This document contains guidance that is amended under the Railway Group Standards Code (Issue Three) as a small scale change. Reference to the amended section is made in the 'Issue record'. All other parts of the document are unchanged from the previous issue.

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GE/GN8573 Guidance on Gauging

Issue 3 October 2009

Rail Industry Guidance Note

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Issue record

Issue	Date	Comments
1	October 2004	Original document
2	April 2008	Replaces issue 1
3	October 2009	Small scale change, replaces issue 2: The guidance with respect to the locomotive gauge in Appendix L, has been amended to correct technical errors and improve clarity.

Amended or additional parts of revised pages have been marked by a vertical black line in the adjacent margin.

Superseded documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
GE/GN8573 Guidance on Gauging Issue 1, October 2004	All	07 June 2008
GE/GN8573 Guidance on Gauging Issue 2, April 2008	Appendix L	05 December 2009

Other parts of GE/GN8573 are unchanged from the previous issue.

Supply

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Part 1 Introduction

1.1 Purpose of this document

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 (RGS):

a) GC/RT5212 Requirements for Defining and Maintaining Clearances

b) GE/RT8073 Requirements for the Application of Standard Vehicle Gauges

c) GE/RT8270 Assessment of Compatibility of Rolling Stock and Infrastructure (in so far as it relates to gauging)

d) GM/RT2149 Requirements for Defining and Maintaining the Size of Railway Vehicles.

1.1.2 This document provides information and additional advisory material in support of the application of the various RGS covering gauging. It also provides background material on the original derivation of the vehicle gauges in common use, as well as a brief introduction to the UIC (International Union of Railways) method of gauge analysis in use throughout Europe (and mandated in the Technical Specifications for Interoperability).

1.1.3 This document contains guidance that is amended under the Railway Group Standards Code (Issue Three) as a small scale change. Reference to the amended guidance is made in the 'Issue record'. All other parts of the document are unchanged from the previous issue.

1.2 Copyright

1.3 Approval and authorisation of this document

The content of this document was approved by:

Infrastructure Standards Committee on 15 July 2009.

This document was authorised by RSSB on 24 August 2009.

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

2.1 Gauging principles

2.1.1 The gauging principles set out in GC/RT5212, GE/RT8270 and GM/RT2149, are based upon a requirement for maintaining adequate clearance between the vehicle and adjacent structures, and maintaining adequate passing clearance between the vehicle and other vehicles operating on adjacent tracks.

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, the documents mentioned above mandate control measures which 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 prevent these clearances becoming negative. Clearances are categorised as normal, reduced and special reduced.

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.

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 Track System Requirements. 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 over time. 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.

2.1.5 Where there are reduced (or tight) clearances all monitoring and measurement is to be undertaken to levels of accuracy commensurate with the accuracy of the original survey and the available clearance.

2.2 Ownership of tolerances and parameters

2.2.1 Tolerances and parameters managed by the infrastructure manager

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.

2.2.1.2 The following tolerances and parameters are managed by the infrastructure manager who has the responsibility to specify limits and maintain them 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:

a) Dynamic cross level error

b) Track roughness and maintenance limits.

2.2.2 Tolerances and parameters managed by the railway undertaking

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 condition

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 (see section 2.2.1.2).

2.2.3 Protocols used in development of historic gauges

2.2.3.1 These protocols have not always been followed in the development of standard vehicle gauges now set out in GE/RT8073. These documents have attempted to preserve historic dimensions, but have provided the infrastructure manager and the railway undertaking with additional information to enable the gauges to be applied safely.

Part 3 Guidance on Considerations for Development of New Vehicle Gauges

3.1 An introduction to gauges

3.1.1 Introduction

3.1.1.1 Standard vehicle gauges, and their rules of application, are defined in GE/RT8073 for general use with the 'Gauging to standard vehicle gauges' set out in GE/RT8270 Appendix C, being one of four recognised gauging procedures (the others being absolute, comparative, and hybrid gauging).

3.1.1.2 This part of the document sets out general guidance on the development of proposals for new vehicle gauges, and the defining of appropriate application rules.

3.1.2 What is a gauge?

3.1.2.1 Gauging frequently refers to gauges, a term whose original definition related to an envelope in which a vehicle is to remain, or within which a structure is not to intrude (vehicle and structure gauge, respectively, separated by a clearance).

3.1.2.2 Sections 3.1.3 to 3.1.6 describe a variety of terms and methodologies used in gauging and specifically in the development of vehicle gauges.

3.1.3 Vehicle gauges

3.1.3.1 A vehicle gauge is the maximum envelope that a vehicle conforming to the gauge is permitted to occupy statically and dynamically, which prescribes maximum permissible vehicle and loading dimensions, certain suspension displacements, and certain curve overthrow limitations (for example, W6a).

3.1.4 Reference profiles

3.1.4.1 Typically a UIC term, this defines an intermediate profile between a vehicle gauge and a structure gauge, defining the limits that a vehicle should conform to in a limited range of operating conditions. An example of this is the GC gauge.

3.1.5 Composite swept envelope

3.1.5.1 An example of this is the W12 gauge, and consists of a composite swept envelope (the outside envelope) of a range of vehicles and notional load sizes, calculated by normal methods. It should be noted that the gauge is specific to the local curvature, speed and cant at the location, and defined clearances are provided to the gauge in relation to the infrastructure. Composite swept envelopes are such as those used in comparative gauging, but may also be used to define a compliant route.

3.1.5.2 In this example where routes are classified as W12, any vehicle whose load envelope remains within the W12 envelope over the full spectrum of route geometry conditions will be clear to run.

3.1.6 Swept envelope suites

3.1.6.1 An example of this is the W10 gauge, and consists of an overlay of the swept envelopes of a range of vehicles at specific conditions of speed, radius and cant. The route would be cleared by ensuring standard clearances to the suite of gauges, which are specific to the local curvature, speed and cant along the route.

3.1.6.2 In this example W10 routes are thus cleared for all the component vehicles of the W10 gauge.

3.2 Developing an appropriate gauge

3.2.1 Gauges simplify the process of gauging. If all vehicles were built within a fixed gauge, and structures constructed to be clear of that gauge in all circumstances, then the gauging process would simply be that of ensuring track and structures retained their clearance to a gauge, and vehicles were always built within the gauge. The development of railways has meant that gauges that were originally fit for purpose no longer satisfy current business capacity needs. In the past, this has meant that progressively larger gauges have been developed.

3.2.2 In order to simplify the calculation process, some existing vehicles possess only basic swept envelope information that represents generalised input conditions. Such vehicles may have restricted gauge clearance due to the cautious approach that is adopted when considering them on this basis in gauging analysis. Advances in computer speed now allow rapid calculation of gauge clearances, which gives a more accurate assessment of the clearances that may exist for the individual input conditions to the vehicle at every location along a route and over the actual shape of the vehicle profile. It is therefore beneficial to enhance the swept envelope information for a vehicle to provide the detailed swept envelope data required to permit more detailed modelling.

3.2.3 Modern advances in computer technology enable vehicle swept envelopes to be calculated with greater confidence so that they reflect the vehicle behaviours more accurately enabling clearances to be analysed more precisely. These advances enable better use to be made of the available capability of the infrastructure.

3.2.4 A variety of gauge types exist to cater for different needs, and to optimise the process of gauge clearance.

3.2.5 Simple static gauges provide a means of clearing infrastructure and vehicles at minimal cost, but have to be sufficiently conservative to allow for variations in vehicle dynamic behaviour.

