Railway Group Standard
GC/RT5021
Issue Three
Date April 2007

Track System Requirements

Synopsis
This document mandates requirements for track geometry, track system, track components and switches and crossings to provide for the safe guidance and support of rail vehicles.

Content approved by:

Infrastructure Standards Committee on 10 January 2007

Authorised by RSSB on 14 February 2007

Published by:

Rail Safety and Standards Board
Evergreen House
160 Euston Road
London NW1 2DX

Issue record

Issue	Date	Comments
One	April 2000	Original document. Superseded Railway Group Standard GC/RT5010 and GC/RT5017 with some further additions.
Two	October 2003	Replaced issue one. Incorporated changes advised in GC/GN5523 and requirements held in GC/RT5011 issue two, GC/RT5014 issue one and GC/RT5024 issue one.
Three	April 2007	Replaces issue two. Incorporates requirements held in GC/RT5014 issue two, GC/RT5022 issue two, and GI/RT7004 issue one. Requirements that do not meet the risk scope test set out in the Railway Group Standards Code (issue two, 2006) have been withdrawn.

Revisions have not been marked by a vertical black line in this issue because the document has been revised throughout.

Superseded documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

Superseded documents	**Sections superseded**	**Date when sections are superseded**
GC/RT5014	C2.1 (part)	02 June 2007
GC/RT5022	C1 (part), D5.1 (part) D6.4 (part), F3.6, F11 (part), F12.2 (part)	02 June 2007
GI/RT7004	4.1 (part), 4.2, 4.3, 6.1, 6.2 (part), 7.1, 7.2 (part), 7.3, 7.4, 7.5, 8.1 (part), 8.2 (part), 8.3 (part), 9.1 (part), 9.2 (part), 9.5, 9.6, 9.7, 13.2 (part), 13.3 (part), 16.2 (part),	02 June 2007
GC/RT5021 issue two	C1, C2 (part), C3, C4.1 (part), C4.5, C5.1, C5.2 (part), C5.4.1, C5.4.2, C5.5, C5.6, C5.8.1, C5.8.2, C5.9, C5.10.1, C5.10.2, C5.10.3, C5.11.1 (part), C5.11.2, C6.1, C6.2, C6.3, C6.4, C6.5, C6.6, C6.7.1, C6.7.2, C6.8, C7.1 (part), C7.2, C7.3, C10.1 (part), C10.2, C11.1 (part), C11.2, C12, D1.1, D5.1, D7.2 (part), D9.4, D10.1 (part), D10.3, D11.1 (part) F16.3, F16.4, G2.1, G2.2 (part), G2.3 (part), G2.4 (part), G2.5 (part), G2.6, G2.7, G3.1 (part), G8.6	02 June 2007

GC/RT5014 issue two ceases to be in force and is withdrawn from 02 June 2007.

GC/RT5021 issue two ceases to be in force and is withdrawn from 02 June 2007.

GC/RT5022 issue two ceases to be in force and is withdrawn from 02 June 2007.

GI/RT7004 issue one ceases to be in force and is withdrawn from 02 June 2007.

Supply

Controlled and uncontrolled copies of this Railway Group Standard may be obtained from the Corporate Communications Department, Rail Safety and Standards Board, Evergreen House, 160 Euston Road, London NW1 2DX, telephone 020 7904 7518 or e-mail enquiries@rssb.co.uk. Railway Group Standards and associated documents can also be viewed at www.rgsonline.co.uk.

Track System Requirements

Contents

Part 1 Purpose and Introduction

1.1 Purpose

1.1.1 This document mandates requirements for track geometry, track system, track components and switches and crossings to provide for the safe guidance and support of rail vehicles.

1.2 Introduction

1.2.1 Background

1.2.1.1 The 'Superseded documents' section on Page 2 lists the documents superseded by this document. All the measures set out in the superseded documents have been reviewed in line with the Railway Group Standards Code issue two and the Strategy for Standards Management 2005.

1.2.1.2 The measures that have been retained in this document are those that are required for interworking as defined in the Strategy for Standards Management 2005. Measures required for interworking are 'those parameters or processes that directly govern the ability of two (or more) duty holders to interface/co-operate with each other to the extent that harmonisation is required to deliver safety in the most economical way'.

1.2.1.3 The measures relating to flangeways in switches, track gauge in S&C and rail profile and steel grade have been revised as part of the review. Other measures in this document remain substantively unchanged from the measures set out in predecessor documents.

1.2.4 Related requirements in other documents

1.2.4.1 The following Railway Group Standards contain requirements that are relevant to the scope of this document:

1.2.4.2 GC/RT5033 defines the arrangements to be provided on terminal tracks to arrest a train and protect people, stations and structures from the effects of an overrun.

1.2.4.3 GC/RT5212 mandates requirements for monitoring and maintaining clearances. It also mandates requirements for new, altered and temporary infrastructure relating to clearances; gauging conditions for passage of exceptional loads; and data relating to gauging and clearances, to be provided to Railway Group members and their suppliers. This document includes requirements for position of check rails, guard rails and other equipment in the lower sector area.

1.2.4.4 GI/RT7006 defines the requirements for risk assessment of the design and operational use of track and signalling, so as to control the risks associated with trains exceeding the end of their movement authority.

1.2.4.5 GI/RT7016 mandates requirements for the design and maintenance of station platforms for their safe interface with trains.

1.2.4.6 GK/RT0064 specifies a range of controls to be applied to mitigate the consequences of a train overrunning a signal at danger.

1.2.4.7 GM/RT2141 prescribes design requirements for traction and rolling stock and for on-track plant to ensure acceptable resistance against flange climbing derailment and against roll-over induced by overspeeding.

1.2.4.8 GM/RT2466 contains mandatory requirements which are to be met during the design of wheelsets and associated components; inspection and testing of railway wheelsets at all stages of manufacture; use, repair and overhaul of railway wheelsets. It also mandates the requirements for a wheelset policy to ensure continued safe use of railway wheelsets.

1.2.4.9 GM/TT0088 sets out the design and maintenance requirements for traction and rolling stock and for on-track plant, to ensure that interactive forces and stresses generated between vehicles and track are limited to acceptable levels. Specifies vehicle performance limits relating to wheel loads, wheel diameters, unsprung masses and suspension characteristics.

1.2.5 Supporting documents

1.2.5.1 GC/RC5521 sets out an approved method of calculating enhanced permissible speeds for tilting trains.

Part 2 Requirements for track geometry

2.1 Normal limiting design values and exceptional limiting design values

2.1.1 This section specifies normal limiting design values and exceptional limiting design values for track geometry parameters.

2.1.2 Where site conditions allow, normal limiting design values shall be used for all parameters.

2.1.3 Where the speed requirements cannot be met by using normal limiting design values it is permissible to use exceptional limiting design values. The reason and implications for their use shall be justified.

2.1.4 When a design value is quoted without being described as either normal or exceptional, it is the only limiting value and no exceptional limiting value is permitted.

2.1.5 Exceptional limiting design values shall not be exceeded.

2.2 General horizontal alignment requirements

2.2.1 On running lines, horizontal alignments shall consist of circular curves and straight track connected where necessary by transition curves. The minimum length of each geometrical element shall be appropriate to the length and characteristics of vehicles likely to use the track.

2.2.2 Restrictions on the location of station platforms in relation to the horizontal alignment of track are set out in GI/RT7016.

2.2.3 The requirements for the alignment of track at buffer stops and arresting devices are set out in GC/RT5033.

2.3 Permissible speed

2.3.1 The permissible speed on a curve shall be calculated taking account of the following factors:

a) The radius of the curve.

b) The applied cant.

c) The permitted values of cant deficiency.

d) The permitted values of rates of change of cant and cant deficiency on the transition curves either side of the circular curve.

2.3.2 There could be reasons other than track geometry design that restrict the permissible speed, for example the ability to maintain the track to sufficiently high track quality standards, the nature of the signalling system, or the strength of structures.

2.4 Enhanced permissible speed

2.4.1 Calculation of enhanced permissible speed

2.4.1.1 The conditions under which trains are permitted to travel at an enhanced permissible speed are set out in GE/RT8012.

2.4.1.2 The enhanced permissible speed shall be calculated for each type of train on each curve. The speed on each track of a double or multiple line shall be considered separately. On bi-directional tracks, the speed in each direction shall be considered separately.

2.4.1.3 The infrastructure manager shall have a procedure for calculating enhanced permissible speeds meeting the requirements of this section. The procedure shall also set out the method of gaining technical approval for the calculated enhanced permissible speed.

2.4.1.4 The calculation of enhanced permissible speed shall take account of the factors listed in section 2.3 together with the following additional factors:

a) The maximum cant deficiency at which the train is designed to travel.

b) The dynamic roll-over resistance of the train (see GM/RT2141).

c) The maintenance tolerances on cant (the amount by which, in practice, the applied cant could be less than its design value).

d) The maintenance tolerances on curvature (the amount by which, in practice, the curve radius could be less than its design value).

e) The expected local wind conditions.

f) The effect of wind on the train, taking into account the characteristics of the train (see GM/RT2142).

g) The system adopted for controlling the speed of the train and the extent to which overspeed can occur (see GE/RT8012).

h) A safety margin equivalent to no less than 50 mm of cant deficiency.

