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GE/GN8573

Guidance on Gauging and Platform Stepping Distances

**Issue Four: December 2015
Rail Industry Guidance Note**



Documents

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Guidance on Gauging and Platform Stepping Distances

Issue record

Issue	Date	Comments
One	October 2004	Original document.
Two	April 2008	Replaces issue one.
Three	October 2009	Small scale change, replaces issue two: The guidance with respect to the locomotive gauge in Appendix L, has been amended to correct technical errors and improve clarity.
Four	December 2015	Replaces issue three. Revised to align with the changes in GM/RT2173, GI/RT7073, GE/RT8273 and GE/RT8073. Guidance on the International Union of Railways (Union Internationale des Chemins de Fer (UIC)) method of gauging, gauging in the High Speed TSIs and railway safety principles and guidance withdrawn. Guidance has been added for pantograph gauging, standard vehicle gauges, platform stepping distances, and a methodology added to determine the effects of cross-wind loading.

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

Superseded documents

The following Rail Industry Guidance Note is superseded, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
GE/GN8573 issue three Guidance on Gauging	All	05 March 2016

GE/GN8573 issue three Guidance on Gauging is withdrawn as of 05 March 2016.

Supply

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

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Part 1 Introduction

G 1.1 Purpose of this document

- G 1.1.1 This document forms a compendium of knowledge and advice relating to all aspects of gauging. It supports the following Railway Group Standards (RGSs):
- a) GI/RT7073 Requirements for the Position of Infrastructure and for Defining and Maintaining Clearances.
 - b) GE/RT8073 Requirements for the Application of Standard Vehicle Gauges.
 - c) GE/RT8273 Assessment of Compatibility of Rolling Stock and Infrastructure – Gauging and Stepping Distances.
 - d) GM/RT2173 Requirements for the Size of Vehicles and position of Equipment.
- G 1.1.2 This document provides information and additional advisory material in support of the application of the various RGSs covering gauging. It also provides background material on the original derivation of the vehicle gauges in common use.
- G 1.1.3 For an introduction to gauging practice in Great Britain (GB) the Vehicle / Structures System Interface Committee (V/S SIC) has produced 'The V/S SIC Guide to British Gauging Practice'.

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G 1.3 Approval and authorisation of this document

- G 1.3.1 The content of this document was approved by Infrastructure Standards Committee on 09 September 2015.
- G 1.3.2 This document was authorised by RSSB on 09 October 2015.

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Part 2 Guidance on the Gauging Principles Used in Railway Group Standards

G 2.1 Gauging principles

- G 2.1.1 The gauging principles set out in GE/RT8073, GE/RT8273, GI/RT7073 and GM/RT2173 are based upon a requirement for maintaining adequate clearances between the vehicle and adjacent structures, and maintaining adequate passing clearances between the vehicle and other vehicles operating on adjacent tracks.
- G 2.1.2 A prime requirement is that there are always to be positive clearances between train and train, or train and infrastructure (excluding items designed to be in contact). In order to provide this, control measures become progressively more stringent as clearances decrease. Thus, where large clearances exist, few control measures are required. Where small clearances exist, controls are required to achieve acceptable operational clearances. Clearances are categorised as normal, reduced or special reduced. Part 4 of this document gives further guidance on clearances.
- G 2.1.3 The track on which trains run is not normally fixed, and the concept of 'effective position of the track' is used in gauging analysis to ensure that clearance calculations take account of the likely variation in track position. Consideration of effective position of the track takes account of the range of positions and inclinations that the track may be expected to occupy in the course of its normal maintenance cycle. Effective position of the track considers lifts and lowers, slues, cant variations and sidewear affecting the effective running line of the vehicles consistent with the track position controls in place. Thus, the use of datum plates and track fixity parameters, for example due to slab track, are intended to constrain the amount a track may move during its service life.
- G 2.1.4 Track is maintained primarily to provide the track geometry for the smooth and reliable running of trains, to the track geometry requirements set out in GC/RT5021. Where no specific reference points or position controls are in place, it can be assumed that the track can move during its normal maintenance cycle and make full use of the available clearances. The concept of effective position used in gauging analysis takes account of the likely position of the track between maintenance interventions. Where reliance is placed upon the application of reduced and special reduced clearances, then more rigorous regimes of track position monitoring and control are required.
- G 2.1.5 The monitoring and measurement of infrastructure for the determination of clearance should be undertaken commensurate with the accuracy of the original survey and the determined clearance.