3.2.6 Composite swept envelopes may be used to define the infrastructure capability more exactly, but require a vehicle builder to ensure that the vehicle remains strictly within the envelope throughout its operating domain.

3.3 Specifying vehicle gauges

3.3.1 An agreed method of specifying vehicle gauges is required to provide clarity to both infrastructure managers and railway undertakings for the construction and operation of new vehicles.

3.3.2 The format for specifying vehicle gauges should include the items set out in Table 1.

Item	Content
Purpose	States what the gauge is intended for.
Gauge diagram	Provides a diagram of the gauge, together with a list of co-ordinates for a semi-section. The coordinates of the gauge should be dimensioned sufficiently to allow the gauge diagram to be redrawn accurately from the information provided. The coordinates of the gauge should include all protrusions, for example door indicator lights, push buttons and nameplates. In order to provide the maximum compatibility with electronic presentation of gauge data, gauge diagrams should be presented as a series of points defining a polyline. Where a curved line is required, it should be replaced with a series of chords having a deviation from the arc of no more than 1 mm. Where arcs have been used to define curved sections, the details of these should be given (describing centre, radius and points linked) in order to preserve the basis of the original gauge. Co-ordinates should be numbered, and given in millimetres from the gauge centre line. Co-ordinates need only describe a semi-vehicle where the vehicle is symmetric about the centre line.
Infrastructure rules	Sets out the rules by which the infrastructure manager might determine the safe clearance for operation of the vehicle. In particular, the rules should specify how the space occupied by the vehicle at each location is calculated.
Vehicle build rules	Sets out the rules that should be used in building a vehicle to the prescribed envelope. In particular, the rules should include: • The standard vehicle arrangement dimensions (length, bogie/wheel centres). • Any width/height reductions applicable as a result of candidate vehicle exceeding the standard arrangement dimensions. • Limits of suspension movement and tolerances included in the gauge, and expected exceedences beyond this that should be taken into account by the infrastructure manager. Tolerances are those applicable to the vehicle, rather than the infrastructure, and could include wheel tread wear, suspension creep, wheel flange sidewear and other parameters affecting the relationship of the vehicle to the track. Flange to rail clearances for 1435 mm are included in the vehicle tolerances. Credible failure modes of suspension systems should be considered.

Table 1 Format for specifying vehicle gauges

Part 4 Lower Sector Vehicle Gauge

4.1 Purpose of lower sector vehicle gauge

4.1.1 This part defines a lower sector vehicle gauge that could be used by vehicle manufacturers to ensure consistency with the lower sector infrastructure gauge set out in GC/RT5212, where one of the standard vehicle gauges set out in GE/RT8073 is not used. This gauge is complementary to Appendix Q.

4.1.2 Section B6.2 of GM/RT2149 sets out requirements for the swept envelopes of vehicles in relation to the lower sector.

4.1.3 Reference has been made to the C1 vehicle gauge (see Appendix I) and TME587 in developing this vehicle gauge.

4.1.4 The vehicle gauge defined has been derived from the information in GM/RT2149 and GC/RT5212 (and its predecessors) and includes the relevant clearances and tolerances.

4.2 Lower sector vehicle gauge

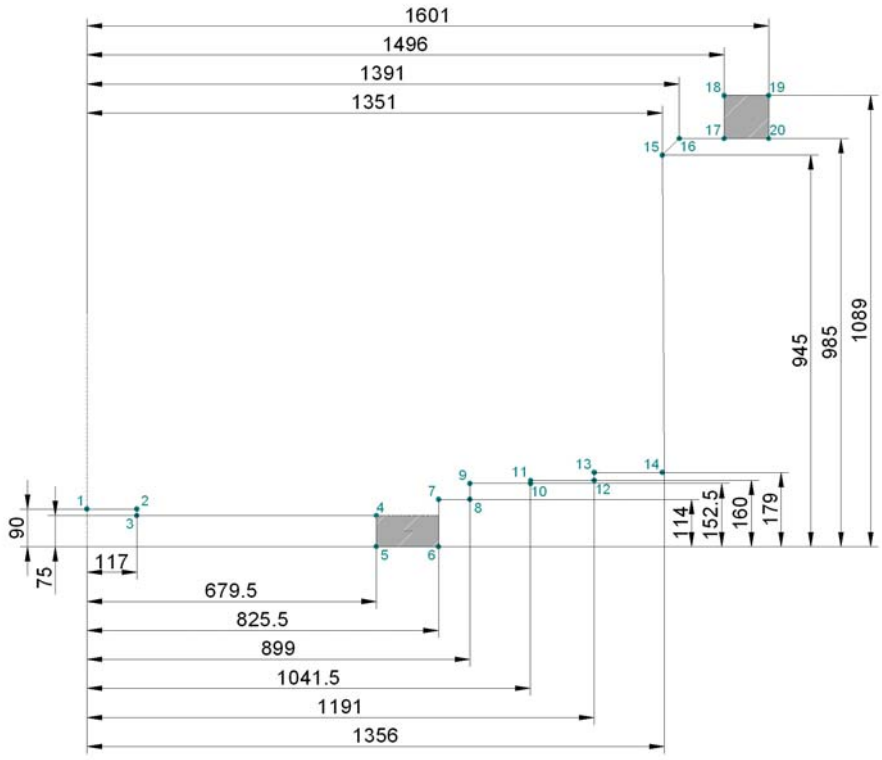


Figure 1 Semi-section of lower sector vehicle gauge

4.2.1 The hatched area bounded by points 17 to 20 has traditionally been reserved for footsteps only.

4.2.2 The hatched area bounded by points 4, 5 and 6 is available for wheels, lifeguards, etc only.

Point	X (mm)	Y (mm)	Coordinate derived from GC/RT5212	Coordinate derived from TME587	Coordinate derived from C1 vehicle gauge
1	0	90	✓		
2	117	90	✓		
3	117	75	✓		
4	679.5	75	✓	✓	✓
5	679.5	0			✓
6	825.5	0			✓
7	825.5	114	✓		✓
8	899	114	✓		
9	899	152.5	✓		✓
10	1041.5	152.5			✓
11	1041.5	160	✓		✓
12	1191	160	✓		
13	1191	179	✓		
14	1356	179	✓		
15	1351	945	✓		
16	1391	985	✓		
17	1496	985	✓	✓	
18	1496	1089		✓	
19	1601	1089		✓	
20	1601	985	✓	✓	

Table 2 Coordinates of semi-section of lower sector vehicle gauge

4.2.3 Items ticked indicate the origin of that coordinate.

4.3 Rules for application to railway undertakings

4.3.1 This gauge is applicable to railway undertakings only. The gauge includes the following tolerances and clearances:

a) Points 12 to 20 include track positional tolerances applicable to low fixity track.

b) All points include allowance for normal clearances.

4.4 Rules for application to infrastructure managers

4.4.1 The lower sector gauge applies, without increasing lateral dimensions to curves of radius of 360 m or more.

4.4.2 Points 14 to 20 are increased laterally on curves of less than 360 m radius according to the following formula:

$$dX = (26000 / R) - 72$$

where R is the curve radius in metres and dX is in mm.