2.4.1.5 The enhanced permissible speed shall ensure that the likelihood of overturning is within tolerable limits.

2.4.2 Enhanced permissible speed for S&C

2.4.2.1 Enhanced permissible speeds shall not be permitted on the turnout route of S&C.

2.5 Circular curves

2.5.1 Minimum radii

2.5.1.1 Horizontal curve radii shall be selected to take account of the curving characteristics of vehicles likely to use the track.

2.5.1.2 The normal minimum radius on passenger running lines shall be 200 m.

2.5.1.3 The exceptional minimum radius on passenger running lines shall be 150 m.

2.5.1.4 The normal minimum radius on non-passenger running lines shall be 150 m.

2.5.1.5 The exceptional minimum radius on non-passenger running lines shall be 125 m.

2.5.2 Reverse curves

2.5.2.1 A length of straight track not less than 3 m long shall be provided between the reverse curves if one of the curves has a radius of less than 160 m.

2.5.3 Limiting design values for cant

2.5.3.1 The normal limiting design values for cant shall be:

a) 110 mm adjacent to station platforms.

b) 110 mm on fixed obtuse crossings.

c) 150 mm elsewhere.

2.5.4 Exceptional limiting design values for cant

2.5.4.1 The exceptional limiting design values for cant shall be:

a) 130 mm adjacent to station platforms.

b) 110 mm on fixed obtuse crossings (unchanged from normal limiting design value).

c) 180 mm elsewhere.

2.5.5 Cant on curves with radii less than 320 m

2.5.5.1 The cant on curves with radii less than 320 m shall not exceed C_{max}, where C_{max} is given by the lesser of:

a) $C_{max} = (R - 50) / 1.5$, where C_{max} is in millimetres and R is the curve radius in metres.

b) C_{max} = the limiting value set out in sub-section 2.5.3.

2.5.6 Negative cant

2.5.6.1 Negative cant shall only be permitted on the turnout route through S&C and in the plain line immediately adjoining the S&C. On fixed obtuse crossings the normal limiting design value for negative cant shall be zero and the exceptional limiting design value shall be 65 mm. Elsewhere negative cant shall not exceed 80 mm.

2.5.7 Normal limiting design values for cant deficiency at permissible speed

2.5.7.1 The normal limiting design value for cant deficiency shall be:

a) 110 mm on plain line CWR.

b) 110 mm on the through route of S&C designed for use in CWR without adjustment switches.

c) 110 mm on the turnout route of S&C where designed to accommodate this value of cant deficiency.

d) 75 mm on fixed obtuse crossings.

e) 90 mm elsewhere.

2.5.8 Exceptional limiting design values for cant deficiency at permissible speed

2.5.8.1 An exceptional limiting design value for cant deficiency on plain line jointed track of 110 mm is permissible for diesel multiple units with axle weights less than 13 tonnes fully seated (all seats full) and fitted with bogies and air suspension, provided:

a) The intrinsic track quality has been assessed and is considered suitable.

b) The condition of rail joints has been assessed and is considered suitable.

2.5.8.2 An exceptional limiting design value for cant deficiency on plain line CWR of 150 mm is permissible for vehicles, other than freight vehicles, accepted for running at this cant deficiency, provided no features likely to contribute to lateral misalignment are situated on the transition or circular curve. Features considered likely to contribute to lateral misalignment shall include catch points, adjustment switches, level crossings, longitudinal timbers and directly fastened track on bridges.

2.5.9 Cant deficiency at switch toes

2.5.9.1 It is permissible for the theoretical cant deficiency at switch toes to exceed the limiting values specified in sub-sections 2.5.7 and 2.5.8 but shall not exceed 125 mm. In order to assess the permissible speed it is necessary to calculate the radius at the switch toe. The radius shall be obtained by calculating the offset at the toe based on a 12.2 m chord centred about the switch toe.

2.5.10 General requirements for cant deficiency on plain line at enhanced permissible speed

2.5.10.1 Cant deficiencies exceeding those set out in sub-sections 2.5.7 and 2.5.8 are permissible on CWR plain line, provided no features likely to contribute to lateral misalignment are situated on the transition or circular curve. Features considered likely to contribute to lateral misalignment shall include catch points, adjustment switches, level crossings, longitudinal timbers and directly fastened track on bridges.

2.5.10.2 The limiting design values set out in sub-sections 2.5.11 and 2.5.12 shall be reduced where necessary to meet the requirements of section 2.4.

2.5.11 Normal limiting design values for cant deficiency on plain line at enhanced permissible speed

2.5.11.1 The normal limiting design values for cant deficiency at enhanced permissible speed shall be:

a) 110 mm for curves under 400 m radius

b) 185 mm for curve radii less than 700 m but greater than or equal to 400 m

c) 265 mm for curve radii greater than or equal to 700 m.

2.5.12 Exceptional limiting design values for cant deficiency on plain line at enhanced permissible speed

2.5.12.1 The exceptional limiting design values for cant deficiency at enhanced permissible speed shall be:

a) 150 mm for curves under 400 m radius

b) 225 mm for curve radii less than 700 m but greater than or equal to 400 m

c) 300 mm for curve radii greater than or equal to 700 m.

2.5.13 Limiting design values for cant deficiency on the through route of S&C at enhanced permissible speed

2.5.13.1 The normal limiting design values for cant deficiency on the through route of S&C shall be the same as those at permissible speed set out in sub-section 2.5.7. Exceptionally, a cant deficiency higher than the normal limiting value is permissible on S&C designed for use in CWR without adjustment switches, up to a limit of 200 mm, provided the radius is greater than or equal to 400 m.

2.5.14 Requirements for cant deficiency above 110 mm on the through route of S&C at enhanced permissible speed

2.5.14.1 Where cant deficiency above 110 mm is proposed, the use of S&C requiring adjustment switches is not permitted.

2.5.14.2 Where cant deficiency above 150 mm is proposed, additional special features shall be incorporated that eliminate discontinuities at crossings.

2.6 Transition curves

2.6.1 General requirements

2.6.1.1 Where possible, a transition curve shall be provided between two circular curves or between a circular curve and straight track. Curvature shall increase (or decrease) regularly over the whole length of the transition curve.

2.6.1.2 Where it is not possible to provide a transition curve, the permissible speed shall be calculated assuming a virtual transition 12.2 m long.

2.6.1.3 Designs of transition curves shall take the permissible speed and any enhanced permissible speeds into account, together with the cant and radius on adjoining curves.

2.6.1.4 On all transition curves, cant shall be proportional to the instantaneous curvature. The instantaneous cant gradient at any point shall not exceed the value set out in sub-section 2.6.4.

2.6.1.5 There are a large number of differing transition curve forms. Whichever form is chosen, curvature shall increase (or decrease) regularly over the whole length of the transition curve.

2.6.1.6 On transitions between reverse curves with no intervening straight, the point of zero cant shall coincide with the reverse point (point of zero curvature). Where possible, the rates of change of cant, cant deficiency and curvature shall be approximately the same on either side of the reverse. The same type of transition shall be used on either side of the reverse.

2.6.2 Particular requirements for clothoid spiral transition curves

2.6.2.1 The clothoid spiral (or its close approximation, the cubic parabola) is the usual form of transition used on Network Rail controlled infrastructure. The limiting values for rates of change of cant and rates of change of cant deficiency set out in sub-sections 2.6.5 to 2.6.9 assume a clothoid spiral transition.

2.6.3 Particular requirements for forms of transition curves other than clothoid spiral

2.6.3.1 The peak rate of change of cant and the peak rate of cant deficiency shall be specified to suit the degree of smoothing offered by the transition's form. The average rate of change of cant deficiency through the transition shall comply with the values set out in sub-sections 2.6.5 to 2.6.8, but it is permissible for the peak rate of change of cant deficiency to exceed the quoted values. However, the peak rate of change of cant deficiency shall not exceed these values by more than 33 percent.

2.6.3.2 A curve other than a clothoid spiral is only permissible if agreement is reached with the railway undertakings that the tilting mechanisms are compatible with the chosen form of transition curve.

2.6.4 Cant gradient

2.6.4.1 The steepest permitted designed cant gradient shall be 1 in 400.

2.6.4.2 The deflection of the track at skew underbridges during the passage of trains shall be taken into account when proposing to install cant gradients approaching 1 in 400.

2.6.5 Rate of change of cant at permissible speed

2.6.5.1 The normal limiting design value for rate of change of cant shall be 55 mm/s.

2.6.5.2 The exceptional limiting design value for rate of change of cant shall be 85 mm/s.

2.6.6 Rate of change of cant at enhanced permissible speed

2.6.6.1 The normal limiting design value for rate of change of cant shall be 75 mm/s.

2.6.6.2 The exceptional limiting design value for rate of change of cant shall be 95 mm/s.

2.6.7 Normal limiting design values for rate of change of cant deficiency at permissible speed

2.6.7.1 The normal limiting design values for rate of change of cant deficiency shall be:

a) 55 mm/s on plain line.

b) 80 mm/s on S&C designed to accommodate this value.

c) 55 mm/s on other S&C.

