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Guidance on the Infrastructure National Technical Specification Notice

This document gives guidance on interpreting the requirements of the Infrastructure National Technical Specification Notice (INF NTSN) for application to the GB mainline railway.

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Synopsis

This document gives guidance on interpreting the requirements of the Infrastructure National Technical Specification Notice (INF NTSN) for application to the GB mainline railway.

Published by RSSB

Issue Record

Issue	Date	Comments
One	01/06/2013	Original document: Guidance on the Conventional Rail and High Speed Infrastructure Technical Specifications for Interoperability (TSIs). This document provides guidance on the requirements set out in the Infrastructure TSIs, clarifies terms that are particular to Great Britain and indicates where there are specific cases.
Two	03/09/2016	Replaces issue one. This document provides guidance on the combined Infrastructure TSI.
Three	06/09/2025 [proposed]	Updated to reference the Infrastructure NTSN. Contains updated clauses from the Infrastructure NTSN, and associated guidance following revisions to the European Union's corresponding Technical Specifications for Interoperability (TSIs).

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

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

Superseded Documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
GIGN7608 Issue 2	All	06/09/2025 [proposed]

Supply

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Part 1 Introduction

G1.1 Purpose

G1.1.1 This document gives guidance on interpreting the requirements of the Infrastructure National Technical Specification Notice (INF NTSN), for application to the GB mainline railway. This document does not set out requirements.

G1.1.2 This document is intended to provide clarification on the requirements set out in the INF NTSN that may be misinterpreted due to ambiguity. This document also gives guidance to clarify terms and indicates where there are specific cases.

G1.1.3 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 NTSN. It does not constitute a recommended method of meeting any set of mandatory requirements. The INF NTSN is to be used in conjunction with national technical rules (NTRs) and company standards in order to define the complete infrastructure system.

G1.2 Structure of this document

G1.2.1 Relevant requirements from the INF NTSN are reproduced with a grey background in this document.

G1.2.2 Guidance is provided immediately below the greyed text to which it relates.

G1.2.3 NTSN text is reproduced to put the guidance in context but not all the text is included.

G1.2.4 Where GB specific cases are included in the INF NTSN, 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.

G1.3 Approval and Authorisation

G1.3.1 The content of this document will be approved by Infrastructure Standards Committee on [08 July 2025].

G1.3.2 This document will be authorised by RSSB on [25 July 2025]

Part 2 Guidance for INF NTSN Chapter 2 Definition and Scope of Subsystem

G2.1 INF NTSN Chapter 2

G2.1.1 Interfaces of INF NTSN with other NTSNs

G2.1.1.1 The INF NTSN has been developed to be consistent with other NTSNs. Key interfaces exist with the Rolling Stock NTSNs for Locomotives and Passenger Vehicles (LOC & PAS NTSN) and for Wagons (WAG NTSN).

G2.1.1.2 Both the Persons with Reduced Mobility NTSN (PRM NTSN) and the Safety in Rail Tunnels NTSN (SRT NTSN) include requirements related to the infrastructure sub-system.

G2.1.1.3 The Energy NTSN (ENE NTSN) 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.

G2.1.1.4 Guidance on these other NTSNs is found in:

- GEGN8615 for the Persons with Reduced Mobility NTSN
- GIGN7619 for the Safety in Rail Tunnels NTSN
- GLGN1600 for the Energy NTSN
- GMGN2615 for the Locomotives and Passenger Rolling Stock NTSN
- GMGN2688 for the Freight Wagon and Noise NTSNs

Part 3 Guidance for INF NTSN Chapter 4 and GB Specific Cases in 7.7.17

G3.1 INF NTSN Chapter 4.1 Introduction

G3.1.1 Chapter 4.1 of the INF NTSN recognises that the NTSNs are not to be an obstacle to running trains that were not built to the rolling stock NTSNs and may have been in service for a number of years. In this context, the NTSN provides a minimum level of infrastructure provision, but additional requirements might be necessary for running other (legacy) trains.

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

G3.1.2 It is important to recognise that the NTSN 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 NTSN, when the use of such values does not prevent the operation of NTSN compliant rolling stock.

G3.1.3 The values stated in the NTSN are used directly in the design of, for example, new, upgraded, and renewed structures in accordance with the requirements of the relevant industry standards for design.

G3.1.4 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.

G3.1.5 Many of the limits for particular parameters are specified as in-service limits. Design limits are generally required to provide for a suitable inspection and / or detection regime, appropriate understanding of deterioration and timely rectification and / or maintenance before the in-service limits are reached.

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

G3.1.6 Within European Standards (ENs) the following types of national deviations may exist:

a) 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.

b) 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.

G3.1.7 ENs may also contain the following national provisions that are not deviations:

a) 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.
b) National Determined Parameters (NDPs), to suit local geographical, geological and climatic conditions. NDPs are published in each EU Member State as a National Annex.

G3.1.8 The ‘national deviations’ referred to in clause 4.1 are considered to be A-deviations and B-deviations.

G3.1.9 The ‘Structures Resistance to Traffic Loads’ section of the INF NTSN (4.2.7) requires the use of BS EN 1991-2:2003/AC:2010 and Annex A2 to EN 1990:2002 (issued as BS EN 1990:2002/A1:2005) ‘to be applied in accordance with the corresponding points in the national annexes to these standards if they exist’. These National Annexes therefore can be applied.

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

G3.1.10 The INF NTSN 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 NTSN sets out agreed values that are to be used to convert from km/h to mph.

G3.2 NTSN Categories of line

INF NTSN
4.2.1 NTSN Categories of Line
(2) The NTSN 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 may be used to describe the performances; 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.
(3) These NTSN categories of line shall be used for the classification of existing lines to define a target system so that the relevant performance parameters will be met.

INF NTSN
4.2.1 NTSN Categories of Line
(4) Lines shall be classified based on the type of traffic (traffic code) characterised by the following performance parameters: • structure gauge, • axle load, • line speed, • train length • usable length of platform. The values in the columns for 'structure gauge' and 'axle load', which directly affect train running, shall be mandatory minimum levels according to the traffic code. 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.
(7) The performance levels for types of traffic are set out in Table 2 and Table 3.
(10) It is permitted to design new and upgraded lines able to accommodate: • Larger vehicle gauges, • Increased vehicle axle loads, • Increased permissible linespeeds, • Increased useable length of platforms, • Increased train lengths, than those specified in Table 2 and Table 3.
(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 NTSN Specific Case GB
7.7.17.1 NTSN 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.

G3.2.1 Note 2 under Table 2 regarding design mass under exceptional payload is not relevant to locomotives and power heads (which do not carry passengers) and these vehicles are only covered by Note 1 under Table 2.

G3.2.2 For clarity, where 'other vehicles' is referenced in Note 3 of Table 2, this includes passenger and freight vehicles.

G3.2.3 GB has a specific case for structure gauge for all lines except new dedicated high speed lines, for example, HS2. 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.

G3.2.4 Where the specific case applies, it covers both the gauge to be used and the assessment method.

G3.2.5 Requirements and guidance on the usable length of platforms can be found in RIS-7016-INS.

G3.3 Basic parameters characterising the infrastructure subsystem

G3.3.1 Requirements for Basic Parameters

INF NTSN
4.2.2.2 Requirements for Basic Parameters
(1) These requirements are described in the following paragraphs, together with any particular conditions that may be allowed in each case for the basic parameters and interfaces concerned.
(2) The values of basic parameters specified are only valid up to a maximum line speed of 350 km/h
(3) This provision has been left intentionally blank
(4) In case of multi-rail track, requirements of this NTSN are to be applied separately to each pair of rails designed to be operated as separate track.
(5) Requirements for lines representing specific cases are described under point 7.7.
(6) A short section of track with devices to allow transition between different nominal track gauges is allowed.
(7) Requirements are described for the subsystem under normal service conditions. Consequences, if any, of the execution of works, which may require temporary exceptions as far as the subsystem performance is concerned, are dealt with in point 4.4.
(8) The performance levels of trains can be enhanced by adopting specific systems, such as vehicle body tilting. Special conditions are allowed for running such trains, provided they do not entail restrictions for other trains not equipped with such systems.