4.4.3 The formula quoted gives the following results for selected radii:

Radius (m)	dX (mm)
360	0
300	15
250	32
200	58
160	90.5

Table 3 Allowances for throw on curves

4.4.4 The above allowances for throw on curves correspond directly with the increased clearance dimension described in GC/RT5212. Where throws of individual sections of the vehicle exceed the above values, an appropriate width reduction to the vehicle should be made.

Part 5 Standard Vehicle Gauges

5.1 Standard vehicle gauges

5.1.1 Requirements for the application of standard vehicle gauges to rolling stock and to the infrastructure are defined in GE/RT8073.

5.1.2 The gauges defined in GE/RT8073 are static gauges. The principle behind static gauging is that the static gauges indicate maximum build dimensions, including tolerances and allowances and that the use of established suspensions, coupled with generous clearance allowances, provided for safe operation. GC/RT5212 separated clearance from 'unknowns' and placed a requirement for the latter (which had previously included dynamic movement) to be explicitly defined if the reduced levels of clearance were to be used. The provision of coordinates of gauges incorporating dynamic movements for the static gauges defined in GE/RT8073, based upon current rolling stock, satisfies the requirement of GC/RT5212 for the use of 'normal', 'reduced' and 'special reduced' clearances.

5.1.3 Appendices A to L provide guidance on standard vehicle gauges.

Appendix	Gauge	Description
A	W6a	Freight vehicle gauge
B	W7	W6a exception for 8' 0'' containers
C	W8	W6a exception for 8' 6" containers
D	W9	Swapbody wagon-load combination gauge
E	W9Plus	Swapbody wagon-load combination gauge
F	W10	Wagon-load combination gauge
G	W11	Wagon-load combination gauge
H	W12	Wagon-load combination gauge
I	C1	Vehicle gauge for coaching stock
J	C1 (Appendix A)	Vehicle gauge for coaching stock
K	UK1 (Issue 2)	Vehicle gauge defined in High Speed TSIs (not a gauge for 373/X trains)
L	Locomotive	Vehicle gauge for locomotives

Table 4 Standard vehicle gauges

5.1.4 Appendices M and N provide guidance on designations frequently confused with vehicle gauges.

Appendix	Gauge	Description
M	C3 and C4 designation	Designation of MK III and Class 390 coaches. Not to be used for gauging
N	Class 373/X (Eurostar)	For gauging routes used by Class 373/X (Eurostar) vehicles. Not UK1 gauge

Table 5 Gauge related designations

5.1.5 Appendices A to E (W6a – W9Plus) form a nest of gauges based upon the W6a freight vehicle gauge.

5.1.6 W6a, W7, W8, W9 and W9Plus are static gauges.

5.1.7 Appendices F to H (W10 to W12) form a nest of wagon–load combination gauges for use with W6a compliant wagons.

5.1.8 W10, W11 and W12 gauges are designed for application by dynamic methods, but their static equivalents have been generated in GE/RT8073.

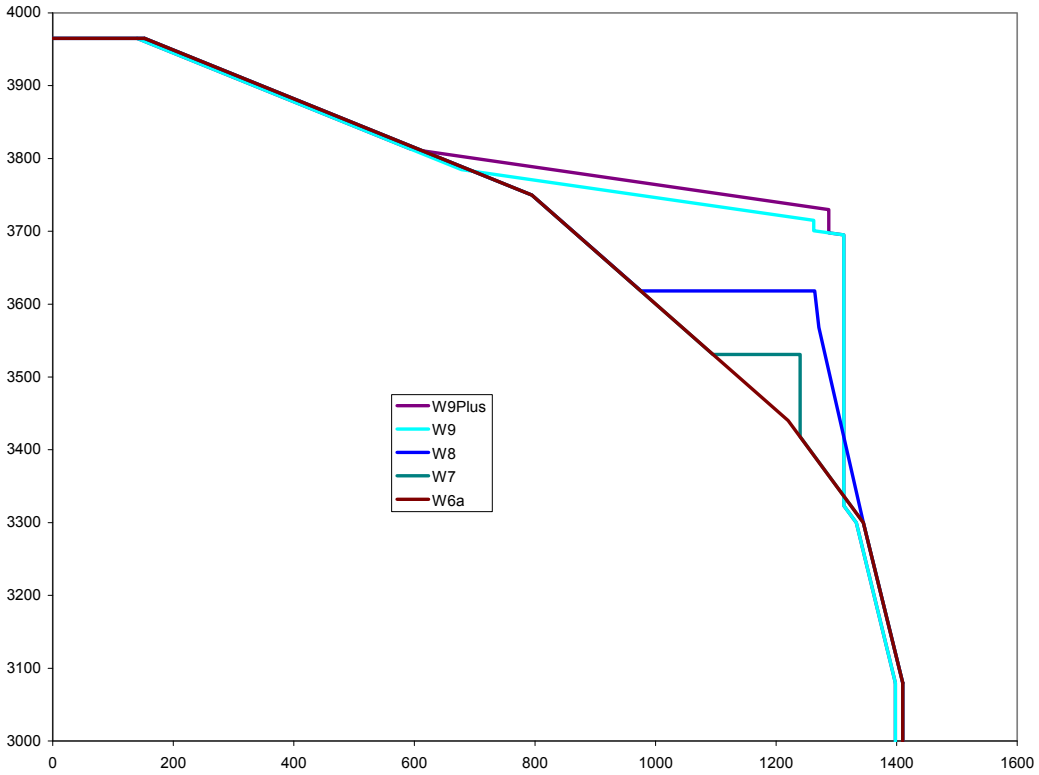


Figure 2 Top corner of W6a to W9Plus gauges

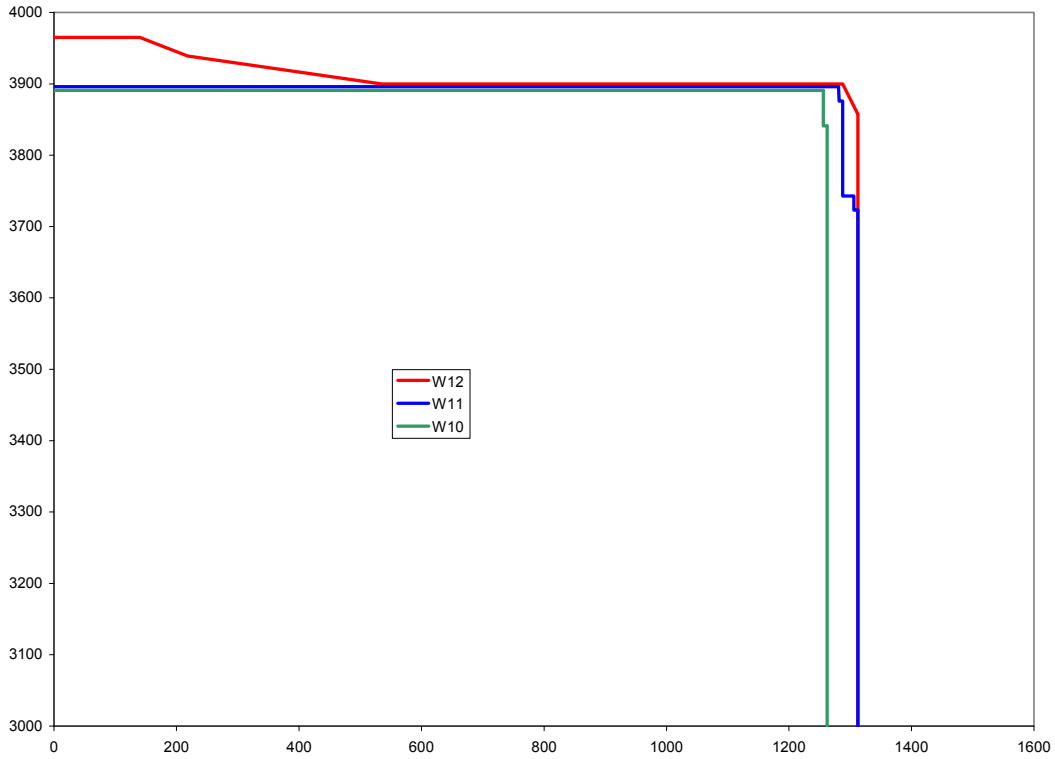


Figure 3 Top corner of W10 to W12 gauges

5.2 Wagon–load combinations

5.2.1 Wagon–load combinations deemed compliant with each gauge are published by Network Rail. The current definitive register of wagon–load combinations accepted as fully compliant with each gauge is held by Network Rail (Commercial Manager Freight).