2.6.7.2 It is permissible to disregard the rate of change of cant deficiency at the switch toes.

2.6.8 Exceptional limiting design values for rate of change of cant deficiency at permissible speed

2.6.8.1 Exceptional limiting design values for rate of change of cant deficiency shall be:

a) 70 mm/s on plain line.

b) 95 mm/s on S&C designed to accommodate this value.

c) 55 mm/s on other S&C (unchanged from the normal limiting design value).

2.6.8.2 It is permissible to disregard the rate of change of cant deficiency at the switch toes.

2.6.9 Transition curves - rate of change of cant deficiency at enhanced permissible speed

2.6.9.1 The normal limiting design value for rate of change of cant deficiency shall be 110 mm/s on plain line.

2.6.9.2 The exceptional limiting design value for rate of change of cant deficiency shall be 150 mm/s on plain line.

2.6.9.3 The limiting design values for rate of change of cant deficiency on S&C shall be the same as those at permissible speed set out in sub-sections 2.6.7 and 2.6.8.

2.7 Vertical alignment

2.7.1 General requirements

2.7.1.1 On running lines, vertical alignments shall consist of lengths of track at constant gradient connected by parabolic vertical curves. The minimum length of each geometrical element shall be appropriate to the length and characteristics of vehicles likely to use the track.

2.7.1.2 Restrictions on the location of station platforms in relation to the vertical alignment of track are set out in GI/RT7016.

2.7.2 Track gradients

2.7.2.1 Design of track gradients shall take account of the following factors:

a) Braking and traction performance of vehicles likely to use the line.

b) Position of signals and operational regime (for example, the likelihood of a train being required to start on the gradient or stop at a station or signal).

c) Projected rail adhesion conditions, including the effect of the weather.

d) The combined effect of gradient and horizontal curvature where the gradient coincides with a small radius horizontal curve.

2.7.3 Vertical curves

2.7.3.1 The maximum vertical acceleration experienced in a vehicle due to the effect of the vertical curve shall be 0.06 g.

2.7.3.2 The design of vertical curves shall take account of the following factors:

a) The ability of vehicles likely to use the line to traverse the curves (considering, for example, vertical buffer locking and vehicle coupling and interconnection designs).

b) Clearances to features on the track under the vehicle.

c) Clearances to structures over the track.

2.7.3.3 The normal limiting design value for vertical curve radii shall be 1000 m, subject to the factors listed in clause 2.7.3.2.

2.7.3.4 The exceptional limiting design value for vertical curve radii shall be 600 m over a convex curve (hog) and 900 m in a concave curve (hollow) subject to the factors listed in clause 2.7.3.2. Where radii less than 1000 m are used, there shall be at least 30 m constant gradient between reverse vertical curves.

2.8 Track geometry requirements for sidings

2.8.1 Horizontal alignment

2.8.1.1 Horizontal curves shall be designed to take account of the curving characteristics of vehicles likely to use the siding.

2.8.1.2 The normal minimum radius on sidings shall be 150 m.

2.8.1.3 The exceptional minimum radius on sidings shall be 125 m.

2.8.1.4 The need for a length of straight track or transition between small radius reverse curves shall be considered, taking account of the following factors:

a) The ability to traverse the curves of vehicles likely to use the sidings.

b) The likelihood of buffer locking.

c) Vehicle coupling designs.

2.8.1.5 A length of straight track not less than 3 m long shall be provided between the reverse curves if one of the curves has a radius of less than 160 m.

2.8.1.6 The requirements for the alignment of track at buffer stops and arresting devices are set out in GC/RT5033.

2.8.2 Vertical alignment

2.8.2.1 The track gradient of sidings where vehicles stand shall not be steeper than 1 in 500.

2.8.2.2 The minimum radius of vertical curves in sidings shall be 600 m over a convex curve (hog) and 900 m in a concave curve (hollow).

2.9 Track gauge

2.9.1 Nominal track gauge

2.9.1.1 New and relaid track shall be designed to give a nominal track gauge of 1435 mm.

2.9.1.2 Sub-sections 2.11.3 and 2.11.4 set out intervention limits for track gauge.

2.9.2 Gauge widening

2.9.2.1 On curves less than 200 m radius consideration shall be given to widening the track gauge, taking account of the following:

a) Characteristics of vehicles likely to use the track.

b) The length and location of the curve.

c) The applied cant.

2.9.2.2 Sub-section 3.2.9 sets out associated requirements for the provision of check rails.

2.9.2.3 Where track gauge is widened, the check flangeway dimension shall be increased to maintain the distance between the rubbing face of the check rail and the running edge of the opposite rail (including a crossing nose) at a nominal 1391 mm.

2.9.2.4 Track gauge shall be widened by moving the inner rail away from the designed track centre line to ensure alignment continuity along the outer (steering) rail.

2.9.2.5 Appendix C of GM/RT2141 sets out values for gauge widening for the purpose of computer simulations designed to examine whether a vehicle has an acceptable resistance to flange climbing derailments at low speed.

2.10 Rail inclination

2.10.1 In plain line track, rails shall have a nominal inclination of 1 in 20 towards the track centre line.

2.10.2 In S&C, rails shall have a nominal inclination of 1 in 20 towards the track centre line or be vertical, depending on the design of S&C considered. Where rails in S&C are vertical, it is permissible for the rails in short lengths of adjacent plain line also to be vertical. To accommodate the change in verticality from inclined track to vertical track, twist rails or transition sleepers shall be used.

2.11 Track geometry faults

2.11.1 General requirements for corrective action

2.11.1.1 The corrective actions set out in sub-sections 2.11.2 to 2.11.7 apply to isolated track faults (that is, they are not combined with other track faults). When track faults are discovered in combination, the circumstances shall be reviewed and, if necessary, action that is more stringent shall be taken.

2.11.2 Twist faults

2.11.2.1 Twists faults (measured over 3 m) worse than 1 in 200 shall not be permitted to remain in the track. When twist faults are discovered they shall be repaired within a timescale commensurate with the risk of derailment, which in any case shall not be less stringent than the timescales set out in Table 1.

Twist fault	Action
1 in 90 or worse	Stop all traffic immediately and correct fault
Between 1 in 91 and 1 in 125	Correct fault within 36 hours of discovery
Between 1 in 126 and 1 in 199	Radius < 400 m: Correct fault within one week of discovery Radius ≥ 400 m: Correct fault within two weeks of discovery

Table 1 Minimum action on discovery of a twist fault

2.11.3 Track gauge in plain line

2.11.3.1 Track gauge shall be maintained within the limits specified in Table 2.

Speed (mph)	Lower limit (mm)	Upper limit (mm)
95 and above	1430	1450
65 to 90	1429	1450
25 to 60	1426	1455
up to 20	1426	1465

Table 2 Track gauge maintenance limits

2.11.3.2 The speed used when determining the lower and upper track gauge limits for a section of track shall be the highest permissible or enhanced permissible speed over the section of track concerned.

2.11.3.3 If a loaded track gauge of greater than 1480 mm is identified, all traffic shall be stopped immediately and action taken to strengthen the track to bring the loaded track gauge within the limits given in Table 2.

2.11.4 Additional Requirements for track gauge in S&C

2.11.4.1 Throughout the moveable length of switches, switch diamonds, and swing-nose crossings, including the 100 mm in front of the switch toes, track gauge shall be maintained within limits required for the maintenance of point operating tolerances and in any case within the ranges set out in Table 3:

Type of S&C	Lower limit (mm)	Upper limit (mm)
Vertical	1430	1438
Bullhead or 109/110A/113A inclined	1433	1441
RT60/NR60 Inclined	1433	1441

Table 3 Maintenance limits of track gauge within moving areas of S&C

2.11.4.2 Sections 4.3 and 4.4 set out requirements relevant to the maintenance of point operating tolerances.

2.11.4.3 Section 4.5 sets out requirements for flangeway gaps and free wheel passage in switches.

2.11.4.4 Section 4.8.2 sets out requirements for flangeway gaps and check gauges for fixed crossings.

2.11.5 Cyclic top faults

2.11.5.1 The infrastructure manager shall ensure that a procedure is in place to determine the severity of cyclic top faults.

2.11.6 Vertical profile (top) faults

2.11.6.1 Where a top fault of 20 mm or more from mean to peak value is measured by a track recording vehicle, or where an equivalent fault is found by other means, the fault shall be repaired within a timescale commensurate with the likelihood of derailment.

2.11.7 Lateral alignment faults

2.11.7.1 Where a lateral alignment fault of 15 mm or more from mean to peak value for track where the permissible speed is greater than or equal to 50 mph, or 30 mm for track where the permissible speed is less than 50 mph, is measured by a track recording vehicle, or where an equivalent fault is found by other means, the fault shall be repaired within a timescale commensurate with the likelihood of derailment.

2.11.8 Maximum and very poor standard deviations

2.11.8.1 The standard deviations of eighth mile sections shall be calculated from measured data for each parameter listed below:

a) The vertical profile (top) of the rails, filtering out wavelengths greater than 35 m.

b) The lateral alignment of the rails, filtering out wavelengths greater than 35 m.

