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.
Guidance on the Infrastructure Technical Specification for Interoperability

Issue Record

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<tbody>
<tr>
<td>One</td>
<td>01/06/2013</td>
<td>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.</td>
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<tr>
<td>Two</td>
<td>03/09/2016</td>
<td>Replaces issue one. This document provides guidance on the combined Infrastructure TSI.</td>
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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Superseded Documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

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<td>GIGN7608 Issue 1</td>
<td>All</td>
<td>03/09/2016</td>
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<td>GCGN5612 Issue 1</td>
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GIGN7608 Issue 1 is withdrawn as of 03 September 2016.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](http://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.


1.1.5 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.
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.
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.

<table>
<thead>
<tr>
<th>INF TSI</th>
<th>4.1 Introduction</th>
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<tr>
<td>(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.</td>
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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.

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<tr>
<th>INF TSI</th>
<th>4.1 Introduction</th>
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<td>(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.</td>
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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.

3.1.9

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<th>INF TSI</th>
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<tr>
<td>4.1 Introduction</td>
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<tr>
<td>(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.</td>
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</table>

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

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<tr>
<td>4.2.1 TSI Categories of Line</td>
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<td>(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.</td>
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<tr>
<td>(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:</td>
</tr>
<tr>
<td>• gauge,</td>
</tr>
<tr>
<td>• axle load</td>
</tr>
<tr>
<td>• line speed</td>
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<tr>
<td>• train length</td>
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<tr>
<td>• usable length of platform</td>
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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.
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.
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.
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

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

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.
3.4.2 Cant

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<tr>
<td>4.2.4.2 Cant</td>
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<tr>
<td>(1) The design cant for lines shall be limited as defined in Table 7.</td>
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<td>(2) The design cant on tracks adjacent to station platforms where trains are intended to stop in normal service shall not exceed 110 mm.</td>
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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: $D \leq \frac{(R-50)}{1.5}$ 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

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<td>4.2.4.3 Cant deficiency</td>
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<td>(1) The maximum values for cant deficiency are set out in Table 8.</td>
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<td>(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.</td>
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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.
3.4.4 Abrupt change of cant deficiency

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

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

<table>
<thead>
<tr>
<th>INF TSI</th>
<th>4.2.4.5 Equivalent conicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) The limiting values for equivalent conicity quoted in Table 10 shall be calculated for the amplitude (y) of the wheelset’s lateral displacement:</td>
<td></td>
</tr>
<tr>
<td>(2) No assessment of equivalent conicity is required for switches and crossings.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INF TSI Specific Case UK (GB)</th>
<th>7.7.17.3 bis Equivalent conicity (4.2.4.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(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</td>
<td></td>
</tr>
<tr>
<td>(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):</td>
<td></td>
</tr>
</tbody>
</table>

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.
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; |
| a) | 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.
3.4.8 Rail inclination – switches and crossings

INF TSI
4.2.4.7 Rail inclination
4.2.4.7.2 Requirements for switches and crossings
(1) The rail shall be designed to be either vertical or inclined.
(2) If the rail is inclined, the designed inclination shall be selected from the range 1/20 to 1/40.
(3) The inclination can be given by the shape of the active part of the rail head profile.
(4) Within switches and crossings where the running speed is more than 200 km/h and no more than 250 km/h, the laying of rails without inclination is allowed provided that it is limited to sections not exceeding 50 m.
(5) For speeds of more than 250 km/h the rails shall be inclined

3.4.8.1 In GB there are designs for both vertical S&C (CEN56) and inclined S&C (NR60), the latter inclined at 1/20. Although current designs apply a different nominal track gauge (see guidance 3.4.1 Nominal track gauge on page 13), both designs are consistent with the TSI requirements for rail inclination.

3.4.8.2 Twist rails are used to accommodate the transition between vertical rails in S&C and inclined rails in adjacent plain line. For practicality, short lengths of vertical rail adjacent to vertical S&C are permitted.

3.5 Switches and crossings

3.5.1 Use of swing nose crossing

INF TSI
4.2.5.2 Use of swing nose crossing
For speeds higher than 250 km/h switches and crossings shall be equipped with swing-nose crossings.

3.5.1.1 In GB the selection of swing nose crossings is required for crossing angles flatter than 1 in 35. This is equivalent to layouts with permissible speeds over 125 mph (200 km/h).

3.5.2 Maximum unguided length of fixed obtuse crossings

INF TSI
4.2.5.3 Maximum unguided length of fixed obtuse crossings
The design value of the maximum unguided length of fixed obtuse crossings shall be in accordance with the requirements set out in Appendix J to this TSI.

INF TSI Specific Case UK (GB)
7.7.17.4 Maximum unguided length of fixed obtuse crossings (4.2.5.3)
Instead of point 4.2.5.3, the design value of the maximum unguided length of fixed obtuse crossing shall be in accordance with the national technical rule set out in Appendix Q.

3.5.2.1 The requirement in Appendix J of the INF TSI was taken from a draft version of EN 13232-3 ‘Railway applications - Track - Switches and crossings - Part 3: Requirements for wheel/rail interaction’ at a
late stage in the TSI drafting process. This benchmark is based on tests completed many years ago by the Office for Research and Experiments (ORE) and Deutsche Bahn (DB) in Minden.

3.5.2.2 In the UK, knowledge was developed by British Rail Research, with a number of studies considering small wheels through obtuse crossings; the results of these studies are set out in GMRT2466. The hazard being mitigated by both methods is a lack of lateral guidance of the wheelset through the obtuse crossings, which could allow a wheelset with an angle of attack to take the unintended route, causing damage to the crossing nose and wheel tread or, in the worst case, derailment.

3.5.2.3 Calculating and comparing the unguided length is complex because several parameters are included within each of the assessment methods. Some of these parameters are common to both methods. However, at least one is not, for example, raised check rails are not generally used in GB and are therefore not considered in the UK low speed rule.

3.5.2.4 The GB Specific Case was included as there was not time to assess whether or not the introduced requirements were suitable for the GB mainline network and its existing operation. The crossing configurations set out in GCRT5021 and the rolling stock requirements set out in GMRT2466 have been used as the basis for compatibility checks for GB operation through obtuse crossings.

3.5.2.5 The extract from EN 13232-3, included in Appendix J, is not complete and does not permit assessment for general obtuse crossing designs which may be on curves other than 450 m radius.

3.6 Track resistance to applied loads

3.6.1 General

3.6.1.1 The general practice for the design of track resistance to applied loads is to make reference to existing designs which have been demonstrated to provide satisfactory performance in similar service conditions.

3.6.1.2 Design practice for ballasted track systems has long been based upon compliance with the loads set out in RGSs such as GCRT5021 and GMTT0088. This has resulted in a situation where the satisfactory in-service performance of ballasted track systems based on the compliant operation of vehicles has evolved. Standards for track construction have been developed and refined in the light of experience of satisfactory in-service performance. It is not normal practice to design the track structure from first principles.

3.6.1.3 For slab track systems, practice has involved the application of cross-discipline standards such as EN 1991-2:2003/AC:2010 ‘UK National Annex to Eurocode 1: Actions on structures –Part 2: Traffic loads on bridges’, which is not optimal for the design of the track system as these standards take no account of the systemic nature of the railway track involving different components with varying performance requirements. This practice is perpetuated in the draft EN prEN 16432-1 ‘Railway Applications - Ballastless Track Systems – Part 1: General Requirements’. There is less experience with other forms of ballastless track.

3.6.1.4 To address uncertainty about the loads to be applied for the design of track systems, and to inform input to future revision of pr EN 16432, research project T1073 ‘Loading Requirements for Track Systems’ is examining the effectiveness of particular vertical load models, taking account of their magnitude and the conditions of their application. The objective is to deliver track loading model(s) which can be specified for the design of track systems, together with the appropriate material and product standards. This is intended to permit the design of track systems which are compatible with the required in-service performance and maintenance regime, for a particular route.
3.6.2 Track resistance to vertical loads

INF TSI

4.2.6.1 Track resistance to vertical loads

The track design, including switches and crossings, shall take into account at least the following forces:

a) the axle load selected according to point 4.2.1;

b) maximum vertical wheel forces. Maximum wheel forces for defined test conditions are defined in EN 14363:2005 point 5.3.2.3.

c) vertical quasi-static wheel forces. Maximum quasi-static wheel forces for defined test conditions are defined in EN 14363:2005 points 5.3.2.3.

3.6.2.1 The INF TSI refers to EN 14363 ‘Railway applications — Testing for the acceptance of running characteristics of railway vehicles — Testing of running behaviour and stationary tests’ limits on the maximum dynamic wheel forces for defined test conditions and states that the resistance of the track to applied loads shall be consistent with these values. The load limits in EN 14363 (both the 2005 version and the revised 2016 version), refer to specific test conditions which are not the most extreme that can exist for either the vehicle or the track, and therefore the actual loads experienced by some track sections may be higher. It is therefore not appropriate for the rolling stock values to be taken as design values for the track: a suitable margin to the rolling stock values is required.

3.6.3 Longitudinal track resistance

INF TSI

4.2.6.2.1 Design forces

The track, including switches and crossings, shall be designed to withstand longitudinal forces equivalent to the force arising from braking of 2,5 m/s² for the performance parameters chosen in accordance with point 4.2.1.

3.6.3.1 The TSI is silent on the other primary sources of longitudinal load, that is, traction and thermal forces.

3.6.3.2 The practice in GCRT5021, has been to specify a longitudinal force per rail of 1200 kN, to allow for train acceleration / deceleration and braking, and also the thermal forces within the rail. For thermal forces, Network Rail Standard N/L2/TRK/2102 ‘Design and construction of track’ specifies a longitudinal tensile force of 700 kN and a longitudinal compressive force of 620 kN per rail.

3.6.3.3 Research project T1073 ‘Loading Requirements for Track Systems’ is examining the effectiveness of particular longitudinal load models, taking account of their magnitude and the conditions of their application.

