

# National Rail System Standard / 6

## ENGINEERING INTEROPERABILITY STANDARDS

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ONE	A E Neilson (P) (A) M S McKeon (R) T R Prestidge (R), L R Major (R). C Thompson (R)	Crown (Letter of Authority)  Toll NZ Consolidated Ltd (D Jackson)	09 July 2004
TWO	A E Neilson (A) JTC - EI (21/6/07 & 2/11/07) (R) NRSS Executive (R)	WJL Peet (Chief Executive, ONTRACK)	12 June 2008
THREE	W Hudson (A) JTC – EI (17/2/09, 22/4/09, 24/6/09 & 20/4/10) (R) NRSS Executive 22/4/10 (R)	J Quinn (Chief Executive, KiwiRail)	26 April 2010
FOUR	W Hudson (A) JTC-EI (17/11/10, 8/6/11) (R) NRSS Executive 13/3/13 (R)	J Quinn (Chief Executive, KiwiRail) 	12 April 2013

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## PREFACE

### National Rail System (NRS) Standard

The objective of this NRS Standard is to provide a generic framework for engineering interoperability requirements. It is applicable for all activities involving operation of the National Rail System and is designed to meet the requirements set out in the relevant legislation and the NZ Transport Agency document "Rail Safety Licensing and Safety Assessment Guidelines".

It is generic and specific to users of the National Rail System. The terminology chosen to apply to the National Rail System has been used in this NRS Standard.

### Review of National Rail System (NRS) Standards

NRS Standards are subject to periodic review and are kept up to date by the issue of amendments or new editions as necessary. The user is responsible for ensuring that they are in possession of the latest edition, and any applicable amendments.

Full details of all NRS Standards are available from *the Access Provider*. The Document Controller for all NRS Standards is *the Access Provider*.

Suggestions for improvements to NRS Standards should be addressed to *the Access Provider*. Any inaccuracy found in *this* NRS Standard should be notified immediately to enable appropriate action to be taken. *Contact the Access Provider at:*

*Chair Joint Technical Committee – Engineering Interoperability  
Wellington Railway Station  
PO Box 593  
Wellington 6140  
www.kiwirail.co.nz*

***IMPORTANT NOTE: This document forms part of any "Access Agreement" between the Access Provider and any Operator, and should be read in conjunction with any such Access Agreement. In particular, the Access Agreement sets out certain procedures relating to vehicle, operational and safety audits, and the rights of the Access Provider in respect of any breach of that Agreement or the standards contained in this document.***

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## 1. GENERAL

### 1.1 Scope

This National Rail System Standard describes the required features and characteristics of Operators' Rail vehicles only as far as are required to ensure safe and effective interface with the National Rail System network.

Operators have the responsibility to ensure that all rail vehicles used on the National Rail System are covered by an approved Safety Case and meet the requirements of this standard.

*This National Rail System Standard does not provide a comprehensive design standard that covers all aspects of vehicle requirements.*

### 1.2 Application

- 1.2.1 This standard applies to all Rail Vehicles on the National Rail System with the exception of hi-rail vehicles and Mobile Track Maintenance Machines.
- 1.2.2 Clause not used.
- 1.2.3 When this document specifies a condition "approved by the Access Provider" or "acceptable to the Access Provider" it means notification in writing from an authorised Officer of the Access Provider.
- 1.2.4 *Undated* documents, drawings and measurement gauges specified in this document shall be the version applicable as at 9 July 2004.

### 1.3 Audit Inspections

The Access Provider (or nominated agents or contractors) may, where doubt exists about rail vehicle compliance with this standard, inspect vehicles, facilities and processes and interview operators, their rail personnel, agents or contractors, to ascertain that:

- The standards in this document and all other National Rail System standards are being achieved
- Work is being carried out in accordance with good sound railway engineering practice.

The Operator of the vehicle is expected to provide appropriate information, records and personnel free of charge and the audit may involve operating tests, with the operating costs of the vehicle and infrastructure to be met by the Operator.

The Access Provider shall be entitled to require that its own employees, agents or contractors accompany any train for technical audit, operational or safety reasons.

The Access Provider will not accept any liability by not inspecting, or not inspecting fully, as compliance with this standard is the responsibility of each Operator.

### 1.4 Variation from Interoperability Standards

Variations to this document may only be made in accordance with change management processes applicable to National Rail System Standards (refer NRSS / 2 - Safety Management).

Operators must obtain an approval for exemption from the Access Provider for any rail vehicle or class of rail vehicle that does not comply with the requirements of this document. The approval may specify conditions including restrictions on running rights. Exemptions from specific requirements of this standard must be approved in writing by the Access Provider.

Any enquiries regarding this standard or applications for specific exemptions from it must be forwarded to the Access Provider.

Any change proposed by the Access Provider or any Operator to technical parameters that could significantly affect the risk profile of another party subject to this standard, are to be notified in accordance with defined change management procedures agreed between parties.

## 1.5 Heritage Vehicles

The Access Provider may make provision for the acceptance of Heritage Vehicles that do not comply with all current interoperability or design requirements, or for which compliance in certain areas cannot be assumed.

A vehicle operating under such provisions will be subject to special requirements that may include operating restrictions that ensure the overall safety of the heritage operation is maintained at a similar level to that of an operation using unrestricted vehicles.

For Heritage Vehicles, NRSS/11 "Heritage Vehicle and Train Management" details additional specific requirements and also takes precedence for Heritage Vehicle inspection and certification requirements. For all such Heritage Vehicles, clause 1.4.2 applies.

## 1.6 Inconsistency with Operators Rail Safety Case

Where any inconsistency exists between this document and the safety system documentation of a licensed Operator, the Operator will need to amend its documentation accordingly to bring it into line with this document to meet the standard within one year of the issue date of this document.

This may require the Operator to vary its safety case and submit the variation to the NZ Transport Agency for approval.

## 2. RAIL VEHICLE QUALIFICATION

### 2.1 General

- 2.1.1 Operators must ensure that their vehicles are designed, constructed, maintained and operated in accordance with good sound railway engineering practice; the Operator's approved Rail Safety System, the requirements of the Railways Act and all National Rail System standards.
- 2.1.2 In the absence of sound alternatives contained in the Operator's Rail Safety System approved by the NZ Transport Agency as part of their Safety Case and agreed to by the Access Provider, Toll Rail (or predecessor) codes, standards and practices effective at 9 July 2004, with subsequent amendments acceptable to the Access Provider will apply with respect to all aspects of design, construction (including vehicle body strength, longitudinal strength and crashworthiness), inspection and maintenance. Note that these Toll Rail (or predecessor) standards are currently generally accepted NZ rail industry practice applicable to the National Rail System.
- 2.1.3 Nation-wide standards specifying minimum rail vehicle construction standards applicable to new and existing rail vehicles may be subsequently developed.

### 2.2 Certification

Before any rail vehicle will be allowed onto the National Rail System for the first time, or after modifications that alter vehicle axle loads, weight distribution and/or physical profile, the Operator must have a competent railway mechanical engineer (the Certifying Engineer) certify it as fit for service on the National Rail System. The Certifying Engineer must be suitably qualified and acceptable to the Access Provider. The Certifying Engineer must subject the rail vehicle to a formal acceptance process to demonstrate compliance with this standard and the Operators engineering standards applicable as a part of their Rail Safety System.

In certifying the rail vehicle the Certifying Engineer must give due weight or consideration to, but not limited to:

- The nature of the service in which the vehicle will be employed
- The operating environment it will be used in
- Its condition and its maintenance history (existing vehicles)
- Proposed maintenance environment
- Its *structural strength*, crashworthiness and other safety features
- The original construction standards and its compliance with these (where applicable)
- Any heritage status
- Other factors pertinent with respect to sound railway engineering practice

All rail vehicles operated by and accepted as fit for service by Toll Rail and any other Operator prior to 9 July 2004, are deemed certified for the purpose of this section 2.2;

Heritage rail vehicles must comply with the requirements of NRSS/11.

### 2.3 Non-Compliance

The Access Provider reserves the right to refuse running rights for vehicles that do not comply with these standards or which raise significant safety or operating issues (including rail personnel qualifications) not covered by these standards.

## 2.4 Maintenance

Before operating on the National Rail System, any rail vehicle must have current compliance with the Operators maintenance system as approved as a part of the Operators Safety Case.

Operators shall maintain their rail vehicles in a safe operational condition in accordance with the requirements covered by their Rail *Safety Case*, sound railway engineering practice and requirements of this standard, and also ensure that they are fit to operate (in all respects) for use in carrying out rail operations.

## 2.5 Incident and Derailment Damage

Operators are responsible to inspect any incident and derailment damage to their rail vehicles to determine whether they are fit for continued service, together with any operating restrictions that must apply for safe operation on the National Rail System pending further interim or permanent repairs.

Where the operator is not the owner of the rail vehicle involved, the owner must have an arrangement in place with the operator to determine whether the vehicle is fit for continued service and is safe for operation on the National Rail System.

The vehicle may not continue in service on the National Rail System until such determination has occurred.

## 3. RAIL PERSONNEL QUALIFICATIONS

After any certification carried out under Section 2.2, Operators' personnel carrying out the following must hold current qualifications and certifications in accordance with the Operator's standards applicable as a part of their Rail Safety System;

- Periodic code inspections and certifying rolling-stock as fit for on-going service
- Re-certification after incident or derailment damage
- Re-certification after overhaul or repairs

Qualifications and certifications held by Operators personnel to carry out the above listed work must be acceptable to the Access Provider.

## 4. RUNNING RIGHTS

### 4.1 Route Authorisation

All rail vehicles are subject to route specific authorisation. Details of this authorisation will be detailed in the Rail Operating Rules and Procedures on a line by line basis, Bulletin, or specific Overgauge Permit. The permit will specify the maximum dimensions of the vehicle plus its load and all other necessary conditions applicable to ensure safe transit.

Route authorisation and any restrictions applicable are primarily dependant on:

- Route clearances
- Capacity of the track and rail structures to carry the axle weights imposed by individual rail vehicles

All Operators must obtain running rights approval from the Access Provider prior to any running on the National Rail System for the following:

- New vehicles to be introduced to the National Rail System,
- Vehicles with modifications that alter vehicle axle loads, weight distribution, vehicle dynamics and/or physical profile.

### 4.2 Clearances

4.2.1 Compliance with the Standard Static Gauge (Appendix B) will allow general operation over most lines comprising the Controlled Network. Some exceptions apply including;

- A number of industrial lines and sidings
- Some loops

For which more restrictive clearances will apply.

Note that drawing 13090429 in *Appendix B* is based on a static rail vehicle of particular ratios of bogie centre distance to overall length. For rail vehicles of different proportions the gauge must be adjusted accordingly.

Standard reduced static clearance criteria and the speed restrictions applicable are shown in the table below. To enable safe operation over the National Rail System, rail vehicles and loads on rail vehicles must comply unless specifically authorised otherwise by the Access Provider.

In specific cases where this static gauge approach is not appropriate, the Access Provider and the Operator may agree to assess clearances using process of kinematic evaluation, where all vehicle movements are taken into account.