2.11.8.2 Where the permissible or enhanced permissible speed exceeds 75 mph the standard deviations of quarter mile sections shall be calculated from measured data for each parameter listed below:

a) The vertical profile (top) of the rails, filtering out wavelengths greater than 70 m.

b) The lateral alignment of the rails, filtering out wavelengths greater than 70 m.

2.11.8.3 The standard deviations for any section of track shall not normally exceed the 'maximum' standard deviations set out in Table 4.

2.11.8.4 When standard deviations greater than those shown as 'very poor' are measured, consideration shall be given to the need for action to improve track geometry.

2.11.8.5 When standard deviations greater than the 'maximum' as set out in Table 4 are measured action shall be taken to restore track geometry or impose a speed restriction at a level where the standard deviation is less than the maximum.

Speed (mph)	Vertical profile standard deviation (mm)			Lateral alignment standard deviation (mm)		
	35 m filter		70 m filter	35 m filter		70 m filter
	Maximum (eighth mile)	Very poor (eighth mile)	Very poor (quarter mile)	Maximum (eighth mile)	Very poor (eighth mile)	Very poor (quarter mile)
10-20	8.3	N/A	N/A	9.3	5.6	N/A
25-30	7.7	N/A	N/A	8.6	5.2	N/A
35-40	7.2	N/A	N/A	7.9	4.7	N/A
45-50	6.7	N/A	N/A	7.3	4.5	N/A
55-60	6.3	N/A	N/A	7.0	4.2	N/A
65-70	6.0	5.4	N/A	6.7	3.6	N/A
75-80	5.7	4.8	6.3*	6.3	3.1	5.7*
85-95	5.3	4.0	5.6	6.0	2.7	5.0
100-110	5.0	3.4	5.0	5.7	2.3	4.3
115-125	4.7	3.0	4.4	5.0	2.0	3.7
130-140	4.4	2.6	3.8	4.7	1.8	3.1

Table 4 'Maximum' and 'very poor' standard deviations

* applies to a speed of 80 mph only.

2.11.8.6 The speed used when determining the 'maximum' standard deviations for a section of track shall be the highest permissible or enhanced permissible speed over the section of track concerned.

Part 3 Requirements for the track system and components

3.1 Performance specification for the track system

3.1.1 Track systems for all new construction shall be designed to have performance characteristics capable of sustaining the following forces:

a) A maximum static axle load of 250 kN (25.5 tonnes).

b) A vertical dynamic force, generated by the static wheel load and the low frequency dynamic forces P2, of 350 kN per wheel and an occasional isolated vertical load of 500 kN per wheel.

c) A longitudinal force of 1200 kN per rail, to allow for train acceleration and braking, and the thermal forces within the rail.

d) A lateral force generated by a train of 100 kN over a length of 2 m.

3.2 Requirements for rails, rail gaps and rail fastenings

3.2.1 Profile of new rails

3.2.1.1 The rail head profile of new rails for plain line shall be as either 60 E 1 or 56 E 1 as defined in BS EN13674-1:2003, or 60 E 2 as defined in Appendix A. The rail head profile of new rails for S&C shall be compatible with the profile of new rails for plain line.

3.2.2 Steel grade of new rails

3.2.2.1 The steel grade of new rails shall be selected from the range set out in BS EN13674-1:2003.

3.2.3 Rails to fit with existing fastenings

3.2.3.1 It is permissible to use historic rails (for example 95 RBH, 98 FB) where either existing fastenings cannot accommodate profiles set out in section 3.2.1 or a short section of track is being relaid in an area of track with historic rail profiles.

3.2.4 Rail fastenings - electrical insulation for track circuits

3.2.4.1 Where track circuits are installed, rail fastenings and supports shall be designed and selected to provide electrical insulation between individual rails and between rails and the adjacent infrastructure and the general mass of the earth. The electrical insulation provided shall be consistent with the requirements of the type of track circuit installed.

3.2.4.2 General requirements for train detection systems, including track circuits, are set out in GK/RT0011.

3.2.5 Rail head width and sidewear

3.2.5.1 Rails shall be changed or transposed before:

a) Sidewear reaches the bottom of the gauge face of the rail.

b) Sidewear results in a head width (measured in accordance with the definition of ‘sidewear’) less than that shown in Table 5.

Permissible or enhanced permissible speed	Minimum head width
≤ 80 mph	52 mm(with no more than 50% of the total permitted head loss on any one side)
> 80 mph and ≤ 125 mph	61 mm
> 125 mph	64 mm

Table 5 Minimum permitted rail head width resulting from sidewear

3.2.5.2 Table 5 assumes an unworn rail head width of not less than 70 mm.

3.2.5.3 The requirements of Table 5 will usually mean that rails are not transposed on lines where the permissible or enhanced permissible speed is greater than 125 mph.

3.2.5.4 Section 3.2.6 sets out wear limits to prevent wheels striking fishplates. These limits may require rails to be changed ahead of the limits set out in this section where rail depths are significantly less than those for new rail.

3.2.6 Rail depth and loss of section - prevention of wheel/fishplate strikes

3.2.6.1 Rails within 9 m of fishplates shall not be permitted to wear below the limits set out in Table 6 below.

Rail section	Minimum permitted rail depth (mm)
60 E 1 (UIC 60)/60 E 2 FB	158.0 + L
109 / 110A / 113A lbs (56 E 1)/yd FB	144.5 + L
98 lbs/yd FB	130.5 + L
95 & 97.5 lbs/yd BH	130.5 + L
85 lb/yd BH	127.0 + L

Table 6 Wear limits to prevent wheel/fishplate strikes

3.2.6.2 Where L is the loss of head width in mm due to sidewear on the current running face (measured in accordance with the definition of ‘sidewear’).

3.2.6.3 Minimum permitted rail depths are depths measured outside the area of underfoot gall.

3.2.7 Interface between rails to be permanently joined

3.2.7.1 There shall be no sudden discontinuity of the rail head and running edge that could cause damage to wheels or initiate a derailment.

3.2.7.2 To reduce the likelihood of wheel flange climbing, wheels shall not be allowed to pass from a sideworn rail to a less worn rail over a very short distance. Where a sideworn rail is to butt up to a new rail or a less sideworn rail at a fishplated or welded joint, the difference between the rail profiles shall be blended in by grinding. The blending shall meet the following requirements:

a) The less sideworn rail shall be blended in over a distance of at least 1.5 m from the joint.

b) The sidewear angle of the more sideworn rail shall be maintained throughout the blended length.

c) The gauge corner shall be rounded throughout the blended length to eliminate sharp or square edges.

3.2.8 Gaps between rail ends

3.2.8.1 Trains shall not be permitted to pass over gaps between rail ends at speeds greater than those shown in Table 7:

Speed (mph)	Gap (mm)	Comments
90 and above	0 (nominal)	CWR is required to satisfy this requirement. Nominal gaps are associated with tight joints and insulated joints.
up to 90	up to 15	In jointed track 15 mm represents maximum nominal expansion gap.
up to 20	up to 50	Used for engineering and emergency repair work
up to 5	up to 75	Used for engineering and emergency repair work
trains not permitted	above 75	Line is blocked

Table 7 Maximum speed of trains over rail gaps

3.2.8.2 The values set out in Table 7 are dependent on arrangements being in place to ensure the integrity and support of the rail.

3.2.9 Check rails on curves

3.2.9.1 All passenger lines, and freight only lines adjacent to passenger lines, with a horizontal radius of 200 m or less shall be fitted with a continuous check rail to the inside rail of the curve, except where the design of S&C prevents this from being provided. The check rail shall extend at least 9 m into the straight or circular curve adjacent to the section of track with a radius of 200 m or less and its associated transitions.

3.2.9.2 All check rails shall have a machined or forged flare at each end of sufficient length to give guidance to vehicle wheel flanges entering the flangeway.

3.3 Performance requirements for trackbed

3.3.1 General performance requirements

3.3.1.1 For new trackbed, a minimum dynamic sleeper support stiffness of 60 kN/mm per sleeper end shall be provided.

3.3.1.2 For trackbed renewal in areas with a history of poor track geometry, or where the vertical or horizontal alignment is to be changed significantly, the infrastructure manager shall be satisfied that the renewed trackbed will provide a minimum dynamic sleeper support stiffness of 30 kN/mm per sleeper end.

3.3.1.3 The design of trackbed layers shall address the need for transition zones where ballasted track abuts non-ballasted track or where a change in support stiffness beneath ballasted track prevents the required track geometry from being readily achieved.

Part 4 Particular requirements for switches and crossings

4.1 Identification of points

4.1.1 Point identity

4.1.1.1 Worked points, train operated points and unworked points that are detected in the signalling system shall have an identity that is unique to the controlling interlocking.

4.1.1.2 Points worked by levers shall be identified by the lever number.

4.1.1.3 Unworked points in running lines that are not detected in the signalling system shall have an identity in a distinct sequence, similar to that for worked points.

4.1.2 Point end identification plates

4.1.2.1 Where a point identity is required, all associated point ends shall have identification plates or equivalent markings.