3.6.4 Compatibility with braking systems

INF TSI

4.2.6.2.2 Compatibility with braking systems

(1) The track, including switches and crossings, shall be designed to be compatible with the use of magnetic braking systems for emergency braking.

(2) The requirements for the design of track, including switches and crossings, which are compatible with the use of eddy current braking systems are an open point.
3.6.4.1 Clause 4.2.4.6.2.1 of the INF TSI gives a maximum deceleration rate of 2.5 m/s² and this is understood to be consistent with existing vehicles which use magnetic track brakes (including Tyne & Wear Metro). It is therefore suggested that the 2.5 m/s² can be used to derive a suitable design longitudinal load for the track structure to demonstrate compliance.

3.6.4.2 Any other potential risks identified as associated with the use of magnetic track brakes may need to be mitigated, perhaps by reference to an existing system. Research project T1099 ‘Enabling magnetic track brakes on GB mainline rail’ is currently reviewing the issues associated with use of magnetic track brakes on the GB network. When this project reports its findings, additional guidance will be added if appropriate.

3.6.5 Lateral track resistance

<table>
<thead>
<tr>
<th>INF TSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.6.3 Lateral track resistance</td>
</tr>
<tr>
<td>The track design, including switches and crossings, shall take into account at least the following forces:</td>
</tr>
<tr>
<td>a) lateral forces; Maximum lateral forces exerted by a wheel set on the track for defined test conditions are defined in EN 14363:2005 point 5.3.2.2.</td>
</tr>
<tr>
<td>b) quasi-static guiding forces; Maximum quasi-static guiding forces Yqst for defined radii and test conditions are defined in EN 14363:2005 point 5.3.2.3</td>
</tr>
</tbody>
</table>

3.6.5.1 The INF TSI refers to EN 14363 ‘Railway applications — Testing for the acceptance of running characteristics of railway vehicles — Testing of running behaviour and stationary tests’ limits on the maximum dynamic wheel forces for defined test conditions and states that the resistance of the track to applied loads shall be consistent with these values. The load limits in EN 14363 (both the 2005 version and the revised 2016 version) refer to specific test conditions, which are not the most extreme that can exist for either the vehicle or the track and therefore the actual loads experienced by some track sections may be higher. It is therefore not appropriate for the rolling stock values to be taken as design values for the track; a suitable margin to the rolling stock values is required.

3.6.5.2 The definition of lateral loads on track systems has proved to be more difficult than for vertical loads, due to the highly non-linear and variable nature of their occurrence. For this reason, practice for determination of lateral load limits has been similar to that for vertical loads, in that the design forces for track are based on the performance limits for rolling stock. Loads for determination of lateral track resistance have been derived from measurement of the maximum lateral vehicle force, based on work undertaken by SNCF. This resulted in the definition of the Prud’homme limit, which has been taken to be representative of the lateral track shifting limit. The measured forces are intended to be representative of all vehicles and do not therefore reflect different types of rolling stock.

3.6.5.3 Current practice in GCRT5021 is to specify a lateral force of 100 kN applied over a length of 2 m. This tends to be greater than the force calculated from the Prud’homme limit equation, and is the same magnitude as the nosing force, which is the lateral force applied for design of bridges (see 3.7.1.4 Nosing forces on page 23). The same practice is specified in Network Rail Standard N/L2/TRK/2102 ‘Design and construction of track’.

3.6.5.4 Research project T1073 ‘Loading Requirements for Track Systems’ will examine the effectiveness of particular lateral load models, taking account of their magnitude and the conditions of their application.
3.7 Structures resistance to traffic loads

The requirements of EN 1991-2:2003/AC:2010 and Annex A2 to EN 1990:2002 issued as EN 1990:2002/A1:2005 specified in this section of the TSI are to be applied in accordance with the corresponding points in the national annexes to these standards if they exist.

Project-specific ('individual project') values and requirements may be given in the National Annexes to Annex A2 of BS EN 1990:2002+A1:2005 'Eurocode - Basis of structural design' and BS EN 1991-2:2003/AC:2010 'UK National Annex to Eurocode 1: Actions on structures –Part 2: Traffic loads on bridges', where a national choice is permitted in the ENs. Such choices, termed Nationally Determined Parameters (NDPs), allow the values and requirements in the ENs to be varied for a specific project. NDPs are likely to vary between Member States of the EU.

Project-specific decisions are likely to be governed by safety and economic considerations. Where the decision for a particular value or requirement is left open in the National Annex, there is a need for project-specific guidance (see 3.7.5 on page 21).

Project-specific values are permitted for the maximum peak values of bridge deck acceleration and the associated loading frequency ranges, as set out in BS EN 1990:2002+A1:2005 clause A2.4.4.2.1 (4)P, Annex A2.

For BS EN 1991-2:2003/AC:2010, project-specific values and requirements are permitted for:

a) The load classification factor in clause 6.3.2 (3)P.
b) The height of the centrifugal force above the running surface in clause 6.5.1 (2).
c) Additional requirements for braking for loaded lengths greater than 300 m in clause 6.5.3 (5).
d) Additional requirements for application of High Speed Load Model A (HSLMA) and High Speed Load Model B (HSLMB) for continuous and complex structures in clause 6.4.6.1.1 (6).
e) Alternative values for the aerodynamic effects from passing trains on structures adjacent to and above the railway track in clause 6.6.1 (3).

Instruction and guidance on the selection of project-specific values and requirements are set out in Network Rail documents:

- NR/L2/CIV/003/F1990: TECHNICAL DESIGN REQUIREMENTS FOR BS EN 1990: Eurocode - Basis of structural design
- NR/L2/CIV/003/F1991: TECHNICAL DESIGN REQUIREMENTS FOR BS EN 1991: Eurocode 1: Actions on structures

Clause 4.2.7 of the INF TSI creates an overarching requirement to apply the requirements of a National Annex where it exists, even where a specific clause requiring the application of a National Annex is not referenced (for example, clause 6.6.1(3)).
3.7.1  Resistance of new bridges to traffic loads

3.7.1.1  Vertical loads

**INF TSI**

<table>
<thead>
<tr>
<th>4.2.7.1.1 Vertical loads</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Structures shall be designed to support vertical loads in accordance with the following load models, defined in EN 1991-2:2003/AC:2010:</td>
</tr>
<tr>
<td>a) Load Model 71, as set out in EN 1991-2:2003/AC:2010 point 6.3.2 (2)P</td>
</tr>
<tr>
<td>b) In addition, for continuous bridges, Load Model SW/0, as set out in EN 1991-2:2003/AC:2010 point 6.3.3 (3)P</td>
</tr>
<tr>
<td>(2) The load models shall be multiplied by the factor alpha (α) as set out in EN 1991-2:2003/AC:2010 points 6.3.2 (3)P and 6.3.3 (5)P.</td>
</tr>
<tr>
<td>(3) The value of factor alpha (α) shall be equal to or greater than the values set out in Table 11.</td>
</tr>
</tbody>
</table>

3.7.1.1.1 The load classification factor alpha (α) can be used to vary the magnitude (positive or negative) of railway traffic loading to suit the capacity required for a particular route. BS EN 1991-2:2003/AC:2010 ‘UK National Annex to Eurocode 1: Actions on structures – Part 2: Traffic loads on bridges’, clause 6.3.2(3) NOTE permits the value to be specified in the UK National Annex (UK NA). The UK National Annex for BS EN 1991-2:2003/AC:2010, clause NA.2.48 recommends a value for α of 1.1 for compatibility with pre-Eurocode safety levels. However, higher values may be appropriate for a particular project, where the impact on safety and economy over the structure’s life can be taken into account.

3.7.1.2  Allowance for dynamic effects of vertical loads

**INF TSI**

<table>
<thead>
<tr>
<th>4.2.7.1.2 Allowance for dynamic effects of vertical loads</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) For bridges for speeds over 200 km/h where EN 1991-2:2003/AC:2010 paragraph 6.4.4 requires a dynamic analysis to be carried out the structure shall additionally be designed for HSLM defined in EN 1991-2:2003/AC:2010 paragraphs 6.4.6.1.1 (3) to (6) inclusive.</td>
</tr>
<tr>
<td>(3) It is permissible to design new bridges such that they will also accommodate an individual passenger train with higher axle loads than covered by HSLM. The dynamic analysis shall be undertaken using the characteristic value of the loading from the individual train taken as the design mass under normal payload in accordance with Appendix K with an allowance for passengers in standing areas in accordance with Note 1 of Appendix K.</td>
</tr>
</tbody>
</table>

3.7.1.2.1 The requirements for making allowance for dynamic effects in the INF TSI, clause 4.2.7.1.2 (1), are generally appropriate for bridges which carry rail traffic at speeds up to and including 125 mph (200 km/h). However, for dynamically sensitive bridges the UK NA for BS EN 1991-2:2003/AC:2010 ‘UK National Annex to Eurocode 1: Actions on structures – Part 2: Traffic loads on bridges’ makes provision for undertaking a dynamic analysis where railway traffic speeds are less than 125 mph (200 km/h). For bridges carrying rail traffic operating at speeds in excess of 125 mph (200 km/h), a dynamic analysis in accordance with the INF TSI, clause 4.2.7.1.2 (2) is required.
3.7.1.3 Centrifugal forces

**INF TSI**  
**4.2.7.1.3 Centrifugal forces**

Where the track on a bridge is curved over the whole or part of the length of the bridge, the centrifugal force shall be taken into account in the design of structures as set out in EN 1991-2:2003/AC:2010 paragraphs 6.5.1 (2), (4) and (7).

3.7.1.3.1 Lateral loads due to centrifugal forces do not ‘in theory’ exist where they are exactly balanced due to compatibility between the cant and curvature of the track, and the mass and speed of a vehicle. However, compatibility for the full range of vehicles and speeds of operation, on a particular network, is not possible, and there are many locations where trains operate with a ‘cant deficiency’. In this situation, a ‘residual’ centrifugal force is then applied to the track.

