels	7.1.6.1	Locomotives: 2mm (specified maximum)
	7.1.6.2	Wagons: 2mm (specified maximum for 26t/axle)
	7.1.6.3	Hollow wear measured in practice up to 6mm and must be designed for accordingly
7.1.7 Wheel flange height	7.1.7.1	Locomotives: 35mm (maximum)
	7.1.7.2	Wagons: 35mm (maximum)
7.1.8 Wheel flange	7.1.8.1	Wheel flange thickness

thickness	<p>7.1.8.1.1 Maximum of 29mm</p> <p>7.1.8.1.2 Minimum of 19mm</p>
7.1.9 Gauge spreading forces	<p>7.1.9.1 Locomotives: 70kN (maximum)</p> <p>7.1.9.2 Wagons: 65kN (maximum)</p>
7.1.10 Distance between couplers	<p>7.1.10.1 Locomotives:</p> <ul style="list-style-type: none"> • 18 465mm (minimum). • 20 470mm (maximum) <p>7.1.10.2 Wagons:</p> <ul style="list-style-type: none"> • 12 070mm
7.1.11 Distance between couplers on a set of two wagons with a Semi-permanent drawbar	<p>7.1.11.1 24 140mm (over coupling lines)</p>
7.1.12 Unsprung mass of wagons with axle load of 32 ton	<p>7.1.12.1 4,962 ton / bogie</p> <p>7.1.12.2 2,481 ton / axle</p>







8 Chairs, slide chairs, buttresses and pads for rail seats

- 8.1 Any chair, slide chair or buttress design should be such that a lateral force of 80kN spin-creep and 65kN flange contact (as measured on tangential track for self-steering bogies) should not place any component in stress above 0.25 of the UTS of the material used for the component.
- 8.2 Resilient HYTREL rail pads with a thickness of 6,5mm shall be used between sleeper and chair / rail. In addition, an additional resilient HYTREL pad shall be used under all bearing areas of the rail foot. (that is: piggyback systems). Vertical deflections of rail pads measured: 0.7mm to 0.9mm under the rail seat and 0.2 to 0.3mm under soleplates at 26-30 ton per axle. Where piggyback systems are in use, HDPE pads may be used between the sole plate and the sleeper bearing areas for cost saving. Care must be taken not to damage the concrete sleeper.
- 8.3 Geometrical design of rail pads to be done by turnout supplier in consultation with approved Transnet Freight Rail pad supplier. Every effort must be made to make use of existing design pads.

9 Insulated rail joints (Block joints).

- 9.1 6-Hole block joints or the equivalent 4 hole heavy duty block joint are required in the turnout
- 9.2 Block joints must be included in the turnout design with specified locations of installation on the turnout to correctly insulate the turnout for signalling purposes
- 9.3 Supplier to advise on the cost implication with respect to the 2 types
- 9.4 Block joints must be structurally sound, maintain insulation properties throughout its full life and not form a weakness to the turnout
- 9.5 Only Transnet Freight Rail approved block joints are allowed in turnouts

10 Tolerance control

- 10.1 Tolerance limits for the whole set, including the resilient HYTREL pads and concrete sleepers, are to be determined by Supplier. Design for tolerances shall be such that it must incorporate the fact that the final position of the rails will be to the field side of the structure. Design should therefore not be based on mean centrelines, but related to the field sides.
- 10.2 No relaxation of these tolerances in the final product will be accepted. Tolerances will be evaluated 30 days after placement of the 1st turnout. The turnout will also be tested thoroughly for integrity and to evaluate/compare the advantages/improvements of the new design to the present standard used in Transnet Freight Rail.

11 Ease and speed of maintenance

- 11.1 Given the premium on maintenance time, logistics and time required for component replacements are crucial. All components should therefore be designed with consideration to time and logistical constraints.
- 11.2 Maintenance guidelines should be provided by supplier/manufacturer for the maintenance in terms of parameters as mentioned in 6.1.8.2 with special reference to critical components including the switch rail and frog.
- 11.3 Guidance on the transportation and installation of turnouts to be provided to ensure optimum standard of installation.

12 Minimising of damage during derailments

- 12.1 Damage to sleepers and sleeper fastenings, as a result of derailments, are costly and problematic. Supplier must design, and use materials, to minimise these effects.
- 12.2 Replacement components to be made available separately in the event of individual replacement due to damage incurred.

13 Manufacturing, inspection and acceptance

- 13.1 The manufacturing process has to be done in accordance with the Quality Assurance System ISO 9001. Full details of the quality assurance process are to be submitted with the design.
- 13.2 The final product has to be accompanied by a works certificate free of charge.
- 13.3 Before commencing with manufacturing, the design has to be approved by Transnet Freight Rail and other bodies including the Rail Safety Regulator.
- 13.4 The final design to be submitted in drawing and electronic format. Electronic format to be in CAD design in DWG or DXF.
- 13.5 Any turnouts designed and manufactured will be made available for quality control and inspection before installation.
- 13.6 Turnouts will be inspected after manufacture with regards to:
- Geometry
 - Components
 - Design
 - Material used (rail, welds, concrete sleepers etc.)
 - Quality of workmanship
- 13.7 After inspection the turnout will be approved for installation in TFR track
- 13.8 Any further information is obtainable from:
- Transnet Freight Rail
 - Technology Management
 - Track Testing Centre
 - Jeppestown
 - Johannesburg

End