4.1.2.2 The identification plates shall display the point identity and any additional suffix. Where necessary to avoid confusion, point identification plates shall include a signal box or locality code prefix.

4.1.2.3 At each point end the identification plate shall be fixed to a bearer. The plate shall be oriented so that it can be read when looking at it in the same direction as when the points are passed over in the facing direction.

4.1.2.4 Where possible, the identification plate shall be fixed near to the toe of the switch rail that is closed when the points are in the normal position.

4.1.2.5 Where this is not possible or where the intended switch rail is not obvious, the identification plate shall incorporate an arrow pointing to the normally closed switch rail.

4.1.2.6 At point ends without a normally closed switch rail (for example a trap point with a single normally open switch rail) the identification plate shall incorporate an arrow pointing in the direction of operation for the normal position.

4.1.2.7 At swing nose crossings, the identification plate shall be fixed next to the normally closed flangeway, adjacent to the crossing nose. The identification plate shall incorporate an arrow pointing in the direction of operation for the normal position.

4.1.3 Guidance on identification of points

4.1.2.1 Additional guidance on identification of points is given in Appendix B.

4.2 Integrity of points and associated operating equipment

4.2.1 Points and their associated operating equipment shall be designed so that a trailing movement passing through a point end which is in other than the correct position does not result in a derailment.

4.2.2 Points and their associated operating equipment shall be designed so that a trailing movement passing through a worked point end which is in other than the correct position results in a loss of detection.

4.3 Facing point locking

4.3.1 Facing point locking - worked points

4.3.1.1 Worked points shall have a facing point lock, other than as set out in clause 4.3.1.2.

4.3.1.2 It is permissible to omit the facing point lock on:

a) Trailing points in mechanically worked installations where it can be demonstrated that the risk of derailment is negligible. Additional requirements for installations where the movement, detection and locking of points are performed mechanically are set out in GK/RT0039.

b) Points in sidings.

4.3.2 Facing point locking - train operated points

4.3.2.1 Train operated points with a maximum facing speed greater than 15 mph shall have a facing point lock.

4.3.3 Facing point locking - settings at switches

4.3.3.1 If the gap between a closed switch rail and its stock rail is 3.5 mm or greater, measured at the centre of the first slide chair or baseplate, the facing point lock shall not engage.

4.3.4 Facing point locking - settings at switch diamonds

4.3.4.1 If the gap between a closed switch rail and its wing rail is 3.5 mm or greater, measured at the centre of the first slide chair or baseplate, the facing point lock shall not engage.

4.3.5 Facing point locking - settings at swing nose crossings

4.3.5.1 If the gap between a closed swing nose crossing vee and its wing rail is 3.5 mm or greater, measured at the crossing nose, the facing point lock shall not engage.

4.4 Detection of points

4.4.1 Detection of worked points

4.4.1.1 Other than as noted in clause 4.4.1.2, all worked points shall be provided with detection (and where required, supplementary detection) to prove that:

a) The point end is set in the correct normal or reverse position.

b) The facing point lock (where provided) is engaged.

c) The closed switch rail is adjacent to the associated stock rail along the length of the switch.

d) The open switch rail has moved to a position that provides the required flangeway gap along the length of the switch rail.

4.4.1.2 It is permissible to omit detection on points in mechanically worked installations used exclusively in the trailing direction, where all of the associated signals are also mechanically controlled.

4.4.1.3 Additional requirements for installations where the movement, detection and locking of points are performed mechanically are set out in GK/RT0039.

4.4.2 Detection of unworked points

4.4.2.1 Detection shall be provided on unworked (hand operated) points where a signalled route on a running line leads over them in a facing direction.

4.4.3 Detection of train operated points

4.4.3.1 Train operated points shall be detected for facing movements in the normal position.

4.4.4 Detection of out of use points

4.4.4.1 Out of use points, which in use would require detection, shall be detected unless the moveable element is prevented from moving by a secure physical obstruction.

4.5 Flangeway gaps and track gauge at points

4.5.1 Flangeway gaps and track gauge - general requirements

4.5.1.1 When the points are in either the normal or reverse position, the open point end shall provide an adequate gap for wheel flanges.

4.5.1.2 Flangeway gaps and the correct track gauge shall be maintained throughout the length of the point end. Where necessary, supplementary drives and supplementary detection shall be provided to achieve this.

4.5.1.3 Requirements for track gauge in points are set out in section 2.11.4.

4.5.2 Flangeway gaps and track gauge - stretcher bars on switches and switch diamonds

4.5.2.1 Sufficient stretcher bars of the required length shall be provided to ensure that the design flangeway is always achieved on the open side when a switch rail is correctly fitting to its adjacent stock rail or wing rail on the closed side. A lock stretcher bar, where provided, is not a stretcher bar for the purpose of this requirement.

4.5.3 Flangeway gaps and track gauge - flangeway gaps at switches

4.5.3.1 A minimum flangeway gap of 100 mm shall be maintained at the toes of switches. A flangeway gap of not less than 60 mm, to provide a minimum free wheel passage of 1375 mm, shall be maintained elsewhere through the switch.

4.5.3.2 There are particular compliance requirements associated with this section as set out in clause 5.1.5.2.

4.5.4 Flangeway gaps and track gauge - flangeway gaps at switch diamonds

4.5.4.1 Flangeway gaps at switch diamonds shall be the same as those for switches specified in section 4.5.3, other than as set out in clause 4.5.4.2.

4.5.4.2 Where switch diamonds are operated by a rail clamp point lock mechanism (clamp lock), it is permitted to reduce the opening at the toe to a minimum of 85 mm.

4.5.5 Flangeway gaps and track gauge - flangeway gaps at swing nose crossings

4.5.5.1 A minimum flangeway gap of 85 mm shall be maintained at the nose of swing nose crossings. A flangeway gap of not less than 60 mm, to provide a minimum free wheel passage of 1375 mm, shall be maintained elsewhere through the crossing.

4.5.5.2 There are particular compliance requirements associated with this section as set out in clause 5.1.5.2.

4.6 Particular requirements for train operated points

4.6.1 The point mechanism shall maintain all moveable track components in the correct position during the passage of a train in the facing direction.

4.6.2 Failure to move to the reverse position on train operated points without facing point lock under a trailing move shall not result in a derailment, but shall result in loss of detection if the points subsequently fail to return to the normal position.

4.6.3 Failure to unlock for a trailing movement on train operated points with facing point lock shall not result in a derailment, but shall result in loss of detection.

4.7 Limits on wear and damage to switches, switch diamonds and swing nose crossings

4.7.1 The infrastructure manager shall define limits of wear and damage to switches, switch diamonds and swing nose crossings installed in the running lines. The limits shall be compatible with the dimensional limits for wheels and wheelsets as set out in GM/RT2466. The limits shall identify when points shall be secured out of use because of an immediate risk of derailment. The limits defined shall, in particular, address the risk of derailment arising from the following circumstances:

a) Where the stock rail and switch rail are both sideworn, particularly where the angle of sidewear on the switch rail is flatter than that on the stock rail.

b) Where a sideworn stock rail is associated with a little used switch rail.

c) Where head wear on the stock rail reduces the difference in height between the stock rail and the switch rail.

d) Where there is damage to the blade of the switch rail, particularly within 2 m of the switch toe.

e) Where a switch rail develops a sharp gauge corner profile or edge, particularly when associated with austenitic manganese steel and heat treated steel.

4.8 Requirements for crossings

4.8.1 Selection of crossings

4.8.1.1 Fixed acute (common) crossings shall not be used where the angle of the crossing is flatter than 1 in 35. Swing nose crossings shall be used where an acute crossing angle flatter than 1 in 35 is required.

4.8.1.2 Fixed obtuse crossings shall not be used where:

a) The angle of the crossing is flatter than 1 in 8.

b) The permissible or enhanced permissible speed exceeds 105 mph.

c) The cant on either route through the crossing exceeds 100 mm.

d) Negative cant in excess of 65 mm occurs on either route through the crossing (see section 2.5.6).

e) The radius of either track is sufficiently small to give rise to an appreciable risk that a wheel flange may pass on the wrong side of a point rail nose.

4.8.1.3 The wheel transfer area between crossing nose and wing rail of fixed crossings shall be protected on the opposite running rail by a check rail on each route.

4.8.1.4 Raised check rails shall only be used in S&C in third or fourth rail electrified areas where the raised check rail presents no possible conflict with the collector shoe.

4.8.1.5 GC/RT5212 sets out requirements for lower sector gauge. These requirements place limits on maximum height and position of check rails for fixed crossings.

4.8.2 Flangeway gaps and check gauges for fixed crossings

4.8.2.1 GM/RT2466 sets out dimensional limits for wheels and wheel sets, including the distance between wheel flange backs. Flangeway gaps and check gauges shall be compatible with the dimensions set out in GM/RT2466.

4.8.2.2 GM/RT2466 assumes a nominal check gauge of 1391 mm.

Part 5 Application of this document

5.1 Application - infrastructure managers

5.1.1 Scope

5.1.1.1 The requirements of this document apply to all track in running lines and sidings on Network Rail controlled infrastructure. Its validity is limited to:

a) Track with permissible or enhanced permissible speeds up to and including 140 mph.

b) Track which carries vehicles with axle loads no greater than 25.5 tonnes.