G3.3.1.1 To clarify, 4.2.2.2 (1) - (8) applies to basic track system parameters as given in clauses 4.2.3 to 4.2.7.4 inclusive.

G3.3.1.2 Multi-rail track refers to track which permits vehicles of differing track gauge to use the same section of track. This can be referred to as polyvalent gauge track. Multi-rail track is inherently more complex to design and maintain with associated increase in cost.

G3.3.1.3 It is recognised that multi-rail track has currently no known use in GB.

G3.4 Line layout

G3.4.1 NTSN structure gauge guidance

INF NTSN Specific Case 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 national technical rules.

G3.4.1.1 A suite of vehicle gauges are set out in GERT8073. The lower sector infrastructure gauge is set out in GIRT7073. Compliance to these gauges are part of the technical compatibility process in GB. The Department for Transport (DfT) holds a definitive list of national technical rules. This is linked on the RSSB website.

G3.4.1.2 Where structures are being built or modified, the aim should always be to maximise the potential for the route, complying with the relevant NTSN over the long term, unless the additional cost of doing so is disproportionate.

G3.4.2 Distance between track centres

INF NTSN Specific Case 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.
(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 national technical rules.

G3.4.2.1 GB practice is to use a nominal interval between running edges of 1 970 mm. This gives a distance between track centres of 1 970 mm + 1 435 mm = 3 405 mm, which is consistent with the nominal 3 400 mm.

G3.4.2.2 For renewed or upgraded lines, options for increasing track centres are constrained by existing infrastructure and railway boundaries. The INF NTSN recognises that the distance between track centres is, to an extent, governed by (structure) gauge and passing clearances.

G3.4.3 Maximum gradients

INF NTSN
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.

INF NTSN
4.2.3.3 Maximum gradients
(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

G3.4.3.1 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 NTSN, but does not restrict access for NTSN compliant vehicles.

G3.4.3.2 NTRs relevant to maximum gradients are contained in GCRT5021.

G3.4.3.3 Modern rolling stock is able to operate on steeper gradients, but very steep gradients can constrain the capacity of a mixed traffic railway. They can also present additional traction and braking issues in poor adhesion conditions and result in greater energy use.

G3.4.3.4 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 NTSN and WAG NTSN would probably need to travel on the new line, the maximum gradients for freight and mixed traffic set out in the INF NTSN should be considered as gradient limits for any new route construction.

G3.4.4 Minimum radius of horizontal curve

INF NTSN
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.
(1) The minimum horizontal design curve radius for new lines shall not be less than 150 m.
(2) Reverse curves, except in marshalling yards where wagons are shunted individually, with small radii for new lines shall be designed to prevent buffer locking.

G3.4.4.1 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 NTSN.

G3.4.4.2 Regarding 4.2.3.4 (2), curves with small radii are considered to be curves with radii of 150 m to 300 m.

G3.4.5 Minimum radius of vertical curve

INF NTSN
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.
(2) For humps in marshalling yards the radius of the vertical curves shall be at least 250 m on a crest or 300 m in a hollow.

G3.4.5.1 It is good practice to not use vertical curves in platforms and in switches and crossings (S&C).

G3.5 Track parameters

G3.5.1 Nominal track gauge

INF NTSN
4.2.4.1 Nominal track gauge
(1) The GB track gauge shall be the European standard nominal track gauge of 1 435 mm.

G3.5.1.1 The value of 1 435 mm is a description of 'standard gauge' and is not a design value.

G3.5.1.2 Work carried out as part of the development of the previous INF TSI recommends that design track gauge for plain line should be 1 435 mm (- 0 mm, + 4 mm), in order to avoid problems with in-service equivalent conicity.

G3.5.1.3 Network Rail 'CEN 56' S&C designs have a nominal track gauge of 1 432 mm and there is concern that this is inconsistent with the required nominal track gauge of 1 435 mm. The CEN 56 S&C designs comply with the required dimensions given in clause 4.2.8.6 of the INF NTSN 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 NTSN are sufficient for wheelset compatibility.

G3.5.2 Cant

INF NTSN
4.2.4.2 Cant
(1) The design cant for lines shall be limited as defined in Table 7.

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

G3.5.2.1 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 cant for any new route construction will need to take such vehicles into account.

G3.5.2.2 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.

G3.5.3 Cant deficiency

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

G3.5.3.1 The design for maximum cant deficiency 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 cant deficiency for any new route construction will need to take such vehicles into account.

G3.5.3.2 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 NTSN. This does not restrict access for NTSN compliant vehicles. GB freight vehicles are generally not compatible with higher values of cant deficiency.

G3.5.3.3 Regarding 4.2.4.3 (2), the INF NTSN does not give details of what is to be demonstrated. Further guidance on GB practice is given in GCRT5021.

G3.5.4 Abrupt change of cant deficiency

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

G3.5.4.1 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. However, GCRT5021 recommends that analysis of bogie centre distances on a planned route may suggest that calculating the virtual transition over a different distance is appropriate.

G3.5.4.2 Historically, it has been permissible to disregard the rate of change of cant deficiency at switch toes. This is no longer considered good practice due to the disturbed vehicle dynamics not being limited and has led to unacceptable ride comfort in some designs of S&C. It is recommended that the values above are used.

G3.5.4.3 Switches and crossings (S&C) designs are generally developed in accordance with metric speeds, and the TSI or NTSN speed categories can be used directly. If conversions from km/h to mph are required, Appendix G of the INF NTSN sets out the agreed conversion.

G3.5.5 Equivalent conicity

INF NTSN
4.2.4.5 Equivalent conicity
(1) The limiting values for equivalent conicity quoted in Table 10 shall be calculated for the amplitude (y) of the wheelset's lateral displacement:
(2) No assessment of equivalent conicity is required for switches and crossings.
(3) Design 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 10 are not exceeded.

INF NTSN
4.2.4.5 Equivalent conicity
(4) The following wheelsets, as defined in the specification referenced in Appendix T, Index [6.1 for (a) and (b)] and Index [6.2 for (c) and (d)] , shall be modelled passing over the designed track conditions (simulated by calculation in accordance with the specification referenced in Appendix T, Index [5.1]: (a) S 1002 with SR1. (b) S 1002 with SR2. (c) GV 1/40 with SR1. (d) GV 1/40 with SR2. For SR1 and SR2 the following values apply:(a) For the 1 435 mm track gauge system SR1 = 1 420 mm and SR2 = 1 426 mm.

INF NTSN Specific Case GB
7.7.17.3.bis Equivalent conicity (4.2.4.5)
(1) Instead of point 4.2.4.5.(3) design values of track gauge, rail head profile and rail inclination for plain line shall be selected to ensure that the equivalent conicity limits set out in Table 32 are not exceeded
(2) Instead of point 4.2.4.5. (4) the following wheelsets shall be modelled passing over the designed track conditions (simulated by calculation according to EN 15302:2008+A1:2010): (a) S 1002 as defined in Annex C of EN 13715:2020 with SR1.(b) S 1002 as defined in Annex C of EN 13715:2020 with SR2. (c) GV 1/40 as defined in Annex B of EN 13715:2020 with SR1. (d) GV 1/40 as defined in Annex B of EN 13715:2020 with SR2. (e) EPS as defined in Annex D of EN 13715:2020 with SR1. For SR1 and SR2 the following values apply: (f) For the 1 435 mm track gauge system SR1 = 1 420 mm and SR2 = 1 426 mm.

G3.5.5.1 This specific case was initially included late in the initial drafting process and numbered ‘7.7.17.3.bis’ to avoid renumbering subsequent sub-clauses.

G3.5.5.2 The definition of equivalent conicity is set out in BS EN 15302:2008+A1:2010. This is not the same as the historical method used by British Rail and the two methods can give slightly different results.

G3.5.5.3 The GB specific case is required as the reference wheelsets specified 4.2.4.5 (4) 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.

G3.5.5.4 It is 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.

