

Rail Industry Guidance Note
GIGN7608
Issue: Two
Date: September 2016

Guidance on the Infrastructure Technical Specification for Interoperability

Synopsis

This document gives guidance on interpreting the requirements of the Infrastructure Technical Specification for Interoperability 2014 (INF TSI), Commission Regulation (EU) No. 1299/2014 for application to the GB mainline railway.

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Issue Record

Issue	Date	Comments
One	01/06/2013	Original document: Guidance on the Conventional Rail and High Speed Infrastructure Technical Specifications for Interoperability (TSIs). This document provides guidance on the requirements set out in the Infrastructure TSIs, clarifies terms that are particular to Great Britain and indicates where there are specific cases.
Two	03/09/2016	Replaces issue one. This document provides guidance on the combined Infrastructure TSI.

This document will be updated when necessary by distribution of a complete replacement.

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Superseded Documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
GIGN7608 Issue 1	All	03/09/2016
GCGN5612 Issue 1	Appendix A	03/09/2016

GIGN7608 Issue 1 is withdrawn as of 03 September 2016.

Supply

The authoritative version of this document is available at www.rssb.co.uk/railway-group-standards. Enquiries on this document can be forwarded to enquirydesk@rssb.co.uk.

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Part 1 Introduction

1.1 Purpose

1.1.1 This document gives guidance on interpreting the requirements of the Infrastructure Technical Specification for Interoperability 2014 (INF TSI), Commission Regulation (EU) No. 1299/2014 for application to the GB mainline railway. This document does not set out requirements.

1.1.2 This document is intended to provide clarification on the requirements set out in the INF TSI for Interoperability that can be misinterpreted due to ambiguity. This document also gives guidance to clarify terms that are particular to Great Britain (GB) and indicates where there are specific cases.

1.1.3 This document is intended to assist project entities, infrastructure managers, railway undertakings and conformity assessment bodies in understanding their responsibilities in relation to interpreting and applying the technical requirements of the INF TSI. It does not constitute a recommended method of meeting any set of mandatory requirements. The INF TSI is to be used in conjunction with National Technical Rules (NTRs) and company standards in order to define the complete infrastructure system.

1.1.4 European Union Agency for Railways (EUAR) and the TSI experts group prepared a 'Guide for the Application of the CR INF TSI'. The Application Guide can be found at <http://www.era.europa.eu/Document-Register/Documents/IU-TSI-Guide-Annex01-INF-v2-00.pdf>.

1.1.5 GIGN7608 does not replicate existing guidance published by the ERA in their Application Guide and therefore the TSI Application Guide of the INF TSI is also useful in conjunction with the INF TSI. Attention has been drawn to some areas where the Application Guide is particularly relevant to GB but other areas may also be useful.

1.2 Structure of this document

1.2.1 Relevant requirements from the INF TSI are reproduced with a grey background in this document.

1.2.2 Guidance is provided immediately below the greyed text to which it relates.

1.2.3 Sufficient of the TSI text is reproduced to put the guidance in context but not all the text is included.

1.2.4 Where GB specific cases are included in the INF TSI, the text of these is included in this document immediately following the main clause to which the specific case refers. It is then followed by related guidance.

1.3 Approval and Authorisation

1.3.1 The content of this document was approved by Infrastructure Standards Committee on 06 July 2016.

1.3.2 This document was authorised by RSSB on 15 July 2016.

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Part 2 Guidance for TSI Chapters 1, 2 and 3 and Generic Topics

2.1 INF TSI scope extension

2.1.1 Merging of two TSIs into one

2.1.1.1 As of the 01 January 2015 the INF TSI now applies to all new infrastructure, and upgrades or renewals to existing infrastructure on the entire GB mainline rail system network in the scope of the Railway (Interoperability) Regulations 2011, and not just to infrastructure on the part of the network classified as part of the Trans-European Transport Network (TEN-T), as in previous TSIs.

2.1.1.2 The Department for Transport (DfT) provides information on the precise geographical scope on their website: <https://www.gov.uk>.

2.1.1.3 The INF TSI now covers requirements for both high speed and conventional speed rail system networks. The high speed and conventional rail infrastructure requirements were previously contained in separate TSIs: the High Speed Infrastructure TSI and the Conventional Rail Infrastructure TSI. The updated INF TSI effectively merges the technical scope of the two previous TSIs into one document.