5.1.1.2 It is permissible for the infrastructure manager to designate specific infrastructure projects, ongoing when this document comes into force, for which compliance with the requirements of this document applicable to the design, construction and commissioning of new or altered infrastructure is not mandatory. When designating such projects, the infrastructure manager shall consider:

a) Its responsibilities under its current safety authorisation.

b) The stage reached by the project at the time this document comes into force (for example, approval in principle).

c) Whether compliance is necessary to ensure compatibility with other parts of the infrastructure.

d) Whether compliance is necessary to facilitate safe interworking having regard to changes to related requirements mandated on another infrastructure manager or railway undertaking.

e) The economic impact of compliance, but subject to its current safety authorisation in relation to the infrastructure in question.

5.1.1.3 Compliance with the requirements of this document relating to maintenance and in-service condition of infrastructure is mandatory, whether or not the infrastructure concerned is the subject of a designation, as set out above.

5.1.2 Exclusions from scope

5.1.2.1 Derailers and scotch blocks, when operated by an external command, are classified as points for the purposes of this document.

5.1.2.2 Parts 2 and 3 of this document do not apply to derailers and scotch blocks. Only the following sections of Part 4 apply to derailers and scotch blocks:

a) Identification of points (section 4.1).

b) Detection of points (section 4.4).

5.1.3 Compliance with Part 2 of this document

5.1.3.1 The requirements of sections 2.1 to 2.10 apply to the design of new and re-laid track and to the design of track geometry alterations (other than minor maintenance re-alignments).

5.1.3.2 The requirements of section 2.11 apply to all track (existing, re-laid and new).

5.1.3.3 Requirements relating to permissible speed (section 2.3), enhanced permissible speed (section 2.4), cant deficiency (sections 2.5.7 to 2.5.14), rate of change of cant (sections 2.6.5 and 2.6.6), rate of change of cant deficiency (sections 2.6.7, 2.6.8 and 2.6.9) and maximum vertical acceleration (clause 2.7.3.1) also apply when the speed of trains using existing tracks is increased.

5.1.3.4 Where it is known, or becomes known, that existing small radius curves do not comply with the requirements of section 2.5.5, action to bring them into compliance is required within six months of discovery.

5.1.3.5 Existing track may have been designed and constructed to standards that differ from those specified in Part 2. Where site constraints make it not reasonably practicable to comply with the requirements for minimum horizontal curve radii (sections 2.5.1 and 2.8.1) and minimum vertical curve radii (sections 2.7.3 and 2.8.2), it is permissible to retain the existing horizontal radii and vertical curves.

5.1.4 Compliance with Part 3 of this document

5.1.4.1 The requirements of Part 3 apply to the design and construction of new and re-laid track.

5.1.4.2 The requirements relating to rail head width and sidewear (section 3.2.5), rail depth and loss of section – prevention of wheel/fishplate strikes (section 3.2.6), interface between rail ends to be permanently joined (section 3.2.7), gaps between rail ends (section 3.2.8) and check rails on curves (section 3.2.9) also apply to existing track.

5.1.4.3 The requirements of section 3.3.1 apply to new trackbed and trackbed renewals (see definitions of ‘new trackbed’ and ‘renewal [of trackbed]’).

5.1.5 Compliance with Part 4 of this document

5.1.5.1 The requirements of part 4 of this document (Particular requirements for switches and crossings) apply to the design and construction of new and re-laid switches and crossings, and existing switches and crossings except as set out in clause 5.1.5.2.

5.1.5.2 The requirements for minimum flangeway and free wheel passage (sections 4.5.3 and 4.5.5) apply to new designs of switches and current designs of switches with a design minimum flangeway gap of 60 mm (for example NR60). It is permissible to perpetuate historic designs of switches with a design minimum flangeway gap of less than 60 mm, provided the flangeway gap is maintained in accordance with the relevant predecessor to this document.

5.1.6 General compliance date for infrastructure managers

5.1.6.1 This Railway Group Standard comes into force and shall be complied with from 02 June 2007, except as specified in section 5.1.7.

5.1.6.2 After the compliance dates or the date by which compliance is achieved if earlier, infrastructure managers are to maintain compliance with the requirements set out in this Railway Group Standard. Where it is considered not reasonably practicable to comply with the requirements, authorisation not to comply should be sought in accordance with the Railway Group Standards Code.

5.1.7 Exceptions to general compliance date

5.1.7.1 There are no exceptions to the general compliance date specified in clause 5.1.6 for infrastructure managers.

5.2 Application - railway undertakings

5.2.1 There are no requirements applicable to railway undertakings.

5.3 Health and safety responsibilities

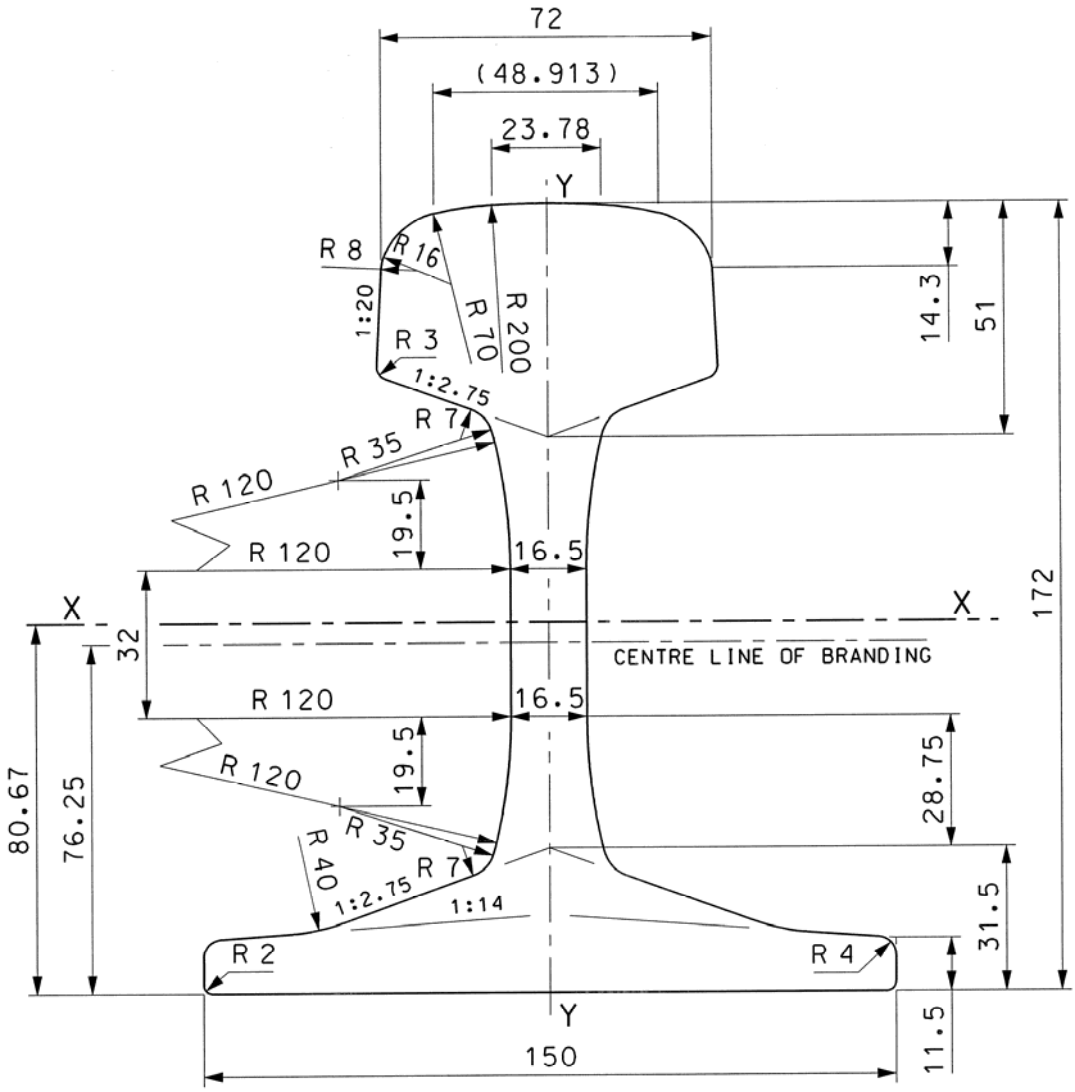
5.3.1 Users of documents published by RSSB are reminded of the need to consider their own responsibilities to ensure health and safety at work and their own duties under health and safety legislation. RSSB does not warrant that compliance with all or any documents published by RSSB is sufficient in itself to ensure safe systems of work or operation or to satisfy such responsibilities or duties.

Appendix A Rail profile 60 E 2

The content of this appendix is mandatory, in so far as it relates to the rail head profile (see clause 3.2.1.1).

A.1 Rail profile 60 E 2

A.1.1 Pending publication of the revised High Speed Infrastructure TSI and the revised BS EN 13674-1, this appendix sets out the 60 E 2 rail profile.