5.2.2 Each of the appendices in this document provides an indicative list of conforming wagon–load combinations for guidance purposes only.

5.2.3 In the tables, heights of the loads above vehicle deck height are stated in millimetres.

5.3 Dynamic movements

5.3.1 Static gauges have traditionally provided dimensions for the maximum static gauge and rules for calculating overthrow, but the amount of movement permitted by the suspension has not generally been prescribed. The assumption that an 'established' suspension would be used has led to an implicit clearance requirement.

5.3.2 The dynamic gauges for W6a to W11 freight gauges developed in GE/RT8073 have been derived from a detailed theoretical analysis of a wide range of UK wagon types in both tare and laden conditions at normal operating speeds and with maximum allowable cant deficiency. A total of 29 wagon types were analysed:

a) Bogie steel flat wagon

b) Bogie covered steel wagon

c) Bogie container flat wagon

d) Bogie coal hopper wagon

e) Bogie stone hopper wagon

f) Bogie covered hopper wagon

g) Bogie open top box wagon

h) Bogie open wagon

i) 2 axle coal hopper wagon

j) 2 axle van

k) 2 axle open wagon

l) 2 axle container flat wagon

m) 2 axle stone hopper wagon

n) 2 axle steel wagon

o) 2 axle tank wagon.

5.3.3 From this analysis, it was concluded that there were two distinct suspension types whose lateral dynamic parameters could be generalised as follows:

Suspension type	Sway at 3080 mm ARL	Sway at 1000 mm ARL
Swing motion or low track force	100 mm	50 mm
All others	75 mm	25 mm

Table 6 General freight vehicle dynamic movements and maximum speed and cant deficiency

5.3.4 For each freight vehicle gauge, the lateral and dynamic movements which have been stated are based on the suite of wagons operating within the gauge. These movements represent the maximum operating envelope of the gauge at maximum speed and cant deficiency.

5.3.5 Established suspensions are unlikely to exceed the dynamic movement used in GE/RT8073. Values for current low track force and swing motion bogies have been used to ensure that vehicles fitted with these, which have been certified as gauge compliant, do not present operational difficulties by the introduction of GE/RT8073. However, the values of dynamic movement for any new wagons should not exceed the values given in GE/RT8073.

5.3.6 For coaching, UK1 and locomotive gauges, the lateral and dynamic movements which have been stated are based on the vehicles operating, or designed to operate, within the gauge. These movements represent the maximum operating envelope of the gauge at maximum speed and cant deficiency.

5.3.7 Wheel / rail clearance and wheel flange wear of 9.5 mm and 3 mm respectively (total 12.5 mm) have been calculated from standard wheel profiles.

5.4 Guidance on application to railway undertakings

5.4.1 In the case of W6a, W7, W8, W9 and W9Plus gauges, the maximum dynamic movement permitted is to be contained within the dynamic gauges shown in GE/RT8073 under all conditions of speed and cant.

5.4.2 In the case of W10, W11 and W12 gauges, the maximum dynamic movement permitted is to be contained within the dynamic gauges shown in GE/RT8073, and additionally is to be contained within the dynamic gauges of the donor vehicles defining the gauge under all conditions of speed and cant.

5.4.3 In the case of C1, C1 (Appendix A), UK1 (Issue 2) and locomotive gauges, the maximum dynamic movement permitted is to be contained within the dynamic gauge shown in GE/RT8073 under all conditions of speed and cant.

5.4.4 The dynamic swept envelopes of the proposed vehicle-load combination shall be within that of already conforming combinations. These combinations shall also comply both statically and dynamically with the designated gauge over the full spectrum of operating conditions.

5.5 Guidance on application to infrastructure managers

5.5.1 GE/RT8073 supports the more controlled clearance regime introduced by GC/RT5212, which allows a reduction in the normal requirements for clearance, where the components of vehicle / infrastructure interaction are clearly understood. The provision of wagon dynamic movement limits brings the current suite of gauges into line with this practice.

5.5.2 Infrastructure should be gauged to the dynamic gauge published in GE/RT8073 with adjustments for overthrow (lateral and vertical where appropriate) and for the effective position of the track. Allowance should also be made for any wheel / rail clearance. The gauges published in GE/RT8073 include the maximum expected dynamic movement for vehicles constructed to the gauge. This envelope will only be fully utilised at the limits of cant excess, cant deficiency and maximum (or critical) speed. In some circumstances, there may not be adequate clearance to accommodate the dynamic gauge. Where track conditions do not excite the full movement of the vehicle, a local dynamic assessment of the particular vehicle or wagon-load combination may indicate adequate clearance as required by GC/RT5212.

Part 6 An Outline of the UIC Method of Gauging

6.1 Introduction

6.1.1 The High-Speed Infrastructure Technical Specification for Interoperability (TSI) mandates the use of GC reference profiles. This section is provided to enable the defined UIC reference profiles to be applied to the infrastructure according to the appropriate rules.