2.2 INF TSI Chapter 2

2.2.1 Interfaces of INF TSI with other TSIs

2.2.1.1 The INF TSI has been developed by the EUAR to be in harmony with other TSIs. Key interfaces exist with the Rolling Stock TSIs for Locomotives and Passenger Vehicles (LOC & PAS TSI) and for Wagons (WAG TSI).

2.2.1.2 Both the Persons with Reduced Mobility TSI (PRM TSI) and the Safety in Rail Tunnels TSI (SRT TSI) include requirements related to the infrastructure sub-system.

2.2.1.3 The Energy TSI (ENE TSI) contains requirements related to infrastructure assets such as parapet heights for bridges over overhead electrified lines and clearance to live parts of the overhead contact line (OCL) or the vehicle from places where people may stand.

2.2.1.4 GB specific guidance on these other TSIs is found in:

- GMGN2615 for Conventional Rail Locomotives and Passenger Rolling Stock
- GMGN2688 for Freight Wagons TSI
- GIGN7619 for the Safety in Rail Tunnels TSI
- GLGN1600 for the Energy TSI

2.3 INF TSI general topics

2.3.1 Numeric values

2.3.1.1 The INF TSI uses the standard European notation for numeric values with 'comma' (,) as the decimal point and 'space' () as the thousands delimiter. Thus, for example, 2,5 mm/m is to be understood as 2.5 mm/m and 1 435 mm is to be understood as 1435 mm.

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Part 3 Guidance for TSI Chapter 4 and UK (GB) Specific Cases in 7.7.17

3.1 INF TSI Chapter 4.1 Functional and technical specifications

3.1.1 Section 4.1 of the INF TSI recognises that the TSIs are not to be an obstacle to running trains that were not built to the rolling stock TSIs and may have been in service for a number of years. In this context, the TSI provides a minimum level for infrastructure provision, but additional requirements might be necessary for running other (legacy) trains.

INF TSI
4.1 Introduction
(2) The limiting values set out in this TSI are not intended to be imposed as usual design values. However, the design values must be within the limits set out in this TSI.

3.1.2 It is important to recognise that the TSI is not a design guide and that design and construction of railway infrastructure is generally based on the application of standards, good practice etc. There may be situations where it is appropriate to use design or in-service values that are more restrictive than those set out in the INF TSI, when the use of such values does not prevent the operation of TSI compliant rolling stock.

3.1.3 It is important to recognise that, even for new high speed lines, engineering trains would need to work on the route and that connections with the domestic network are likely to be needed.

3.1.4 Many of the limits for particular parameters are specified as in-service limits. Design limits are generally required to provide for a suitable inspection and / or detection regime, appropriate understanding of deterioration and timely rectification and / or maintenance before the in-service limits are reached.

INF TSI
4.1 Introduction
(5) Where reference is made to EN standards, any variations called 'national deviations' in the EN do not apply, unless otherwise specified in this TSI.

3.1.5 Within European Standards (ENs) the following types of national deviations may exist:

- An A-deviation is a national deviation due to a conflict between the requirement in the EN and domestic regulations or conditions the alteration of which is, at least for the time being, outside the competence of the National Committee. This is effectively a derogation.
- A B-deviation is a national deviation due to particular technical requirements permitted to be maintained only for a specified transitional period in the Member State.

3.1.6 ENs may also contain the following national provisions that are not deviations:

- National conditions are national characteristics or practices that cannot be changed even over a long period, for example climatic conditions, electrical earthing conditions etc. Provisions relating to special national conditions may be included in the standard as an Annex.
- National Determined Parameters (NDPs), to suit local geographical, geological and climatic conditions. NDPs are published in each EU Member State as a National Annex.

3.1.7 The 'national deviations' referred to in clause 4.1 are considered to be A-deviations and B-deviations.

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3.1.8 The 'Structures Resistance to Traffic Loads' section of the INF TSI (4.2.7) requires the use of EN 1991-2:2003/AC:2010 'UK National Annex to Eurocode 1: Actions on structures –Part 2: Traffic loads on bridges' and Annex A2 to EN 1990:2002 'Eurocode - Basis of structural design' (issued as EN 1990:2002/A1:2005) 'to be applied in accordance with the corresponding points in the national annexes to these standards if they exist'. These national annexes therefore can be applied.