3.7.1.3.2 For the design of bridge structures, the practice has long been to assume that the full centrifugal force applies, less the effect of track cant: ‘Where the track on a bridge is curved over the whole or part of the length of the bridge, the centrifugal force and the track cant.’ (clause 6.5.1(1) of BS EN 1991-2:2003/AC:2010 ‘UK National Annex to Eurocode 1: Actions on structures – Part 2: Traffic loads on bridges’).

3.7.1.3.3 The loaded length for centrifugal force is assumed to be compatible with that for vertical loading applied to the bridge; that is, a concentrated load to represent an individual axle or a uniformly distributed load to represent the average vehicle loading over a particular length. Provision is made for calculation of the centrifugal force component which is compatible with the vertical load component, through the application of a reduction factor ‘f’ which takes account of the fact that freight vehicle speeds are limited to 120 km/h.

3.7.1.4 Nosing forces

**INF TSI**  
**4.2.7.1.4 Nosing forces**

The nosing force shall be taken into account in the design of structures as set out in EN 1991-2:2003/AC:2010 point 6.5.2.

3.7.1.4.1 The nosing force represents the maximum contact force applied to the rails by the wheel flanges of railway vehicles, due to lateral track alignment irregularities ‘on both straight track and curved track’ (clause 6.5.2(1), BS EN 1991-2:2003/AC:2010 ‘UK National Annex to Eurocode 1: Actions on structures – Part 2: Traffic loads on bridges’). It is generally in excess of the Prud’homme limit, which is taken to represent the limiting force above which track shift can occur. It is intended to ensure that sufficient lateral track resistance is provided to avoid damage to the track as a result of damage to the track supporting bridge structure.

3.7.1.4.2 The characteristic value of the force is ‘taken as a concentrated force acting horizontally, at the top of the rails, perpendicular to the centreline of the track.’ (clause 6.5.2(1), BS EN 1991-2:2003/AC:2010). The characteristic value of the nosing load is not required to be multiplied by the dynamic factor $\Phi$ (clause 6.5.2(2), BS EN 1991-2:2003/AC:2010), but it is to be multiplied by the load classification factor $\alpha$ (clause 6.5.2(3)).

3.7.1.4.3 Network Rail standard NR/L2/CIV/020 ‘Design of Bridges’, clause 10.2.1, permits the nosing load to be distributed over three adjacent sleepers in the proportions $\frac{1}{4} : \frac{1}{2} : \frac{1}{4}$. 
3.7.1.5  Actions due to traction and braking (longitudinal loads)

**INF TSI**

4.2.7.1.5 Actions due to traction and braking (longitudinal loads)

Traction and braking forces shall be taken into account in the design of structures as set out in EN 1991-2:2003/AC:2010 paragraphs 6.5.3 (2)P, (4), (5), (6), and (7)P.

3.7.1.5.1 For bridge design, longitudinal loads are considered to represent the traction and braking forces from railway vehicles applied to the track. These forces are applied at the top of the rails and are ‘considered as uniformly distributed over the corresponding influence length $L_{a,b}$ for traction and braking effects for the structural element considered.’ (clause 6.5.3(1), BS EN 1991-2:2003/AC:2010 ‘UK National Annex to Eurocode 1: Actions on structures –Part 2: Traffic loads on bridges’). The assumption that braking loads are uniformly distributed over the length of the bridge is likely to be satisfactory for design of bridge supports (for example, abutments and piers), but may not be representative for the design of local details on the bridge (for example, cross girders) where load concentration from an individual braking wheelset can occur.

3.7.1.5.2 Characteristic values of traction and braking effects are provided, which are considered to be coexistent with the appropriate vertical loads. ‘The characteristic values of traction and braking forces’ are not required to be multiplied by the dynamic factor $\Phi$ or by the reduction factor $f$ (clause 6.5.3(2), BS EN 1991-2:2003/AC:2010), but it is to be multiplied by the load classification factor $\alpha$ (clause 6.5.3(4), BS EN 1991-2:2003/AC:2010).

3.7.1.6  Design track twist due to rail traffic actions

**INF TSI**

4.2.7.1.6 Design track twist due to rail traffic actions

The maximum total design track twist due to rail traffic actions shall not exceed the values set out in paragraph A2.4.4.2.2(3)P in Annex A2 to EN 1990:2002 issued as EN 1990:2002/A1:2005.

3.7.1.6.1 The limit for the maximum total design track twist set out in the INF TSI, clause 4.2.7.1.6, is taken into account when determining the components of twist due to vertical track alignment, track alignment defects, and deformation of the track due to rail traffic load. Requirements for the steepest permitted designed cant gradient and repair of track twist are set out in GCRT5021.

3.7.2  Equivalent vertical loading for new earthworks and earth pressure effects

**INF TSI**

4.2.7.2 Equivalent vertical loading for new earthworks and earth pressure effects

(1) Earthworks shall be designed and earth pressure effects shall be specified taking into account the vertical loads produced by the Load Model 71, as set out in EN 1991-2:2003/AC:2010 paragraph 6.3.2(2).

(2) The equivalent vertical loading shall be multiplied by the factor alpha ($\alpha$) as set out in EN 1991-2:2003/AC:2010 paragraph 6.3.2 (3)P. The value of $\alpha$ shall be equal to or greater than the values set out in Table 11.

3.7.2.1 The INF TSI section 4.2.7.2 covers not only the vertical load effects on earthworks but also the consequential additional horizontal earth pressure effects due to the weight of trains acting on the backfill (surcharge). These vertical and horizontal loads on earthworks are utilised in the design of bridge abutments, and similar earth retaining elements (for example, retaining walls and wing walls).
3.7.3 Resistance of new structures over or adjacent to tracks

<table>
<thead>
<tr>
<th>INF TSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.7.3 Resistance of new structures over or adjacent to tracks</td>
</tr>
</tbody>
</table>


3.7.3.1 Clause 4.2.7 of the INF TSI states, ‘The requirements of BS 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 BS EN 1990:2002 issued as BS EN 1990:2002/ A1:2005 ‘Eurocode - Basis of structural design’ specified in this section of the TSI are to be applied in accordance with the corresponding points in the national annexes to these standards if they exist.’. This creates an overarching requirement to apply the requirements of a National Annex where it exists, even where a specific clause requiring the application of a National Annex is not referenced as here.

3.7.3.2 In this case, clause 6.6.1(3) is as follows: (3) The actions may be approximated by equivalent loads at the head and rear ends of a train, when checking ultimate and serviceability limit states and fatigue. Characteristic values of the equivalent loads are given in 6.6.2 to 6.6.6.

**Note:** The National Annex or the individual project may specify alternative values. The values given in 6.6.2 to 6.6.6 are recommended.

3.7.3.3 In the absence of ‘alternative values’ in the UK National Annex for BS EN 1991-2:2003/AC:2010, RSSB has undertaken research (see RSSB research project T750 ‘Review of Euronorm design requirements for trackside and overhead structures subjected to transient aerodynamic loads’ for further details), which provides the basis for providing the alternative GB specific design requirements to replace the existing clause NA.2.74 of UK National Annex for BS EN 1991-2:2003/AC:2010.

3.7.3.4 Until the UK National Annex is updated, the guidance in section 3 of GCGN5612 has been provided to help the industry when considering the design of structures that are subject to aerodynamic actions.

3.7.4 Resistance of existing bridges and earthworks to traffic loads

<table>
<thead>
<tr>
<th>INF TSI</th>
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</thead>
<tbody>
<tr>
<td>4.2.7.4 Resistance of existing bridges and earthworks to traffic loads</td>
</tr>
</tbody>
</table>

(1) Bridges and earthworks shall be brought to a specified level of interoperability according to the TSI category of line as defined in point 4.2.1.

(2) The minimum capability requirements for structures for each traffic code are given in Appendix E. The values represent the minimum target level that structures must be capable of for the line to be declared interoperable.

(3) The following cases are relevant:

a) Where an existing structure is replaced by a new structure then the new structure shall be in accordance with the requirements of point 4.2.7.1 or point 4.2.7.2.

b) If the minimum capability of the existing structures expressed by the published EN line category in combination with the allowed speed satisfies the requirements in Appendix E then the existing structures satisfy the relevant interoperability requirements.

c) Where the capability of an existing structure does not satisfy the requirements in Appendix E and works (e.g. strengthening) are being carried out to raise the capability of the structure to meet the requirements of this TSI (and the structure is not to be replaced by a new structure) then the structure shall be brought into conformity with the requirements in Appendix E.
4.2.7.4 Resistance of existing bridges and earthworks to traffic loads

(4) For the United Kingdom of Great Britain and Northern Ireland networks, in paragraphs (2) and (3) above the EN line category may be replaced by Route Availability (RA) number (delivered in accordance with the national technical rule notified for this purpose) and consequently reference to Appendix E are replaced by reference to Appendix F.

3.7.4.1 Sub clause (4) is effectively a Specific Case for UK (GB) but is written into the main TSI text. This permits the continued use of the ‘route availability (RA)’ structure classification. GERT8006 is the relevant RGS.

3.7.4.2 It is suggested that new structures are also assessed to the EN 15528:2008 ‘Railway applications - Testing for the acceptance of running characteristics of railway vehicles - Testing of running behaviour and stationary tests’ line categories and that assessment of existing structures to these categories is also considered when the opportunity arises.

3.8 Immediate action limits on track geometry defects

3.8.1 General considerations

3.8.1.1 GCRT5021 sets out a range of parameters and values to be taken into account for determining appropriate immediate action, intervention and alert limits.

3.8.1.2 The definition of ‘immediate action limit’ in the TSI Appendix S, Glossary, states: ‘The value which, if exceeded, requires taking measures to reduce the risk of derailment to an acceptable level.’ A slightly longer definition is given in EN 13848:5:2008 ‘Railway applications – Track – Track geometry quality - Part 5: Geometric quality levels - Plain line’ Section 7: ‘Immediate Action Limit (IAL): refers to the value which, if exceeded, requires taking measures to reduce the risk of derailment to an acceptable level. This can be done either by closing the line, reducing speed or by correction of track geometry’.