**STATIC CLEARANCE / SPEED TABLES**

<b>FOR HEIGHTS ABOVE THE VEHICLE FLOOR</b>	
Lateral Static Clearance (mm)	Maximum Speed (km/h)
Greater than 200	Line speed applicable
150 to 200	55
75 to 149 structural components	25
Exclude frangible components from the analysis for 75 mm clearance and above	
50 to 74	15
Less than 50	Not to run unless piloted

<b>FOR HEIGHTS AT OR BELOW THE VEHICLE FLOOR</b>	
Lateral/Vertical Static Clearance (mm)	Maximum Speed (km/h)
Greater than 50	Line speed applicable
30 to 50	25
Less than 30	Not to run unless piloted

Frangible components are defined as items attached to rolling stock that are designed such that if they strike a fixed structure, the structure is not damaged. Examples of the sort of components to which it is intended this requirements applies include car step extensions and locomotive rear vision mirrors.

Frangible components must remain within the rolling stock static gauge, or the approved vehicle gauge for the route concerned and electrical clearances must be maintained.

- 4.2.2 Rail vehicles that do not comply with the Standard Static Gauge are likely to be prohibited from some routes and will be subject to speed restrictions on others.

**4.3 Load Limit for Rail Vehicles**

The load rating system used by Access Providers for structures is a function of axle weight, axle spacing and train speeds. Nominally, rail vehicles with 18 tonnes axle loads travelling at 80 km/h have running rights on most principal lines on the Controlled Network.

Final determination of acceptable weights and loadings for each route will be made by the Access Provider in consultation with Operators.

**5. NOT USED IN THIS ISSUE**

## 6. AXLE LOADS

### 6.1 Axle Weight Ratio

The ratio of axle load (kg) divided by wheel diameter (mm) shall not exceed 30.

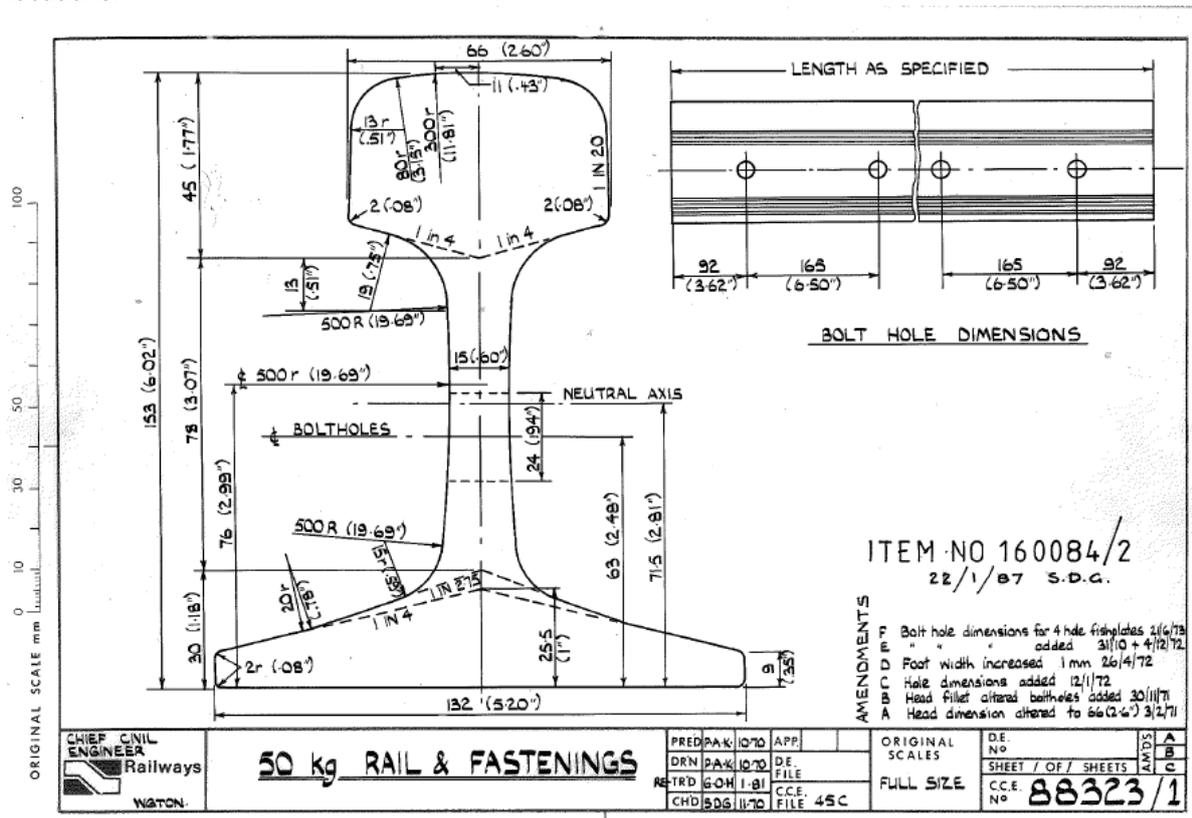
### 6.2 Weight Imbalance

Rail vehicles must not exceed a 10% weight imbalance over a wheelset.

Example: If wheel weights in a wheel set are 7 tonnes and 11 tonnes respectively, the average weight is 9 tonnes and the weight imbalance is  $(11 - 7)/9 \times 100\% = 44\%$ , which exceeds 10% and therefore does not comply with this requirement.

### 6.3 Rail Profile

The following is the standard 50kg unworn rail profile. Note that there are several other rail profiles and the user should contact the Access Provider for specific details of different profiles at different locations.



### 6.4 Minimisation of Track Forces

New or modified rolling stock must be designed to minimise transient track forces, and to operate without bogie or body instability over the designed range of speeds and loads.

The Access Provider reserves the right to impose operating restrictions on unsatisfactory designs.

## 6.5 Operation of Signalling Systems

To *reliably* operate signalling and activate level crossing alarms, single vehicles travelling alone must have a minimum of four axles with a 10 tonne axle load on each. Other vehicles, such as railcars, will be treated on a case-by-case basis by The Access Provider and may be subject to speed restrictions or the Rail Operating Rules and Procedures pertaining to Mobile Track Maintenance Vehicles.

Axles on all rail vehicles running on the Controlled Network must be fully conductive with the following exceptions:

- Mobile Track Maintenance Vehicles
- Hi-rail Vehicles
- Special rail vehicles where a dispensation is approved by the Access Provider together with any operating restrictions applicable

## 7. CURVE NEGOTIATION & STABILITY

### 7.1 Vertical and Horizontal Curve and Track Twist Negotiation

7.1.1 All new rail vehicles must, in a quasi-static state, be capable of safely negotiating extremes of track curvature and twist, being:

- (a) A curve of centreline radius 70 metres #
- (b) 1:7.5 turnouts forming a reverse curve of 82m radius between parallel tracks 3800 mm apart (see Appendix D)
- (c) Maximum track twist of 28 mm over 4 metre length at slow speed @
- (d) A vertical curve (both convex and concave) of 300m radius while coupled

For the purposes of quasi-static analysis, slow is defined as 25 km/hr.

These criteria for checking vehicle performance and are not track design standards.

@ Note that this is the corrective intervention limit, not an absolute limit. Twists of up to 50 mm measured over a 4 m length can occur in isolated instances. In slow speed situations for construction, loops and some yard locations the variations encountered would be in excess of normal main line tolerances.

7.1.2 Where existing unaltered ex-Toll Rail (or predecessor) rail vehicles are used, these will be deemed as complying with the requirements in 7.1.1.

# *Owing to gauge tightening, some ex NZR or ex-NZGR steam locomotives may not be able to meet this requirement. In such cases, the locomotive will be unable to operate over some yard and workshop tracks. Where necessary the Access provider will apply running rights restrictions.*

# *Note that curves of radius 70 metres are not on the mainline and severe speed restrictions apply.*

7.1.3 *The Operator must satisfy the Access provider that new vehicles or modified running gear has satisfactory dynamic performance. This may require testing, dynamic modelling, etc.*

### 7.2 Maximum L/V Ratio in Curves

The combination of bogie centres, end overhang and coupler length shall be so determined that the ratio between the total lateral force per bogie and the total vertical load per bogie (L/V ratio) shall not exceed 0.82 under the specified conditions (refer Association of American Railroads (AAR) Manual of Standards, Section CII, Clause 2.1.6).

The L/V ratio for the *rail vehicle* shall be determined under the following conditions:

- draft force of 570 kN
- coupled to a base wagon (class US) at the front end and a like wagon at the rear
- on a horizontal curve of 70m
- the subject vehicle shall be unloaded (i.e. at tare)

The method of computing couple angles and lateral forces shall be in accordance with Section 2.1.6 of the AAR Manual of Standards, Section CII.

Nationwide standards that specify the overall limits of applied lateral forces applied by rail vehicles to the track may be subsequently developed;

### 7.3 Vehicle Combinations

All conditions in 7.1 and 7.2 above shall be evaluated with the vehicle coupled to a like vehicle or a base wagon (class US), whichever is the worst case.

*The US class base wagons have the following relevant characteristics:*

- *Length over coupler faces*            13870 mm
- *Distance between bogie centres* 10058 mm
- *Coupler face to yoke pin*            726 mm

### 7.4 Centre of Gravity

The centre of gravity height for any vehicle loading condition must not exceed 2.0m above rail level for bogie vehicles and 1.65m above rail level for 4 wheel vehicles. Vehicle design must prevent any *unintended* significant shifting of the position of the centre of gravity.

The centre of gravity should be as low as practicable.

### 7.5 Wind loading

*Wind loadings of up to at least 130 km/hr gale-force are occasionally experienced throughout the country. Unloaded rail vehicles must remain stable while travelling at normal speeds) and subject to 130 km/h wind.*

## 8. WHEELS AND AXLES

### 8.1 Back to Back Dimensions

The back to back dimensions between inside faces of wheels or tyres on a wheelset must be between 997.0 mm and 998.0 mm, measured at three, equidistant positions around the circumference using gauge Y/X 4603/10.

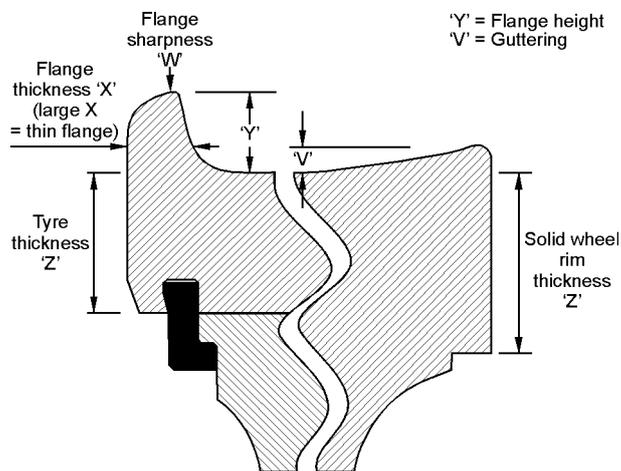
### 8.2 Wheel Profile

Wheel profiles must be to a National Rail System standard. Modified Heumann profile wheels with a *fundamental* tread conicity of 1 in 20 are used on the National Rail System. The current family of acceptable profiles is shown on drawings 7604/11 - 7604/13 in Appendix A.