G 2.2 Ownership of tolerances and parameters

G 2.2.1 Tolerances and parameters managed by the infrastructure manager

- G 2.2.1.1 The following tolerances and parameters are managed by the infrastructure manager, who has the responsibility to specify limits, and maintain within these limits:
- a) Lateral track alignment tolerance.
 - b) Vertical track alignment tolerance.
 - c) Static cross level error.
 - d) Rail sidewear.
 - e) Rail headwear.
 - f) Track gauge variation from standard (1435 mm) gauge.
- G 2.2.1.2 Track roughness is managed by the infrastructure manager, who has the responsibility to specify maintenance limits and maintain the track geometry within these limits. However, since they implicitly affect the dynamic performance of the vehicle, these limits should be mutually agreed between the infrastructure manager and the railway undertaking.

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G 2.2.2 Tolerances and parameters managed by the railway undertaking

G 2.2.2.1 The following tolerances and parameters are managed by the railway undertaking, who has the responsibility to specify limits, and maintain within these limits:

- a) Suspension performance parameters.
- b) Suspension creep.
- c) Wheel tread wear.
- d) Wheel flange wear.
- e) Wheel flange to rail clearance for standard (1435 mm) gauge.
- f) Height setting tolerances.
- g) Vehicle build tolerances.
- h) Vehicle maintenance tolerances.
- i) Dynamic performance based on track tolerances and parameters (see G 2.2.1.2).

G 2.2.3 Protocols used in development of historic gauges

G 2.2.3.1 The protocols set out in G 2.2.1.1 and G 2.2.2.1 have not always been followed in the development of standard vehicle gauges. For current standard vehicle gauges, GE/RT8073 sets out the information to enable the gauges to be applied safely.

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Part 3 Guidance on Gauging Processes

G 3.1 Guidance on absolute gauging

- G 3.1.1 The absolute gauging process requires the calculation of clearance between the swept envelope of the rolling stock and the infrastructure at every location along a route. The local conditions (for example track curvature, installed cant, line speed, track fixity) are used to determine the swept envelope of rolling stock and the minimum clearance at every location, and this information is used to assess the gauging compatibility of the rolling stock and infrastructure.
- G 3.1.2 There are typically many thousands of infrastructure profiles for each route, each item of infrastructure being measured either by hand or by automated measuring systems. Where an item of infrastructure has significant length (for example station platforms), a number of infrastructure profiles will be required to describe it. The infrastructure profiles are normally held in a database along with a record of the local conditions at each location.
- G 3.1.3 Rolling stock is described by a series of vehicle profiles specific to each vehicle type, and which will vary along the length of the vehicle. Corresponding information about the movement characteristics of the vehicle under all likely operating conditions is also required, so that the swept envelope of the vehicle can be calculated for any given set of local conditions. This information about rolling stock is also normally held in a database.
- G 3.1.4 Absolute gauging is a complex process and usually requires the use of specialised computer software tools to analyse the large amounts of rolling stock and infrastructure data and to perform the large number of numerical calculations required.
- G 3.1.5 The basic elements required to describe the absolute gauging process are:
- a) A continuously maintained database of infrastructure profiles and associated track parameters.
 - b) A database of vehicle profiles applicable to rolling stock operating on the route.
 - c) Gauging rules applicable to both rolling stock and infrastructure.
- G 3.1.6 The use of absolute gauging requires the agreement of the railway undertaking and the infrastructure manager.
- G 3.1.7 As the absolute gauging process makes a unique comparison of the swept envelope of the rolling stock and the infrastructure at every location on a route, it enables the rolling stock to be built to the maximum possible dimensions which the infrastructure along the route will accommodate. However, many calculations are required, and regular measurement of the infrastructure is required to maintain the infrastructure database.

G 3.2 Guidance on comparative gauging

G 3.2.1 Introduction

- G 3.2.1.1 The comparative gauging process provides for the demonstration of gauging compatibility by comparing the 'candidate' vehicle with a 'comparator' vehicle demonstrated to have gauging compatibility with a route(s). The comparison includes a risk assessment that would vary depending on the degree of similarity between the candidate and comparator vehicles and how they have been / are to be used.
- G 3.2.1.2 It is unlikely that a passenger vehicle can be comparatively gauged by comparing with a freight vehicle or a freight vehicle with a passenger vehicle. This is because:
- a) Passenger vehicle and freight vehicle suspension arrangements and failure modes are significantly different.
 - b) The nature of freight loading and passenger loading has different management arrangements.