3.1.9

INF TSI
4.1 Introduction
(6) Where line speeds are stated in [km/h] as a category or performance parameter in this TSI, it shall be allowed to translate the speed to equivalent [mph] as in Appendix G, for Ireland and for the United Kingdom of Great Britain and Northern Ireland networks.

3.1.10 The INF TSI uses km/h in a number of clauses to differentiate between requirements. Strict arithmetical conversion of these figures to mph would lead to inappropriate requirements for the GB mainline railway. For example, 'speeds greater than 200 km/h' would include 125 mph, which is not the intention. Appendix G of the INF TSI sets out agreed values that are to be used to convert from km/h to mph where the figures are used to differentiate requirements.

3.2 TSI Categories of line

INF TSI
4.2.1 TSI Categories of Line
(3) The TSI category of line shall be a combination of traffic codes. For lines where only one type of traffic is carried (for example a freight only line), a single code can be used to describe the requirements; where mixed traffic runs the category will be described by one or more codes for passenger and freight. The combined traffic codes describe the envelope within which the desired mix of traffic can be accommodated.
(4) For the purpose of TSI categorisation, lines are classified generically based on the type of traffic (traffic code) characterised by the following performance parameters: • gauge, • axle load • line speed • train length • usable length of platform The columns for 'gauge' and 'axle load' shall be treated as minimum requirements as they directly control the trains that may run. The columns for 'line speed', 'usable length of platform' and 'train length' are indicative of the range of values that are typically applied for different traffic types and they do not directly impose restrictions on the traffic that may run over the line.
(10) Article 5(7) of Directive 2008/57/EC states: 'The TSIs shall not be an impediment to decisions by the Member States concerning the use of infrastructures for the movement of vehicles not covered by the TSIs.' It is therefore allowed to design new and upgraded lines such that will also accommodate larger gauges, higher axle loads, greater speeds, greater usable length of platform and longer trains than those specified.

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INF TSI
4.2.1 TSI Categories of Line
(12) It is permissible for specific locations on the line to be designed for any or all of the performance parameters line speed, usable length of platform and train length less than those set out in Table 2 and Table 3, where duly justified to meet geographical, urban or environmental constraints.

INF TSI Specific Case UK (GB)
7.7.17.1 TSI categories of line (4.2.1)
(2) Instead of the column 'Gauge' in Table 2 and Table 3 of point 4.2.1(7), for the gauge of all lines except new, dedicated high speed lines of traffic code P1, it shall be allowed to use national technical rules as set out in Appendix Q.

3.2.1 GB has a specific case for structure gauge for all except new dedicated high speed lines. In determining the structure gauge, consideration is given to the trains likely to use the line. The consideration would take account of:

- a) The vehicles for which the route is being built or upgraded.
- b) The potential for additional passenger or freight traffic.
- c) Legacy vehicles that might use the route.
- d) Engineering trains.

3.2.2 Where the specific case applies, it covers both the gauge to be used and the assessment method.

3.3 Line layout

3.3.1 TSI Structure gauge guidance

INF TSI Specific Case UK (GB)
7.7.17.2 Structure gauge (4.2.3.1)
Instead of point 4.2.3.1, for national gauges selected according to point 7.7.17.1(2), the structure gauge shall be set according to Appendix Q.

3.3.1.1 It is recognised that GB does not yet have a suite of 'national gauges' and Appendix Q refers to the Railway Group Standard (RGS) suite of gauging standards for national rules.

3.3.1.2 Where structures are being built or modified, the aim should always be to maximise the potential for the route, complying with the relevant TSI over the long term, unless the additional cost of doing so is disproportionate.

3.3.2 Distance between track centres

INF TSI Specific Case UK (GB)
7.7.17.3 Distance between track centres (4.2.3.2)
(1) Instead of point 4.2.3.2, the nominal distance between track centres shall be 3 400 mm on straight track and curved track with a radius of 400 m or greater.