### 8.3 Tread Wear Limits

8.3.1 Wear on tread profiles must not exceed the following dimensions:

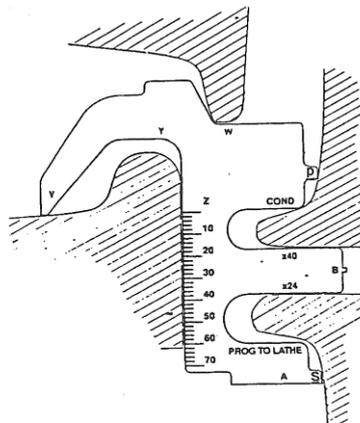
FIGURE 1



Note that the tread shape illustrated in figure 1 is an exaggerated example.

- 8.3.2 A wheel flange must not show an 'X' reading of more than 40 as indicated by Gauge 13090426 or PD100766.
- 8.3.3 A wheel must not have flange height, 'Y' reading or guttering 'V' reading, of more than 6 mm as indicated by Gauge 13090426 or PD100766, or PD100766/4;
- 8.3.4 A wheel flange must not show sharpness that allows rocking as indicated by Gauge 13090426 or shows 'W' reading more than 14 on gauge PD 100991.

FIGURE 2



Wheel Profile Gauge 13090426 for use in the field.

8.3.5 Tread or tyre thickness “Z” shall not to be less than the tread condemning limits specified in the Operators engineering standards applicable as a part of their Rail Safety System. These standards must ensure that the risk of wheel failure resulting in a derailment is As Low As Reasonably Practicable (ALARP) – (refer National Rail System Standard / 4 - Risk Screening and Assessment).

8.3.6 *Alternative measurement methods that produce reliable wheel profile measurements consistent with the above are acceptable.*

## 8.4 Permissible Differences in Wheel Tread Diameters

8.4.1 The diameters of two wheels on the same axle must not differ by more than 1.0 mm as measured on a wheel lathe comparator.

8.4.2 The diameters of wheels coupled by side rods or drive shafts must not differ by more than 1.0 mm as measured on a wheel lathe comparator.

## 8.5 Wheel Defects

8.5.1 A wheel must not show signs of having been overheated as evidenced by a reddish brown discoloration, on the face of the rim, i.e., extending on the face more than 100 mm into the plate area measured from the inner edge of the rim;

A tyred wheel that shows signs of overheating must not run in service before its tyre is inspected and found not to be loose, and *complies with clause 8.1.*

8.5.2 No wheel rim, flange, or tread may have a *crack exceeding* the following;

Description of defect	Action
Wheels with any crack; <ul style="list-style-type: none"> <li>• Less than 25mm long in tread area, <u>or</u></li> <li>• Not extending onto the chamfer area or front face of the rim, <u>or</u></li> <li>• Less than 10mm and located partially or totally within the flange area or chamfer area</li> </ul>	Okay to run
Wheels with any crack; <ul style="list-style-type: none"> <li>• Greater than 25mm long, <u>or</u></li> <li>• Extending onto the chamfer area or front face of the rim, <u>or</u></li> <li>• Greater than 10mm and located partially or totally within the flange area or chamfer area</li> </ul>	Not to run

Note – applicable definitions for the table above are;

- Flange area – extends 30mm from back face of the wheel
- Chamfer area – extends 12mm from the front face of the wheel
- Tread area – area contained between flange and chamfer areas

8.5.3 No wheel plate, or hub area may have a crack or break.

8.5.4 No wheel or tyre may have a chip or gouge in the flange that is greater than 2 mm deep and that is also greater than 40 mm in length and greater than 12 mm in width;

8.5.5 Operational limits on tread defects in wheels and tyres are as follows:

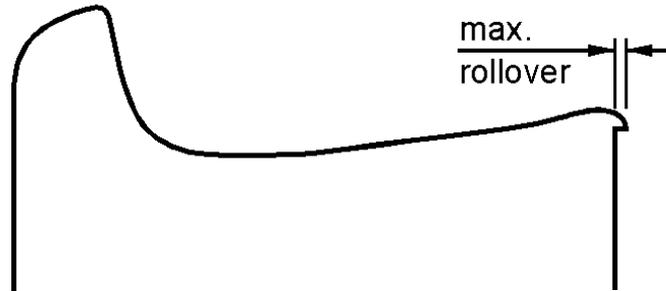
Length of skid flat, shelled spot or spall	Operating limitation
0 – 25 mm	Continue in service with no new limitation
25 – 40 mm	Continue in service and limited to 80 km/h
40 – 60 mm	Only relocate for repair and limited to 40 km/h
60 – 100 mm	Only relocate for repair and limited to 25 km/h
Over 100 mm	Must not run on the Controlled Network

*For information only, users may refer to the RISSB wheel defect manual.*

8.5.6 No wheel may show evidence of being loose on the axle.

- 8.5.7 No wheel or tyre may have any groove running circumferentially that is greater than 3 mm deep;
- 8.5.8 No wheel or tyre may have been welded or gas cut;
- 8.5.9 No wheel or tyre may show a build-up of metal on the tread;
- 8.5.10 No tyre may show any clear evidence of having moved on the wheel.
- 8.5.11 Tread edge rollover:

FIGURE 3



Any vehicle running on services carrying passengers must not have any tread edge rollover. Otherwise edge rollover shall not exceed 3 mm.

## 8.6 Wheel Hardness

The hardness of new wheels shall not exceed AAR Class C (refer to AAR M-107).

## 9. BRAKING AND ACCELERATION

### 9.1 Acceleration Affecting Signalling Systems

Signalling systems are designed on the assumption that no train will accelerate more rapidly than a standard light locomotive (currently assessed as being 0 - 100 km/h in 25 seconds and 435 metres on level track). Operators contemplating the introduction of any new form of motive power or traction control system with a rate of acceleration exceeding the above parameters must consult with the Access Provider to gain approval for running rights on the National Rail System.

### 9.2 Braking Continuous

The brake is to be continuous throughout the train and is to apply automatically throughout the train should a parting occur anywhere in the train. (See also 13.4 - Vigilance Device.)

### 9.3 Control of Braking

The brake must be controllable and designed to allow application of maximum normal deceleration without wheel locking in normal conditions (except when rail vehicles have nearly stopped, i.e. speed below 5 km/h) and continuous control of the train down a grade of 1 in 33 (3.03%).

### 9.4 Rail Vehicle Braking Performance

9.4.1 The braking system must achieve the following stopping distances from 80 km/h for freight trains or 100 km/hr for passenger trains or design maximum operating speed if different from these. The brake system must achieve this performance *from the time of application* under the following conditions:

- At all combinations of block or wheel wear and block material variation;
- On straight and level track
- In *all load conditions*
- Under normal climatic conditions
- With *maximum* wheel to rail coefficient of friction 0.12
- With individual vehicle brakes cut out as per Rail Operating Rules and Procedures
- No traction power applied by the locomotive
- Locomotive brakes remain applied and effective
- A full service brake application
- Brake system fully charged before application

9.4.2 For a single vehicle (in a break-away test) a stopping distance of 650 metres or less is required. *This includes locomotives introduced after the date of issue 4. Other locomotives must comply with 9.4.3.*

9.4.3 For freight trains a stopping distance of no more than 885 metres is required.

9.4.4 *Passenger* trains must be designed to stop in as short a distance as possible, without skidding with the following specific requirements defined:

- (a) *Locomotive hauled passenger trains must be able to stop within 750 metres from 100 km/h.*
- (b) Electric Multiple Units, within the Wellington suburban area, must stop within 460 m from 100 km/h or be subject to Rail Operating Rules and Procedures speed restrictions.
- (c) *Electric Multiple Units, within the Auckland suburban area, are subject to requirements set out in Rail Operating Rules and Procedures speed restrictions.*

9.4.5 For requirements applying to vehicles or trains designed to operate at speeds greater or less than 80 to 100 km/h contact the Access Provider. *Expectations are* that braking will be as effective as possible when these curves are applied to slow-speed operation.

## 9.5 **Not used in this issue**

## 9.6 **Park brake**

9.6.1 Each individual rail vehicle must be equipped with an effective parking brake, capable of holding the vehicle on a 1 in 33 grade, for an indefinite period.

9.6.2 This brake shall be capable of easy and safe operation in the operating environment on the National Rail System.

## 9.7 **Air Brake System Type**

The braking system fitted to rail vehicles are to be compatible with the single pipe direct release "Westinghouse" type automatic continuous brake system which has been traditionally used on the National Rail System.

This air brake system has the following parameters:

- Normal brake pipe pressure is 550 kPa
- Full service braking is to be achieved by a reduction of brake pipe pressure to 400 kPa  $\pm$  10 kPa
- Freight trains operate on "direct release"
- Passenger and selected unit freight trains may operate on either "direct release" or "graduated release".

Where vehicles capable of graduated release are run on train consists with direct release vehicles, the locomotive automatic brake valve must be set in the "direct release" mode.

To ensure compatibility, all air brake equipment must operate correctly at a pressure of 650 kPa.

Where rail vehicles equipped with "graduated release" or any other special braking system are run on train consists with rail vehicles operating on "direct release", one of the following must apply:

- The vehicle brake must be fully compatible with, and operate in the "direct release" mode or
- Special arrangements must apply so that the rail vehicle can run without active brakes.

## 9.8 Compliance with Braking Standards

In general, the simplest way of meeting this brake standard is to provide a braking system that is compatible with the "Westinghouse" system (see 9.7 above) with brake pipe pressure set at 550 kPa, and stopping distances as in 9.4 above. In such a case, interoperability will be assessed as:

- (a) Being an **unaltered** former Toll Rail (or predecessor) rail vehicle;
- or**
- (b) Satisfactory Performance in a stopping distance and general test programme and design clearance by reputable railway brake supplier.

and in all cases passing a standard air brake test which is appropriate for that type of rail vehicle and acceptable to the Access Provider.

## 10. MAXIMUM SPEEDS

### 10.1 General

Line speed restrictions are set out in the Rail Operating Rules and Procedures or Bulletins issued by the Access Provider.

### 10.2 Heritage Equipment

Refer to RORP *section 10, instruction 6* for Heritage Vehicle speed limits.

### 10.3 Curve radius, speed, cant, transition and gauge

Radius (metres)	Curve speed (km/hr)	Cant (mm)	Transition length		Gauge (mm)
			Standard (m)	Minimum (m)	
100 - 110	35	70	70	35	1074
111 - 140	40				
141 - 170	45				
171 - 210	50				
211 - 250	55				
251 - 300	60	70	70	35	1068
301 - 350	65				
351 - 400	70				
401 - 460	75				
461 - 540	80	60	60	30	
541 - 620	85				
621 - 700	90				
701 - 800	95				
801 - 900	100	50	50	25	
901 - 1100	105				
1101 - 1200	110				
1201 - 1500	110	40	40	20	
1500 - 2000	110	30	30		
2001 - 2400	110	20	20		
Over 2400	110	0			

Vehicle design must also allow for an additional 26mm maintenance tolerance for cant.

Users should consult the Access Provider in case the source is altered.

## 11. COUPLERS

### 11.1 Drawbar Height

11.1.1 Drawbars required to directly couple to standard rail vehicles operating on the National Rail System must not be visibly bent.