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G 3.2.1.3 Locomotives could be comparatively gauged by comparing with other locomotives.

G 3.2.1.4 Given the range of On-Track Machines (OTMs) and their potential network wide but less frequent in-traffic running, comparative gauging for such candidate and comparator vehicles would necessitate an assessment on a case-by-case approach.

G 3.2.2 Guidance on assessment of suitability of comparator vehicle

G 3.2.2.1 In order to demonstrate that the introduction of the candidate vehicle would not import risk above that of operation of the comparator, the assessment is likely to consider factors including:

- a) Frequencies of proposed candidate and proposed comparator(s) operation.
- b) History of operation of the proposed comparator.
- c) Clearances to the proposed comparator (if known) and the arrangements for the management of clearances.
- d) The speed at which proposed comparator and candidate vehicles travel past structures and vehicles on adjacent tracks.
- e) Any significant difference in expected behaviour in cross-winds.
- f) Effects of failure modes on swept envelopes.

G 3.2.2.2 GE/RT8270 sets out requirements for the provision of information on compatibility to affected parties.

G 3.2.3 Guidance on the consideration of significant and regular traffic

G 3.2.3.1 Industry practice is that the determination of significant and regular traffic takes into account a number of factors, including:

- a) The lines travelled on a route, including junctions.
- b) The platforms called at, for example the terminal station might have many platforms.
- c) The loading pattern, including:
 - i) Comparable loading conditions and loading calculations.
 - ii) Loading is the same for each line, for example a vehicle might travel with tare loading only on part of the route for maintenance.
- d) The number of times rolling stock has travelled over a route.
- e) Experience of travelling over a range of track qualities, seasonal movements, monitoring and maintenance cycles.

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Part 4 Clearance

G 4.1 The purpose of clearance

G 4.1.1 The purpose of clearance is to provide for trains safely passing infrastructure and passing each other. Clearance is provided between trains and the infrastructure for a number of reasons, including:

- a) When using dynamic computer simulations, maximum vehicle movements are specified as the mean + 2.12 standard deviations (which corresponds approximately to the root mean square (RMS) value). Since peak movements caused by discrete track features can lead to movements beyond this value, clearance is required to accommodate the additional movement.
- b) Uncertainty of tolerances and allowances is another area to be considered. Some values are not accurately defined, particularly those associated with the movement of track, although routine aggregation of tolerances and allowances generally accommodates 'out of bounds' tolerances in isolation.
- c) Unknowns in the gauging system – although understanding of the components of gauging is increasing, and in particular that the characterisation of components is quite advanced, there are, nevertheless, minor components or inaccuracies that are routinely ignored. As calculation techniques become more sophisticated, allowances for such parameters in clearances are likely to become smaller.

G 4.1.2 Clearances are to be calculated under conditions leading to the generation of the minimum clearance. Examples of typical conditions would be considering the maximum movement of the vehicle (or gauge) towards the outside of curved track and towards the inside of curved track as a result of installed cant and dynamic movements.

G 4.2 The nature of clearance

G 4.2.1 The gauging system is statistical in its nature. As such, calculated clearances exist to a degree of certainty which is seldom calculated. However, there is no such thing as an exact clearance.

G 4.2.2 Limits of clearance have been established to regulate infrastructure monitoring, and relate to the level of certainty that has evolved through the application of allowances and tolerances. A margin of safety related to the local risk regime is typically reflected in the clearances being managed at a particular location.

G 4.2.3 Uncertainty techniques have been developed which may enable a more detailed risk assessment of clearances to be made, and as such generate usable space that conventional techniques might not allow. However, the application of such techniques needs to be in line with other areas of risk in consultation with the infrastructure manager.

G 4.3 Clearance regimes

G 4.3.1 Normal clearance provides for 100 mm of space around the dynamic swept envelope of a vehicle in the upper sector and 50 mm of space around the dynamic swept envelope in the lower sector.

G 4.3.2 The lower sector extends to 1100 mm above rail level (ARL), and is designed to accommodate infrastructure items such as platforms (where it is important to minimise stepping distances) and bridge girders. Platforms with height in excess of 1100 mm ARL are therefore technically in the upper sector but would normally be considered to be lower sector items.