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INF TSI Specific Case UK (GB)
7.7.17.3 Distance between track centres (4.2.3.2)
(2) Where topographical constraints prevent a nominal distance of 3 400 mm between track centres being achieved, it is permissible to reduce the distance between track centres provided special measures are put in place to ensure a safe passing clearance between trains.
(3) Reduction in the distance between track centres shall be in accordance with the national technical rule set out in Appendix Q.

3.3.2.1 GB practice is to use a nominal interval between running edges of 1970 mm. This gives a distance between track centres of 1970 mm + 1435 mm = 3405 mm, which is consistent with the nominal 3400 mm.

3.3.2.2 For renewed or upgraded lines, options for increasing track centres are constrained by existing infrastructure and railway boundaries. The INF TSI recognises that the distance between track centres is, to an extent, governed by (structure) gauge and passing clearances.

3.3.3 Maximum gradients

INF TSI
4.2.3.3 Maximum gradients
(1) Gradients of tracks through passenger platforms of new lines shall not be more than 2,5 mm/m, where vehicles are intended to be regularly attached or detached.
(2) Gradients of new stabling tracks intended for parking rolling stock shall not be more than 2,5 mm/m unless specific provision is made to prevent the rolling stock from running away.
(3) Gradients as steep as 35 mm/m are allowed for main tracks on new P1 lines dedicated to passenger traffic at the design phase provided the following 'envelope' requirements are observed: a) the slope of the moving average profile over 10 km is less than or equal to 25 mm/m. b) the maximum length of continuous 35 mm/m gradient does not exceed 6 km

3.3.3.1 GB practice is to use 1 in 500 (2 mm/m) as the maximum gradient for new stabling tracks. This is more restrictive than the TSI, but does not restrict access for TSI compliant vehicles.

3.3.3.2 Modern rolling stock is able to operate on steeper gradients, but very steep gradients can constrain the capacity of a mixed railway. They can also present additional traction and braking issues in poor adhesion conditions and result in greater energy use.

3.3.3.3 The design of gradients for new lines is a complex subject and needs to be considered with other system requirements. It is likely that any new high speed line needs to connect with the existing network. As trains, and in particular engineering trains, built to comply with the LOC & PAS TSI and WAG TSIs would probably need to travel on the new line, the maximum gradients for freight and mixed traffic set out in the INF TSI should be considered as gradient limits for any new route construction.

3.3.4 Minimum radius of horizontal curve

INF TSI
4.2.3.4 Minimum radius of horizontal curve
The minimum design radius of horizontal curve shall be selected with regard to the local design speed of the curve.

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INF TSI
4.2.3.4 Minimum radius of horizontal curve
(1) The minimum horizontal design curve radius for new lines shall not be less than 150 m.
(2) Reverse curves (other those in marshalling yards where wagons are shunted individually) with radii in the range from 150 m up to 300 m for new lines shall be designed to prevent buffer locking. For straight intermediate track elements between the curves, Table 43 and Table 44 of Appendix I shall apply. For non-straight intermediate track elements, a detailed calculation shall be made in order to check the magnitude of the end throw differences.

3.3.4.1 The design of curvature is one of the fundamental considerations of a new route. In most situations, the 'curvier' the route the more expensive it is to maintain for both infrastructure and rolling stock. For curvature that would be compatible with trains running on the existing network, NTRs such as GCRT5021 should be considered in addition to the TSI.

3.3.5 Minimum radius of vertical curve

INF TSI
4.2.3.5 Minimum radius of vertical curve
(1) The radius of vertical curves (except for humps in marshalling yards) shall be at least 500 m on a crest or 900 m in a hollow.

3.3.5.1 GB practice is to use 600 m as the minimum radius of vertical curve on a crest (hog). This is more restrictive than the TSI, but does not restrict access for TSI compliant vehicles.

3.3.5.2 Vertical curves should not be used in platforms and in switches and crossings (S&C).

3.4 Track parameters

3.4.1 Nominal track gauge

INF TSI
4.2.4.1 Nominal track gauge
(1) European standard nominal track gauge shall be 1 435 mm.