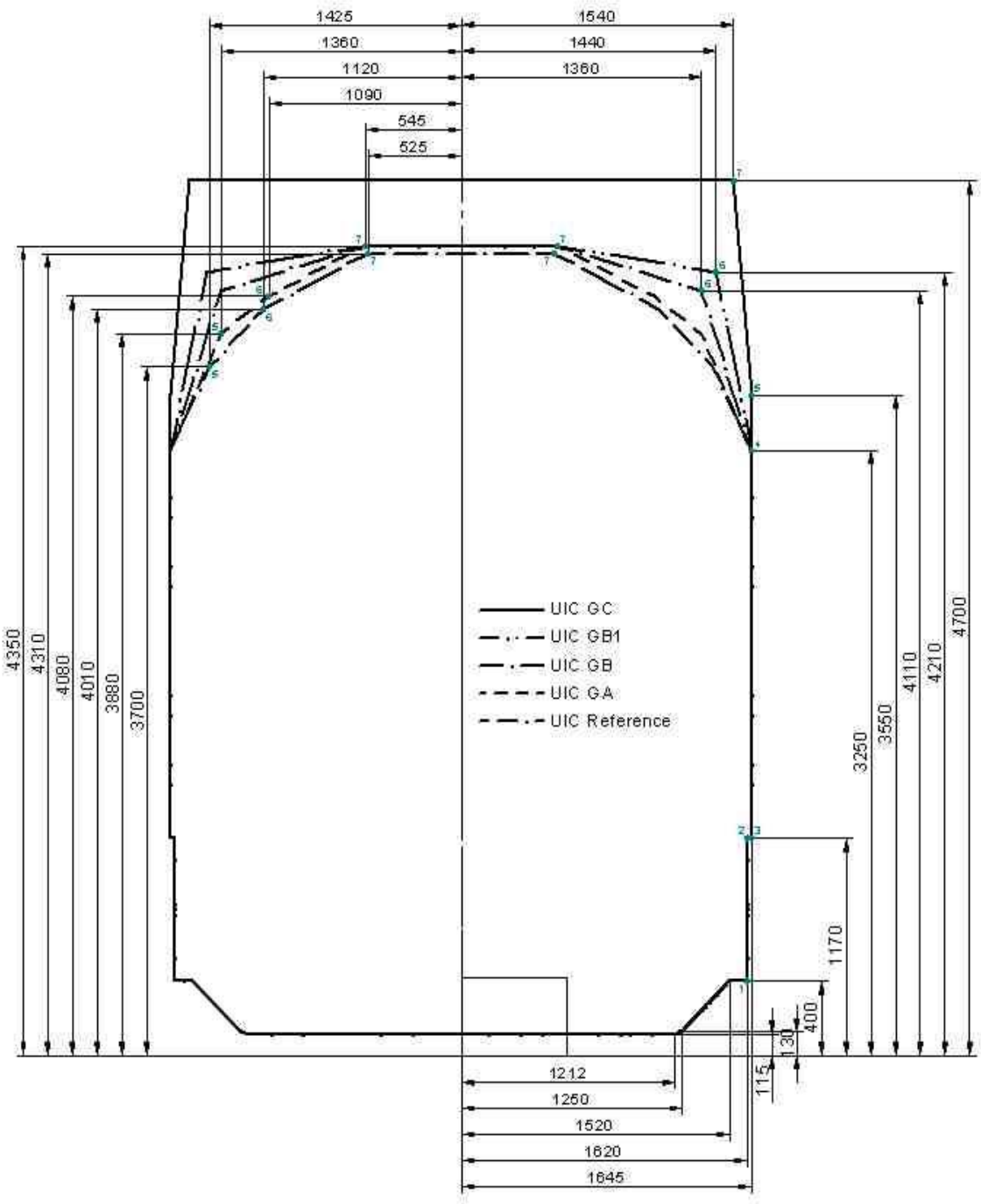


Figure 4 The UIC reference profiles

6.2 Background

6.2.1 The UIC 505 gauging method dates back to 1913. It has been developed as a hand-calculated technique, and contains a number of simplifications. No clearance is required – the conservatism of the method ensures that contact is not physically possible.

6.2.2 UIC gauging is described in a UIC series of leaflets. UIC 505-1 describes how vehicles may be gauged relative to a reference profile and UIC 505-4 describes the allowances that should be included between this reference profile and the infrastructure. 'Extended' reference profiles GA, GB, GB1 and GC are defined in UIC 506. Key to the process of UIC gauging is the reference profile, sometimes described as a reference gauge. This is neither a vehicle gauge nor a structure gauge (a common misunderstanding) but an intermediate profile defining the boundary between vehicle and infrastructure which dimensionally fulfils certain specified conditions, and is respected by railway undertakings and infrastructure managers alike. European railway administrations apply individual variations to the UIC codes.

UIC point	UIC reference		UIC GA		UIC GB		UIC GB1		UIC GC	
	x	y	x	y	x	y	x	y	x	y
	1212	115	1212	115	1212	115	1212	115	1212	115
	1250	130	1250	130	1250	130	1250	130	1250	130
	1520	400	1520	400	1520	400	1520	400	1520	400
1	1620	400	1620	400	1620	400	1620	400	1620	400
2	1620	1170	1620	1170	1620	1170	1620	1170	1620	1170
3	1645	1170	1645	1170	1645	1170	1645	1170	1645	1170
4	1645	3250	1645	3250	1645	3250	1645	3250	1645	3250
5	1425	3700	1360	3880					1645	3550
6	1120	4010	1090	4080	1360	4110	1440	4210		
7	525	4310	545	4350	545	4350	545	4350	1540	4700

Table 7 Coordinates of UIC reference profiles (coordinates in mm)

6.3 Rules for application to infrastructure managers

6.3.1 It is important to note that the concepts of normal, reduced and special reduced clearances as defined in GC/RT5212 do not apply to UIC gauging.

6.3.2 It is necessary to enlarge the reference profiles to take into account what are known as 'infrastructure additions'. These are as follows:

a) Curve radius, gauge variation and authorised projections – the basic reference profile is calculated on the basis of curves having a radius of ≥ 250 m, however a modification of the profile allows it to be applied down to curves of 150 m radius. The reference profile cannot be used on curves below 150 m radius. Gauge widening should be accounted for. Also 'authorised projections', or parts of the vehicle that are allowed to project beyond the reference profiles, should be considered in relation to the curve radius.

b) Track tolerances – these relate to positional and static cross level error tolerances.

c) Roll due to cant excess or deficiency, and other roll inducing parameters – the calculation of the reference profiles includes an allowance for up to 50 mm of vehicle roll. Above this, the infrastructure gauge should be enlarged to allow for additional vehicle semi-static roll. A roll centre of 500 mm ARL is assumed. Included in this are the effects of dynamic cross level error, roll due to track condition (this assumes either 'lines in good repair' or 'lines in poor repair'. Published track maintenance standards in Britain are lower than those usually found in Europe, and it would thus be appropriate to assume 'lines in poor repair' in the absence of qualitative information) and vehicle / load dissymmetry.

6.4 Rules for application to railway undertakings

6.4.1 The design of vehicles to UIC 505-1 is beyond the scope of this document.

6.5 Development of a structure gauge

6.5.1 Development of a structure gauge using UIC 505-4

6.5.1.1 The following describes the development of a structure gauge using the principles described in UIC 505-4.

6.5.1.2 All formulae generate additions to the semi-width appropriate to the height of the profiles and hand of the curve.

6.5.2 Curve radius, gauge variation and 'authorised projections':

R is radius in metres

L is actual gauge in mm

For points above 400 mm ARL:

For curve radius ≥ 250 m (outside, inside and straight track)

Addition = (3750/R) + ((L-1435)/2)

For curve radius ≥ 150 m and < 250 m (outside)

Addition = (60000/R) – 225 + ((L-1435)/2)

For curve radius ≥ 150 m and < 250 m (inside)

Addition = (50000/R) – 185 + ((L-1435)/2)

For points below 400 mm ARL:

For curve radius ≥ 250 m (outside, inside and straight track)

Addition = (2500/R) + ((L-1435)/2)

For curve radius ≥ 150 m and < 250 m (outside)

Addition = (60000/R) – 230 + ((L-1435)/2)

For curve radius ≥ 150 m and < 250 m (inside)

Addition = (50000/R) – 190 + ((L-1435)/2)

6.5.3 Roll above 500 mm ARL

E is cant excess in mm, and is towards the inside of the curve

I is cant deficiency in mm, and is towards the outside of the curve

h is the height ARL in mm

E and I should also include the additions below, which add to the effect of cant excess and cant deficiency:

For cant excess situations

Addition = (0.4/1505) x (h – 500)>0 x (E – 50)>0

For cant deficient situations

Addition = (0.4/1505) x (h – 500)>0 x (I – 50)>0

Note that neither h-500, nor (E or I) – 50 may be less than 0

Additions to E and I:

Parameter	Addition to outside (I)	Addition to inside (E)
Dynamic CLE > 80 km/h	15	15
Dynamic CLE ≤ 80 km/h	20	20
Oscillations good track	39(1)	7(1)
Oscillations poor track	65(1)	13(1)
Dissymmetry	65(1)	65(1)

Table 8 Additions to E (cant excess) and I (cant deficiency)

(1) The dynamic effect of a cant deficiency of 65 mm corresponds to an angle of 1° when the roll stiffness of 400 mm/m (included in the formula) is considered.