3.8.1.3 If the ‘immediate action limit’ is reached the action required is to ‘reduce the risk of derailment to an acceptable level’ and an appropriate time interval is to be specified for this action. Where time intervals are specified, for example in GCRT5021, these could be appropriate to meet the TSI requirements.

3.8.1.4 The ERA Application Guide points out that several networks already use IAL values that are stricter than the ones referred to in the TSI and that an infrastructure manager (IM) decision to relax such limits ‘should never come from the application of the INF TSI itself’. The Safety Management System and appropriate risk assessment, taking into account the IM’s inspection and maintenance regime, would be needed to justify a change to the values used.

3.8.2 The immediate action limit for alignment

4.2.8.1 The immediate action limit for alignment

(1) The immediate action limits for isolated defects in alignment are set out in point 8.5 of EN 13848-5:2008+A1:2010. Isolated defects shall not exceed the limits of wavelength range D1 as set out in Table 6 of the EN Standard.

(2) The immediate action limits for isolated defects in alignment for speeds of more than 300 km/h are an open point.
3.8.2.1 The D1 wavelength range used in the EN and TSI is from 3 m to 25 m. GB track measurement has traditionally used a slightly different wavelength range extending to 35 m. The figures used are therefore not directly comparable. The limit values used on the GB network are understood to be consistent with the TSI requirements and do not restrict access for TSI compliant vehicles.

3.8.3 The immediate action limit for longitudinal level

<table>
<thead>
<tr>
<th>INF TSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.8.2 The immediate action limit for longitudinal level</td>
</tr>
<tr>
<td>(1) The immediate action limits for isolated defects in longitudinal level are set out in point 8.3 of EN 13848-5:2008+A1:2010. Isolated defects shall not exceed the limits of wavelength range D1 as set out in table 5 of the EN Standard</td>
</tr>
<tr>
<td>(2) The immediate action limits for isolated defects in longitudinal level for speeds of more than 300 km/h are an open point.</td>
</tr>
</tbody>
</table>

3.8.3.1 The D1 wavelength range used in the EN and TSI is from 3 m to 25 m. GB track measurement has traditionally used a slightly different wavelength range extending to 35 m. The figures used are therefore not directly comparable. The limit values used on the GB network are understood to be consistent with the TSI requirements and do not restrict access for TSI compliant vehicles.

3.8.4 The immediate action limit for track twist

<table>
<thead>
<tr>
<th>INF TSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.8.3 The immediate action limit for track twist</td>
</tr>
<tr>
<td>(1) The immediate action limit for track twist as an isolated defect is given as a zero to peak value. Track twist is defined in EN 13848-1:2003+A1:2008 point 4.6.</td>
</tr>
<tr>
<td>(2) The track twist limit is a function of the measurement base applied according to EN 13848-5:2008+A1:2010 point 8.6.</td>
</tr>
<tr>
<td>(3) The infrastructure manager shall set out in the maintenance plan the base-length on which it will measure the track in order to check compliance with this requirement. The base-length of measurement shall include at least one base between 2 and 5 m.</td>
</tr>
</tbody>
</table>

3.8.4.1 There has been some concern that the limits generally used on the GB network are less onerous than those given in the TSI. This arises from a misunderstanding of the term ‘immediate action limit’ (see: 3.8.1 General considerations on page 26). With the correct understanding of this term the values are consistent.

3.8.4.2 GB practice is to measure twist over a 3 m base, which is consistent with the TSI requirement.

3.8.5 The immediate action limit of track gauge as an isolated defect

<table>
<thead>
<tr>
<th>INF TSI</th>
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</thead>
<tbody>
<tr>
<td>4.2.8.4 The immediate action limit of track gauge as an isolated defect</td>
</tr>
<tr>
<td>(1) The immediate action limits of track gauge as an isolated defect are set out in Table 12.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Speed [km/h]</th>
<th>Dimensions [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum track gauge</td>
</tr>
<tr>
<td>v ≤ 120</td>
<td>1 426</td>
</tr>
</tbody>
</table>
### 4.2.8.4 The immediate action limit of track gauge as an isolated defect

<table>
<thead>
<tr>
<th>Condition</th>
<th>Limit 1</th>
<th>Limit 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 &lt; v ≤ 160</td>
<td>1 427</td>
<td>1 470</td>
</tr>
<tr>
<td>160 &lt; v ≤ 230</td>
<td>1 428</td>
<td>1 463</td>
</tr>
<tr>
<td>v &gt; 230</td>
<td>1 430</td>
<td>1 463</td>
</tr>
</tbody>
</table>

3.8.5.1 GB practice has been to use values which are more onerous than those given in the TSI. This does not restrict access for TSI compliant vehicles.

### 4.2.8.5 The immediate action limit for cant

<table>
<thead>
<tr>
<th>Condition</th>
<th>Limit 1</th>
<th>Limit 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) The maximum cant allowed in service is 180 mm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) The maximum cant allowed in service is 190 mm for dedicated passenger traffic lines.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.8.6.1 Normal GB practice is to limit track cant to 150 mm with 180 mm as the exceptional value. Specific sites can exceed this value by special permission and the site at Cullompton was installed to trial 200 mm cant. This required strict controls on types of freight vehicles passing the site, as there was a significant risk of load shift on wagons as, even at moderate speeds, the cant excess is significant. There are no plans to extend this trial.

### 4.2.8.6 The immediate action limits for switches and crossings

1. The technical characteristics of switches and crossings shall comply with the following in-service values:
   a) Maximum value of free wheel passage in switches: 1 380 mm. This value can be increased if the infrastructure manager demonstrates that the actuation and locking system of the switch is able to resist the lateral impact forces of a wheelset.
   b) Minimum value of fixed nose protection for common crossings: 1 392 mm. This value is measured 14 mm below the running surface, and on the theoretical reference line, at an appropriate distance back from the actual point (RP) of the nose as indicated in Figure 2. For crossings with point retraction, this value can be reduced. In this case the infrastructure manager shall demonstrate that the point retraction is sufficient to guarantee that the wheel will not hit the nose at the actual point (RP).
   c) Maximum value of free wheel passage at crossing nose: 1 356 mm.
   d) Maximum value of free wheel passage at check rail/wing rail entry: 1 380 mm.
   e) Minimum flangeway width: 38 mm.
   f) Minimum flangeway depth: 40 mm.
   g) Maximum height of check rail: 70 mm.

2. All relevant requirements for switches and crossings are also applicable to other technical solutions using switch rails, for example side modifiers used in multi-rail track.
The immediate action limits for switches and crossings (4.2.8.6)

Instead of point 4.2.8.6(1)(b), for the ‘CEN56 Vertical’ design of switches and crossings, a minimum value of fixed nose protection for common crossings of 1,388 mm is allowed (measured 14 mm below the running surface, and on the theoretical reference line, at an appropriate distance back from the actual (RP) of the nose as indicated in Figure 2).

3.8.7.1 The requirements for in-service geometry of S&C are based on maximum / minimum values that are not to be exceeded. The IM is required to determine a suitable range of design and intervention limits, taking account of inspection, maintenance and wear. GCRT5021 sets out a range of design and intervention limits for particular parameters.

3.8.7.2 It is important to note that the position at which the track gauge is measured (that is, 14 mm below the running surface), is not the same as the position where the flange thickness of a wheel is measured (and this position differs between ENs and RGSs). This difference is to be taken into account in any assessment of the wheel / rail interface in S&C.

3.8.7.3 Network Rail CEN 56 S&C designs can have a maximum freewheel passage of 1432-50 mm = 1382 mm, which is in excess of the maximum permitted in the TSI of 1380 mm. It is therefore necessary to understand how to demonstrate ‘that the actuation and locking system of the switch is able to resist the lateral impact forces of a wheelset’. It is suggested that the required demonstration can be achieved by reference to experience with existing S&C design / installation which meets the operating conditions intended for the subsystem concerned (that is, the use of a reference system).

3.8.7.4 The specific case for minimum crossing fixed nose protection of 1388 mm allows for a nominal cover check gauge of 1391 mm with a 3 mm maintenance tolerance for cover check rail wear.

3.9 Platforms

3.9.1 Platforms general

The Platform Train Interface (PTI) Strategy, which is available on the RSSB website (www.rssb.co.uk), describes the GB approach to making the gap between the platform and the train safer, and to ensure that growing numbers of passengers can continue to enjoy safe and efficient train services in the future.
3.9.2 Platform height

INF TSI

4.2.9.2 Platform height

(1) The nominal platform height shall be 550 mm or 760 mm above the running surface for radii of 300 m or more.

INF TSI Specific Case UK (GB)

7.7.17.6 Platform height (4.2.9.2)

Instead of point 4.2.9.2, for platform height, national technical rules as set out in Appendix Q shall be allowed.

3.9.2.1 The UK (GB) specific case refers to GIRT7016 for platform height. These requirements are not retrospective and it is recognised that many of the existing platforms on the network do not conform to the current standard.

3.9.2.2 GIGN7616 sets out guidance on platform height for the GB mainline network.

3.9.2.3 Any project considering a non-standard platform height will also need to consider the resulting clearances to OCL equipment and relevant electrical clearance requirements.

3.9.3 Platform offset

INF TSI

4.2.9.3 Platform offset

(1) The distance between the track centre and the platform edge parallel to the running plane (bq), as defined in chapter 13 of EN 15273-3:2013, shall be set on the basis of the installation limit gauge (bqlim). The installation limit gauge shall be calculated on the basis of the gauge G1.

INF TSI Specific Case UK (GB)

7.7.17.7 Platform offset (4.2.9.3)

Instead of point 4.2.9.3, for platform offset, national technical rules as set out in Appendix Q shall be allowed.