3.4.1.1 The value of 1435 mm is a description of 'standard gauge' and is not a design value.

3.4.1.2 Work carried out for the EUAR Dynamics Working Party, as part of the development of the current INF TSI, recommends that design track gauge for plain line should be 1435 mm (- 0 mm, + 4 mm), in order to avoid problems with in-service equivalent conicity.

3.4.1.3 Network Rail 'CEN 56' S&C designs have a nominal track gauge of 1432 mm and there is concern that this is inconsistent with the required nominal track gauge of 1435 mm. The CEN 56 S&C designs comply with the required dimensions given in clause 4.2.8.6 of the INF TSI and the associated GB Specific Case in 7.7.17.5. The nominal track gauge requirement is not relevant for S&C as the required dimensions in clause 4.2.8.6 of the INF TSI are sufficient for wheelset compatibility.

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3.4.2 Cant

INF TSI
4.2.4.2 Cant
(1) The design cant for lines shall be limited as defined in Table 7.
(2) The design cant on tracks adjacent to station platforms where trains are intended to stop in normal service shall not exceed 110 mm.
New lines with mixed or freight traffic on curves with a radius less than 305 m and a cant transition steeper than 1 mm/m, the cant shall be restricted to the limit given by the following formula: $D \leq (R - 50)/1,5$ where D is the cant in mm and R is the radius in m.

3.4.2.1 The design of cants for new lines is a complex subject and needs to be considered with other system requirements. It is likely that any new high speed line needs to connect with the existing network and non-high speed trains, such as engineering trains, would probably need to travel on the new line. Maximum cants for any new route construction will need to take such vehicles into account.

3.4.2.2 It is important to recognise that, although most sections of a high speed route would operate at high speed, there will be parts of the network that operate at lower speeds, for example station throats and sidings. For these parts of the network, it is appropriate to consider NTRs set out in GCRT5021, because of the likely need for existing vehicles to use these lines.

3.4.3 Cant deficiency

INF TSI
4.2.4.3 Cant deficiency
(1) The maximum values for cant deficiency are set out in Table 8.
(2) It is permissible for trains specifically designed to travel with higher cant deficiency (for example multiple units with axle loads lower than set out in table 2; vehicles with special equipment for the negotiation of curves) to run with higher cant deficiency values, subject to a demonstration that this can be achieved safely.

3.4.3.1 The design for maximum cant deficiency for new lines is a complex subject and needs to be considered with other system requirements for the project. It is likely that any new high speed line needs to connect with the existing network and non-high speed trains, such as engineering trains, would probably need to travel on the new line. Maximum cant deficiency for any new route construction will need to take such vehicles into account.

3.4.3.2 GB practice is to use 110 mm on continuously welded rail and 90 mm elsewhere as the limiting values for cant deficiency on mixed traffic lines compared with 130 mm in the TSI. This does not restrict access for TSI compliant vehicles. GB freight vehicles are generally not compatible with higher values of cant deficiency.

3.4.3.3 The note (2) states '...subject to a demonstration that this can be achieved safely'. The INF TSI does not give details of what is to be demonstrated. More information on GB practice in this area is set out in GCRT5021.

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3.4.4 Abrupt change of cant deficiency

INF TSI
4.2.4.4 Abrupt change of cant deficiency
(1) The maximum values of abrupt change of cant deficiency shall be: a) 130 mm for $v \leq 60$ km/h, b) 125 mm for $60 \text{ km/h} < v \leq 200$ km/h, c) 85 mm for $200 \text{ km/h} < v \leq 230$ km/h d) 25 mm for $v > 230$ km/h.
(2) Where $v \leq 40$ km/h and cant deficiency ≤ 75 mm both before and after an abrupt change of curvature, the value of abrupt change of cant deficiency may be raised to 150 mm.

3.4.4.1 GB practice addresses maximum cant deficiency (mm) and the rate of change of cant deficiency with respect to time (mm/s). Traditionally abrupt change of cant deficiency is not specifically addressed in GB track design. The principle of the virtual transition can be used to determine an equivalent rate of change of cant deficiency, based upon the assumption that a vehicle travelling over an abrupt change of cant deficiency gains, or loses, cant deficiency over a length equal to the distance between the bogie centres. Historically, in GB the calculation has been based on a bogie centre (chord length) of 12.2 m. A longer chord length may be appropriate where a high speed route is being designed because the bogie centres of vehicles may be significantly longer.