G3.5.6 Railhead profile for plain line

INF NTSN
4.2.4.6 Railhead profile for plain line
(1) The railhead profile shall be selected from the range set out in one of the specifications referenced in Appendix T, Index [7.1] and Index [8.1] or shall be in accordance with as defined in point (2).
(2) The design of railhead profiles for plain line shall comprise: a) a lateral slope on the side of the railhead angled to between vertical and 1/16 with reference to the vertical axis of the railhead; b) the vertical distance between the top of this lateral slope and the top of the rail shall be less than 20 mm; c) a radius of at least 12 mm at the gauge corner; d) the horizontal distance between the crown of the rail and the tangent point shall be between 31 and 37,5 mm.

G3.5.6.1 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. BS 113B (BR variant) is included in BS EN 13674-1:2011 as 56E1.

G3.5.6.2 GCRT5021 sets out more information on the use of other rail sections where required to fit with existing fastenings.

G3.5.6.3 It is 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).

G3.5.7 Rail inclination – plain line

INF NTSN
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) For tracks intended to be operated at speeds greater than 60 km/h, 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.

G3.5.7.1 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.

G3.5.8 Rail inclination – switches and crossings

INF NTSN
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.

G3.5.8.1 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 *G3.5.1*), both designs are consistent with the NTSN requirements for rail inclination.

G3.5.8.2 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.

G3.6 Switches and crossings

G3.6.1 Use of swing nose crossing

INF NTSN
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.

G3.6.1.1 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).

G3.6.2 Maximum unguided length of fixed obtuse crossings

INF NTSN
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 NTSN.

INF NTSN Specific Case 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 national technical rules.

G3.6.2.1 The requirement in Appendix J of the INF NTSN was taken from a draft version of BS EN 13232-3:2023 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.

G3.6.2.2 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.

G3.6.2.3 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.

G3.6.2.4 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.

G3.6.2.5 The extract from BS EN 13232-3:2023, 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.

G3.7 Track resistance to applied loads

G3.7.1 General

G3.7.1.1 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.

G3.7.1.2 Design practice for ballasted track systems has long been based upon compliance with the loads set out in GCRT5021 and GMRT2141. Compliance with these standards has resulted in the satisfactory in-service performance of ballasted track systems, based on the compliant operation of vehicles. Standards for track construction have been developed and refined in light of experience of satisfactory in-service performance. It is not normal practice to design the track structure from first principles.

G3.7.1.3 For slab track systems, practice has involved the application of cross-discipline standards such as the UK National Annex for EN 1991-2:2003/AC:2010. This standard is not optimal for the design of the track system as it does not take account of the systemic nature of the railway track involving different components, with varying performance requirements. This practice is perpetuated in BS EN 16432-1:2017. There is less experience with other forms of ballastless track.

G3.7.1.4 To address uncertainty about the loads to be applied for the design of track systems, and to inform input to future revision of BS EN 16432, RSSB Research Project T1073 has examined the effectiveness of particular vertical load models, taking account of their magnitude and the conditions of their application. The objective was to deliver track loading models 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.

G3.7.2 Track resistance to vertical loads

INF NTSN
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 set out in the specification referenced in Appendix T, Index [9.1]. c) vertical quasi-static wheel forces. Maximum quasi-static wheel forces for defined test conditions are set out in the specification referenced in Appendix T, Index [9.1].

G3.7.2.1 Appendix T, Index [9.1] of the INF NTSN refers to BS EN 14363:2016+A2:2022, which sets 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 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.

G3.7.3 Longitudinal track resistance

INF NTSN
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/s^2 for the performance parameters chosen in accordance with point 4.2.1.

G3.7.3.1 The NTSN is silent on the other primary sources of longitudinal load, that is, traction and thermal forces.

G3.7.3.2 For thermal forces, Network Rail Standard NR/L2/TRK/2102 specifies a longitudinal tensile force of 700 kN and a longitudinal compressive force of 620 kN per rail, on Network Rail infrastructure. GCRT5021 requires the predicted forces on the rail to be calculated, prior to specifying design forces for track.

G3.7.3.3 Research projects T1073 and COF-UOH-59, examine the effectiveness of particular longitudinal and lateral load models, taking account of their magnitude and the conditions of their application.

G3.7.4 Compatibility with braking systems

INF NTSN
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) Provisions for the use of eddy current braking systems on track shall be defined at operational level by the infrastructure manager on the basis of the specific characteristics of the track, including switches and crossings. The conditions of use of this braking system are registered in accordance with Commission Implementing Regulation (EU) 2019/777[3] (RINF).

G3.7.4.1 Clause 4.2.6.2.1 of the INF NTSN gives a maximum deceleration rate of 2.5 m/s^2 and this is understood to be consistent with existing vehicles which use magnetic track brakes (including Tyne & Wear Metro). It is suggested that the 2.5 m/s^2 can be used to derive a suitable design longitudinal load for the track structure to demonstrate compliance.

G3.7.4.2 Any other potential risks identified as associated with the use of magnetic track brakes may need to be mitigated, for example, by reference to an existing system. RSSB Research Project T1099 has reviewed the issues associated with use of magnetic track brakes on the GB network, and has also identified several economic benefits to be gained from their use on the GB network. RIS-2710-RST sets out requirements for driver-actuated magnetic track brakes fitted to rail vehicles used on the GB mainline railway.

G3.7.5 Lateral track resistance

INF NTSN
4.2.6.3 Lateral track resistance
The track design, including switches and crossings, shall take into account at least the following forces: a) lateral forces; maximum lateral forces exerted by a wheel set on the track for defined test conditions are set out in the specification referenced in Appendix T, Index [9.2]. b) quasi-static guiding forces; maximum quasi-static guiding forces Y_{qst} for defined radii and test conditions are set out in the specification referenced in Appendix T, Index [9.1].

G3.7.5.1 The INF NTSN refers to EN 14363, which sets 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 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.

G3.7.5.2 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.

G3.7.5.3 GCRT5021 specifies 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. The same practice is specified in Network Rail Standard NR/L2/TRK/2102, for Network Rail infrastructure.

G3.7.5.4 Research projects T1073 and COF-UOH-59, examine the effectiveness of particular longitudinal and lateral load models, taking account of their magnitude and the conditions of their application.

G3.8 Structures resistance to traffic loads

INF NTSN
4.2.7 Structures resistance to traffic loads
The requirements of the specifications referenced in Appendix T, Index [10.1] and Index [11.1] specified in this point of the NTSN are to be applied in accordance with the corresponding points in the national annexes to those specifications if they exist.

G3.8.1 Project-specific ('individual project') values and requirements may be given in the National Annexes to Annex A2 of BS EN 1990:2002+A1:2005 and BS EN 1991-2:2003/AC:2010, 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.

G3.8.2 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 *G3.8.5*).

G3.8.3 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.

G3.8.4 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 (HSLM-A) and High Speed Load Model B (HSLM-B) 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).

G3.8.5 Instruction and guidance on the selection of project-specific values and requirements are set out in Network Rail documents NR/L2/CIV/003/F1990 and NR/L2/CIV/003/F1991.

G3.8.6 Clause 4.2.7 of the INF NTSN 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)).

G3.8.1 Resistance of new bridges to traffic loads

G3.8.1.1 Vertical loads

INF NTSN
4.2.7.1.1 Vertical loads
(1) Bridges shall be designed to support vertical loads in accordance with the following load models, set out in the specification referenced in Appendix T, Index [10]: a) Load Model 71, as set out in the specification referenced in Appendix T, Index [10.2] b) In addition, for continuous bridges, Load Model SW/0, as set out in the specification referenced in Appendix T, Index [10.3]
(2) The load models shall be multiplied by the factor alpha (α) as set out in the specification referenced in Appendix T, Index [10.4].
(3) The value of factor alpha (α) shall be equal to or greater than the values set out in Table 11.

G3.8.1.1.1 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, clause 6.3.2(3) NOTE permits the value to be specified in the UK National Annex. 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.

G3.8.1.2 Allowance for dynamic effects of vertical loads

INF NTSN
4.2.7.1.2 Allowance for dynamic effects of vertical loads
(1) The load effects from the Load Model 71 and Load Model SW/0 shall be enhanced by the dynamic factor phi (Φ) as set out in the specification referenced in Appendix T, Index [10.5].
(2) For bridges for speeds over 200 km/h where the specification referenced in Appendix T, Index [10.6] requires a dynamic analysis to be carried out, the bridge shall additionally be designed for HSLM defined in the specification referenced in Appendix T, Index [10.7].
(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.