11.1.2 The distance from the centre line of the drawbar to rail level shall be within the following dimensions in the tare condition:

Class	Minimum Height above rail at Tare	Maximum Height above rail at Tare
All locomotives	710 mm	760 mm
Cars, vans and wagons running on passenger services	735 mm	767 mm
Wagons equipped with AAR heavy duty couplers	725 mm	792 mm
Wagons with kidney links	702 mm	767 mm
All other rail vehicles	725 mm	767 mm

*Mis-matched coupler heights can compromise crashworthiness of passenger vehicles.*

### 11.2 Drawgear Strength

All drawgear connections must be strong enough to allow for normal rail operation as well as safe towing of a disabled train. As a guide, the following forces may be expected:

- Passenger trains: 245 kN direct pull
- Freight trains: 345 kN direct pull

All new rail vehicles *intended for movement on freight services on the National Rail System* must be designed for a minimum of 1600kN drawbar force.

### 11.3 Standard Types of Drawgear

The following drawbar types are general standard types used on the National Rail System:

11.3.1 Hook and Pin coupler compatible to “JL” drawbar (11051167) and associated hook (drawing 11090508), bridle and pin assembly (drawing 11050917).

11.3.2 Automatic coupler *with* No.10A contour to AAR Standard S-106 and compatible with the AAR “E” coupler (refer AAR Standards S-102 and S-107 and Specifications M-211 and M-212).

### 11.4 Non Standard Drawgear

Each rail vehicle with non-standard drawgear required to be coupled to rail vehicles with standard types of drawgear (including the haulage of failed vehicles by any locomotive), must have a suitable coupling device (or adapter) at each end compatible with either the standard hook and pin drawgear or the standard “automatic” drawgear

### 11.5 Brake Line Couplings

11.5.1 Where brakes are compatible, the brake couplings are to be compatible with the standard Westinghouse FP5 coupling head (Part A86739).

11.5.2 Non-brake pipe lines should be clearly labelled and must use a fitting which cannot be coupled to the brake pipe.

## 12. SAFETY EQUIPMENT

### 12.1 Safe Riding Positions

All locomotive hauled vehicles must be equipped with a safe riding position to allow any Operator's personnel involved in shunting or marshalling to travel on the rail vehicle safely and securely.

Vehicles without riding positions approved by the Operator must display standard "No Ride" placards approved by the Operator.

Shunting handholds must be conspicuous.

Footsteps must be provided with a non-slip surface effective under all environmental conditions.

### 12.2 Headlights

All leading vehicles operating on the Controlled Network must show an effective white headlight to the front for normal rail operations and must be fitted with two to provide redundancy, unless they were supplied new to New Zealand prior to 1970 with one headlight. Facilities must be provided so that the headlights can be dimmed.

### 12.3 Tail Lights

All rail vehicles running on the back of a train must be designed to show at least one effective red tail light. Passenger trains must be fitted with at least two effective tail lights to provide redundancy.

Tail lights may flash.

Special red reflectorised discs may be used instead of red tail lights as specified by the Rail Operating Rules and Procedures.

### 12.4 Audible Warning Devices

All self-propelled rail vehicles running as a train must be fitted with an effective audible warning device (air-horn or steam whistle). Air horns are to be Federal Railway Administration standard 49CFR Part 229.129 "Audible Warning Device".

Where the vehicle uses a whistle or horn previously used on a Toll Rail (or predecessor) vehicle, operating at the same pressure, this will be accepted as meeting the requirements of this standard. Any other alternatives require approval by the Access Provider.

### 12.5 Cow Catchers

All leading rail vehicles must be fitted with a cowcatcher or similar device, capable of deflecting objects on the rails from the path of the wheels. The cowcatcher or similar device must be capable of deflecting an adult cattle beast without derailing the train.

This device must be maintained at a height of between 100 - 175 mm above rail in all operating conditions (e.g. under full or no-load).

## 12.6 Visibility of Leading Vehicles

All leading vehicles must have high visibility front ends to a conspicuity standard acceptable to the Access Provider. Rail vehicles classed as Heritage Vehicles in accordance with section 1.5 are exempt from this clause provided that high visibility front ends were not in their original construction specification.

## 12.7 Ditch Lights on Lead Vehicle

The purpose of ditch lights is to provide adequate conspicuity of trains, ahead of their travel direction, particularly at level crossings.

12.7.1 All dedicated motive power units, multiple unit driving trailers and push-pull driving trailers used on the lead end of a train that operate on the Controlled Network must be equipped with effective ditch lights as follows:

- (a) All new or re-built main line locomotives, electric multiple units, diesel multiple units and other self-propelled or lead vehicles.
- (b) All locomotives, electric multiple units, diesel multiple units and other self-propelled or lead vehicles not fitted as at 9 July 2004 must be subject to an upgrade programme acceptable to the Access Provider with a programme completion date by 31 December 2010.
- (c) Once fitted, ditch lights are not to be removed.
- (d) Where approval is granted by the Access Provider, individual rail vehicles classed as Heritage Vehicles are excluded from this requirement but remain subject to any other conditions that may apply (e.g. speed restrictions over level crossings).
- (e) *Bi-directional lead vehicles require ditch lights at both ends.*

12.7.2 The ditch lights must flash, at a rate between 40 and 180 flashes per minute, alternately for a minimum of 15 seconds on full beam when the horn is operated, or when operated from a separate control to initiate flashing. Provided they flash as specified, ditch lights may be operated continuously.

12.7.3 The ditch light beams are to be aligned so that they first cross and then strike the rail head  $240 \pm 15$  metres ahead of the lead vehicle. Systems installed to previous versions of NRSS/6 need not be altered.

12.7.4 As an aid to visual and spatial awareness, ditch lights shall be mounted a minimum of 900 mm above rail level and laterally spaced to produce a triangular or rectangular pattern when operated with the headlights.

## 12.8 Rail Vehicle Side Conspicuity

12.8.1 Nationwide standards for the application to all rail vehicles have not yet been developed.

12.8.2 Standards developed by Operators can continue to be used in the interim (e.g. reflectorised side numbers on locomotives).

12.8.3 An appropriate international standard for retro reflective material is AS/NZS 1906.1

12.8.4 For guidance, about four strips approximately 300mm x 100mm of high visibility tape, for example 3M Diamond Grade Reflective tape, should be applied to the sides of the vehicle unless the vehicle is predominantly white. This tape is used to increase train visibility at night, particularly at level crossings.

## 12.9 Traction Overhead Electrical Hazards

Any vehicles with ladders, handholds or any other facility allowing access higher than 1.8 metres above rail level must be fitted with clearly legible labels or lettering with the wording "Danger Live Wires Above" and carrying the electricity hazard symbol (equivalent to transfer E009A or name plate E009B specified in the Access Providers document CSG/107).

Safety requirements for operating under overhead line equipment are contained in the Rail Operating Rules and Procedures.

## 12.10 Passenger Activated Train Emergency Stop

Every passenger train must have a passenger-operable emergency stop signal that either brings the train to a stop directly or signals to crew that an urgent stop is required.

The selected system must be supported by a full hazard assessment and must comply with the operator's safety system.

## 12.11 European Train Control System

*ETCS will be introduced* in Auckland and possibly Wellington metropolitan areas. It is recommended an Operator seek guidance from the Access Provider before specifying new or refurbished *lead* vehicles for operation in these areas.

## 13. INSTRUMENTS & MONITORING EQUIPMENT

### 13.1 Speedometer

All self-propelled vehicles must be equipped with a speedometer visible to the driver operating the rail vehicle at all times and any pilot, legibly marked and with the maximum authorised speed of the vehicle marked in red. Speedometers are to read to within  $\pm 5$ km/h of actual speed at all speeds between 25 km/h and the maximum authorised speed, and within  $\pm 10$  km/h of actual speed for speeds below 25 km/h.

### 13.2 Event Recorder

13.2.1 All self-propelled rail vehicles operating as trains on the Controlled Network, are to be equipped with a data logger or event recorder to record operating parameters in a form which can be played back for use in an investigation if required.

Exemptions to this requirement are as follows:

- (a) Heritage vehicles operating at speeds under 50 km/h.
- (b) Clause not used in this issue.
- (c) Existing shunting locomotives not fitted with a compliant event recorder must be completely confined to terminals and sidings unless being towed dead on the Controlled Network.
- (d) Mobile Track Maintenance Vehicles (which along with Hi-Rail vehicles are subject to various operating restrictions).

13.2.2 Each event recorder must display a unique identification number and display an annual test certificate.

13.2.3 Each event recorder must record the following parameters as a minimum:

- (a) Speed # \$
- (b) Brake Pipe Pressure #
- (c) Brake Cylinder locos #
- (d) Throttle (power) position #
- (e) Direction of Travel #
- (f) Time # \$
- (g) Vigilance Operation (where fitted) #
- (h) Dynamic brake operation (where fitted) #
- (i) End of Train brake pipe pressure via train end monitor (where fitted) #
- (j) Date \$
- (k) *EP brake train-lines (where fitted)*
- (l) *Door control train-lines (where fitted)*
- (m) *Doors closed warning light train-line (where fitted)*
- (n) *Guards right of way signal train-line (where fitted)*
- (o) *MA set / APU status to show when the pantograph is down (where fitted)*

It is recommended that new event recorders fitted record the parameter for operation of headlights and ditch lights for either end of the vehicle.

*Any other event recorder features must not interfere with the performance of the event recorder in measuring the minimum parameters listed above.*

*Heritage vehicle event recorders need only record time and speed, and from the date in the Access Agreement, brake pipe pressure and brake cylinder pressure.*

13.2.4 The following clauses also apply for new event recorders that vary from those used by Toll Rail on 9 July 2004:

- (a) Sampling frequency is to be at not more than ten second intervals. To reduce required memory capacity, parameters marked # in 13.2.3 may be stored in a short term memory which holds details for not less than the previous five minutes of vehicle operation.
- (b) Parameters marked \$ in 13.2.3 must also be stored in a long term memory which holds details for not less than the previous thirty hours of vehicle operation.
- (c) The event recorder is to be of robust construction, capable of resisting the normal forces encountered in a vehicle and surviving foreseeable impacts, with data intact in accordance with a recognised rail industry standard acceptable to the Access Provider. The unit must be mounted such that it is protected in the event of an accident.
- (d) The recording function is to be independent of the operation of a locomotive's electrical system and internal standby batteries capable of providing one year's protection of memory are to be fitted.
- (e) The unit is to be fitted with a self-test function and is to indicate correct function to the driver and pilot. On integrated systems, this may be in the form of a single flash on the vigilance light when the system goes active, and three flashes on the vigilance light when the vigilance portion is suppressed.
- (f) The unit is to be fitted with a clear and obvious means of immediately stopping the recording so that short-term memory can be preserved in the event of an accident.
- (g) The event recorder memory unit must be easily removable from the vehicle and the data readily extracted by the Operator. The data must be presented in a readily understood format when required by The Access Provider or any third party.

For heritage vehicles, full compliance with this clause will be required by the date agreed in individual Access agreements.

13.2.5 The Access Provider reserves the right to download the data stored in an event recorder or require a report to be downloaded.