G 4.3.3 Where normal clearances cannot be achieved, it is useful to identify the associated region of the vehicle, for example the cant rail, waistline or solebar or other body mounted equipment. Knowing the region of the vehicle helps to understand the potential issues involved and the appropriateness of the management regime, particularly when comparing to other existing vehicles operating on the route.

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- G 4.3.4 Reduced clearance is an option where normal clearances are not appropriate. However, reduced clearances require an enhanced inspection regime to ensure (particularly) that track movements remain within acceptable bounds and, as such, represent a more expensive option to the infrastructure manager. Further, locations with reduced clearances require a more detailed recording and management regime.
- G 4.3.5 Special reduced clearance is an option where a reduced clearance is not appropriate. However, special reduced clearances are associated with an even more enhanced inspection regime and, as such, represent a very expensive option to the infrastructure manager, as they require an even more detailed recording and management regime. Effectively, special reduced clearances allow no margin for error and are thus to be extremely well analysed.
- G 4.3.6 It is permitted (by GM/RT2173 and GI/RT7073) to allow reduced clearances in the lower sector to vehicles running with suspension failure (such as the case of air spring deflation). This permission is based upon the low frequency of occurrence and operational controls and, accordingly, having minimal effect on local risk.
- G 4.3.7 GI/RT7073 sets out a requirement for additional clearances at window level for new infrastructure. This requirement is maintained to recognise that there is still a significant number of different types of rolling stock operating with opening windows allowing passengers to lean out, but also opening windows in cabs are provided for train crew to look out of the train. Rolling stock with opening windows allowing passengers to lean out include Mk 3 coaches and heritage coaches, typically Mk 2 and Mk 1 coaches. The majority, if not all, of cabs have opening windows for train crew use.

G 4.4 Equipment that needs to be in close proximity or be in contact

G 4.4.1 Types of equipment that need to be in close proximity or contact

- G 4.4.1.1 Most gauging requirements relate to the provision of adequate structure and passing clearances. Clearly, the interaction of wheels and running rails is based on managed contact and is outside the scope of this document. However, some systems utilise equipment which is shared between rolling stock and infrastructure and rely on the equipment remaining in close proximity or being in contact in order for it to function correctly. Typical examples of this are:

- a) Passenger footsteps and platforms.
- b) Train signalling / control transmitters and receivers.
- c) Wheels and check rails.
- d) Track brakes.
- e) Shoe gear and conductor rails.
- f) Pantographs and overhead line equipment.

G 4.4.2 Equipment requiring continuous contact

- G 4.4.2.1 In cases where continuous contact is required, for example pantographs and overhead line equipment, the infrastructure guides the parts of the rolling stock contacting it in one plane (vertical in this case), but not in others. In cases such as shoe gear and conductor rails, the collector shoe is able to drop off the conductor rail at certain locations and is to remain within a defined swept envelope under these conditions.
- G 4.4.2.2 Gauging assessments need to recognise the existence of current collection systems. GI/RT7073 sets out positional requirements for current collection systems in the lower sector. The infrastructure manager is responsible for maintaining the position of the particular equipment within defined tolerances, which usually take the form of a height and offset from track centreline. Where different systems need to be in a similar position at the same location, for example guard rails and conductor rails, the infrastructure manager is to take into account the requirements for each system and gauging considerations to decide the arrangement.

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G 4.4.3 Installation arrangements

G 4.4.3.1 There are essentially two types of installation arrangements:

- a) Track mounted equipment.
- b) Non-track mounted equipment.

G 4.4.3.2 Track mounted equipment will move with the track (as it moves under traffic or is maintained), and therefore some track tolerances do not need to be taken into account.

G 4.4.3.3 Non-track mounted equipment is to take into account all relevant allowances.

G 4.4.4 Control, command and signalling equipment

G 4.4.4.1 Control, command and signalling equipment includes a range of assets, such as contact ramps, magnets and detection devices that interact with systems mounted on vehicles.

G 4.4.4.2 The positioning of such equipment is to respect the functionality of the system, provide for other systems to operate and respect gauge requirements. The gauging considerations for the positioning of this equipment are, to some extent, managed by the following typical installation approaches:

- a) Generally, these systems are installed in the track centreline slightly above the running surface.
- b) By positioning the vehicle mounted receivers close to the axle centrelines, their geometrical overthrow values become very small, or even negligible.