G3.8.1.2.1 The requirements for making allowance for dynamic effects in the INF NSTN, 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 National Annex for BS EN 1991-2:2003/AC:2010 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 NTSN, clause 4.2.7.1.2 (2) is required.

G3.8.1.2.2 There is a GB specific case relevant to point 4.2.7.1.2 for HS2 infrastructure.

G3.8.1.3 Centrifugal forces

INF NTSN
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 bridges as set out in the specification referenced in Appendix T, Index [10.8].

G3.8.1.3.1 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.

G3.8.1.3.2 For the design of bridge structures, the practice has been to assume that the full centrifugal force applies, less the effect of track cant as per clause 6.5.1(1) of the UK National Annex for BS EN 1991-2:2003/AC:2010.

G3.8.1.3.3 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 75 mph (120 km/h).

G3.8.1.4 Nosing forces

INF NTSN
4.2.7.1.4 Nosing forces
The nosing force shall be taken into account in the design of bridges as set out in the specification referenced in Appendix T, Index [10.9].

G3.8.1.4.1 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), UK National Annex for BS EN 1991-2:2003/AC:2010). 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.

G3.8.1.4.2 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 Φ (clause 6.5.2(2), BS EN 1991-2:2003/AC:2010), but it is to be multiplied by the load classification factor α (clause 6.5.2(3)).

G3.8.1.4.3 On Network Rail infrastructure, Network Rail standard NR/L3/CIV/020, clause 10.2.1, permits the nosing load to be distributed over three adjacent sleepers in the proportions ¼ : ½ : ¼.

G3.8.1.5 Actions due to traction and braking (longitudinal loads)

INF NTSN
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 bridges as set out in the specification referenced in Appendix T, Index [10.10].

G3.8.1.5.1 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), UK National Annex for BS EN 1991-2:2003/AC:2010). 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.

G3.8.1.5.2 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 Φ 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 α (clause 6.5.3(4), BS EN 1991-2:2003/AC:2010).

G3.8.1.6 Design track twist due to rail traffic actions

INF NTSN
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 the specification referenced in Appendix T, Index [11.2].

G3.8.1.6.1 The limit for the maximum total design track twist 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.

G3.8.1.6.2 There is a GB specific case relevant to point 4.2.7.1.6 for HS2 infrastructure.

G3.8.2 Equivalent vertical loading for new geotechnical structures, earthworks and earth pressure effects

INF NTSN
4.2.7.2 Equivalent vertical loading for new geotechnical structures, earthworks and earth pressure effects
(1) Geotechnical structures and 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 the specification referenced in Appendix T, Index [10.2].
(2) The equivalent vertical loading shall be multiplied by the factor alpha (α) as set out in the specification referenced in Appendix T, Index [10.4]. The value of α shall be equal to or greater than the values set out in Table 11.

G3.8.2.1 The INF NTSN 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).

G3.8.3 Resistance of new structures over or adjacent to tracks

INF NTSN
4.2.7.3 Resistance of new structures over or adjacent to tracks
Aerodynamic actions from passing trains shall be taken into account as set out in the specification referenced in appendix T, Index [10.11].

G3.8.3.1 Clause 4.2.7 of the INF NTSN states, ‘The requirements of the specifications referenced in Appendix T, Index [10.1] and Index [11.1] specified in this point of the NTSN are to be applied in accordance with the corresponding points in the National Annexes to those specifications 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.

G3.8.3.2 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. The National Annex or the individual project may specify alternative values.

G3.8.3.3 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), 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.

G3.8.3.4 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.

G3.8.3.5 There is a GB specific case relevant to point 4.2.7.3 for HS2 infrastructure.

G3.8.4 Resistance of existing structures (bridges, geotechnical structures and earthworks) to traffic loads

INF NTSN
4.2.7.4 Resistance of existing structures (bridges, geotechnical structures and earthworks) to traffic loads
(1) Bridges and earthworks shall be brought to a specified level of interoperability according to the NTSN 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 satisfy 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 NTSN (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) For the networks of Great Britain, in points (2) and (3) the EN line category may be replaced by Route Availability (RA) number (delivered in accordance with the national technical rule) and consequently reference to Appendix E are replaced by reference to Appendix F

G3.8.4.1 4.2.7.4 (4) is effectively a specific case for GB but is written into the main NTSN text. This permits the continued use of the ‘Route Availability (RA)’ structure classification as set out in GERT8006.

G3.8.4.2 It is good practice for new structures to be assessed to the BS EN 15528:2021 line categories, and that assessment of existing structures to these categories is also considered when the opportunity arises.

G3.9 Immediate action limits on track geometry defects

G3.9.1 General considerations

G3.9.1.1 GCRT5021 sets out a range of parameters and values to be taken into account for determining appropriate immediate action, intervention and alert limits.

G3.9.1.2 The definition of 'immediate action limit' in the NTSN 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 BS EN 13848:5:2008 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'. An appropriate time interval is to be specified for this action.

G3.9.1.3 Infrastructure Managers may already use stricter IAL values than those set out in the INF NTSN. When making any decision to relax these limits to those in line with the INF NTSN, it is good practice to use an appropriate Safety Management System and risk assessment, taking into account the IM's inspection and maintenance regime, to justify the change to the values used.

G3.9.2 The immediate action limit for alignment

INF NTSN
4.2.8.1 The immediate action limit for alignment
(1) The immediate action limits for isolated defects in alignment are set out in the specification referenced in Appendix T, Index [12.1]. Isolated defects shall not exceed the limits of wavelength range D1.
(2) The immediate action limits for isolated defects in alignment for speeds of more than 300 km/h are an open point.

G3.9.2.1 The D1 wavelength range used in EN 13848-5: 2017 and the INF NTSN 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 INF NTSN requirements and do not restrict access for NTSN compliant vehicles.

G3.9.3 The immediate action limit for longitudinal level

INF NTSN
4.2.8.2 The immediate action limit for longitudinal level
(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
(2) The immediate action limits for isolated defects in longitudinal level for speeds of more than 300 km/h are an open point.

G3.9.3.1 The D1 wavelength range used in the EN and NTSN 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 NTSN requirements and do not restrict access for NTSN compliant vehicles.

G3.9.4 The immediate action limit for track twist

INF NTSN
4.2.8.3 The immediate action limit for track twist
(1) The immediate action limit for track twist as an isolated defect is given as a zero to peak value. Track twist is set out in the specification referenced in Appendix T, [13.1].
(2) The track twist limit is a function of the measurement base applied in accordance with the specification referrenced in Appendix T, Index [12.3].
(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.

G3.9.4.1 There has been some concern that the limits generally used on the GB network are less onerous than those given in the NTSN. This arises from a misunderstanding of the term 'immediate action limit' (see: *G3.9.1*). With the correct understanding of this term the values are consistent.

G3.9.4.2 GB practice is to measure twist over a 3 m base, which is consistent with the NTSN requirement.

G3.9.5 The immediate action limit of track gauge as an isolated defect

INF NTSN		
4.2.8.4 The immediate action limit of track gauge as an isolated defect		
(1) The immediate action limits of track gauge as an isolated defect are set out in Table 12.		
Speed [km/h]	Dimensions [mm]	
	Minimum track gauge	Maximum track gauge
v ≤ 120	1 426	1 470
120 < v ≤ 160	1 427	1 470
160 < v ≤ 230	1 428	1 463
v > 230	1 430	1 463

G3.9.5.1 GB practice has been to use values which are more onerous than those given in the NTSN. This does not restrict access for NTSN compliant vehicles.

G3.9.6 The immediate action limit for cant

INF NTSN
4.2.8.5 The immediate action limit for cant
(1) The maximum cant allowed in service is 180 mm.
(2) The maximum cant allowed in service is 190 mm for dedicated passenger traffic lines.

G3.9.6.1 Normal GB practice is to limit track cant to 150 mm with 180 mm as the exceptional value, as set out in GCRT5021. Specific sites can exceed these values by special permission. For example, 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.