### 13.3 Radio Equipment

13.3.1 All locomotives and self-propelled rail vehicles are to be equipped with radio receiving and transmitting equipment allowing communication with the Access Provider's Train Controllers and with other trains on the Controlled Network.

13.3.2 This equipment must be specified, installed and maintained in accordance with The Access Provider's *Code Supplement Signals Telecommunications Electrical: S/RA003 "Rail Vehicle Operators – Radio Equipment"* issued 1 July 2010.

### 13.4 Vigilance Device

13.4.1 The driving cabs of all vehicles, except double-crewed steam locomotives, must be equipped with a vigilance system acceptable to the Access Provider.

13.4.2 The vigilance system is to monitor crew alertness by requiring a response to indicator lights and/or audible warning devices within a maximum period of 70 seconds. An automatic brake operation is to apply if the driver fails to respond within this period.

### 13.5 Future Upgrades

- 13.5.1 Operators should consult and gain approval from the Access Provider before making any changes to vigilance and event recorder monitoring systems that vary from the minimum requirements of this specification.
- 13.5.2 The Access Provider may develop proposals that oblige Operators to upgrade systems from time to time in line with changing systems (e.g. radio) or contemporary expectations for operation on the Controlled Network. Obligations to upgrade such systems may also be required by statutory regulation or Regulator directive.
- 13.5.3 For guidance, given the on-going development of in-cab systems, Operators should ensure interfaces with in-cab systems are provided on common platforms and are as generic as possible to better allow for future upgrades.

## 14. VEHICLE IDENTIFICATION

- 14.1 All rail vehicles must be stencilled externally with an identifying number on each side, in characters of 50 mm or higher. Any changes to existing vehicle identification systems or the introduction of new identification number systems for rail vehicles must have prior approval from the Access Provider.
- 14.2 A nationwide Rail Vehicle classification system to be applied by the Access Provider may be subsequently developed. In the meantime the current system used by KiwiRail which follows the format of "class letters (up to 3 used), then a numeral (up to 5 digits used)" will apply.
- 14.3 All wagons must have legible markings for "tare" and "gross" weights (in metric units of kg or tonnes) stencilled or permanently marked on each side of the wagon.

## 15. ENVIRONMENTAL RESTRICTIONS

### 15.1 Toilet Waste

All rail vehicles fitted with on-board toilets and running scheduled and other services must be equipped with systems that retain all human waste. Human waste or effluent may not be discharged directly from the rail vehicle except into a sewer or septic tank.

Where specific approval is granted by the Access Provider, individual rail vehicles classed as heritage vehicles in accordance with section 1.5 are excluded from this requirement but remain subject to any other conditions that may apply (e.g. agreed date for provision as per *the Access* agreement).

### 15.2 Noise

Vehicles and equipment must be designed, operated and maintained to minimise noise emissions and nuisance.

### 15.3 Exhaust and Spark Emissions

15.3.1 Locomotive and other engine exhaust gas emissions must be minimised.

15.3.2 Locomotive and other engines must be operated with their exhaust systems maintained in good condition to minimise the risk of hot particulate emissions (and hence the risk of line-side fires). For heritage equipment the minimum standard shall be that to which they were manufactured e.g. steam locomotive spark arrestor condition must be as originally built or better. In certain dry conditions the Access Provider may prohibit steam locomotives from operating on particular lines. In addition, the Access Provider may place limitations on smoke emissions, or prohibit the operation of steam locomotives when that is necessary to comply with any emissions limitations imposed by an outside authority.

15.3.3 Brake systems must be maintained and operated to minimise the risk of sparks (and hence the risk of line-side fires).

### 15.4 Fuel, Lubricant and Coolant Leakage

Operators must take reasonable steps to prevent leakage of fuel, lubricants, coolants and other substances from rail vehicles that could contaminate the track bed.

## 16. GANGWAYS AND HANDRAILS

### 16.1 *End platforms*

*New and modified rail vehicles must feature industry best practice for end platform safety rails and access gates to ensure the safety and security of passengers when riding on open platforms.*

### 16.2 **Clause not used in this issue.**

### 16.3 **Designs to Ensure Safety**

Inter-car access arrangements are safety critical and Operators must ensure that their designs and maintenance ensure safety for passengers and rail personnel at all conditions of vehicle and track wear and geometry. This requirement is to be assessed by a suitably qualified Certifying Engineer acceptable to the Operator(s) involved.

### 16.4 **Shunter's handgrabs and footsteps**

- 16.4.1 All rail vehicles shall have designated safe-ride positions for shunter's and, if required, for other operational staff or shall be labelled "No Ride".
- 16.4.2 Where provided, shunter's' handgrabs and footsteps shall be arranged as shown on *the drawing in Appendix C.*
- 16.4.3 Other ride positions, such as car or wagon platforms, must be subject to a full hazard analysis in accordance with NRSS/4 *and be approved by the Access Provider.*
- 16.4.4 For information, any designated safe ride position intended for use by KiwiRail staff will require approval from the KiwiRail Industrial Council.

## 17. RAIL VEHICLE ELECTRICAL POWER SYSTEMS

### 17.1 Scope

Section 17 covers general electrical power systems on rail vehicles. Traction systems are excluded as follows:

- (a) Traction power systems for self-propelled diesel electric or electric rail vehicles comprising the heavy current AC and DC circuits and connected auxiliary circuits of the same voltages.
- (b) Traction control earth free circuits operating at “extra-low voltages” including those that loop between rail vehicles for multiple unit operation.

Particular requirements for non-traction systems additional to statutory requirements are detailed in the following sections.

The Electricity Regulations (applicable at the date of issue of this document) define the following voltages:

- “Extra-low voltage” means any voltage normally not exceeding 50 volts AC or 120 volts ripple free DC.
- “Low voltage” means any voltage exceeding 50 volts AC or 120 volts ripple free DC but not exceeding 1000 volts AC or 1500 volts DC.

### 17.2 “Extra-low Voltage” Control Circuits

Control circuits not exceeding extra low voltages can be safely run between rail vehicles providing that:

- (a) They are designed, installed and maintained as earth free circuits
- (b) The circuits have a minimum insulation rating suitable for 230 volt AC circuits

Special monitoring circuits used between vehicles for test purposes must be site supervised if the above criteria cannot be met.

### 17.3 Single Vehicles or Permanently Coupled Vehicles

This covers the case where a fixed internal combustion driver alternator plant (or fixed wired inverter plant) feeds low voltage fixed wiring in the following situations:

- (a) Single self-contained rail vehicle
- (b) Two rail vehicles designed to operate permanently coupled together where the connecting drawgear is bolted and the wiring between both vehicles is fixed (e.g. ET-EM, Silver Fern railcars, ADC-ADL)

The statutory periodic inspection and Warrant of Electrical Fitness requirements applicable to caravans with their own internal power supply are to apply.

## 17.4 Coupled Vehicles with Standard Drawgear Types

17.4.1 This covers the case where low voltage circuits are run between rail vehicles that can be readily disconnected by train operations personnel or where circuits are run between freight vehicles (these may be fitted with readily dis-connectable couplers or couplers that are semi-permanently bolted to form liner trains).

17.4.2 The following general standards for train line circuits apply:

- (a) The neutral and earth legs are separated downstream of the main switchboard protecting all train lines.
- (b) The generator set is provided with a star point winding connection so that a neutral-earth link connection can be provided.
- (c) The earth leg is solidly bonded to each rail vehicle.
- (d) The train line earth leg must have a high probability of remaining intact so that it can clear any phase to earth fault promptly and also ensure that stray fault currents do not loop through the rails between wagons (see below).
- (e) The train line must be protected by a 30mA residual current device (RCD) unless the criteria in 17.4.3 below are in place to a standard acceptable to the Operator and the Access Provider.

17.4.3 The risk of problems with passenger carriage train lines are deemed as relatively low when the following requirements are met, and thus earth leakage circuit breakers may not be required to protect the main train lines:

- (a) Wiring in each carriage is completely enclosed and effectively immune from damage.
- (b) The end of train cable termination box and jumper design is such that potential damage is minimised.
- (c) Adjacent train line fixed wired plugs/sockets are on the same side and kept well away from rail vehicle buffer couplings.
- (d) Passenger carriages are operated in captive consists and routinely serviced at specific depots.
- (e) 30mA earth leakage circuit breakers are provided on internal carriage sub-circuits feeding power outlets and fixed appliances.
- (f) Passenger carriage consists are normally plugged into a shore supply (protected with a 30mA RCD) at the end of every round trip so that any defective circuit or equipment insulation is identified.

17.4.4 Annual Certification for Continued Operation

All train line power circuits between rail vehicles as detailed in 17.4.2 and 17.4.3 above must carry an annual Warrant of Electrical Fitness issued as specified in the Access Providers Code Supplement E/CSO/410 Issue 2.

## 17.5 Shore Supplies

Shore supplies (or lineside supplies) used to feed rail vehicles must be fitted with 30mA residual current devices (RCD's). Additional Access Provider requirements may apply when railway signalling track circuits and / or electric traction is installed on the rail lines immediately adjacent to the shore supply point.

## 17.6 Power Circuits fed from a Rail Vehicle

- 17.6.1 Any low voltage fixed wired power outlet feeding appliances or equipment away from a rail vehicle must be equipped with a 30mA RCD located on the rail vehicle (the RCD may be fixed wired or portable).
- 17.6.2 Any low voltage portable alternator set feeding appliances or equipment located on an adjacent wagon must be equipped with a fixed wired 30mA RCD protecting the power outlet, or a portable 30mA RCD unit used to provide protection to the extension cord (and connected appliance or equipment) placed at the portable alternator set.

## 17.7 Electrical Compatibility between Rail Vehicles

It is the responsibility of Operators to ensure that the connectivity between different rail vehicles is “fit for purpose” and that requirements of the Electrical Regulations are met in respect of the following:

- (a) Train lines are protected from damage.
- (b) Compliance with authorised jumper design and application.
- (c) Compliance with any instructions necessary to ensure electrical compatibility.

## 17.8 Electrical Emergency Systems

### 17.8.1 New passenger vehicles

- a. *Passenger* vehicles introduced to the National Rail System after the date of Issue 4 of this standard shall be equipped with the following electrical emergency systems, which shall provide a minimum of 180 minutes of operation after battery charging stops.

Safety critical functions

- Cab lights and tail lights
- Door controls (where fitted)
- Emergency lights and boarding lights
- Public address system (where fitted)
- Train control radio

- b. In addition, battery back-up of the following functions (where fitted) must provide 90 minutes of operation after battery charging stops.

Operationally critical functions

- Closed circuit television
- Emergency powered ventilation
- Headlights
- Passenger information display system
- Public address system
- Reduced interior lighting and boarding lights
- Train computers and controls

### 17.8.2 Existing passenger vehicles

Rail vehicles introduced before 26/4/10 shall be brought into compliance with 17.8.1 by 31/12/12.

## 17.9 Interior lighting

Locomotives and passenger vehicles must be equipped with interior lighting systems, including emergency lighting that will continue to operate in the event of losing normal power supplies as detailed in 17.8.

As a minimum, one operative emergency light must be visible in each passenger area, and steps and vestibules must be adequately lit to allow safe evacuation of the vehicle in darkness.