G 4.4.5 Check rails

G 4.4.5.1 Like the contact ramps, check rails are designed for contact; in this case with the flange back of the wheels.

G 4.4.5.2 In the vertical direction, the check rail is not to project outside the gauge used.

G 4.4.6 Conductor rail

G 4.4.6.1 The conductor rail system is, in most cases, track mounted and requires contact from the shoe gear mounted on the vehicle. The position of the conductor rail system additionally takes account of the electrical insulating requirements between the live parts and any other structure, see GL/RT1212.

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Part 5 Positioning of New and Altered Infrastructure Adjacent to the Tracks

G 5.1 Requirements of GI/RT7073

G 5.1.1 Positioning of new and altered infrastructure

G 5.1.1.1 The clearance requirements set out in GI/RT7073 are not the only determinant of the position of new and altered infrastructure adjacent to the tracks – see section G 6.2 of this document.

G 5.1.2 Alterations to infrastructure

G 5.1.2.1 GI/RT7073 does not require that alterations to infrastructure achieve an improvement in clearances to trains. However, at locations with existing reduced or special reduced clearances, there is a long-term benefit to be gained in reduced maintenance costs if the alteration results in normal clearances being provided. Generally, it is good practice to improve any clearance where the nature of the alteration permits this to be done with little increased cost or other implications.

G 5.1.2.2 When existing infrastructure is altered to permit the passage of vehicles with a larger swept envelope, it is permissible for the alteration to be limited to that which is just sufficient to allow the passage of the larger vehicles, provided control measures are implemented appropriate to the resulting clearance category, for example special reduced clearance.

G 5.1.3 Temporary infrastructure

G 5.1.3.1 Temporary infrastructure can be a greater hazard than permanent infrastructure where clearances are limited, as its presence might not be known by users of the railway.

G 5.1.3.2 GI/RT7073 therefore requires temporary infrastructure, for example scaffolding or temporary alignments during staged works, to meet the requirements for new infrastructure.

G 5.1.4 Guidance on determining the relative positions of tracks and structures

G 5.1.4.1 GI/RT7073 requires that track data shall be recorded at regular longitudinal (spatial) intervals at the location under consideration, and for 10 m beyond. There continue to be advances in technology that provide for the achievement of closer intervals than traditional practices.

G 5.1.4.2 Where structures are in close proximity to the track, then, typically, longitudinal measurements have been taken at 5 m intervals, and at such additional locations as necessary to accommodate specific features of the infrastructure profile.

G 5.1.4.3 To identify the likely tightest clearance it is important to capture the structure profile using sufficient points. On simple structures (such as platforms), key points are normally measured. On smooth curved structures, industry practice has been to take measurements at no more than 100 mm intervals. On rough surfaces, all protrusions may need to be measured where these are likely to represent the minimum clearance(s) at that location.

G 5.1.4.4 For any survey to relate to other infrastructure features it is necessary to record the Engineers Line Reference and route mileage.

G 5.2 Interface between GI/RT7073 and other Railway Group Standards

G 5.2.1 As noted above, the clearance requirements set out in GI/RT7073 are not the only (or even the most important) determinant of the position of new, altered and temporary infrastructure adjacent to the tracks. Guidance on other determinants for infrastructure provision and related RGSs that should be considered when designing, is given in G 6.2 and G 6.3 of this document.

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G 5.2.2 The following standards are the most relevant for determining the size and position of structures:

- a) GC/RT5021 Track System Requirements.
- b) GL/RT1210 AC Energy Subsystem and Interfaces to Rolling Stock Subsystem.
- c) GL/RT1212 DC Energy Subsystem and Interfaces to Rolling Stock Subsystem.
- d) GE/RT8034 Maintenance of Signal Visibility.
- e) GI/RT7016 Interface between Station Platforms, Track and Trains.

G 5.3 Track system requirements

G 5.3.1 When considering the position of new, altered or temporary infrastructure adjacent to the tracks, the geometry of the track should be taken into account. It should be recognised that track maintenance or renewal work may take place that could alter the position of the track, both horizontally and vertically.

G 5.3.2 GC/RT5021 specifies design values for track geometry parameters and sets out requirements for the management of track geometry faults.

G 5.4 Personal safety

G 5.4.1 Other than where the railway runs in a tunnel, it is usually necessary to make provision for the access of authorised people along running lines, for example, for maintenance. Space should therefore be provided for such access.