G3.9.7 The immediate action limits for switches and crossings

INF NTSN
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.

INF NTSN Specific Case GB
7.7.17.5 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).

G3.9.7.1 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.

G3.9.7.2 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.

G3.9.7.3 Network Rail CEN 56 S&C designs can have a maximum freewheel passage of 1 432-50 mm = 1 382 mm, which is in excess of the maximum permitted in the NTSN 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).

G3.9.7.4 The specific case for minimum crossing fixed nose protection of 1 388 mm allows for a nominal cover check gauge of 1 391 mm with a 3 mm maintenance tolerance for cover check rail wear.

G3.10 Platforms

G3.10.1 Platforms general

INF NTSN
4.2.9 Platforms
(1) The requirements of this point are only applicable to passenger platforms where trains are intended to stop in normal service.
(2) For the requirements of this point it is permissible to design platforms required for the current service requirement provided provision is made for the reasonably foreseeable future service requirements. When specifying the interfaces with trains intended to stop at the platform, consideration shall be given to both the current service requirements and the reasonably foreseeable service requirements at least 10 years following the bringing into service of the platform.

G3.10.1.1 Further information on the Platform Train Interface (PTI) is available on the RSSB website. Topics include safe dispatch procedures, Platform Train Interface Bowtie Risk Models, and the GB approach to making the gap between the platform and the train safer.

G3.10.2 Platform height

INF NTSN
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 NTSN Specific Case GB
7.7.17.6 Platform height (4.2.9.2)
Instead of point 4.2.9.2, for platform height, national technical rules shall be allowed.

G3.10.2.1 The GB specific case refers to GIRT7020 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.

G3.10.2.2 RIS-7016-INS sets out guidance on platform height for the GB mainline network.

G3.10.2.3 Any project considering a non-standard platform height will also need to consider the resulting clearances to OCL equipment and relevant electrical clearance requirements.

G3.10.3 Platform offset

INF NTSN
4.2.9.3 Platform offset
(1) The distance between the track centre and the platform edge parallel to the running plane (b_q), as defined in the specification referenced in Appendix T, Index [3.5], shall be set on the basis of the installation limit gauge (b_{qlim}). The installation limit gauge shall be calculated on the basis of the gauge G1.

INF NTSN Specific Case GB
7.7.17.7 Platform offset (4.2.9.3)
Instead of point 4.2.9.3, for platform offset, national technical rules shall be allowed.

G3.10.3.1 The requirements for the GB specific case are set out in GIRT7073. 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 standards are:

a) GIRT7073 Requirements for the Position of Infrastructure and for Defining and Maintaining Clearances

b) GMRT2173 Requirements for the Size of Vehicles and Position of Equipment
c) RIS-8273-RST Assessment of Compatibility of Rolling Stock and Infrastructure - Gauging and Stepping Distances
d) GERT8073 Requirements for the Application of Standard Vehicle Gauges

G3.10.3.2 RIS-7016-INS sets out guidance on platform offset for the GB mainline network.

G3.10.4 Track layout alongside platforms

INF NTSN
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.

G3.10.4.1 GB practice has been to use a minimum radius of 1 000 m for new platforms and 500 m for extension to existing platforms. Both values are more onerous than the INF NTSN figure, but do not restrict access for NTSN compliant vehicles.

G3.10.4.2 Platforms adjacent to curved track generally give larger stepping distances for passengers and are therefore to be avoided where possible.

G3.10.4.3 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.

G3.11 Health, safety and environment

G3.11.1 Maximum pressure variations in tunnels and underground structures

INF NTSN
4.2.10.1 Maximum pressure variations in tunnels and underground structures
(1) Any new, renewed or upgraded tunnel or underground structure in the categories described in Table 12A has to ensure that the maximum pressure variation, caused by the passage of a train running at the maximum allowed speed in the tunnel or underground structure, does not exceed 10 kPa during the time taken for the train to pass through the tunnel or underground structure.
(2) Above requirement has to be fulfilled along the outside of any train complying with the Locomotives and Passenger NTSN.

G3.11.1.1 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.

G3.11.1.2 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.

G3.11.1.3 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.

G3.11.1.4 Any train compliant with the LOC&PAS NTSN 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 BS EN 14067-5:2006+A1:2010, Section 4.2.1.

G3.11.1.5 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.

G3.11.1.6 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.

G3.11.1.7 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.

G3.11.1.8 All NTSN compliant 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 rolling stock are those having reference cross-sectional areas determined according to the kinematic profile (see INF NTSN clause 6.2.4.12(3)), and having the relevant reference characteristic pressure signatures for their maximum speeds, according to the LOC&PAS NTSN. It is also appropriate that different operational train length combinations and relative train entry times are assessed.

G3.11.1.9 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.

G3.11.2 Effect of crosswinds

INF NTSN
4.2.10.2 Effect of crosswinds
(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.
(2) The rules for proving conformity shall take into account the characteristic wind curves of the reference trains defined in the LOC&PAS NTSN.
(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: • locally reducing train speeds, possibly temporarily during periods at risk of storms, • installing equipment to protect the track section concerned from cross winds, • other appropriate means.
(4) It shall be demonstrated that safety is achieved after measures taken.

G3.11.2.1 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.

G3.11.2.2 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.

G3.11.2.3 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.

G3.11.2.4 The effect of crosswinds is currently not fully covered in the LOC&PAS NTSN, as no limit values have been set for conventional trains with maximum speed less than

250 km/h, due to lack of consensus. For these trains 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. Limit values for trains with a maximum speed of 250 km/h and greater are given in BS EN 14067-6:2018+A1:2022, which is referenced in the LOC&PAS NTSN.

G3.11.2.5 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.

G3.11.2.6 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.

G3.11.2.7 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 GMRT2142. In GB, a probabilistic methodology and safety target was defined during studies to prove the crosswind safety of the Class 390 Pendolino train.

G3.11.2.8 For clarity, the mention of 'equipment' in 4.2.10.2(3) refers to the installation of additional infrastructure to protect track sections concerned from crosswinds.

G3.11.3 Aerodynamic effect on ballasted track

INF NTSN
4.2.10.3 Aerodynamic effect on ballasted track
(1) The aerodynamic interaction between rolling stock and infrastructure may cause the lifting and further blowing away of ballast stones from the track bed in plain line and switches and crossings (Ballast pick up). This risk shall be mitigated.
(2) The requirements for the infrastructure subsystem aimed at mitigating the risk for "ballast pick up" apply only to lines intended to be operated at speed greater than 250 km/h.
(3) The requirements of point (2) above are an open point.

G3.11.3.1 Following input from CEN TC256 WG6 (Aerodynamics) and a proposal by ERA, the threshold for 4.2.10.3 (2) has been raised from 200 km/h to 250 km/h. No action is therefore required for projects on the GB mainline network.

G3.12 Provision for operation

G3.12.1 Location markers

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

G3.12.1.1 There are no specific requirements for the spacing or style of location (distance) markers. Conventional GB mileposts (and quarter mileposts) are fully compliant.

G3.12.2 Equivalent conicity in service

INF NTSN
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 NTSN LOC & PAS for action on rolling stock.
(2) The infrastructure manager shall measure the track gauge and the railhead profiles at the site in question at a distance of approximate 10 m. The mean equivalent conicity over 100 m shall be calculated by modelling with the wheelsets (a) – (d) mentioned in paragraph 4.2.4.5(4) of this NTSN in order to check for compliance, for the purpose of the joint investigation, with the limit equivalent conicity for the track specified in Table 14
(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.

INF NTSN Specific Case GB
7.7.17.8 Equivalent conicity in service (4.2.11.2)
Instead of point 4.2.11.2.(2) the infrastructure manager shall measure the track gauge and the railhead profiles at the site in question at a distance of approximate 10 m. The mean equivalent conicity over 100 m shall be calculated by modelling with the wheelsets (a) – (e) mentioned in paragraph 7.7.17.3(2) of this NTSN in order to check for compliance, for the purpose of the joint investigation, with the limit equivalent conicity for the track specified in Table 14.