## 18. ELECTRIC TRACTION COMPATIBILITY

- 18.1 In the event that new or altered vehicles are intended to use the Access Provider's electric overhead traction systems as a source of traction or other power, special conditions will apply to ensure interference with traction and other infrastructure systems (e.g. signals, communications, radio) is limited to specified levels.
- 18.2 *Not used in this issue*
- 18.3 Specific acceptance criteria will need to be negotiated and agreed with the Access Provider.

## 19. TRACK STANDARDS

19.1 The relevant track standards affecting rail vehicle static and dynamic stability primarily reside in the following of the Access Provider documents (as updated from time to time):

- T200 - Infrastructure Engineering Handbook
- T003 - Track Code
- T100 – Track Supplements
- Standard and special plans for turnouts and other track structures
- General Code (Section 4.01)
- Significant Information Notices (SIN's) that may modify the above documents from time to time

These standards encompass the following:

- Track gauge
- Track construction and maintenance standards
- Railhead profiles
- Fixed structure gauge for main lines and sidings (showing minimum dimensions for new construction) shown in Appendix E.

## 20. NETWORK STANDARDS

- 20.1 The Access Provider is required to consult through the Joint Technical Committee processes with Operators using the National Rail System before making any changes to track standards that could affect the static and dynamic response of rail vehicles or adversely affect train performance.

The following are the thresholds for temporary and permanent features *on the main line* beyond which the Access Provider must consult Operators through the Joint Technical Committee.

Curve radius	minimum 100 metres
Grade	maximum 1 in 32
Wire height	minimum 3.94 metres above rail; <i>Except north of Khandallah on the Johnsonville Line, where the minimum threshold will be 3.86 metres above rail</i>

- 20.2 The aspiration is for new fixed structures to accommodate vehicle heights up to 4.2 metres above rail level and vehicle widths of up to 3.2 metres.

Note, however that the risk management of new track or operations is outside the terms of reference of this National Rail System Standard.

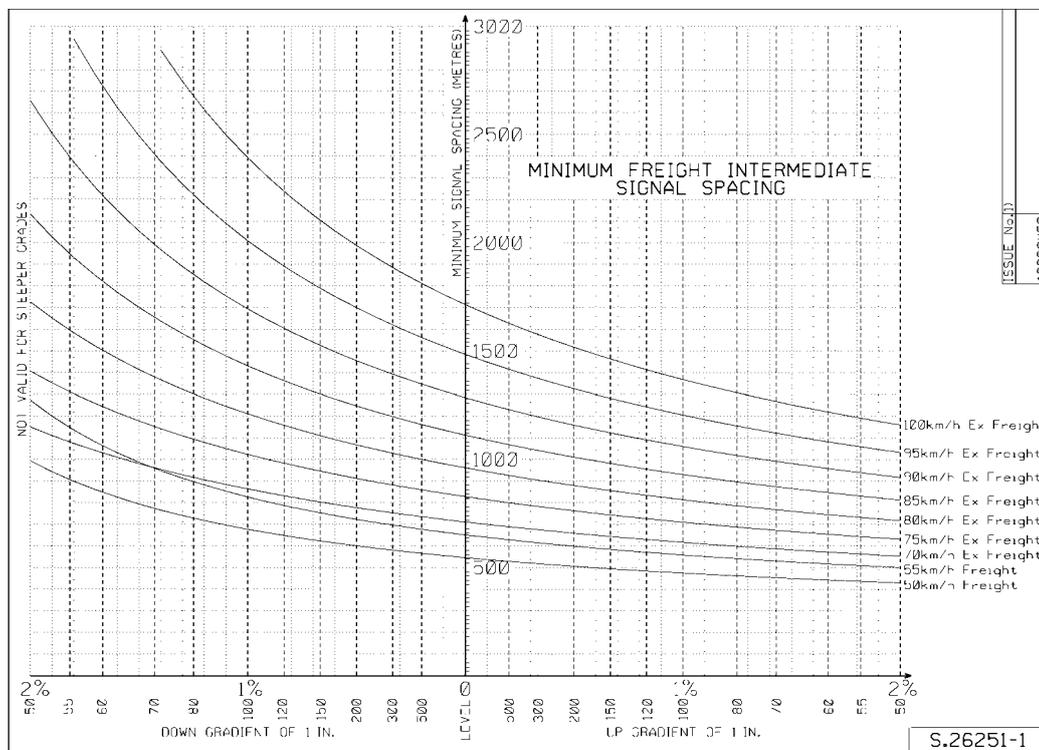
- 20.3 *The aspiration for design and construction on the National Rail System is to accommodate the following generic rail vehicles:*

Class	Bogie centres	Over headstocks	Over couplers
ID1	20,428 mm	25,366 mm	
ID2	17,936 mm	25,366 mm	
IW1	15,011 mm	18,894 mm	19,632 mm (see Appendix F)

- 20.4 *The Access Provider is required to consult through the Joint Technical Committee processes with Operators using the National Rail System before reducing any signal spacing distances.*

## 21 SIGNAL SPACING PRINCIPLES

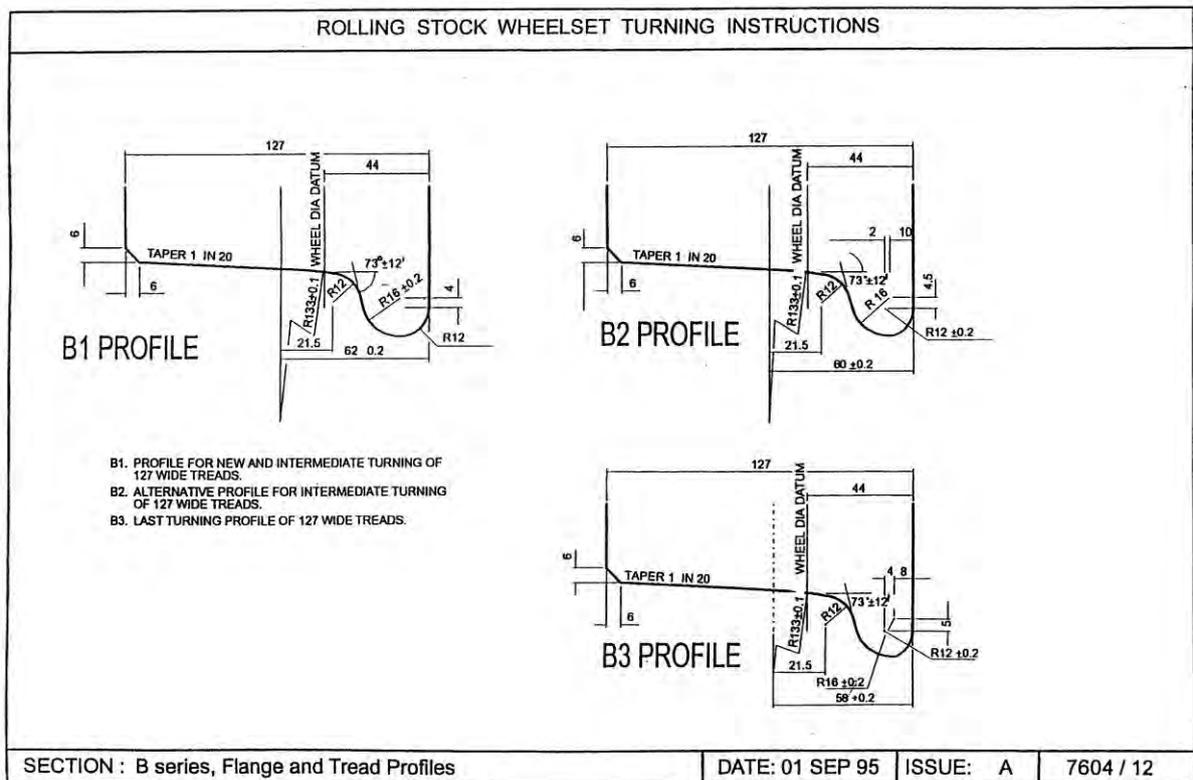
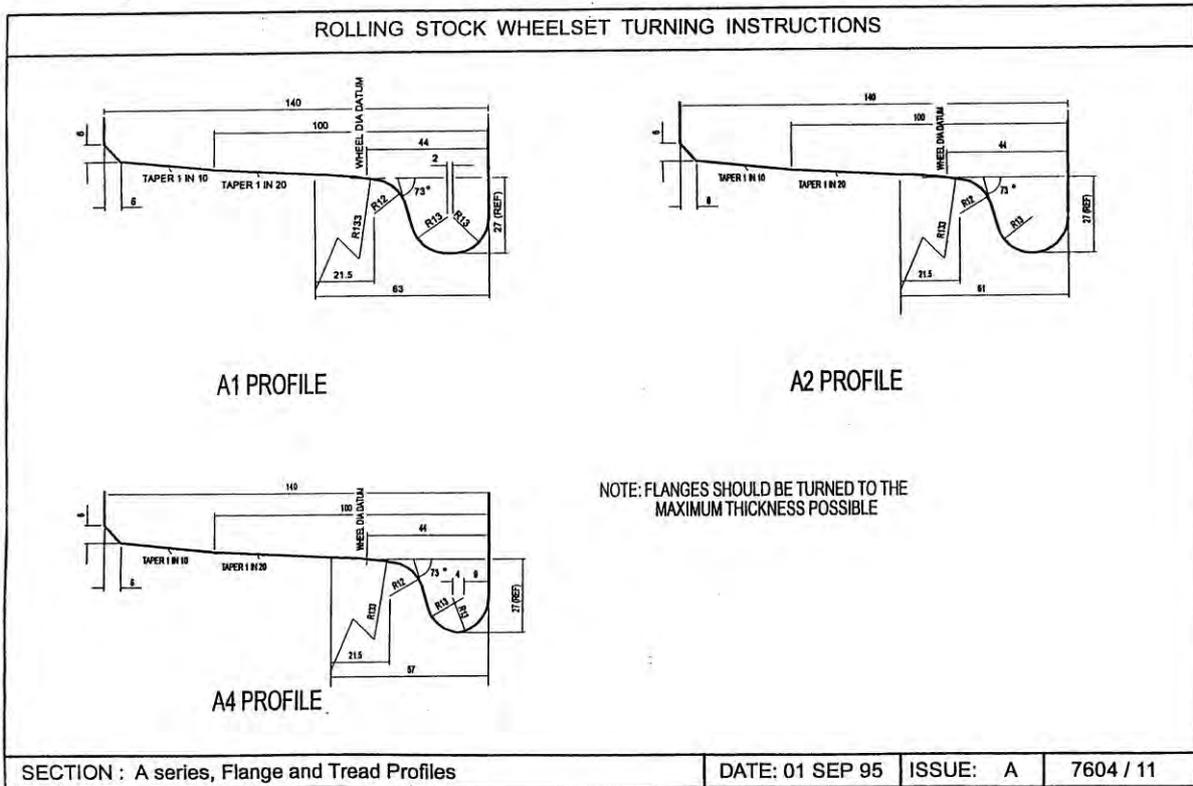
21.1 Minimum signal spacing is based on the train braking curves below. These curves include a 10% margin to allow for variables that include driver reaction time. This minimum signal spacing curve is based on the New Zealand Railways' Chief Mechanical Engineer's Research Report No 5 dated January 1966 and the stopping distance curves dated 18 August 1972 issued by the Chief Mechanical Engineer.