G 5.5 Electrical protective provisions

G 5.5.1 Where lines are electrified, and particularly where they are electrified using the 25 kV overhead line equipment system, adequate electrical clearances are required between structures and live parts of the electrification equipment and of electrical equipment on trains. These electrical clearances, for example to pantographs, can be greater than the physical clearances required by GI/RT7073.

G 5.5.2 GL/RT1210 sets out some design requirements for the avoidance of direct contact between persons and live parts of electrification equipment and of electrical equipment on trains. Requirements for electrical clearances to infrastructure to avoid electric shock due to indirect contact are also included.

G 5.5.3 GM/RT2111 sets out requirements for all rolling stock operating over the AC electrified railway, in order to manage interfaces with the AC energy subsystem. Requirements for electrical clearances to avoid electric shock due to indirect contact are also included.

G 5.5.4 The height of the contact wire, plus required clearances, determines the height of structures above a railway electrified using the 25 kV overhead line equipment system. However, the height of the contact wire depends on a number of factors, including the size and characteristics of vehicles to be accommodated. Part 6 of this document discusses the development of structure gauges, making allowance for the height of the contact wire.

G 5.5.5 GL/RT1210 sets out the minimum height requirements for the lowest live part of the overhead line equipment above the road surface of a public road level crossing.

G 5.6 Signal positioning and visibility

G 5.6.1 GE/RT8034 sets out the requirements necessary to ensure that the visibility and alignment of signals, and signs that perform the function of signals, are not adversely affected during the life of the equipment.

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G 5.7 Station platforms

- G 5.7.1 Station platforms are a special case of structures that are designed to come into close proximity to trains. GI/RT7016 sets out requirements for the design and maintenance of station platforms for their safe interface with trains.
- G 5.7.2 GI/RT7016 requires the height at the edge of the platform to be 915 mm (within a tolerance of + 0 mm, - 25 mm), measured at right angles to the plane of the rails of the track adjacent to the platform.
- G 5.7.3 GI/RT7016 requires the platform edge to be the minimum distance from the adjacent track consistent with the lower sector infrastructure gauge set out in GI/RT7073 Appendix A.
- G 5.7.4 For most rolling stock, this requirement is met on curves with radii greater than or equal to 360 m by a platform offset of 730 mm (within a tolerance of + 15 mm, - 0 mm). GI/RT7073 sets out exceptions where Class 373 trains or 2.6 m wide containers are required to pass the platform. GI/RT7073 also sets out requirements where the curve radius is less than 360 m.

G 5.8 Provision for the future

- G 5.8.1 Railway infrastructure generally has a very long life and, once built, it is difficult and expensive to alter. When deciding on the clearances to be provided, careful consideration should be given to the potential for:
- a) Upgrading the route in the future to carry larger vehicles.
 - b) Future provision of overhead electrification on non-electrified lines.
 - c) Future increases in speed requiring, for example, an increase in the distance between cess walkways and continuous positions of safety and the distance to the running edge of the nearest rail.

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Part 6 Structure Gauges

G 6.1 National structure gauges

- G 6.1.1 GI/RT7073 sets out requirements for Lower Sector Infrastructure Gauge (LSIG). The provision of upper sector infrastructure gauges for the GB railway network is a commercial issue, and such gauges are determined by the infrastructure manager. However, the development of infrastructure gauges may be undertaken by third parties, particularly on major projects.
- G 6.1.2 The terms 'vertical' and 'lateral' are used to describe dimensions perpendicular to, and parallel with, the plane of the rails respectively, irrespective of track cant.
- G 6.1.3 The following considerations set out in G 6.2 relate to straight and level track. Adjustments should be made for the effects of curvature.

G 6.2 Lateral clearances

G 6.2.1 Basis for lateral clearances

- G 6.2.1.1 Lateral clearance is determined according to the widest dynamic envelope of rolling stock, and the clearances to cess walkways required, depending on speed. There are additional requirements at platforms.

G 6.2.2 Allowance for access

- G 6.2.2.1 For efficient and effective maintenance of a route, provision should be made for access along the railway. This can range from cess walkways to road vehicle access depending on site constraints and the need to bring in heavy materials.