3.4.4.2 GB practice is to disregard rate of change of cant deficiency at switch toes.

3.4.4.3 Switches and crossings (S&C) designs are generally developed in accordance with metric speeds, and the TSI speed categories can be used directly. If conversions from km/h to mph are required, Appendix G of the INF TSI sets out the agreed conversion.

3.4.5 Equivalent conicity

INF TSI
4.2.4.5 Equivalent conicity
(1) The limiting values for equivalent conicity quoted in Table 10 shall be calculated for the amplitude (y) of the wheelset's lateral displacement:
(2) No assessment of equivalent conicity is required for switches and crossings.

INF TSI Specific Case UK (GB)
7.7.17.3 bis Equivalent conicity (4.2.4.5)
(1) Instead of point 4.2.4.5.(3) design values of track gauge, rail head profile and rail inclination for plain line shall be selected to ensure that the equivalent conicity limits set out in Table 32 are not exceeded
(2) Instead of point 4.2.4.5. (4) the following wheelsets shall be modelled passing over the designed track conditions (simulated by calculation according to EN 15302:2008+A1:2010):

3.4.5.1 This specific case was included very late in the drafting process and numbered '7.7.17.3 bis' to avoid renumbering subsequent sub-clauses.

3.4.5.2 The definition of equivalent conicity is set out in BS EN 15302:2008+A1:2010 'Railway applications - Method for determining the equivalent conicity'. This is not the same as the historical method used by British Rail and the two methods can give slightly different results.

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3.4.5.3 The EUAR Application Guide includes a list of the rail profile / gauge / inclination combinations that have been demonstrated to comply with the equivalent conicity values. More information is given in the guidance on clause 6.2.4.6 of the INF TSI below.

3.4.5.4 The GB Specific Case is required as the reference wheelsets specified in the main TSI text are suitable for 1/40 rail inclination but do not give a good reference for 1/20 rail inclination, which is used on the GB network. The requirements are otherwise equivalent.

3.4.5.5 It is normal GB practice that the design values for equivalent conicity are applied to the rail profiles specified for rail grinding (not to the actual achieved profiles). Application of the equivalent conicity limit values will minimise the risk of vehicle instability following grinding.

3.4.6 Railhead profile for plain line

INF TSI
4.2.4.6 Railhead profile for plain line
(1) The railhead profile shall be selected from the range set out in Annex A of EN 13674-1:2011, Annex A of EN13674-4:2006+A1:2009 or shall be in accordance with as defined in point (2).
(2) The design of railhead profiles for plain line shall comprise: a) a lateral slope on the side of the railhead angled to between vertical and 1/16 with reference to the vertical axis of the railhead; b) the vertical distance between the top of this lateral slope and the top of the rail shall be less than 20 mm; c) a radius of at least 12 mm at the gauge corner; d) the horizontal distance between the crown of the rail and the tangent point shall be between 31 and 37,5 mm.

3.4.6.1 The most common rail profiles used on the GB network are BS 113A and CEN60 (either E1 or E2 head profiles) which all meet the requirements set out in (2) above. BS113B (BR variant) is included in EN 13674-1:2011 'Railway applications – Track - Rail Part 1: Vignole railway rails 46 kg/m and above' as 56E1.

3.4.6.2 GCRT5021 sets out more information on the use of other rail sections where required to fit with existing fastenings.

3.4.6.3 It is normal GB practice that design requirements for rail head profile are applied to the rail profiles specified for rail grinding (not to the actual achieved profiles).

3.4.7 Rail inclination – plain line

INF TSI
4.2.4.7 Rail inclination
4.2.4.7.1 Plain line
(1) The rail shall be inclined towards the centre of the track.
(2) The rail inclination for a given route shall be selected from the range 1/20 to 1/40.
(3) For sections of not more than 100 m between switches and crossings without inclination where the running speed is no more than 200 km/h, the laying of rails without inclination is allowed.

3.4.7.1 The nominal rail inclination for the GB network is 1/20. If a different nominal value is selected, then compatibility with the existing network will be difficult to achieve and through-running of vehicles could give rise to problems such as vehicle instability or excessive wear of wheels / rails.