Note that the additions stated are 'in the absence of other rulings or practices authorised by experience'.

6.5.3.1 In Britain, the dynamic cross level error is determined according to the track fixity. 10 mm cross level error (normal fixity) and 7.5 mm (medium fixity) should be used.

6.5.4 Track tolerances

Simple lateral displacement

Track alignment error (outside, inside and straight track)

Addition = 25

6.5.4.1 In Britain, conforming to GC/RT5212, the effective position of the track for the appropriate fixity regime should be used. Low fixity track would require an addition of 25 mm, medium fixity 15 mm and high fixity (slab) 0 mm.

Height related displacement

h is the height ARL in mm

Static cross level error (outside, inside and straight track) > 80 km/h

Addition = 0.01 x h

Static cross level error (outside, inside and straight track) ≤ 80 km/h

Addition = 0.0133 x h

6.5.4.2 These values correspond to 15 mm and 20 mm static cross level error respectively. In Britain, according to GC/RT5212, the dynamic cross level error is determined according to the track fixity. 10 mm cross level error (normal fixity) and 7.5 mm (medium fixity) should be used.

6.5.5 Vertical additions

VR is the vertical radius in metres

Vertical curvature

Addition = 50000/VR

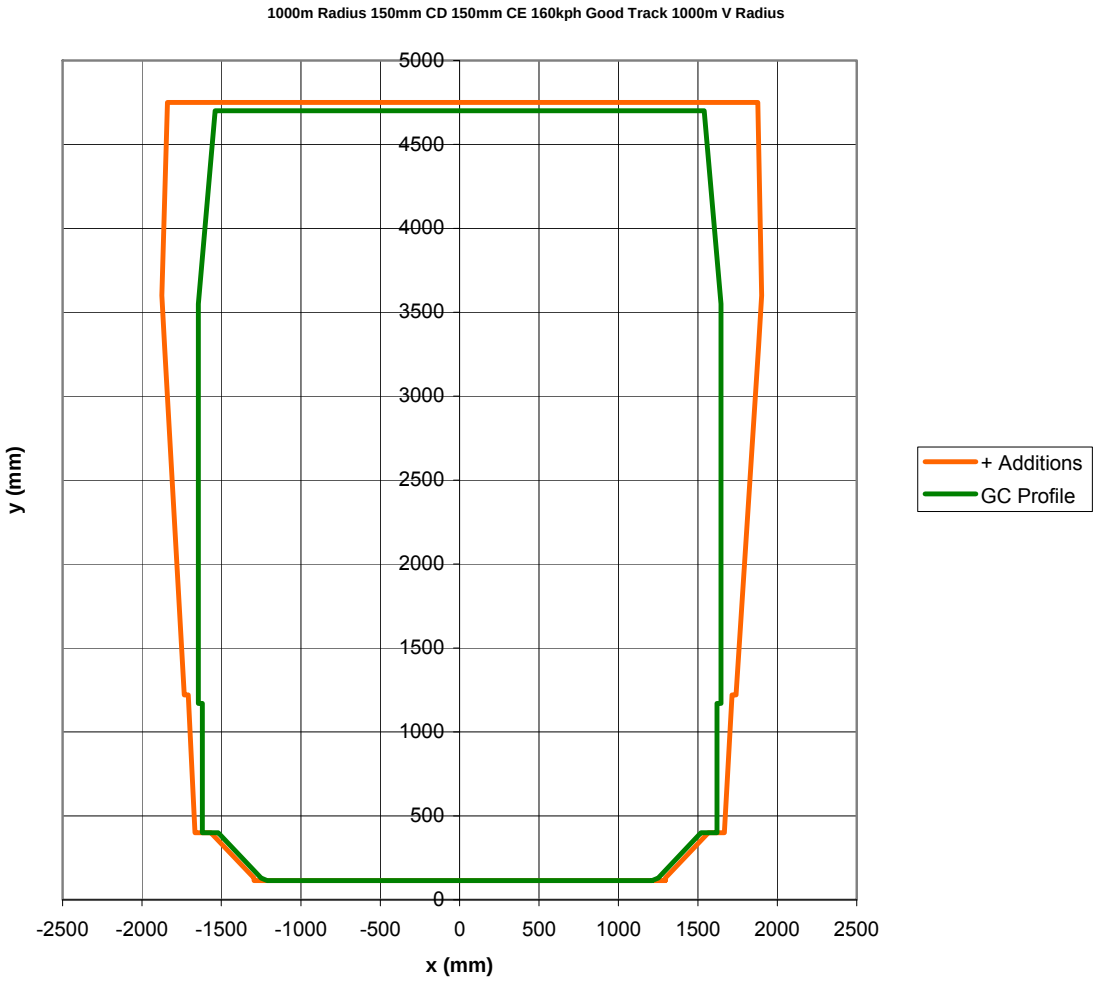


Figure 5 Example of UIC reference profile and infrastructure additions

Part 7 Positioning of New, Altered and Temporary Infrastructure Adjacent to the Tracks

The RGSs referenced in this section are current at the date of publication of this document. Readers should consult the RGS catalogue (www.rgsonline.co.uk) to establish the current status of these RGSs.

7.1 Requirements of GC/RT5212

7.1.1 Requirements of GC/RT5212 Part G

7.1.1.1 GC/RT5212 Part G sets out requirements for:

a) Minimum upper sector clearances for new infrastructure

b) Additional clearances at vehicle window level

c) Lower sector structure gauge for new infrastructure

d) Track intervals for new infrastructure

e) Alterations other than to permit the passage of larger rail vehicles

f) Alterations to permit the passage of larger rail vehicles

g) Complete rebuilding of existing structures

h) Temporary infrastructure.

7.1.1.2 The clearance requirements set out in GC/RT5212 are not the only (or even the most important) determinant of the position of new, altered and temporary infrastructure adjacent to the tracks - see section 7.2 of this document.

7.1.2 Alterations to infrastructure

7.1.2.1 GC/RT5212 does not require that alterations to infrastructure achieve an improvement in the 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.

7.1.2.2 It should be noted that when existing infrastructure is altered to permit the passage of larger rail vehicles, it is permissible for the alteration to be limited to that which is just sufficient to allow the passage of the larger vehicles, provided the control measures appropriate to the resulting clearance category (for example, special reduced clearance) are implemented.

7.1.3 Temporary infrastructure

7.1.3.1 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.

7.1.3.2 GC/RT5212 therefore requires temporary infrastructure (for example, scaffolding or temporary alignments during staged works) to meet the requirements for new infrastructure, ‘so far as it is practicable to do so within the constraints of the site’.