G3.12.2.1 The GB specific case is required as the reference wheelsets specified in the equivalent 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.

G3.12.2.2 For clarity, the track gauge and railhead profile measurements required in 4.2.11.2(2) are to be taken at intervals of approximately 10 m across the site concerned.

G3.12.2.3 An equivalent clause is included in the LOC&PAS NTSN 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.

G3.13 Fixed installations for servicing trains

G3.13.1 Toilet discharge

INF NTSN
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 LOC & PAS NTSN.

G3.13.1.1 Toilet discharge is covered in the LOC&PAS NTSN Clause 4.2.11.3, and Appendix G shows the vehicle connection.

G3.13.1.2 BS EN 16922:2017+A1:2019 covers both the vehicle and infrastructure elements.

G3.13.2 Water restocking

INF NTSN
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 LOC & PAS NTSN.
(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

G3.13.2.1 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.

G3.13.2.2 It is good practice for the fixed installation water supply pipework and flexible water supply hose to be suitable for drinking water and compliant with BS EN 12502-1:2004. Further information on preventing contamination is set out in BS EN 16362:2011.

G3.13.2.3 It is good practice for the flexible water supply hose to be fitted with an end-fitting for connection to the rail vehicle. Water supply connections on new vehicles use the bayonet connection shown in BS EN 13262:2011. It has been GB practice for rail 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 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.

G3.13.2.4 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.

G3.13.2.5 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 GB practice to seek guidance from the local water supply company.

G3.13.2.6 It is good practice either to ensure the flexible water supply hose is self-draining, preventing water from remaining in the hose, or to use trace heating to prevent freezing.

G3.13.3 Refuelling

INF NTSN
4.2.12.5 Refuelling
Refuelling equipment shall be compatible with the characteristics of the fuel system specified in the LOC & PAS NTSN.

G3.13.3.1 To meet the requirement of the NTSN, it is good practice 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 Type II.

G3.13.3.2 Current GB practice is to use a connector compliant with BS 3818:1964. BS EN 16507:2014 Annex A includes a GB special National Condition that refers to BS 3818:1964. While vehicles for use in GB are likely to continue to use BS 3818:1964 connectors, it is good practice for those fuelling points that might be used by a diesel locomotive from another country to be equipped with at least one facility with equipment compliant with BS EN 13012:2001.

G3.13.3.3 It is good practice for the diesel fuel supply device to deliver fuel with a maximum flow rate of 200 l/min.

G3.13.4 Electrical shore supply

INF NTSN
4.2.12.6 Electrical shore supply
Where provided, electrical shore supply shall be by means of one or more of the power supply systems specified in the LOC & PAS NTSN.

G3.13.4.1 It is good practice to use an external power supply as specified in LOC&PAS NTSN clause 4.2.11.6(2).

G3.13.4.2 The plug is provided by the infrastructure and the socket on the train.

G3.13.4.3 BS EN 50467:2011 gives application-specific requirements for the plug design.

G3.14 INF NTSN Chapter 4.3 Functional and technical specification of the interfaces

G3.14.1 It is important to note that the interface tables given in 4.3 are not complete, and there may be inconsistencies between the interface tables given in other NTSNs.

Part 4 Guidance for INF NTSN Chapter 5 Interoperability Constituents

G4.1 INF NTSN Chapter 5.2 List of constituents

INF NTSN
5.2 List of constituents
(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.

G4.1.1 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.

G4.1.2 The reuse of existing ICs which have been in use prior to the publication of the NTSN is covered in Point 6.6 of the INF NTSN.

G4.2 INF NTSN Chapter 5.3 Constituents performances and specifications

G4.2.1 The rail

INF NTSN
5.3.1 The rail
The specifications of the 'rail' interoperability constituent concern the following parameters: a) railhead profile, b) rail steel.

G4.2.1.1 The railhead profile requirements are given in clause 4.2.4.6 (see *G3.5.6*).

G4.2.1.2 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.

G4.2.2 The rail fastening systems

INF NTSN
5.3.2 The rail fastening systems
(2) The rail fastening system shall comply in laboratory test conditions with the following requirements: a) the longitudinal force required to cause the rail to begin to slip (i.e. move in an inelastic way) through a single rail fastening assembly shall be at least 7 kN and for speeds of more than 250 km/h shall be at least 9 kN, b) the rail fastening shall resist application of 3,000,000 cycles of the typical load applied in a sharp curve, such that the change in performance of the fastening system shall not exceed: 20 % in terms of clamping force, 25 % in terms of vertical stiffness, a reduction of more than 20 % in terms of longitudinal restraint. The typical load shall be appropriate to: the maximum axle load the rail fastening system is designed to accommodate, the combination of rail, rail inclination, rail pad and type of sleepers with which the fastening system may be used

G4.2.2.1 Typical load applied in curves refers to both quasi-static and dynamic forces. Quasi-static loads include the weight of the train, centrifugal forces due to curvature, and wind-induced forces. Dynamic loads arise from geometric irregularities in the track and rail, and wheelset defects, for example.

Part 5 Guidance for INF NTSN Chapter 6 Assessment of Conformity of Interoperability Constituents and UK Verification of the Subsystems

G5.1 Assessment of structure gauge

INF NTSN Specific Case 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 national technical rules.

G5.1.1 The GB specific case points to the national gauging process for assessment of structure gauge.

G5.2 Assessment of nominal track gauge

INF NTSN
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.

G5.2.1 Assessment of nominal track gauge is only relevant to plain line track.

G5.2.2 For switch and crossing work, the in-service limits control the key dimensions and the nominal track gauge is not relevant.

G5.3 Assessment of design values for equivalent conicity

INF NTSN
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 the specification referenced in Appendix T, Index [5.2].

G5.3.1 Appendix 2 of the ERA Application Guide for the INF TSI lists several track configurations which are deemed to fulfil the requirements for design equivalent conicity.

Rail head profile	Design track gauge (mm)	Rail inclinations for 60 km/h < V ≤ 200 km/h	Rail inclinations for 200 km/h < V ≤ 280 km/h	Rail inclinations for V ≥ 280 km/h
BS113a	1 435	1/20	1/20	1/20
BS113a(note i)	1 435	1/20	-	-

Table 1: Track configurations which are deemed to fulfil the requirements for design equivalent conicity

G5.3.2 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 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.

G5.3.3 Appendix 2 of the ERA Application Guide for the INF TSI 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.

G5.3.4 Table 2 gives rail head profiles assessed by RSSB using the EPS wheel profile, which fulfills the requirements of the GB specific case.

Rail head profile	Design track gauge (mm)	Rail inclinations for 60 km/h < V ≤ 200 km/h	Rail inclinations for 200 km/h < V ≤ 280 km/h	Rail inclinations for V ≥ 280 km/h
60 E1	1 435	1/20	-	-
	1 437	1/20	-	-
60 E2	1 435	1/20	1/20	1/20
	1 437	1/20	1/20	1/20

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

G5.3.5 Rail head profile 60 E1 does not meet the requirements for greater than 200 km/h at 1 435 mm or 1 437 mm gauge with the EPS wheel profile.

G5.3.6 The ERA Application Guide for the INF TSI also notes that, for projects where serviceable rails are used, the theoretical rail head profile may be used for this assessment.

G5.4 Assessment procedure of existing structures

INF NTSN
6.2.4.10 Assessment procedure of existing structures
(1) The assessment of existing structures against the requirements of point 4.2.7.4 (3) (b) and (c) shall be done by one of the following methods (a), (b) or (c) and additionally method (d) for dynamic loading using the HSLM or additionally (e) for alternative dynamic loading:
(3) For existing structures assessment point 4.2.7.4(4) applies respectively

G5.4.1 The methods specified in 6.2.4.10(1) require the use of Appendix E, which uses EN line categories. As GB uses the Route Availability (RA) system instead of EN line categories, the use of Appendix F is allowed by 4.2.7.4(4) for the assessment of existing structures, as reiterated by 6.2.4.10(3).

G5.4.2 For further information on the use of the RA system, refer to GERT8006, RIS-8706-INS, and GEGN8616.