3.9.3.1 The requirements for the UK (GB) specific case are set out in GIRT7016 and the Gauging RGSs, and in particular GIRT7073, for platform offset. These requirements are not retrospective and it is recognised that many of the existing platforms on the network do not conform to the current standard. The suite of revised Gauging RGSs, published in December 2015, are:

- GIRT7073 Requirements for the Position of Infrastructure and for Defining and Maintaining Clearances
- GMRT2173 Requirements for the Size of Vehicles and Position of Equipment
- GERT8273 Assessment of Compatibility of Rolling Stock and Infrastructure – Gauging and Stepping Distances
- GERT8073 Requirements for the Application of Standard Vehicle Gauges
- GEGN8573 Guidance on Gauging and Platform Stepping Distances

3.9.3.2 GIGN7616 sets out guidance on platform offset for the GB mainline network.
3.9.4 Track layout alongside platforms

**INF TSI**

### 4.2.9.4 Track layout alongside platforms

1. Track adjacent to the platforms for new lines shall preferably be straight, but shall nowhere have a radius of less than 300 m.

2. No values are specified for an existing track alongside new, renewed or upgraded platforms.

3.9.4.1 GB practice has been to use a minimum radius of 1000 m for new platforms and 500 m for extension to existing platforms. Both values are more onerous than the TSI figure, but do not restrict access for TSI compliant vehicles.

3.9.4.2 Platforms adjacent to curved track generally give larger stepping distances for passengers and are therefore to be avoided where possible.

3.9.4.3 It is not desirable to locate S&C adjacent to platforms. In cases where it is unavoidable, the effects of throw need to be taken into account and control measures considered for the detrimental impact on stepping distances.

3.10 Health, safety and environment

3.10.1 Maximum pressure variations in tunnels

**INF TSI**

### 4.2.10.1 Maximum pressure variations in tunnels

1. Any tunnel or underground structure intended to be operated at speeds greater than or equal to 200 km/h has to provide that maximum pressure variation, caused by the passage of a train running at the maximum allowed speed in the tunnel, do not exceed 10 kPa during the time taken for the train to pass through the tunnel.

2. Above requirement has to be fulfilled along the outside of any train complying with the Locomotives and Passenger TSI.

3.10.1.1 A train entering and running through a tunnel generates pressure waves, which move at the speed of sound in the tunnel, reflecting from portals, airshafts and other trains in the tunnel. This means that the train travels through a complex pattern of pressure variations above and below atmospheric pressure. These can be detected aurally by most people, and most train / tunnel operations are subject to a limit on the pressure variations to ensure aural comfort.

3.10.1.2 The 10 kPa limit was recommended by the European Rail Research Institute (ERRI) working group C218 in their report RP 5 in 1998. The group was led by an Aerodynamics expert from BR Research, with involvement from a number of medical specialists. More background information and reports can be found by searching the key words ‘pressure comfort’ in the SPARK knowledge portal on the RSSB website (www.rssb.co.uk).

3.10.1.3 A very small proportion of the population could suffer aural damage if subjected to pressure changes over 10 kPa over a relatively short period; hence this requirement.

3.10.1.4 Any train compliant with the LOC & PAS TSI will generate limited reference pressure changes, during its entry at its maximum speed into a reference tunnel of fixed cross-sectional area. These reference pressure changes constitute the reference characteristic pressure signature, which is described in EN
3.10.1.5 The requirement for infrastructure is to ensure that a compliant train does not generate a total pressure change anywhere alongside the train of greater than 10 kPa during the time that any part of the train is in the tunnel that is under consideration. The assumption is that passengers could be exposed to this pressure change, either because the train is unsealed or because the pressure sealing has failed. This means that, in practice, the complete time variation of pressure at points alongside the train is considered from the moment the points enter the tunnel and the pressure deviates from ambient level, to the time when the pressure returns to local ambient pressure level outside the tunnel. For a pressure-sealed train, this latter time may be several seconds after the particular points on the train have left the tunnel. For a non-sealed train this time is almost instantaneous.

3.10.1.6 The determination of train-induced pressures in tunnels is made using calculations for the specific tunnel of interest, using a tunnel modelled with the correct length, cross-sectional area (including any variations along the length), airshafts and cross-passages (with their lengths and cross-sectional areas) and portals with any special design features (such as flaring or porosity). Data which characterise the aerodynamic design of the train can be inferred for a train which just meets the tunnel reference pressure changes in coefficient form, and are included in the calculations of pressure changes in the tunnel.

3.10.1.7 The calculations for the specific tunnel of interest are usually undertaken with software based on the method of characteristics, although computational fluid dynamics methods based on RANS (Reynolds’-averaged Navier-Stokes) may be used as long as compressibility effects are included.

3.10.1.8 All TSI compliant high speed and conventional rolling stock, and combinations thereof, using the tunnel are to be checked to ensure that the 10 kPa pressure change is not exceeded. The compliant trains are those having reference cross-sectional areas determined according to the kinematic profile (see INF TSI clause 6.2.4.12(3)), and having the relevant reference characteristic pressure signatures for their maximum speeds, according to the LOC & PAS TSI. It is also appropriate that different operational train length combinations and relative train entry times are assessed.

3.10.1.9 At the tunnel design stage, the tunnel cross-sectional area can be varied to ensure the 10 kPa limit is maintained for all foreseen train operations. However, once the cross-section is fixed, it might be necessary to reduce train operating speeds through the tunnel or introduce pressure-relieving devices, such as airshafts, in order that the limit can be met.

3.10.2 Effect of crosswinds

<table>
<thead>
<tr>
<th>INF TSI</th>
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<tbody>
<tr>
<td><strong>4.2.10.2 Effect of crosswinds</strong></td>
</tr>
<tr>
<td>(1) A line is interoperable from the cross wind point of view if safety is ensured for a reference train running along that line under the most critical operational conditions.</td>
</tr>
<tr>
<td>(2) The rules for proving conformity shall take into account the characteristic wind curves of the reference trains defined in the LOC&amp;PAS TSI.</td>
</tr>
<tr>
<td>(3) If safety cannot be achieved without mitigating measures, either due to the geographic situation or to other specific features of the line, the infrastructure manager shall take the necessary measures to maintain the safety, for example by:</td>
</tr>
<tr>
<td>• locally reducing train speeds, possibly temporarily during periods at risk of storms,</td>
</tr>
<tr>
<td>• installing equipment to protect the track section concerned from cross winds,</td>
</tr>
<tr>
<td>• other appropriate means.</td>
</tr>
<tr>
<td>(4) It shall be demonstrated that safety is achieved after measures taken.</td>
</tr>
</tbody>
</table>
3.10.2.1 The risk being controlled by this requirement is that of vehicle overturning under the effect of crosswinds. This requirement is not intended to cover the effect of crosswinds on either gauge clearance or pantograph sway, which are included in the GB Specific Case for Gauging.

3.10.2.2 High speed interoperable trains have a defined minimum level of stability when exposed to crosswinds. This stability is expressed as tabulated values of wind speeds (termed characteristic wind curves), that lead to 90% unloading of the most critical bogie on the most crosswind sensitive vehicle of the train. The aerodynamic forces, generated by the combination of the relative wind speed caused by the train forward motion and the crosswind itself, are greatest on the leading vehicle, which makes it the most critical in terms of aerodynamics alone. The most crosswind sensitive vehicle in a train is determined by consideration of the vehicle masses and their aerodynamics.

3.10.2.3 The characteristic wind curves are determined by making dynamic calculations of wheel unloading. A complete set of aerodynamic force and moment time histories are generated from aerodynamic coefficients determined from wind tunnel tests on a reference train model, and an assumed wind gust model. This latter consists of a theoretical isolated gust superimposed on a mean wind speed. The force and moment time histories are used as inputs to a train vehicle multi-body simulation model, assuming that the train travels at a number of speeds.

3.10.2.4 As yet, there is no agreement on crosswind safety targets that have to be met at a European level; different assessment methods and safety philosophies are used by the major European railways. Therefore, national standards apply, see GCRT5521. In GB, a probabilistic methodology and safety target was defined during studies to prove the crosswind safety of the Class 390 Pendolino train.

3.10.2.5 In general, the assessment of crosswind safety requires a detailed knowledge of the route infrastructure (locations, lengths and heights of embankments, viaducts, cuttings and tunnels, curve lengths and cant deficiencies), line speed profile and local exposure to wind at all points along the route.

3.10.2.6 With the above knowledge, a method for safety assessment and a safety target, together with the reference characteristic wind curves, the IM can identify locations along a route where an interoperable vehicle would be subjected to wind speeds exceeding the relevant characteristic wind speed. At such locations, measures such as those suggested in 4.2.10.2(3) are appropriate to ensure the safety of the vehicle according to the safety target.

3.10.2.7 The effect of crosswinds is currently not fully covered in the LOC & PAS TSI, as no limit values have been set; there is only the requirement to calculate the characteristic wind curves of the most sensitive vehicle in the train and record these in the technical file. CEN TC256 WG6 has developed limit values for trains with a maximum speed of 250 km/h and greater, based on AeroTRAIN project results. These will go into the short revision of EN 14067-6 ‘Railway applications - Aerodynamics - Part 6: Requirements and test procedures for cross wind assessment’ to be published in 2016, and is expected to be incorporated into the LOC&PAS TSI thereafter. For trains with lower maximum speeds, there is no European consensus on limit values.

### 3.10.3 Ballast pick-up

<table>
<thead>
<tr>
<th>INF TSI</th>
<th>4.2.10.3 Ballast pick-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) The aerodynamic interaction between rolling stock and infrastructure may cause the lifting and further blowing away of ballast stones from the track bed.</td>
<td></td>
</tr>
<tr>
<td>(2) The requirements for the infrastructure subsystem aimed at mitigating the risk for ‘ballast pick up’ apply only to lines with maximum speed greater than or equal to 200 km/h.</td>
<td></td>
</tr>
<tr>
<td>(3) The requirements of point (2) above are an open point.</td>
<td></td>
</tr>
</tbody>
</table>
3.10.3.1 Following input from CEN TC256 WG6 (Aerodynamics), the ERA is proposing to raise the threshold speed to 250 km/h. No action is therefore required for projects on the GB mainline network.

3.11 Provision for operation

3.11.1 Location markers

**INF TSI**

4.2.11.1 Location markers

Location markers shall be provided at nominal intervals along the track of not more than 1 000 m.