Cross-sectional area	:	76.48	cm^2
Mass per metre	:	60.03	kg/m
Moment of inertia x-x axis	:	3021.5	cm^4
Section modulus-Head	:	330.8	cm^3
Section modulus-Base	:	374.5	cm^3
Moment of inertia y-y axis	:	510.5	cm^4
Section modulus y-y axis	:	68.1	cm^3

Appendix B Guidance on identification of points

The content of this appendix is not mandatory and is provided for guidance only.

B.1 Point identity

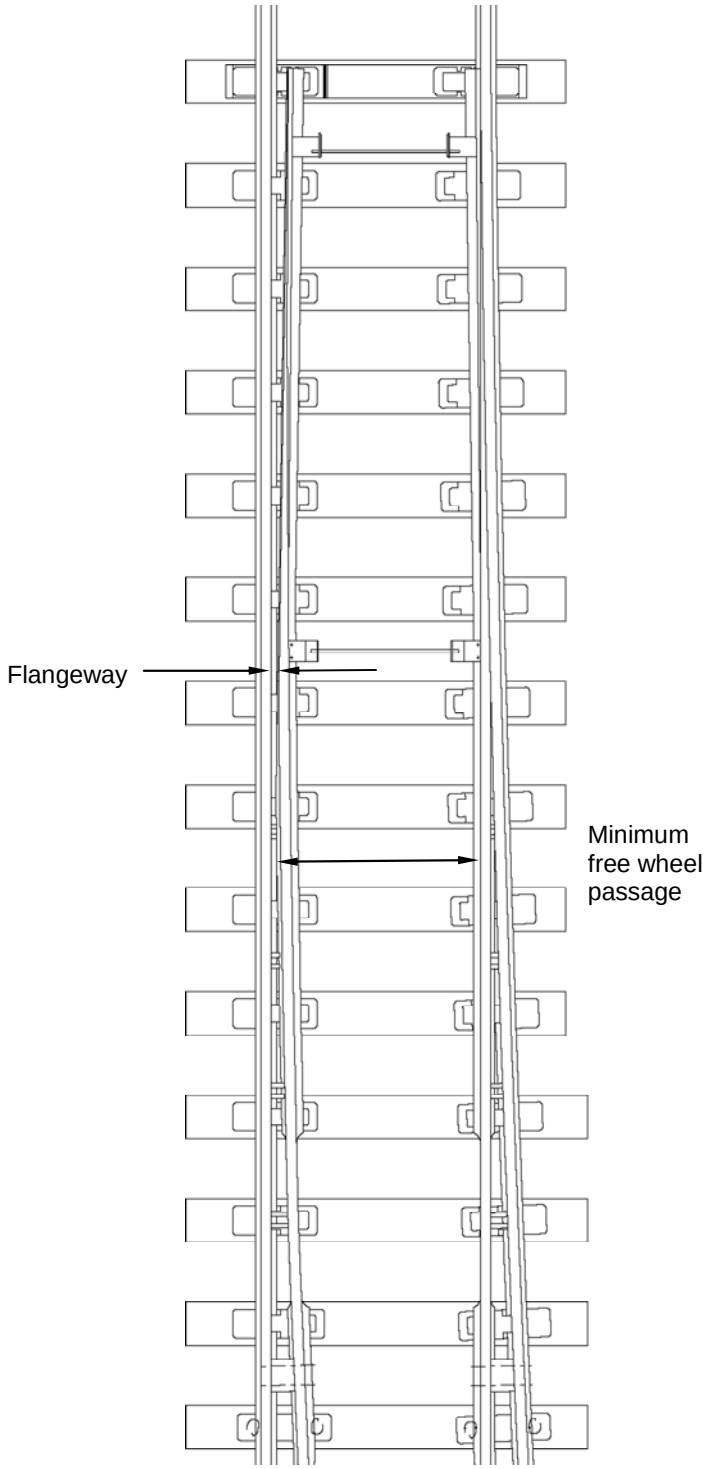
B.1.1 Points with two or more ends that are required to be operated by the same interlocking element should be identified by a common identity and a unique suffix for each end. Each signal box should have a convention for the allocation of suffixes. Where practicable, the suffixes for new layouts should increment alphabetically in the down direction. Where existing layouts are modified established conventions should be followed.

Appendix C Free wheel passage and flangeway in switches

The content of this appendix is not mandatory and is provided for guidance only.

C.1 Free wheel passage and flangeway in switches

C.1.1 This diagram is provided to support the definition of free wheel passage and also indicates the flangeway in switches.



Definitions

Adjustment switch

A scarf joint installed at the junction of continuous welded rail and jointed track to accommodate expansion of the continuous welded rail track. Adjustment switches are also used to protect track features such as S&C not designed for use in CWR and at the ends of some types of bridges. An adjustment switch is a particular type of expansion device and is also known as an expansion switch.

Ballast

Nominally single–sized granular material of specified properties, placed on the blanket (where provided), subgrade or structure to provide vertical and lateral support to the sleepers or bearers.

Bearer

A transverse beam that provides vertical and lateral support to S&C, usually cut from hardwood or softwood or made of steel or pre-stressed concrete.

Buffer stop

An assembly provided at the end of a terminal track to arrest an overrunning train, designed to take the impact of the train at buffer or coupling height.

Cant

For the purposes of this document, cant is expressed as the design difference in level, measured in millimetres, between rail head centres (generally taken to be 1500 mm) of a curved track.

Cant deficiency

The difference between actual cant and the theoretical cant that would have to be applied to maintain the resultant of the weight of the vehicle and the effect of centrifugal force, at a nominated speed, such that it is perpendicular to the plane of the rails. For the purposes of this document, cant deficiency is always the cant deficiency at the rail head, not that experienced within the body of a vehicle.

Cant gradient

The rate at which cant changes in a specific length.

Catch point

Points provided for derailing a vehicle running back on a gradient in the wrong direction.

Check gauge

The distance between the running edge of a running rail and the bearing face of the opposite check rail, measured at right angles to the rails in a plane 14 mm below their top surface.

Check rail

A rail or special section provided alongside a running rail at a specified dimension inside gauge to provide a flangeway, to give guidance to wheelsets by restricting lateral movement of the wheels.

Clamp lock

A point operating mechanism which locks the points by directly clamping the closed switch rail to the stock rail.

Clothoid spiral (transition curve)

A transition curve between a straight and a curve where the curvature (the reciprocal of the radius) is proportional to the distance along the curve from its tangent point with the straight.

Crossing

A cast or fabricated portion of the track layout which enables the rails of the two tracks to cross each other, while still providing support and guidance for smooth passage of the vehicle's wheels.

Crossing vee

Two rails which are joined at an acute angle.

Curvature

The reciprocal of the radius of a curve.

Cyclic top

Cyclic top is the term used to describe a series of regular dips in the vertical alignment of one or both rails. They may not always be apparent visually because other top irregularities may obscure the cyclic pattern. Cyclic irregularities in track geometry have the potential, when combined with a vehicle's natural vertical response for a given speed and load, to cause a derailment.

CWR

Abbreviation for 'continuous welded rail':

a) Rails installed in the track that have been welded together to form a single rail greater than a nominal 55 m in length.

b) Track constructed with continuous welded rail.

Derailer

A device attached to a rail that will, when in its effective position, cause the derailment of a vehicle. It is used to guard against unauthorised movements.

Detection

A mechanism that proves and provides an output to indicate the actual position of a point end (normal or reverse), and that where fitted, the facing point lock is fully engaged.

Dynamic sleeper support stiffness

The peak load divided by the peak deflection of the underside of a rail seat area of an unclipped sleeper subjected to an approximately sinusoidal pulse load at each railseat; the pulse load being representative in magnitude and duration of the passage of a heavy axle load at high speed, typically 20 tonnes at 100 mph. A falling weight deflectometer can be used to measure dynamic sleeper support stiffness directly.

Enhanced permissible speed

The permitted speed (higher than the permissible speed) over a section of line which applies to a specific type of train operating at cant deficiencies in excess of those permitted at the permissible speed. Enhanced permissible speeds are detailed in the Sectional Appendix. There may be more than one enhanced permissible speed applicable to a given section of line.

External command

An instruction sent to the point operating mechanism by the interlocking to move the point ends to the normal or reverse position.

Facing point lock

A mechanical means of physically locking points in the normal or reverse position so that they cannot be moved other than in response to an external command or manual operation. The lock may be provided independently or incorporated into a point operating mechanism.

Flange

The projecting rim of a rail vehicle wheel.

Flangeway gap

The gap provided to permit the passage of the wheel flanges of rail vehicles, for example between a check rail and a running rail.

Free wheel passage

The dimension provided to allow a wheelset to pass through a set of switches or a swing nose crossing, without undesirable contact being made with the wheel flange back and the open switch rail or crossing. In switches this dimension is taken from the back edge of an open switch rail and the running edge of the closed switch rail.

Fully fabricated crossing

Fully fabricated crossings are made by machining rolled rails to produce a point rail and a splice rail fastened together with bolts or multi-groove locking pins. The wing rails are produced from rolled rail and are fastened to the vee by bolts or multi–groove locking pins.