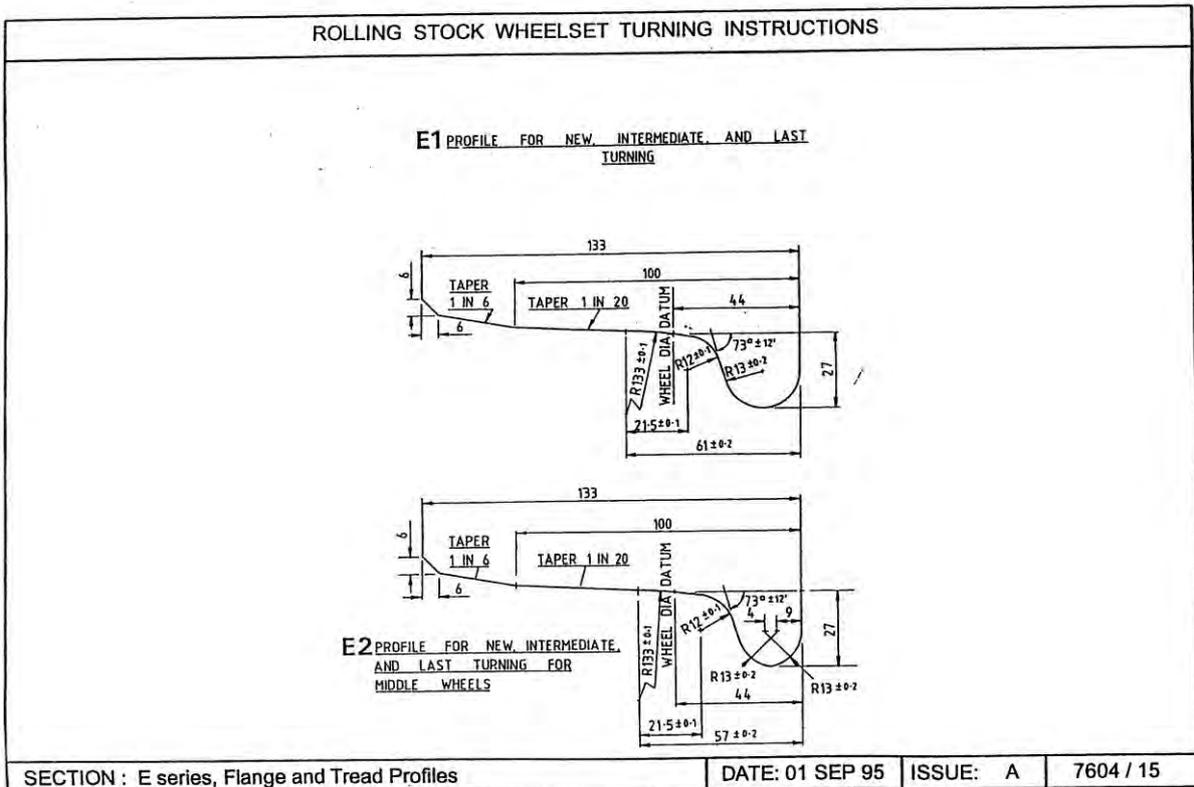
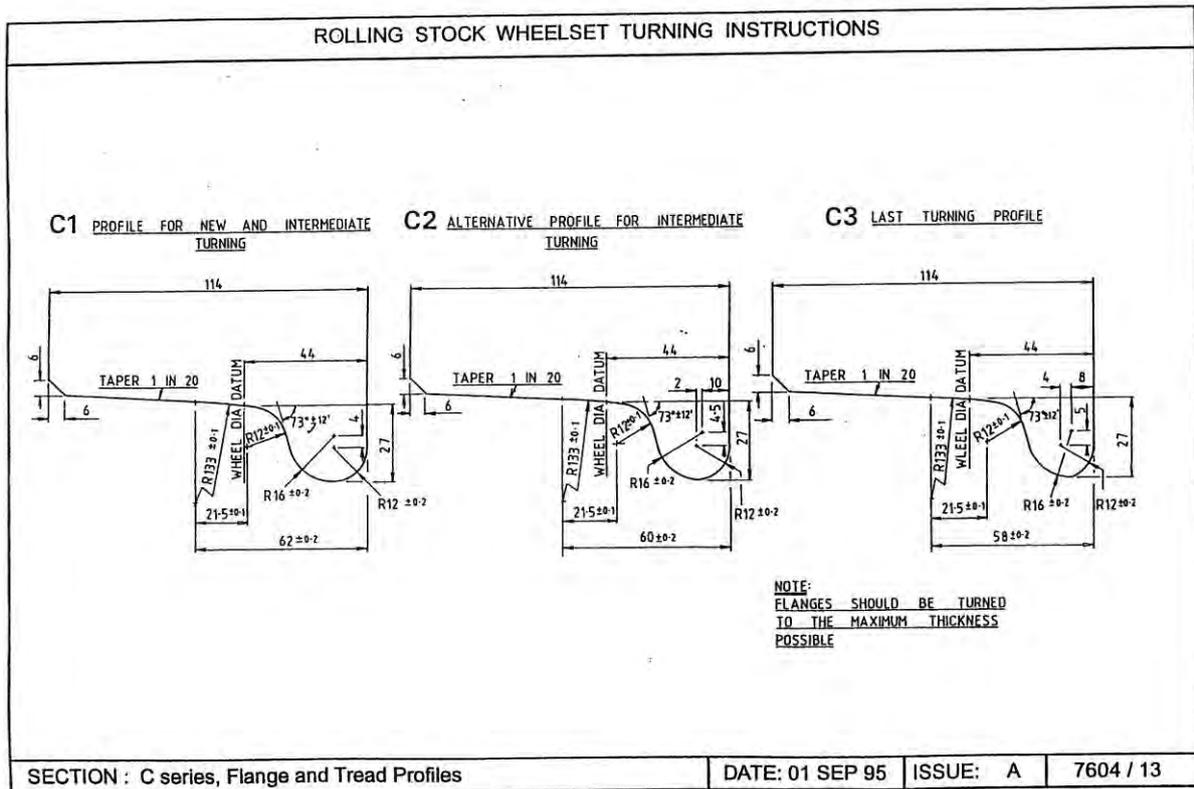


21.2 Shorter signal spacing's than those shown may be used. Where the signal spacing in drawing S26251 is not achieved the shorter distance will be mitigated, where necessary, by the likes of reduced speeds for rolling stock that can not stop within the signal spacing minus the 10% signals safety margin, or aspect sequence modification.