G 6.2.3 Allowance for platforms

- G 6.2.3.1 The lateral platform offset (see G 5.7.4) should be increased according to curve radius using the formula set out in GI/RT7073, and where required for specific vehicles.
- G 6.2.3.2 Platform clearances are subject to the maintenance of required stepping distances. These are normally calculated and assessed using the static vehicle envelope subject to overthrow, and are vehicle specific. See G 8.2.

G 6.2.4 Allowance for tilting trains

- G 6.2.4.1 The dimensions may need to be increased if tilting trains are required to operate in potential tilt failed mode. It is not possible to provide detailed guidance about this within the scope of this document.

G 6.2.5 Allowance for electrification

- G 6.2.5.1 Where overhead line equipment is present, additional clearance provision might be required to accommodate electrical clearances in relation to pantograph sway, particularly through arched structures. This may be calculated using absolute gauging techniques according to vehicle characteristics described in GM/RT2173.
- G 6.2.5.2 To achieve vertical clearance through structures for overhead line construction, track lowering has been carried out on a number of routes. In some cases this can be a suitable long term solution, but there can be associated longer term problems such as foundation stability of adjacent structures (for example platforms), formation performance and drainage.

G 6.3 Vertical clearances

G 6.3.1 Basis for vertical clearances

- G 6.3.1.1 Vertical clearance is determined according to the tallest dynamic envelope of rolling stock, and whether overhead line equipment is present.

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G 6.3.1.2 The maximum static height of any vehicle currently permitted on the GB railway network is 3965 mm (W6a gauge). An additional 25 mm should be allowed for dynamic bounce, generating a maximum vertical swept envelope on straight and level track of 3990 mm.

G 6.3.2 Routes where 25 kV overhead electrification is not foreseeable

G 6.3.2.1 The case for electrifying non-electrified routes depends on many factors and will almost certainly change over time as AC electrification schemes are implemented. For any new or replacement over line structure it is essential that future considerations for AC electrification are taken into account to avoid unnecessary future modification costs.

G 6.3.2.2 Table 1 sets out recommended minimum allowances for a range of clearance regimes for routes where 25 kV overhead electrification is not foreseeable.

	Normal Clearance	Reduced Clearance
Minimum Bridge Soffit Gauge Height	4240 mm	4140 mm
Bridge Construction Allowance	50 mm	50 mm
Clearance (Physical)	100 mm	50 mm
Dynamic Bounce Allowance	25 mm	25 mm
Load Gauge Height	3965 mm	3965 mm
Track Lift Allowance	100 mm	50 mm

Table 1 Recommended allowances and clearances for routes where 25 kV electrification is not foreseeable

G 6.3.3 Existing routes with 25 kV overhead electrification

G 6.3.3.1 On existing routes where 25 kV overhead electrification exists, or is planned to be installed, the vertical clearance is based on the required wire height and overhead line construction arrangement. Table 2 sets out the recommended minimum allowances.

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	Free Running Design (not attached to bridge)	Supported from Bridge		Notes
		Electrical dimensions providing basic insulation	Electrical dimensions providing functional insulation	
Minimum Bridge Soffit Gauge Height	6335 mm	5130 mm	4850 mm	
Bridge Construction Allowance	50 mm	50 mm	50 mm	G 6.3.4.2 (a)
Electrical Clearance	600 mm	≥ 370 mm	≥ 270 mm	G 6.3.4.2 (e)
Overhead Line Equipment Uplift	Within system height	80 mm	80 mm	G 6.3.4.2 (c)
Overhead Line Equipment System Height	1000 mm	120 mm	120 mm	G 6.3.4.2 (h)
Overhead Line Equipment Construction Allowance	75 mm	25 mm	10 mm	G 6.3.4.2 (g)
Overhead Line Equipment Contact Wire Height	4610 mm	4485 mm	4320 mm	
Overhead Line Equipment Construction Allowance	75 mm	25 mm	10 mm	G 6.3.4.2 (g)
Contact Wire Sag	75 mm	-	-	G 6.3.4.2 (f)
Electrical Clearance	370 mm	370 mm	270 mm	G 6.3.4.2 (e)
Dynamic Bounce Allowance	25 mm	25 mm	25 mm	G 6.3.2.2
Load Gauge Height	3965 mm	3965 mm	3965 mm	G 6.3.1.2
Track Lift Allowance	100 mm	100 mm	50 mm	G 6.3.4.2 (d)

Table 2 Recommended minimum dimensions for new overhead line equipment electrification.