3.11.1.1 There are no specific requirements for the spacing or style of distance markers. Conventional GB mileposts (and quarter mileposts) are fully compliant.

3.11.2 Equivalent conicity in service

**INF TSI**

4.2.11.2 Equivalent conicity in service

(1) If ride instability is reported, the railway undertaking and the infrastructure manager shall localise the section of the line in a joint investigation according to paragraphs (2) and (3) hereafter. Note: This joint investigation is also specified in point 4.2.3.4.3.2 of TSI LOC & PAS for action on rolling stock.

(3) If the mean equivalent conicity over 100 m complies with the limit values in Table 14, a joint investigation by the railway undertaking and the infrastructure manager shall be undertaken to specify the reason for the instability.

3.11.2.1 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.

3.11.2.2 An equivalent clause is included in the LOC & PAS TSI for the railway undertaking (RU) to investigate the rolling stock side of the interface. A joint investigation, such as described in these clauses, is normal GB practice where instability is reported. There is no requirement to make any measurements or assessments unless instability is reported.

3.12 Fixed installations for servicing trains

3.12.1 Toilet discharge

**INF TSI**

4.2.12.2 Toilet discharge

Fixed installations for toilet discharge shall be compatible with the characteristics of the retention toilet system specified in the rolling stock TSI.

3.12.1.1 Toilet discharge is covered in the LOC & PAS TSI Clause 4.2.11.3, and Annex G 1 shows the vehicle connection.
3.12.1.2 EN 16922 ‘Railway applications - Ground based services – Vehicle waste water discharge equipment’ covers both the vehicle and infrastructure elements. This EN was out for enquiry at the end of 2015 and is expected to be published in early 2017.

3.12.2 Water restocking

INF TSI

4.2.12.4 Water restocking

(1) Fixed equipment for water restocking shall be compatible with the characteristics of the water system specified in the rolling stock TSI.

(2) Fixed equipment for drinking water supply on the interoperable network shall be supplied with drinking water meeting the requirements of Council Directive 98/83/EC (1).

3.12.2.1 Water restocking only permits the supply to vehicles of drinking quality water (meeting the requirements of the Directive 98/83/EC). Therefore there is no opportunity for rainwater or other recycling initiatives for use in toilets on vehicles.

3.12.2.2 It is recommended that the fixed installation water supply pipework and flexible water supply hose be suitable for drinking water and compliant with EN 12502-1:2004 ‘Protection of metallic materials against corrosion - Guidance on the assessment of corrosion likelihood in water distribution and storage systems - Part 1: General’. Further information on preventing contamination is set out in EN 16362:2011 ‘Railway applications - Ground based services - Water restocking equipment’.

3.12.2.3 It is recommended that the flexible water supply hose be fitted with an end-fitting for connection to the railway vehicle. All new railway vehicles will be fitted with a bayonet connection, as shown in EN 16362:2011. It has been standard GB practice for railway vehicles to be fitted with a tapered rigid pipe and the flexible water supply hose to have a plain end suitable to push directly onto the tapered pipe. This practice is likely to continue for some time as there are many such vehicles still in traffic, and will continue in service. It is therefore normal GB practice that the fixed installation flexible water supply hose is ended with a bayonet connection fitting, which then has an adaptor ending in a short length of plain hose, enabling both designs of connection to be used.

3.12.2.4 Water supplied at a pressure of between 3 bar and 6 bar, with a flow rate of between 80 l/min and 150 l/min, will enable railway vehicles to be restocked in a reasonable time, without undue risk of rupturing the vehicle’s water retention tank due to pressurisation.

3.12.2.5 A device to prevent water going backwards towards the mains water supply for each flexible water supply hose will prevent back siphoning. The actual method for achieving this requirement, for example non-return valve or sealed break tank will vary according to the location of the servicing point. It is normal GB practice to seek guidance from the local water supply company.

3.12.2.6 To avoid the risk of freezing, it is recommended that the flexible water supply hose either be self-draining to prevent water remaining in the hose, or have sufficient trace heating.

3.12.3 Refuelling

INF TSI

4.2.12.5 Refuelling

Refuelling equipment shall be compatible with the characteristics of the fuel system specified in the rolling stock TSIs.
3.12.3.1 To meet the requirement of the TSI, it is recommended that at each fixed refuelling device the flexible fuel supply hose be fitted with a nozzle on the end compliant with BS EN 13012:2001 ‘Petrol filling stations - Construction and performance of automatic nozzles for use on fuel dispensers’ Type II.

3.12.3.2 Current GB practice is to use a connector compliant with BS 3818:1964 ‘Self-sealing fuelling couplings for diesel locomotives and diesel railcars’. EN16507:2014 ‘Railway applications – Ground based services – Diesel refuelling equipment’ which has now been published and contains in Annex A Special national conditions that includes for GB a direct reference to BS 3818:1964. It is the intention that vehicles for use within GB will continue to use BS 3818:1964 for the foreseeable future. It is therefore only those fuelling points that have a possibility to receive a visiting diesel locomotive from another country that will need to have at least one refuelling facility with an EN 13012:2001 nozzle.

3.12.3.3 It is recommended that the diesel fuel supply device delivers fuel with a maximum flow rate of 200 l/min.

3.12.4 Electrical shore supply

<table>
<thead>
<tr>
<th>INF TSI</th>
<th>4.2.12.6 Electrical shore supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where provided, electrical shore supply shall be by means of one or more of the power supply systems specified in the rolling stock TSIs.</td>
<td></td>
</tr>
</tbody>
</table>

3.12.4.1 Convention is to use an external power supply as specified in (5) of LOC & PAS TSI clause 4.2.11.6

3.12.4.2 The plug is provided by the infrastructure and the socket on the train.

3.12.4.3 For application specific requirements for the plug use EN 50467:2011 ‘Railway applications - Rolling stock – Electrical connectors, requirements and test methods’.
Part 4 Guidance for TSI Chapter 5 Interoperability Constituents

4.1 INF TSI Chapter 5.2 List of constituents

<table>
<thead>
<tr>
<th>INF TSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2 List of constituents</td>
</tr>
</tbody>
</table>

(1) For the purposes of this technical specification for interoperability, only the following elements, whether individual components or subassemblies of the track are declared to be ‘interoperability constituents’:

a) the rail (5.3.1),
b) the rail fastening systems (5.3.2),
c) track sleepers (5.3.3).

(2) The following points describe the specifications applicable to each of these constituents.

(3) Rails, fastenings and sleepers used for short length of track for specific purposes, for example in switches and crossings, at expansion devices, transition slabs and special structures, are not considered to be interoperability constituents.

4.1.1 The EUAR Application Guide notes that the following are not considered to be interoperability constituents and such elements are assessed at subsystem level:

a) Steel sleepers (or other material which is not concrete or wood).
b) Specific fastenings, see (3) above.
c) Any element specifically used only on non-ballasted track.

4.1.2 The reuse of existing ICs which have been in use prior to the publication of the TSI is covered in Point 6.6 of the INF TSI.

4.2 INF TSI Chapter 5.3 Constituents performances and specifications

<table>
<thead>
<tr>
<th>INF TSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.3.1 The rail</td>
</tr>
</tbody>
</table>

The specifications of the ‘rail’ interoperability constituent concern the following parameters:

a) railhead profile,
b) rail steel.

4.2.1 The railhead profile requirements are given in clause 4.2.4.6 (see 3.4.6 Railhead profile for plain line on page 16).

4.2.2 For the rail steel, minimum requirements are given for the rail Brinnell Hardness Number (HBW), the tensile strength and the minimum number of cycles of fatigue testing without failure. All modern rail steels, including premium steels, are likely to meet these requirements.
Part 5 Guidance for TSI Chapter 6 Assessment of Conformity of Interoperability Constituents and EC Verification of the Subsystems

5.1 Assessment of structure gauge

**INF TSI Specific Case UK (GB)**

### 7.7.17.9 Assessment of structure gauge (6.2.4.1)

Instead of point 6.2.4.1, it shall be allowed to assess structure gauge in accordance with the national technical rules as set out in Appendix Q.

5.1.1 The GB Specific Case points to the RGS gauging process for assessment of structure gauge.

5.2 Assessment of nominal track gauge

**INF TSI**

### 6.2.4.3 Assessment of nominal track gauge

1. Assessment of the nominal track gauge at design review shall be done by checking the self-declaration of the applicant.

2. Assessment of the nominal track gauge at assembly before putting into service shall be done by checking the interoperability constituent sleeper’s certificate. For non-certified interoperability constituents assessment of the nominal track gauge shall be done by checking the self-declaration of the applicant.

5.2.1 Assessment of nominal track gauge is only relevant to plain line track.

5.2.2 For switch and crossing work, the in-service limits control the key dimensions and the nominal track gauge is not relevant.

5.3 Assessment of design values for equivalent conicity

**INF TSI**

### 6.2.4.6 Assessment of design values for equivalent conicity

Assessment of design values for equivalent conicity shall be done using the results of calculations made by the infrastructure manager or the contracting entity on the basis of EN 15302:2008+A1:2010.

5.3.1 Appendix 2 of the ERA Application Guide lists several track configurations which are deemed to fulfil the requirements for design equivalent conicity.

<table>
<thead>
<tr>
<th>Rail head profile</th>
<th>Design track gauge (mm)</th>
<th>Rail inclinations for $60 \text{ km/h} &lt; V \leq 200 \text{ km/h}$</th>
<th>Rail inclinations for $200 \text{ km/h} &lt; V \leq 280 \text{ km/h}$</th>
<th>Rail inclinations for $V \geq 280 \text{ km/h}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS113a</td>
<td>1435</td>
<td>1/20</td>
<td>1/20</td>
<td>1/20</td>
</tr>
</tbody>
</table>
Table 1: Track configurations which are deemed to fulfil the requirements for design equivalent conicity

5.3.2 The note states ‘(i) Assessed with S1002, GV 1/40 and EPS’, which is the requirement of the GB specific case. The speeds $V > 200 \text{ km/h}$ have only been assessed with the wheel profiles S1002 & GV 1/40, which are not sufficient for use on GB track laid at 1/20, and additional assessment with EPS (which has a tread profile identical to the BR-P8 profile) would be appropriate if BS113a rail were to be used for speeds greater than 200 km/h.