G5.4.3 While the register of infrastructure (RINF) is not used in GB, the load carrying capacities of existing, Network Rail owned structures, may be found in Sectional Appendices. Sectional Appendices are documents owned and managed by Network Rail.

G5.4.4 It is understood that the introduction of the High Speed Load Model (HSLM) in GB can be useful in the design of new bridges.

G5.5 Assessment of platform offset

INF NTSN Specific Case GB
7.7.17.11 Assessment of platform offset (6.2.4.11)
Instead of point 6.2.4.11, it shall be allowed to assess platform offset in accordance with national technical rules.

G5.5.1 The GB specific case points to the national gauging process for assessment of platform offset.

G5.6 Assessment of maximum pressure variations in tunnels and underground structures

INF NTSN
6.2.4.12. Assessment of maximum pressure variations in tunnels and underground structures
(1) Assessment of the maximum pressure variation in the tunnel or underground structure (10 kPa criterion) shall be done in accordance with the specification referenced in Appendix T, Index [14.3] with the trains complying with the LOC & PAS NTSN and that are able to run at the design speed in the specific tunnel or underground structure to be assessed.
(3) The reference cross section areas are set out in the specification referenced in Appendix T, Index [14.4] and taken as 10 m^2 for the GB mainline railway.

G5.6.1 GMRT2100 sets out requirements for the design and integrity of primary and secondary rail vehicle structures, including aerodynamic and transient pressure loads.

G5.6.2 While the LOC&PAS NTSN sets out the requirement to aerodynamically design vehicles of design speed equal to or higher than 200 km/h, these speeds tend not to be a problem in GB. Rail vehicles in GB do not travel fast enough in long enough tunnels such that people are exposed to large pressure changes in a short period of time,

G5.6.3 Analysis by RSSB has shown that aerodynamic cross sectional areas of common trains in GB, such as the Class 800 and the HST are less than 10 m^2, and hence provides reasonable opportunity to use a reduced cross-sectional area of 10 m^2 in pressure variation calculations.

G5.7 Assessment of track resistance for plain line

INF NTSN
6.2.5.1 Assessment of track resistance for plain line
(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.
(2) A track design shall be defined by the technical characteristics as set out in Appendix C.1 to this NTSN and by its operating conditions as set out in Appendix D.1 to this NTSN.
(3) A track design is considered to be existing, if both of the following conditions are met: a) the track design has been in normal operation for at least one year and b) the total tonnage over the track was at least 20 million gross tons for the period of normal operation

INF NTSN
6.2.5.1 Assessment of track resistance for plain line
(4) The operating conditions for an existing track design refer to conditions which have been applied in normal operation.
(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 NTSN and conditions of use as set out in Appendix D.1 to this NTSN are specified and that the reference to the previous use of the track design is available.
(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.
(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.
(8) A track design is considered to be new, if at least one of the technical characteristics set out in Appendix C to this NTSN or one of conditions of use set out in Appendix D to this NTSN is changed.

G5.7.1 The ERA INF Work Programme 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 ERA that they would not include such a list in the Application Guide, but the Community of European Railway and Infrastructure Companies (CER) and European Rail Infrastructure Managers (EIM) are still considering if there is some other way to maintain such a list.

Part 6 Guidance for INF NTSN Chapter 7 Implementation of the Infrastructure NTSN

G6.1 Definition of an upgrade of a line

INF NTSN
7.3.1 Upgrading of a line
(1) In accordance with regulation 2 of the Railways (Interoperability) Regulations 2011, "upgrading" means any major modification work on a subsystem or part of it which results in a change in the technical file accompanying the "EC" or "UK" declaration of verification, if that technical file exists, and which improves the overall performance of the subsystem.
(2) The infrastructure subsystem of a line is considered to be upgraded in the context of this NTSN when at least the performance parameters axle load or gauge, as defined in point 4.2.1 are improved in order to meet the requirements of another traffic code

G6.1.1 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).

G6.1.2 Any project which is not covered by 7.3.3 ‘Substitution in the framework of maintenance’ will be categorised as either ‘Upgrade’ or ‘Renewal’.

G6.2 Resistance of new structures over or adjacent to tracks

INF NTSN Specific Case GB
7.7.20.7. Resistance of new structures over or adjacent to tracks (4.2.7.3)
For the HS2 infrastructure, the aerodynamic actions from passing trains shall be calculated in accordance with point 6.1.3 of BS EN 14067-4:2013+a1:2018 with an air density of 1.25 kg/m^3.

G6.2.1 BS EN 14067-4:2013+a1:2018, clause 6.1.3 offers a range of methods to calculate aerodynamic actions of passing trains on adjacent infrastructure, including full-scale, reduced-scale moving model, and reduced-scale static model tests in 6.1.3.1, 6.1.3.2, and 6.1.3.3 respectively.

G6.2.2 BS EN 14067-4:2013+a1:2018, clause 6.1.3.5 also offers a predictive formulae method, which is used in some cases.

G6.2.3 Clause 7.7.20.7 of the INF NTSN leaves options open to allow flexibility in the use of calculation methods.

Part 7 Guidance for INF NTSN Appendices

G7.1 INF NTSN Appendix E and Appendix F - Capability requirements for structures according to traffic codes and the GB specific requirements

G7.1.1 Table 38A and Table 39A in Appendix E provide the loading capability requirements for existing passenger traffic bridges and freight traffic bridges respectively. The capability requirements are based on EN line categories and corresponding speeds, or by LM71 with a factor alpha.

G7.1.2 Table 38B and 39B in Appendix E provide the loading capability requirements for existing geotechnical structures and earthworks, based on passenger traffic and freight traffic respectively.

G7.1.3 Appendix E is not applicable to GB since GB uses the Route Availability (RA) system, see INF NTSN point 4.2.7.4 (4). It is important to note that the INF NTSN retains Appendix E, as it may be relevant to HS2 infrastructure.

G7.1.4 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. Appendix F has the effect of a GB specific case, although it is not listed as such.

G7.1.5 To clarify, read ‘this’ as ‘these’ in Note (7) for tables 38A and 39A.

G7.1.6 There are open points in both Appendix E and Appendix F for multiple units with speeds greater than 160 km/h. The ERA has provided a mandate to CEN TC256 to extend the BS EN 15528 categorisation to cover such vehicles, and work is underway. GB is considering how to extend the applicability of the RA system.

G7.1.7 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.

G7.1.8 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. GERT8006 contains no information about the process of demonstrating compatibility of vehicles with structures, taking account of speed. However, GEGN8616 is now published to give guidance on carrying out dynamic checks. RSSB research project T1066 presents an opportunity to incorporate relevant information on this topic.

G7.2 INF NTSN Appendix G Speed conversion to mph

G7.2.1 The conversions given in Appendix G of the INF NTSN are intended specifically for speed conversions from km/h to mph where speed is used to differentiate requirements in the INF NTSN (see *G3.1*) and may not be appropriate for any other purpose.

G7.3 INF NTSN Appendix J Safety assurance over fixed obtuse crossings

G7.3.1 See *G3.6.2* of this document.

G7.4 INF NTSN Appendix R List of open points

G7.4.1 List of open points

G7.4.1.1 Appendix R lists the recognised open points in the NTSN.

G7.4.1.2 Comparison of the requirements of the INF NTSN with the requirements of GB RGSs has identified a number of areas where there are interface requirements in the RGS but the NTSN is silent. In some cases the lack of requirements in the NTSN is intentional, in other cases it may be an omission.

G7.4.2 Areas where the INF NTSN is intentionally silent

G7.4.2.1 The NTSN is intentionally silent regarding track stiffness, as this is not something that can be controlled at an interoperability level.

G7.4.3 Areas not covered by the NTSN

G7.4.3.1 As explained in *G3.1* of this document, the NTSN is not a design guide and there is a need to capture other design and construction requirements from other sources. The NTSNs only specify requirements to the extent necessary to meet the objectives of the Railways (Interoperability) Regulations 2011.

G7.4.3.2 Therefore, the following are identified as areas that are not covered by the NTSN 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 sidewear limit.
e) Accidental actions (loads) arising due to impact with railway infrastructure as a consequence of derailment.