Note: Definitions for basic insulation and functional insulation are set out in GL/RT1210

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- G 6.3.3.2 For optimum current collection, the contact wire should remain level under the bridge structure and should be supported in a similar manner to the contact wire away from the bridge. This requires a substantial height between the bridge soffit and the contact wire, unless low profile equipment is used.
- G 6.3.3.3 Compromises are possible to reduce the space required by the electrification equipment, but these may bring with them an impact on the quality of current collection and may also impose limits on the speed of operation. Such compromises include the use of components supported from the bridge, and a reduction in system height and contact wire height under the bridge.
- G 6.3.3.4 There is considerable variation in the height of the contact wire used in GB. Typically the contact wire height is 4700 mm, but the range is 4165 mm (or even lower in certain special circumstances) to 5900 mm at public level crossings. The minimum permitted contact wire height above a level crossing is 5800 mm or in some cases 5600 mm.
- G 6.3.3.5 Standard contact wire heights defined by the Energy Technical Specification for Interoperability (ENE TSI) and the associated GB specific case will determine the contact wire height on routes where compliance with the ENE TSI is required.
- G 6.3.4 Factors to be allowed for on 25 kV overhead line equipment routes**
- G 6.3.4.1 Factors to be allowed for in the derivation of a structure gauge in areas electrified using 25 kV overhead line equipment are set out in G 6.3.4.2.
- G 6.3.4.2 These factors can be used to determine a contact wire height. However, the type of traffic and speed of operation of the line may determine that the required height of the contact wire is significantly higher than the minimum value determined by these factors:
- Bridge construction allowance – a further bridge construction allowance could be appropriate for different types of bridge design and construction methods, typically 50 mm, in determining a structure gauge.
 - Vertical track curvature – the effect on the rolling stock height of a concave track dip at a bridge may increase the effective height of long vehicles.
 - Uplift – this is the amount by which the contact wire is lifted by the passage of a pantograph.
 - Track lift allowance – where necessary, allowance should be made for any likely future designed track lift, for example to increase cant (and so permit increased speeds), or as a result of a change from 113 A rail section to 60 E 1 (UIC 60) rail, or replacement of timber sleepers by concrete sleepers. Consideration should also be given to maintenance lifts over the whole life of the track, rather than simply considering the single-cycle maintenance allowance.
 - Electrical clearance – Where GL/RT1210 applies, the minimum static electrical clearance is 370 mm for basic insulation, but may be reduced to 270 mm static electrical clearance if only functional insulation is required. In some cases, smaller dimensions are permissible as set out in GL/RT1210:
 - The static electrical clearance can be reduced to 200 mm, where this reduction is caused by the dynamic interaction of the pantograph and the Overhead Line Equipment (OLE) during the passage of electric trains.
 - Where a free running design is required (that is to say, a design where the overhead line equipment is not attached to the bridge), 600 mm is preferred. This is the static electrical clearance and aligns with the requirements set out in EN 50124.
 - Contact wire (or beam) sag below supported height – where appropriate an allowance should be made for ice loading, weight of the beam (if used) between supports and other external influences.

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- g) Construction allowance – applied above and below the designed contact wire height. Usually 75 mm, but can be reduced to 10 mm with special measures. This is also known as installation allowance.
- h) System height – the system height is typically taken from the top of the supported catenary wire to the bottom of the contact wire. The support arrangement may vary widely depending on the style of the construction and the intended speed of the operation. This can be as little as 120 mm for a bridge supported arrangement to 1000 mm plus for a 'free-running' arrangement not supported from the bridge.
- i) Flashover protection and secondary insulation – above the extreme height of live equipment, protection needs to be given to some types of bridge if live parts are less than 600 mm below the soffit. The protection could include 50 mm for flashover protection and, in some cases, an additional 120 mm for secondary insulation. The bridge construction and function will determine whether these additional precautions are required.
- j) Other features such as track arrangement, electrical sectioning and proximity of level crossings should also be considered.

Note: On very high-speed lines, or in long tunnel installations, aerodynamic forces are increased and their effect on uplift should be considered. Further guidance on uplift is given in G 7.2.

G 6.3.5 Allowance for vertical deflections of overbridges

- G 6.3.5.1 The above calculations make no allowance for vertical deflections of overbridges under load. These can be significant, particularly for steel overbridges. When calculating the electrical clearances, these should be increased to allow for the deflection of the bridge under load where this is necessary.