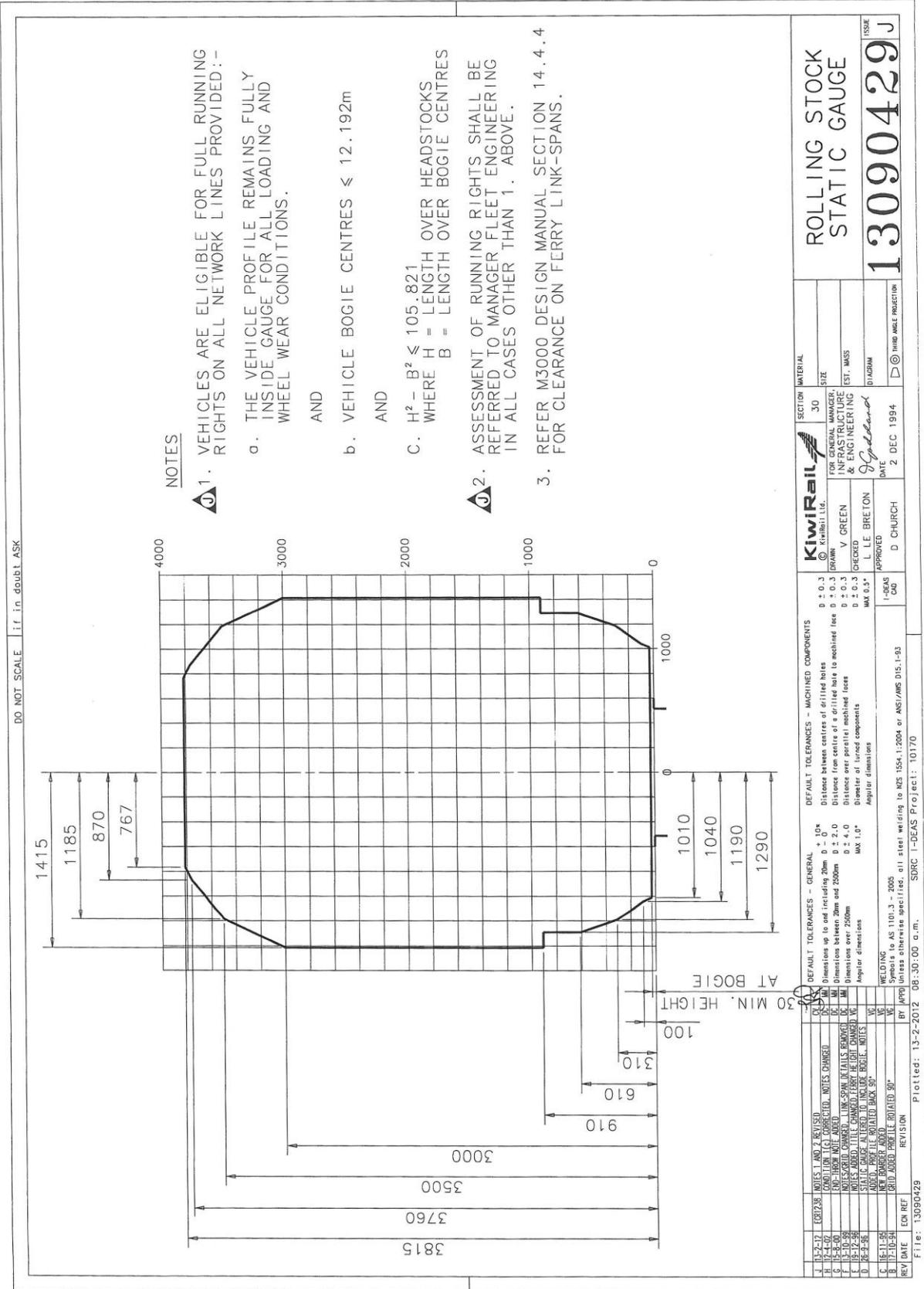
## APPENDIX A

Standard Tread Profiles. Drawing 7604, Sheets 11,12,13 and 15





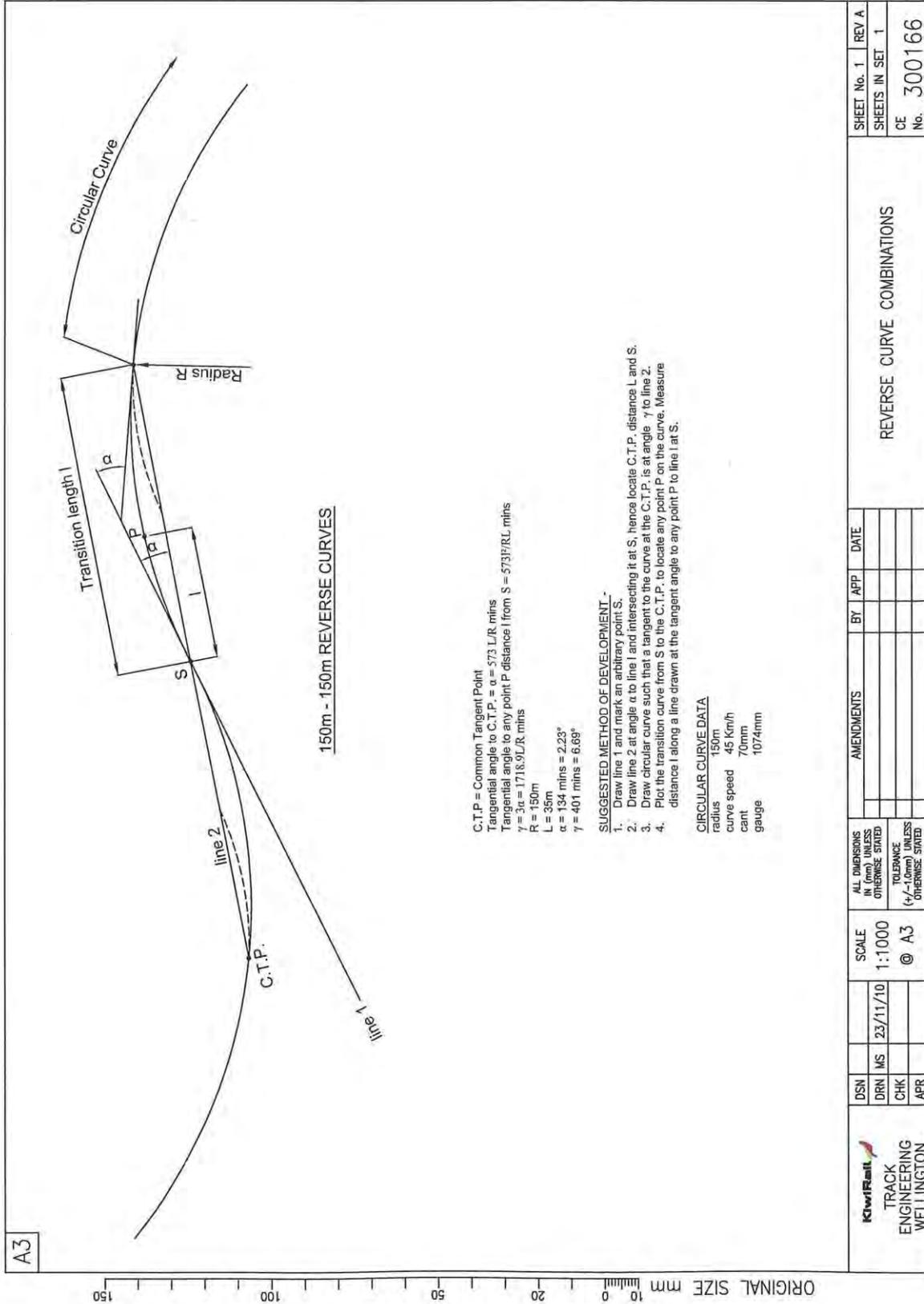
**APPENDIX B**  
Drawing 13090429





**APPENDIX D**

Drawing CCE 300166

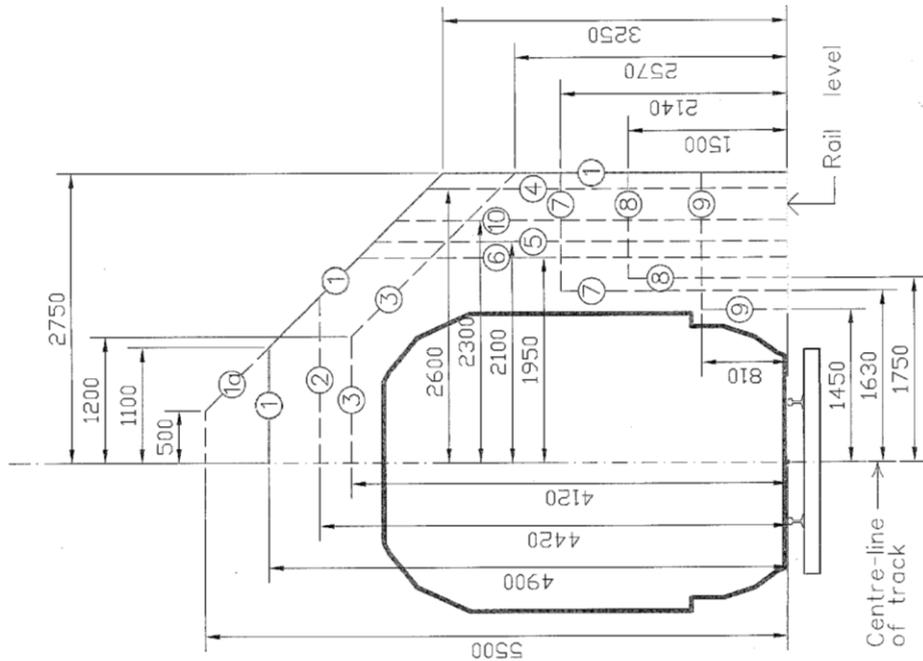


A3

Kiwirail TRACK ENGINEERING WELLINGTON		DSN	DRN	MS	23/11/10	SCALE	1:1000 @ A3	ALL DIMENSIONS IN (mm) UNLESS OTHERWISE STATED	TOLERANCE (+/-1.0mm) UNLESS OTHERWISE STATED	AMENDMENTS	BY	APP	DATE	SHEET No. 1	REV A
REVERSE CURVE COMBINATIONS														SHEETS IN SET	1
														CE	300166
														No.	300166

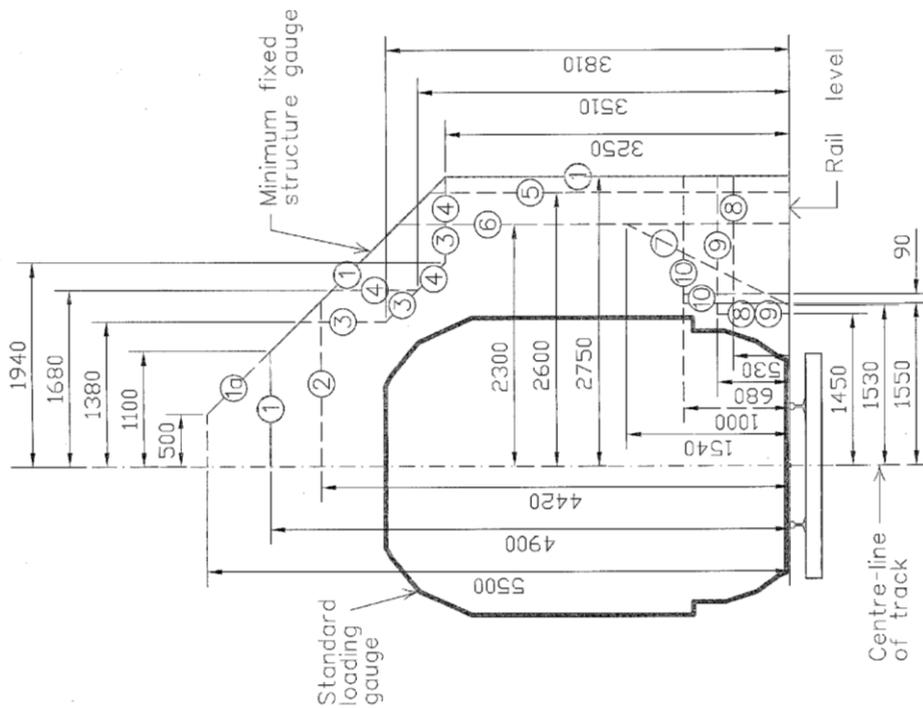
## APPENDIX E

Minimum clearances for new construction



Minimum dimensions for new construction

## YARDS AND SIDINGS



Minimum dimensions for new construction

## MAIN LINES AND LOOPS

Main lines and loops

- a) Index of lines on drawing of minimum dimensions for new construction for main lines and loops.
- Line 1 Minimum fixed structure gauge except for the items listed below or specially approved by the Manager Track *Engineering or Manager Structures Engineering*.
  - Line 1a See note (d) below.
  - Line 2 Minimum vertical clearance where specially approved by the Manager Track Engineering; used for temporary work and scaffolding in non-electrified areas.
  - Line 3 Station verandahs.
  - Line 4 Signals and verandahs with no alternative unrestricted track for high over-gauge loads.
  - Line 5 Isolated obstructions up to 2m long; e.g. poles, columns, traction masts, buttresses, *track signs*, km posts, hand-rails on bridge footways. Non-railway power structures are regulated by statute.
  - Line 6 Bridge trusses, signals, temporary work and scaffolding.
  - Line 7 Bridge bracing.
  - Line 8 Passenger platforms not referred to in note on Line 9; points motors and ground equipment (including 2 position ground signals).
  - Line 9 Passenger platforms at major stations, suburban stations and terminals.
- b) Dimensions (in mm) are the minimum for new construction and changes to existing structures.
- c) The clearances shown apply to straight track only. If the track is curved, adjustments for cant and curvature must be made.
- d) *Consult Manager Structures Engineering and Manager Traction Engineering* about any structure proposed to be constructed over any electrified railway or when any structure less than 5.5 metres above railway level is proposed over any line likely to be electrified (remainder of NIMT, ECMT, or Auckland suburban area). Note that, depending on the location of existing or proposed traction structures, the proposed length or degree of skew of the new structure, a minimum clearance may be fixed at some point between line 1 and line 1 (a).

Yards and sidings

- a) Index of lines on drawing of minimum dimensions for new construction in yards and sidings.
- Line 1 Minimum fixed structure gauge except for the items listed below or specially approved by the Manager Track *Engineering or Manager Structures Engineering*.
  - Line 1a See note (d) above.
  - Line 2 Minimum vertical clearance in non-electrified areas where road vehicles run. Applies also to bridges, gantries, scaffolding etc.
  - Line 3 Minimum fixed structure overhead gauge in non-electrified areas where motor vehicles do not run. Applies to doorways, floor-beams inside buildings, roof trusses, bracing, scaffolding etc.
  - Line 4 Isolated obstructions up to 2m long (bridge columns, posts, etc), where a clear way is required for operating staff (see also line 10). Non-railway power structures are regulated by statute.
  - Line 5 Interior walls of buildings (one side of track only).
  - Line 6 Columns inside buildings (including door posts) on one side of track only, stockyard loading doors closed.
  - Line 7 High level loading banks.
  - Line 8 Points levers.
  - Line 9 Stockyard stages, ground equipment (ground signals, etc), loading platforms and banks.
  - Line 10 Signals, gantries, temporary work, scaffolding, doorways (see note for line 6). Other structures, on one side of the track only *and* where staff can safely work on the other side.
- b) See note b) above.
- c) See note c) above.

**APPENDIX F**

Aspirational information for planning future construction on the National Rail System