5.3.3 The ERA Application Guide Appendix 2 also lists a range of other rail head profiles which have been assessed using S1002 and GV 1/40. These cannot automatically be assumed to be suitable for GB installation with 1:20 inclination.

Table 2: Rail head profiles assessed by RSSB using the EPS wheel profile and demonstrated to meet the requirements of the GB Specific Case

5.3.4 Rail head profile 60 E1 does not meet the requirements for > 200 km/h at 1435 mm or 1437 mm gauge with the EPS wheel profile.

5.3.5 The ERA Application Guide also notes that, for projects where serviceable rails are used, the theoretical railhead profile may be used for this assessment.

5.4 Assessment of platform offset

5.4.1 The GB Specific Case points to the RGS gauging process for assessment of platform offset.
5.5 Assessment of track resistance for plain line

<table>
<thead>
<tr>
<th>INF TSI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>6.2.5.1 Assessment of track resistance for plain line</strong></td>
</tr>
<tr>
<td>(1) The demonstration of conformity of the track to the requirements of point 4.2.6 may be done by reference to an existing track design which meets the operating conditions intended for the subsystem concerned.</td>
</tr>
<tr>
<td>(2) A track design shall be defined by the technical characteristics as set out in Appendix C.1 to this TSI and by its operating conditions as set out in Appendix D.1 to this TSI.</td>
</tr>
<tr>
<td>(3) A track design is considered to be existing, if both of the following conditions are met:</td>
</tr>
<tr>
<td>a) the track design has been in normal operation for at least one year and</td>
</tr>
<tr>
<td>b) the total tonnage over the track was at least 20 million gross tons for the period of normal operation.</td>
</tr>
<tr>
<td>(4) The operating conditions for an existing track design refer to conditions which have been applied in normal operation.</td>
</tr>
<tr>
<td>(5) The assessment to confirm an existing track design shall be performed by checking that the technical characteristics as set out in Appendix C.1 to this TSI and conditions of use as set out in Appendix D.1 to this TSI are specified and that the reference to the previous use of the track design is available.</td>
</tr>
<tr>
<td>(6) When a previously assessed existing track design is used in a project, the notified body shall only assess that the conditions of use are respected.</td>
</tr>
<tr>
<td>(7) For new track designs that are based on existing track designs, a new assessment can be performed by verifying the differences and evaluating their impact on the track resistance. This assessment may be supported for example by computer simulation or by laboratory or in situ testing.</td>
</tr>
<tr>
<td>(8) A track design is considered to be new, if at least one of the technical characteristics set out in Appendix C to this TSI or one of conditions of use set out in Appendix D to this TSI is changed.</td>
</tr>
</tbody>
</table>

5.5.1 The EUAR INF WP has discussed the possibility of developing a library of existing track designs which can be used as reference, in accordance with the characteristics listed in Appendix C and Appendix D. It was stated by the EUAR that they would not include such a list in the Application Guide, but CER / EIM are still considering if there is some other way to maintain such a list.
Part 6 Guidance for TSI Chapter 7 Implementation of the Infrastructure TSI

6.1 Definition of an upgrade of a line

<table>
<thead>
<tr>
<th>INF TSI</th>
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<tbody>
<tr>
<td><strong>7.3.1 Upgrading of a line</strong></td>
</tr>
<tr>
<td>(1) In accordance with Article 2(m) of Directive 2008/57/EC, ‘upgrading’ means any major modification work on a subsystem or part of a subsystem which improves the overall performance of the subsystem.</td>
</tr>
<tr>
<td>(2) The infrastructure subsystem of a line is considered to be upgraded in the context of this TSI when at least the performance parameters axle load or gauge, as defined in point 4.2.1, are changed in order to meet the requirements of another traffic code.</td>
</tr>
</tbody>
</table>

6.1.1 Sub-clause (2) is intended to provide clarification on the interpretation of the general sub-clause (1) in the context of this TSI. Unfortunately, because of the UK (GB) Specific Cases and permissions within the TSI, a pedantic application of sub-clause (2) could imply that no project on the existing GB mainline is an ‘upgrade’. This is because the classification used for ‘axle load’ in the TSI is EN 15528 ‘Railway applications - Testing for the acceptance of running characteristics of railway vehicles - Testing of running behaviour and stationary tests’, while GB has permission (see INF TSI clause 4.2.7.4 (4)) to use the RA system for existing bridges, and the GB specific case for ‘gauge’ (7.7.17.2) also allows use of National Rules for this purpose in place of the EN 15273 ‘Railway applications – Gauges’ used in the core TSI.

6.1.2 Projects are categorised as either ‘Upgrade’ or ‘Renewal’ based on an objective assessment of whether the ‘overall performance of the sub-system’ is improved in line with sub-clause (1) rather than a rigid application of sub-clause (2).

6.1.3 Any project which is not covered by 7.3.3 ‘Substitution in the framework of maintenance’ will be categorised as either ‘Upgrade’ or ‘Renewal’.

6.2 Existing lines that are not subject to a renewal or upgrading project

<table>
<thead>
<tr>
<th>INF TSI</th>
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</thead>
<tbody>
<tr>
<td><strong>7.3.4 Existing lines that are not subject to a renewal or upgrading project</strong></td>
</tr>
<tr>
<td>The demonstration of the level of compliance of existing lines with the basic parameters of the TSI is voluntary. The procedure for this demonstration shall be in accordance with Commission Recommendation 2014/881/EU of 18 November 2014</td>
</tr>
</tbody>
</table>

6.2.1 The ERA are currently updating the Commission Recommendation 2014/881/EU to clarify the level and type of assessment expected. For a number of design parameters (such as curve radius and installed cant) it is being clarified that current measurements may be used as an alternative to the ‘design’ information.

6.2.2 The revised version of 2014/881/EU is intended to make it more practical for voluntary declarations of compliance to be made for existing lines, and this could permit longer continuous sections of infrastructure to be declared compliant.
6.3 INF TSI Chapter 7.4 Application of this TSI to existing platforms

<table>
<thead>
<tr>
<th>INF TSI</th>
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<tbody>
<tr>
<td><strong>7.4 Application of this TSI to existing platforms</strong></td>
</tr>
<tr>
<td>In case of upgrade or renewal of the infrastructure subsystem, the following conditions related to platform height governed by point 4.2.9.2 of this TSI, shall apply:</td>
</tr>
<tr>
<td>a) It shall be allowed to apply other nominal platform heights for consistency with a particular upgrade or renewal programme of a line or a section of a line.</td>
</tr>
<tr>
<td>b) It shall be allowed to apply other nominal platform heights, if the work requires structural alterations to any load bearing element.</td>
</tr>
</tbody>
</table>

6.3.1 GIGN7616 gives guidance on the application of GIRT7016 to existing platforms.
Part 7 Guidance for Infrastructure TSI Appendices

7.1 INF TSI Appendix B Assessment of the infrastructure subsystem

7.1.1 Table 37 Assessment of the infrastructure subsystem for the EC verification of conformity

7.1.1.1 Clause 7.3.4 of the INF TSI permits the voluntary declaration of conformity for existing sections of line that are not subject to a renewal or upgrading project. In this case, the full assessment in accordance with Table 37 is often not practical as, for example, the original design information may not be available. Discussions in the INF TSI ERA WP indicated that, where the in-service values are within the specified limits, then it is not always necessary to assess the design values. This may apply to (list not exhaustive):

a) Curve radius.
b) Cant.
c) Gauge.
d) ..... 

7.2 INF TSI Appendix E and Appendix F - Capability requirements for structures according to traffic codes and the UK (GB) specific requirements

7.2.1 Table 38 and Table 39 in Appendix E provide the definitions of the different line categories in accordance with the method of EN 15528:2008 ‘Railway applications - Testing for the acceptance of running characteristics of railway vehicles - Testing of running behaviour and stationary tests’.

7.2.2 For the GB railway, Tables 40 and 41 of Appendix F set out the equivalent definitions to those set out in Appendix E, but expressed in terms of the RA number. Equivalence is expressed in terms of the route availability number and the coincident maximum speed for which the loading is compatible with the stated traffic category.

7.2.3 Appendix F has the effect of a GB Specific Case, although it is not listed as such.

7.2.4 There are open points in both Appendix E and Appendix F for multiple units with speeds > 160 km/h. The EUAR has provided a mandate to CEN TC256 to extend the EN 15528 categorisation to cover such vehicles, and work is underway. GB is considering how to extend the applicability of the RA system.

7.2.5 Currently GERT8006 is restricted to compatibility assessment using the RA loading models, which may not be wholly representative of all existing and potential future traffic. There is an opportunity to include additional models for compatibility assessment, taking account of the findings from RSSB research project T1066 ‘Bridge Compatibility Assessment’.

7.2.6 The requirement for bridges is to determine the RA number at the standard permissible speed. The assessed capacity of the bridge is required to take account of the dynamic effects attributable to a vehicle travelling at the standard permissible speed. Therefore the stated capacity is presented in terms of the combination of static RA loading and associated speed at which the vehicle and structure capacity are compatible. Currently, GERT8006 contains no information about the process of demonstrating compatibility of vehicles with structures, taking account of speed. RSSB research project T1066 ‘Bridge Compatibility Assessment’ presents an opportunity to incorporate relevant information on this topic.
7.3 INF TSI Appendix G Speed conversion to mph

7.3.1 The conversions given in Appendix G of the INF TSI are intended specifically for speed conversions from km/h to mph where speed is used to differentiate requirements in the INF TSI (see 3.1 INF TSI Chapter 4.1 Functional and technical specifications on page 9) and may not be appropriate for any other purpose.