Gauge point

The point of intersection of the gauge corner radius and the flat side of the rail head. For 60E1 and BS113A rails this is nominally 14.5 mm below the top of the rail head, measured parallel to the vertical axis of the rail.

Head width

The width of the rail head measured perpendicular to the vertical axis of the rail at the gauge point.

Jointed track

A method of track construction where rails are joined together by fishplates, with an expansion gap between rail ends.

Level crossing

An intersection at the same level of a road, footpath or bridleway and one or more railway tracks.

Lightweight sleepers

Sleepers installed in CWR or jointed track that have reduced resistance to lateral forces when compared with concrete sleepers, for example softwood sleepers and non-spade ended steel sleepers.

Loaded track gauge

The track gauge measured in a loaded condition, representing the track gauge under the passage of trains. See also ‘track gauge’.

Lock stretcher bar

A bar that connects together the two switch rails of a set of switches and which incorporates or is connected to a bolt which locks the switch rails in the normal or reverse position.

Longitudinal timber

A timber parallel to and supporting a running rail.

Loss of section

The reduction in the cross sectional area of a rail, compared to that when new.

Misalignment

Deformation or displacement of a rail or track from its designed alignment.

Negative cant

Cant is negative when the inner rail of a curve track is raised above the level of the outer rail. Also known as adverse cant.

New trackbed

Trackbed layers placed where there was previously no track. Compare with 'Renewal (of trackbed)'.

Non-ballasted track

Track that is not supported on ballast, including concrete slab track, track supported on longitudinal timbers and directly fastened track on bridges.

Normal and reverse

The two defined positions for worked points that are set by the signalling system. The normal and reverse position of each point end is determined by the configuration of the signalling arrangement.

Obtuse crossing

An assembly to permit the passage of wheel flanges where two rails intersect at an obtuse angle.

Out of use points

Points not in use, either newly laid in, awaiting commissioning, temporarily decommissioned or awaiting removal.

Overspeed

The amount by which the actual speed of a train could exceed the enhanced permissible speed for any reason.

Permissible speed

The maximum permitted speed over a section of line that applies to trains when not operating at an enhanced permissible speed. Permissible speeds are detailed in the Sectional Appendix.

Plain line

Track not incorporating switches and crossings. The term 'plain line' therefore excludes the through route of S&C.

Point end

An item with a movable track component forming one element in a set of points. For the purpose of this document, the term includes a set of switches, one half of a set of switch diamonds, a swing nose crossing, all forms of trap points, a derailer or a scotch block.

Point operating mechanism

Equipment provided to drive a point end between the normal and reverse positions, using powered or mechanical means.

Points

A group of one or more point ends which are operated together by a common external command and may be aligned to one of two positions, normal or reverse, according to the train movement required.

Primary drive

The point operating mechanism positioned at the toe of points.

Rail fastenings

Any device used to secure running rails into chairs or baseplates or directly to sleepers, bearers or other rail supports.

Rate of change of cant

The rate at which a vehicle experiences the change in design cant measured in millimetres per second.

Rate of change of cant deficiency

The rate at which a vehicle experiences the change in design cant deficiency measured in millimetres per second.

Renewal (of trackbed)

The replacement of existing trackbed layers or provision of new trackbed layers. For the purposes of this document, renewal includes remodelling, relaying, track lowering and reballasting.

The replacement of former trackbed layers or provision of new trackbed layers when track that has been removed is subsequently re-instated is classed as a 'renewal' for the purposes of this document, not a 'new trackbed'.

Reverse curve

Two abutting curves of opposite flexure or hand.

Running line

A line as shown in Table A of the Sectional Appendix.

Scotch block

A device attached to a rail that will, when in its effective position, prevent the movement of stationary vehicles.

Sidewear

The loss of head width on the running edge of the rail measured perpendicular to the vertical axis of the rail at the gauge point.

Sleeper

A transverse beam that provides vertical and lateral support to plain line running rails, rail fastenings and where appropriate check rails, guard rails, conductor rails and ancillary operating equipment.

Standard deviation

Standard deviation is a universally used scientific measure of the variation of a random process. Track profiles have been found to have sufficiently similar statistical properties to random processes to enable a measure of the magnitude of track irregularities to be obtained from the standard deviation of the vertical and horizontal profile data. This form of analysis provides track quality indices.

Stretcher bar

A bar that connects together the two switch rails of a set of switches to maintain flangeway gaps.

Structure

Something built to support or retain a load. For the purposes of this document, the term includes bridges, viaducts, tunnels and culverts, but excludes earthworks.

Supplementary detection

One or more additional point detectors provided to prove the position of switch rails at a distance from the switch toes.

Supplementary drive

A drive provided where necessary in addition to the primary drive to ensure that switch rails or a swing nose crossing are correctly aligned and provide an adequate flangeway gap throughout their length. For the purpose of this document, the term 'supplementary drive' includes back drives and supplementary point operating mechanisms.

Swing nose crossing

A common crossing in which the crossing vee can move laterally to close the flangeway to one or other of the wing rails to provide continuous support to wheelsets. This type of crossing does not require the use of check rails. A swing nose crossing counts as one point end.

Switch diamonds

A set of switch diamonds consists of two obtuse crossings in which the obtuse point rails are replaced by switch rails and a check rail is not required. A set of switch diamonds counts as two point ends.

Switches

A set of switches consists of two fixed stock rails with their two associated moveable switch rails. A set of switches counts as one point end.

S&C

Abbreviation for switch and crossing. A track layout incorporating switches and/or crossings that allows one track to cross another or diverge from or merge with another.

Switch toe

The end of the switch rail that is traversed first by a vehicle negotiating the switch in the facing direction.

Through route and turnout route in S&C

In most S&C the through route is the one that carries the majority of traffic and is usually the route through which permissible speed remains unchanged. The turnout route is typically the one that carries less traffic and usually has a permissible speed substantially lower than that of the through route.

Tight joint

Non-insulated connection of two rails by means of specially drilled fishplates and rail fastening devices but without an expansion gap between the rail ends.

Track fault

A hazardous track geometry condition requiring remedial attention. In this document, the conditions covered by this term include twist (unintentional or non-compliant variation in cross level), track gauge, vertical profile (including cyclic top) and lateral alignment.

Track gauge

The distance between the running edges of the rails in a track, measured without load at right angles to the running edges of the rails in a plane 14 mm below their top surface. See also 'Loaded track gauge'.

Track system

The assemblage of rails, rail supports, rail fastenings, sleepers, timbers or bearers and ballast or other forms of support, acting together to provide guidance and support for rail vehicles.

Trackbed

A general term referring to the ballast, blanket and subgrade.

Trackbed layers

A general term referring to all layers placed between the subgrade and the underside of sleepers or bearers.

Train operated points

Points which are designed for use in running lines with facing movements in the normal position only. They are operated by the passage of trains in the trailing reverse direction. They are restored to the normal position by the point operating mechanism after the passage of each train (compare with 'worked points'). 'Hydro-pneumatic self restored points' are a type of train operated points.

Transition curve

A curve between a straight and a curve, or between curves of different radius, along which the radius changes in a regular (though not necessarily uniform) manner.

Trap points

Facing points provided at an exit from a siding or converging line to de-rail an unauthorised movement, thus protecting the adjacent Running Line.

Twist fault

A difference in cross-levels over a short distance (usually measured over 3 m) that is greater than a predetermined amount.

Twist rail

A length of rail that changes in inclination from generally 1 in 20 to generally vertical.

Unworked points

Points not controlled by the signalling system, other than train operated points. Hand points, runaway catch points and spring operated points (usually only used as trap or catch points) are examples of unworked points.

Vertical curve

A curve joining two track gradients in their vertical alignment.

Worked points

Points which are controlled by the signalling system (compare with 'train operated points').

References

The Catalogue of Railway Group Standards and the Railway Group Standards CD-ROM give the current issue number and status of documents published by RSSB. This information is also available from www.rgsonline.co.uk.

Documents referenced in the text

RGSC01	The Railway Group Standards Code

Railway Group Standards

GC/RT5033	Terminal Tracks – Managing the Risk
GC/RT5212	Requirements for Defining and Maintaining Clearances
GE/RT8012	Controlling the Speed of Tilting Trains Through Curves
GI/RT7006	Prevention and Mitigation of Overruns – Risk Assessment
GI/RT7016	Interface between Station Platforms, Track and Trains
GK/RT0011	Train Detection
GK/RT0039	Semaphore and Mechanical Signalling
GK/RT0064	Provision of Overlaps, Flank Protection and Trapping
GM/RT2141	Resistance of Railway Vehicles to Derailment and Roll-Over
GM/RT2142	Resistance of Railway Vehicles to Roll-Over in Gales
GM/RT2466	Railway Wheelsets
GM/TT0088	Permissible Track Forces for Railway Vehicles

RSSB documents

GC/RC5521	Calculation of Enhanced Permissible Speeds for Tilting Trains

Other References

BS EN13674-1	Railway Applications – Track- Rail – Part 1: Vignole railway rails 46 kg/m and above