G7.5 INF NTSN Appendix T Technical specifications referenced in this NTSN

G7.5.1 All EN technical specifications that were referenced in the body of the NTSN have been moved from the main text to Appendix T. This is to simplify the main body and ensure that all NTSN points associated with an EN specification can be accessed from a single source.

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 NTSNs.
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.
Community of European Railway and Infrastructure Companies (CEM)	No definition
conformity	Compliance with applicable requirements of a product, process, service, system, person or body.
Department for Transport (DfT)	No definition.
Deutsche Bahn (DB)	German Railway.
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 Infrastructure Managers (EIM)	No definition
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. It is a system for providing real-time control and supervision of trains, consisting of trainborne, track and lineside equipment. The objective is to enable the operation on compatible signalling systems across European borders.
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 Train Control System (ETCS)	The signalling, control and train protection part of the European Rail Traffic Management System designed to provide interoperability and standardisation across European railways.
European Union Agency for Railways (ERA)	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.
HBW (Brinnell Hardness Number)	No definition.
Immediate Action Limit (IAL)	No definition.
interoperability constituent (IC)	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.
mean useful voltage train	Voltage identifying the dimensioning train and enables the effect on its performance to be quantified. Source: *ENE NTSN*
National Determined Parameters (NDPs)	No definition.
National Technical Rule (NTR)	A technical rule used for implementing the essential requirements in the circumstances listed in *RIR*.
Office for Research and Experiments (ORE)	No definition.
Open Point	Parameters that have been formally identified as in scope of a NTSN or Railway Group Standard for which no common requirement has been agreed.
overhead contact line (OCL)	Contact line placed above (or beside) the upper limit of the rail vehicle gauge and supplying vehicles with electric energy through roof-mounted current collection equipment. Sources: *IEV 811-33-02, ENE NTSN* **Note:** Where this includes, in addition to all current-collecting conductors, the following elements: reinforcing feeders; cross-track feeders; disconnectors;

	section insulators; overvoltage protection devices; supports that are not insulated from the conductors; insulators connected to live parts; along-track feeders; conductors connected permanently to the contact line for supply of other electrical equipment; earth wires and return conductors.
platform train interface (PTI)	No definition.
Railway Group Standard (RGS)	No definition.
railway undertaking (RU)	Has the meaning given to the term 'transport undertaking' in the Railways and Other Guided Transport Systems (Safety) Regulations 2006 as amended, but is limited to 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. Source*: ROGS*
register of infrastructure (RINF)	A register that is maintained in accordance with regulation 35 of the Railways (Interoperability) Regulations 2011 (as amended).
Reynolds'-averaged Navier-Stokes (RANS)	No definition.
Route Availability (RA) Number	The number derived in accordance with the provisions of *GERT8006* to express either of the following: a) The rail vehicle load carrying capacity of an underline bridge or infrastructure route section. b) The static load characteristics of a rail vehicle type. For on-track machines, the static load characteristics of the rail vehicle are those applicable to the on-track machine in its running mode outside of a possession.
specific case	A special provision in relation to the technical specifications for a subsystem or an interoperability constituent to allow for its compatibility with the rail system, which is set out in an NTSN or an NTR and described in that NTSN or that NTR as a 'UK specific case'.
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.
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)	Sometimes points and crossings. All the ironwork associated with a set of points. It covers switch toes, switch rails, heels of switch rails, closure rails, stock rails, crossings and check rails.
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.
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 https://www.rssb.co.uk/standards-catalogue.

RGSC 01	Railway Group Standards Code
RGSC 02	Standards Manual

Documents referenced in the text

Railway Group Standards

GCRT5021	Track System Requirements
GERT8006	Route Availability Number for Assessment of Compatibility between Rail Vehicles and Underline Bridges
GERT8073	Application of Standard Vehicle Gauges
GIRT7020	GB Requirements for Platform Height, Platform Offset and Platform Width
GIRT7073	Requirements for the Position of Infrastructure and for Defining and Maintaining Clearances
GMRT2100	Rail Vehicle Structures and Passive Safety
GMRT2141	Permissible Track Forces and Resistance to Derailment and Roll-Over of Railway Vehicles
GMRT2173	Size of Vehicles and Position of Equipment
GMRT2142	Resistance of Railway Vehicles to Roll-Over in Gales
GMRT2466	Railway Wheelsets

RSSB Documents

COF-UOH-59 (Research project)	Loading requirement for tracks systems - lateral loading
GCGN5612	Rail Traffic Loading Requirements for the Design of Railway Structures
GEGN8615	Guidance on the Persons with Reduced Mobility NTSN
GEGN8616	Guidance on Evaluating Excessive Dynamic Effects in Underline Bridges
GIGN7619	Guidance on the Safety in Rail Tunnels NTSN
GLGN1600	Guidance on the Energy TSI
GMGN2615	Guidance on the Application of the Locomotives and Passenger Rolling Stock NTSN

GMGN2688	Application of the WAG NTSN and NOI NTSN to the Design of Freight Wagons
RIS-2710-RST	Magnetic Track Brakes
RIS-7016-INS	Interface between Station Platforms, Track, Trains and Buffer Stops
RIS-8273-RST	Assessment of Compatibility of Rolling Stock and Infrastructure - Gauging and Stepping Distances
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
T750 (Research project)	Review of Euronorm design requirements for trackside and overhead structures subjected to transient aerodynamic loads

Other References

BS 3818:1964	Self-sealing fuelling couplings for diesel locomotives and diesel railcars
BS EN 12502-1:2004	Protection of metallic materials against corrosion. Guidance on the assessment of corrosion likelihood in water distribution and storage systems - General
BS EN 13012:2001	Petrol filling stations. Construction and performance of automatic nozzles for use on fuel dispensers
BS EN 13232-3:2023	Railway applications. Track. Switches and crossings for Vignole rails - Requirements for wheel/rail interaction
BS EN 13674-1:2011	Railway applications. Track. Rail - Vignole railway rails 46 kg/m and above
BS EN 13848-5:2008	Railway applications. Track. Track geometry quality - Geometric quality levels. Plain line
BS EN 14067-4:2013+a1:2018	Railway applications. Aerodynamics - Requirements and test procedures for aerodynamics on open track
BS EN 14067-5:2006+A1:2010	Railway applications. Aerodynamics - Requirements and test procedures for aerodynamics in tunnels
BS EN 14067-6:2018+A1:2022	Railway applications. Aerodynamics - Requirements and test procedures for cross wind assessment
BS EN 14363:2016+A2:2022	Railway applications. Testing and Simulation for the acceptance of running characteristics of railway vehicles. Running Behaviour and stationary tests
BS EN 15302:2008+A1:2010	Railway applications - Method for determining the equivalent conicity

BS EN 15528:2021	Railway applications. Line categories for managing the interface between load limits of vehicles and infrastructure
BS EN 16362:2011	Railway applications - Ground based services - Water restocking equipment
BS EN 16432-1:2017	Railway applications. Ballastless track systems - General requirements
BS EN 16507:2014	Railway applications – Ground based services – Diesel refuelling equipment
BS EN 16922:2017+A1:2019	Railway applications. Ground based services. Vehicle waste water discharge equipment
BS EN 1990:2002+A1:2005	Eurocode - Basis of structural design
BS EN 1991-2:2003/ AC:2010	UK National Annex to Eurocode 1: Actions on structures –Part 2: Traffic loads on bridges
BS EN 50467:2011	Railway applications. Rolling stock. Electrical connectors, requirements and test methods
Directive 98/83/EC	Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption
EN 16432-1:2017	Railway Applications - Ballastless Track Systems – General Requirements'
ENE NTSN	Energy National Technical Specification Notice
ERA Application Guide	Guide for the application of the INF TSI
LOC & PAS NTSN	Locomotives and Passenger Rolling Stock National Technical Specification Notice
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.
NR/L2/TRK/2102	Design and construction of track
NR/L3/CIV/020	Design of Bridges
PRM NTSN	Persons with Reduced Mobility National Technical Specification Notice
SRT NTSN	Safety in Rail Tunnels National Technical Specification Notice
WAG NTSN	Wagons National Technical Specification Notice