7.1.3.3 Where these requirements cannot be met, consideration is to be given to the need for mitigation measures. The mitigation measures considered, and the mitigation measures adopted, are both to be documented.

7.1.4 Planning of construction work

7.1.4.1 GI/RT7003 requires that:

Construction work including staged and/or temporary construction work (including scaffolding, screens and hoardings) and the use of associated plant and equipment (including lights) shall be planned so that no interference is caused to any of the following, unless appropriate alternative control measures have been put in place: …

The maintenance of adequate clearances between any passing rail vehicles and the construction work and associated equipment (including allowing for the possibility of train crew or passengers leaning out of windows).

7.1.4.2 Whilst materials and equipment placed on or near the track in readiness for maintenance or renewals work are not 'temporary infrastructure' within the meaning of GC/RT5212, the clearances provided to such materials and equipment should at least meet the requirements for temporary infrastructure.

7.1.4.3 Instructions for unloading of rails are issued by Network Rail.

7.1.4.4 Rail should not be planned to be unloaded in the four foot if it will be in a position such that it is above the height of the running rails. The actual height of the unloaded rail in the four foot should be no more than 25 mm above the height of the running rails at any point.

7.2 Interface between GC/RT5212 and other Railway Group Standards

7.2.1 As noted above, the clearance requirements set out in GC/RT5212 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 the requirements of other RGS that should be considered when designing new and altered infrastructure is given in sections 7.3 to 7.6 below.

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

a) GC/RT5021 Track System Requirements

b) GC/RT5203 Infrastructure Requirements for Personal Safety in Respect of Clearances and Access

c) GE/RT8025 Electrical Protective Provisions for Electrified Lines

d) GE/RT8034 Maintenance of Signal Visibility

e) GI/RT7016 Interface between Station Platforms, Track and Trains.

7.3 Track system requirements

7.3.1 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.

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

7.4 Personal safety

7.4.1 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 therefore should be provided for such access.

7.4.2 GC/RT5203 sets out the design, construction and maintenance requirements for means of access onto, along or across running lines that are provided for authorised people. In particular, GC/RT5203 requires that:

Where reasonably practicable, a continuous cess walkway shall be provided on at least one side of any railway where people are regularly permitted access on or near the line whilst trains are running.

Where reasonably practicable, a continuous position of safety shall be provided on each side of any railway where people are regularly permitted access on or near the line whilst trains are running. It is permissible to use a cess walkway as a continuous position of safety.

7.4.3 GC/RT5203 sets out dimensions for cess walkways and continuous positions of safety, including the distance to the running edge of the nearest rail (which vary according to the permissible speed of the line).

7.5 Electrical protective provisions

7.5.1 Where lines are electrified, and particularly where they are electrified using the 25 kV overhead contact line (OCL) 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 GC/RT5212.

7.5.2 GE/RT8025 mandates 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 are also included.

7.5.3 The height of the contact wire, plus required clearances, determines the height of structures above a railway electrified using the 25 kV OCL system. However, the height of the contact wire is not defined in RGS, as this depends on a number of factors, including the size and characteristics of vehicles to be accommodated, which are commercial issues. Part 8 of this document discusses development of standard structure gauges, making allowance for the height of the contact wire.

7.5.4 GE/RT8025 does however set a minimum height for the lowest live part of the OCL equipment above the road surface of a public road level crossing.

7.6 Signal positioning and visibility

7.6.1 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. In particular, GE/RT8034 requires that:

When a railway group member is responsible for any new or altered structural design, they shall advise the infrastructure controller of any alterations planned to take place in the vicinity of signals so that the potential affect on signal visibility can be assessed. This shall include the provision of a new signal structure which could itself adversely affect the visibility of an existing signal.

7.6.2 It also requires that:

The infrastructure controller shall arrange for all reports received regarding proposed changes to, or deficiencies in, signal visibility to be initially assessed by a person competent in the requirements of GK/RT0037. This initial assessment shall review the information provided in order to determine whether a signal sighting committee is required to make a detailed assessment of the affected signal(s).

7.7 Station platforms

7.7.1 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.

7.7.2 GI/RT7016 requires the height at the edge of the platform to be 915 mm (within a tolerance of + 0, - 25 mm) measured at right angles to the plane of the rails of the track adjacent to the platform.

7.7.3 GI/RT7016 requires the platform edge to be the minimum distance from the adjacent track (within a tolerance of + 15, - 0 mm) consistent with the lower sector structure gauge set out in Appendix 1 of GC/RT5212.

7.7.4 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, - 0 mm). GC/RT5212 sets out exceptions where Class 373 trains or 2.6 m wide containers are required to pass the platform. GC/RT5212 also sets out requirements where the curve radius is less than 360 m.

7.8 Provision for the future

7.8.1 Railway infrastructure generally has a very long life, and once built 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).

Part 8 Factors to be Taken into Account When Determining Structure Gauges

8.1 A possible structure gauge for Britain

8.1.1 The following model allows the development of a standard structure gauge based upon the parameters discussed in sections 8.2 and 8.3.

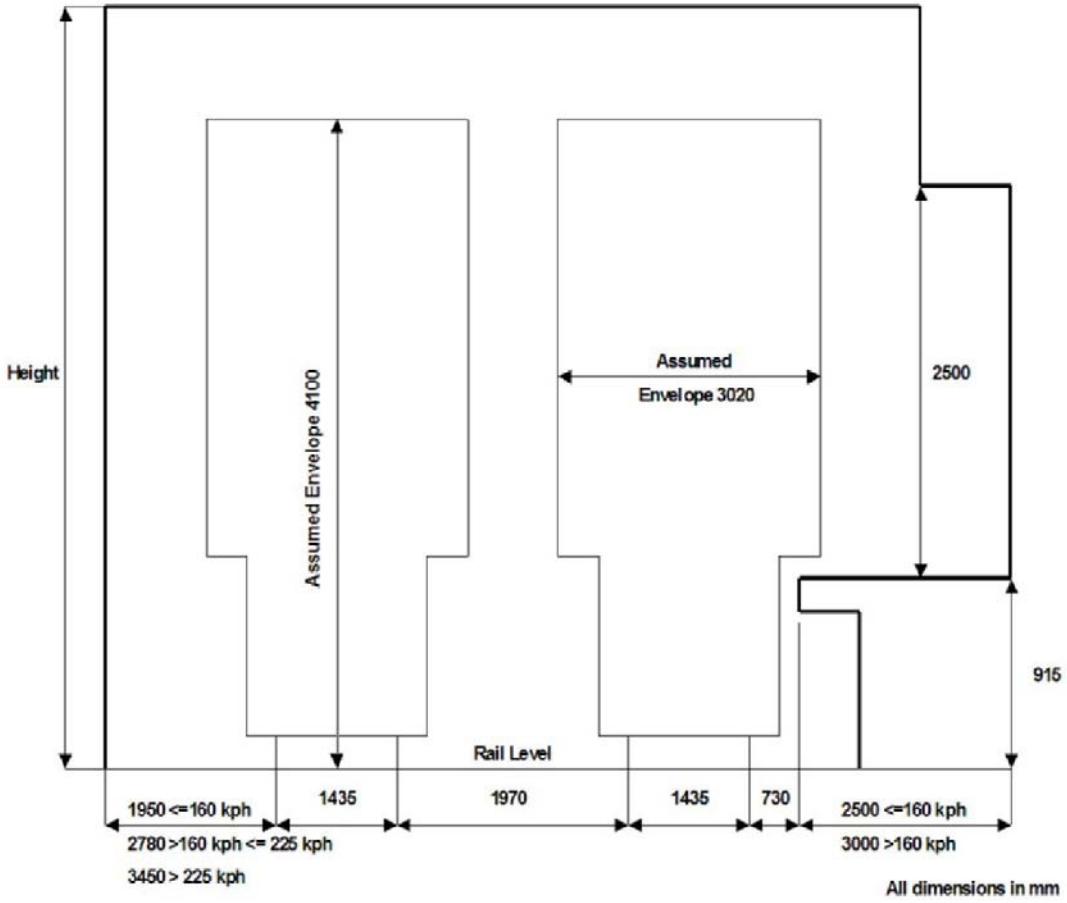


Figure 6 Model structure gauge requiring minimum associated control measures (applicable to straight and level track)

8.1.2 The structure gauge model is based upon the traditional BR structure gauge defined in BR Handbook 4 and further described in withdrawn GC/RT5204.