7.4 INF TSI Appendix J Safety assurance over fixed obtuse crossings

7.4.1 See 3.5.2 Maximum unguided length of fixed obtuse crossings on page 17.

7.5 INF TSI Appendix Q National Technical Rules for UK (GB) Specific Cases

7.5.1 In earlier versions of the TSIs the detailed requirements for some UK (GB) Specific Cases were explicitly written in the TSI. In the current revision this has been replaced by references to the relevant NTRs.

7.5.2 It was a requirement from the EUAR that the NTR references for UK (GB) Specific Cases were listed in Appendix Q.

7.5.3 The NTRs applicable to infrastructure for the UK (GB) are also available from the DfT website.

7.6 INF TSI Appendix R List of open points

7.6.1 List of open points

7.6.1.1 Appendix R lists the recognised open points in the TSI.

7.6.1.2 Comparison of the requirements of the INF TSI with the requirements of GB RGSSs has identified a number of areas where there are interface requirements in the RGS but the TSI is silent. In some cases the lack of requirements in the TSI is intentional, in other cases it may be an omission. These areas are under discussion with the EUAR.

7.6.2 Areas where the INF TSI is intentionally silent

7.6.2.1 Following discussions in the EUAR WP meetings, the TSI is intentionally silent regarding track stiffness, as this is not something that can be controlled at an interoperability level.

7.6.3 Areas not covered by the TSI

7.6.3.1 As explained in 3.1 INF TSI Chapter 4.1 Functional and technical specifications on page 9, the TSI is not a design guide and there is a need to capture other design and construction requirements from other sources. The TSIs only specify requirements to the extent necessary to meet the objectives of the Interoperability Directive. This essentially means that the parameters covered in the TSI are where there is an identified need for European harmonisation in order to achieve the Single European Rail Area.

7.6.3.2 Therefore, the following are identified as areas that are not covered by the TSI but may have interface implications and are typically considered when designing, constructing and maintaining infrastructure:

a) Check rails on plain line curves.

b) Rail joints (including expansion joints).
c) Cyclic top track faults.
d) In-service railhead width or sideway limit.
e) Accidental actions (loads) arising due to impact with railway infrastructure as a consequence of derailment.
Definitions

Accidental Actions (loads) An action, usually of short duration but of significant magnitude, that is unlikely to occur on a given structure during the design working life. The term is generally taken to refer to the effects of derailment of a railway vehicle on, below or adjacent to a railway structure.

Action A set of rail traffic forces (loads) applied to a structure.

Basic Parameter Any regulatory, technical or operational condition which is critical to interoperability and is specified in the relevant TSIs.

Brinnell Hardness Number (HBW) No definition

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.

Conformity Compliance with applicable requirements of a product, process, service, system, person or body.

Department for Transport (DFT) No definition

Deutsche Bahn (DB) No definition

Engineering Train Train used for infrastructure construction, inspection or maintenance.

Equivalent Conicity Parameter for characterisation of the wheel / rail contact. For a given wheelset running on given track it equals the tangent of the taper angle of a tapered profile wheelset whose transverse movement has the same wavelength of kinematic yaw as the wheelset under consideration.

European Rail Research Institute (ERRI) No definition

European Rail Traffic Management System (ERTMS) Signalling and operation management system encompassing ETCS for control command and GSM-R for voice and data.

European Standards (EN) Europe-wide standards that help in developing the single European market for goods and services in all sectors. The intention of ENs is to facilitate trade between countries, create new markets, and cut compliance costs.

European Union Agency for Railways EUAR The European Railway Agency (ERA) is an agency of the European Union charged with the facilitation of a safe, modern integrated European railway network so that railways become more competitive and offer
high-quality, end-to-end services without being restricted by national borders via interoperability.

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.

Immediate Action Limit (IAL)
No definition

Interoperability Constituents
An elementary component, group of components, subassembly or complete assembly of equipment incorporated or intended to be incorporated into a subsystem. Interoperability constituents are placed on the market with an intended area of use and are assessed for conformity independently of the subsystem.

National Determined Parameters (NDPs)
No definition

National Technical Rule (NTR)
A technical rule used for implementing the essential requirements in the circumstances listed in Article 17(3) of the Railway Interoperability Directive 2008/57/EC.

Office for Research and Experiments (ORE)
No definition

Open Point
Parameters that have been formally identified as in scope of a TSI or Railway Group Standard for which no common requirement has been agreed.

Overhead Contact Line (OCL)
No definition

Platform Train Interface (PTI)
No definition

Rail Group Standard RGS
No definition.

Railway Undertaking (RU)
Any private or public undertaking the principal business of which is to provide rail transport services for goods and/or passengers, with a requirement that the undertaking must ensure traction, this also includes undertakings which provide traction only Railways and Other Guided Systems Regulations 2006.

Register of Infrastructure (RINF)
A register that shall be maintained for each TSI-certified line that describes the main features and requirements of each subsystem and their correlation with the relevant TSI.

Reynolds’-averaged Navier-Stokes (RANS)
No definition

Specific Case
A specific case is a special provision defined in a TSI that applies to a part of the railway system because of geographical, topographical or urban environment constraints; or to maintain
compatibility with the existing system. A specific case may be either temporary or permanent.

Structure
An element of the infrastructure built to support or retain a railway traffic load including, but not limited to, bridges, culverts, cut and cover structures, structures over or adjacent to the track, earth retaining structures, and earthworks.

Structure Gauge
An outline drawing or specification, complete with application rules, defining a line relative to the track inside which structures are not permitted to intrude.

Subsystem
One of the subsystems (of the European railway system) identified by the Interoperability Directive. Subsystems can be structural or functional.

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.

Switches and Crossings (S&C)
No definition

Technical Specification for Interoperability (TSI)
A TSI is a specification adopted in accordance with the Railway Interoperability Directive 2008/57/EC by which each subsystem or part subsystem is covered in order to meet the essential requirements and ensure the interoperability of the rail system.

Track Gauge
The distance between the running edges of the running rails in a track, measured at right angles to the rails in a plane 14 mm below their top surface.

Trans-European Transport Network (TEN-T)
No definition.

UK National Annex (UK NA)
No definition

Unguided Length
The length within an obtuse crossing where the wheel has no flange guidance and is dependent on frictional guidance alone.
References

The Catalogue of Railway Group Standards gives the current issue number and status of documents published by RSSB. This information is also available from http://www.rssb.co.uk/railway-group-standardsne.co.uk.

RGSC 01 Railway Group Standards Code
RGSC 02 Standards Manual

Documents referenced in the text

Railway Group Standards

GCR75021 Track System Requirements
GERT8006 Assessment of Compatibility of Rail Vehicle Weights and Underline Bridges
GERT8073 Requirements for the Application of Standard Vehicle Gauges.
GERT8273 Assessment of Compatibility of Rolling Stock and Infrastructure - Gauging and Stepping Distance
GIRT7016 Interface between Station Platforms, Track and Trains
GIRT7073 Requirements for the Position of Infrastructure and for Defining and Maintaining Clearances
GMRT2173 Requirements for the Size of Vehicles and Position of Equipment.
GMRT2466 Railway Wheelsets
GMTT0088 Permissible Track Forces for Railway Vehicles

RSSB Documents

GCRC5521 Calculation of Enhanced Permissible Speeds for Tilting Trains
GEGN8573 Guidance on Gauging and Platform Distances
GIGN7619 Guidance on the Safety in Railway Tunnels Technical Specification for Interoperability
GLGN1600 Guidance on the Energy TSI
GMGN2615 Guidance on the Conventional Rail Locomotives and Passenger Rolling Stock TSI
GMGN2688 Guidance on Designing Rail Freight Wagons for use on the GB Mainline Railway

Platform Train Interface Strategy
T1066 (Research project) Bridge compatibility assessment for GB passenger rail vehicles for risk of excessive dynamic effects including resonance

T1073 (Research project) Loading Requirements for Track Systems

T1099 (Research Project) Enabling magnetic track brakes on GB mainline rail

Other References

1299/2014/EU Technical specification for interoperability relating to the infrastructure subsystem of the rail system in the European Union.

2014/881/EU Commission Recommendation on the procedure demonstrating the level of compliance of existing railway lines with the basic parameters of the technical specifications for interoperability

BS 3818:1964 Self-sealing fuelling couplings for diesel locomotives and diesel railcars


EN 12502-1:2004 Protection of metallic materials against corrosion - Guidance on the assessment of corrosion likelihood in water distribution and storage systems - Part 1: General

EN 13012:2001 Petrol filling stations - Construction and performance of automatic nozzles for use on fuel dispensers

EN 13232-3 Railway applications - Track - Switches and crossings - Part 3: Requirements for wheel/rail interaction

EN 13674-1:2011 Railway applications – Track - Rail Part 1: Vignole railway rails 46 kg/m and above

EN 13848-5:2008 Railway applications – Track – Track geometry quality - Part 5: Geometric quality levels - Plain line


EN 14363 Railway applications — Testing for the acceptance of running characteristics of railway vehicles — Testing of running behaviour and stationary tests

EN 15273 Railway applications – Gauges


EN 15528:2008 Railway applications - Testing for the acceptance of running characteristics of railway vehicles - Testing of running behaviour and stationary tests
<table>
<thead>
<tr>
<th>Standard Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 16362:2011</td>
<td>Railway applications - Ground based services - Water restocking equipment</td>
</tr>
<tr>
<td>EN 16507:2014</td>
<td>Railway applications – Ground based services – Diesel refuelling equipment</td>
</tr>
<tr>
<td>EN 50467:2011</td>
<td>Railway applications - Rolling stock – Electrical connectors, requirements and test methods</td>
</tr>
<tr>
<td>ERA/GUI/07-2011/INT</td>
<td>Guide for the application of the INF TSI (draft following linguistic comments – check before publication)</td>
</tr>
<tr>
<td>NR/L2/CIV/003/F1990</td>
<td>Technical design requirements for BS EN 1990: Eurocode - Basis of structural design</td>
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<td>Railway applications - Ground based services – Toilet discharge equipment</td>
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