8.1.3 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.

8.2 Lateral clearances

8.2.1 Basis for lateral clearances

8.2.1.1 Lateral clearance is determined according to the widest vehicle, and the clearances to cess walkways required, depending on speed. There are additional requirements at platforms.

8.2.2 Assumed width of dynamic envelope

8.2.2.1 Lateral clearances are based upon a maximum dynamic envelope width of 3020 mm. This is equivalent to:

a) Mark III coach at cantrail (2620 mm) plus 200 mm lateral suspension travel

b) Mark I coach (2820 mm) plus 100 mm lateral suspension travel.

8.2.3 Allowance for cess walkway

8.2.3.1 The model structure gauge includes provision for a cess walkway in accordance with GC/RT5203. This dimension should be increased on curved track to allow for the overthrow of vehicles.

8.2.3.2 This dimension could possibly be reduced in tight situations where alternative access is available, via a route in a position of safety, connected with walkways each side of the structure, or where the railway operates on a 'no person' basis, whereby staff are only allowed on the track when special protection measures are in place.

8.2.4 Allowance for platforms

8.2.4.1 The lateral platform offset (730 mm) should be increased according to curve radius using the formula given in GC/RT5212, and where required for specific vehicles.

8.2.4.2 Platform clearances are subject to maintenance of required stepping distances. Note that these are normally calculated and assessed using the static (thrown) vehicle envelope, and are vehicle specific. See also section 9.7 of this document.

8.2.5 Allowance for tilting trains

8.2.5.1 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.

8.3 Vertical clearances

8.3.1 Basis for vertical clearances

8.3.1.1 Vertical clearance is determined according to the tallest vehicle, and whether OCL is present.

8.3.2 Routes not electrified using overhead contact line equipment

8.3.2.1 On non-OCL routes, where there is no requirement to allow for future OCL electrification, a minimum vertical clearance of 4325 mm ARL is recommended.

8.3.2.2 The vertical clearance is based upon a maximum dynamic envelope height of 4100 mm. This is equivalent to a 9' 6" container on a 1100 mm deck height wagon, plus 100 mm of vertical suspension travel / vertical vehicle tolerances.

8.3.2.3 The vertical height may require adjustment for the effects of vertical curvature.

8.3.2.4 The vertical clearance allows for 200 mm passing clearance and + 25 mm track maintenance tolerance.

8.3.2.5 A minimum vertical clearance of 5200 mm ARL is recommended for non-OCL routes where there is a requirement to allow for future OCL electrification (but see also sections 8.3.3 and 8.3.4). The vertical height recommended would allow the passage of GC vehicles if no contact wire were present.

8.3.3 Routes electrified using overhead contact line equipment

8.3.3.1 On OCL routes, the vertical clearance is based on the required wire height.

8.3.3.2 For optimum current collection, the contact wire should remain level through 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.

8.3.3.3 Compromises are possible to reduce the space required by the electrification equipment but these may bring with them reductions in 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 of contact wire height through the bridge.

8.3.3.4 There is considerable variation in the height of the contact wire used in Britain. Typically the contact wire height is 4700 mm, but the range is 4200 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 5600 mm).

8.3.3.5 Standard contact wire heights defined by the High-Speed Energy TSI will determine the contact wire height required on routes where compliance with the TSI is required.

8.3.3.6 Section 8.3.4 sets out typical arrangements to illustrate the height required to allow for electrification through a bridge structure, or the construction of a bridge over an existing electrified line.

8.3.4 Factors to be allowed for on overhead contact line routes

8.3.4.1 Factors to be allowed for in the derivation of a structure gauge in areas electrified using OCL equipment are listed below.

8.3.4.2 These factors can be used to determine the lowest possible designed contact wire height. However the type of traffic and speed of operation of the line may determine that the nominal height of the contact wire is substantively higher than the minimum value determined by these factors.

a) **Dynamic envelope**
This is defined in the definitions.

b) **Vertical track curvature**
The effect of the rolling stock height of a concave track dip at a bridge may increase the effective height of long vehicles.

c) **Track maintenance tolerance**
This is defined in track maintenance standards - typically + 25 mm, but could be reduced to + 15 mm with special measures.

d) **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.

e) **Passing electrical clearance**
Normal passing clearance is defined in GE/RT8025 as 200 mm minimum for a 25 kV system, but should be increased to 270 mm static electrical clearance if vehicles regularly stop at that point.

f) **Sag of contact wire below supported height**
An allowance for systems using a pre-sagged contact wire, and for the effect of ice etc.

g) **Construction tolerance**
Applied above and below the designed contact wire height. Usually 75 mm, but can be reduced to 10 mm with special measures.

h) **Construction depth**
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 1 m plus for a 'free-running' arrangement not supported from the bridge.

i) **Uplift**
This is the amount by which the contact wire is lifted by the passage of a pantograph.

j) **Electrical clearance**
A static electrical clearance of at least 270 mm is always required if 'normal' clearances are to be applied. Where the contact wire is subject to uplift, a passing electrical clearance of at least 200 mm is required to the uplifted contact wire.

k) **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 (see note l below). The protection could include 50 mm flashover protection and, in some cases, an additional 120 mm for secondary insulation. The bridge construction and function will determine if these additional precautions are required.

l) **Clearance to live parts**
Where a free running design is required (that is, a design where the OCL equipment is not attached to the bridge), an additional clearance of 400 mm is required, giving a total passing clearance of 600 mm. However, if a flashover protection and / or secondary insulation are provided (see note k above), this value can be reduced.

m) **Bridge construction tolerance**
A further bridge construction tolerance could be appropriate, typically 50 mm.

n) Other features such as track arrangement, electrical sectioning and proximity of level crossings and wire grading should also be considered.

o) On very high-speed lines, or in long tunnel installations, the effect of aerodynamics can predominate.

8.3.4.3 Table 9 gives examples for typical wire heights of 4700 mm, 5000 mm (for TSI upgraded lines), and for a restricted wire height of 4200 mm (however this will restrict the rolling stock that can be used). The notes refer to the alphabetic numbering of the list of factors set out above.

	Supported from bridge	Free running design	TSI upgrade	Minimum design	Factors to be considered
Minimum bridge soffit height	**5150**	**6575**	**5450**	**4650**	
[Total allowances above contact wire height]	*[450]*	*[1875]*	*[450]*	*[450]*	
Bridge construction tolerance	50	50	50	50	m)
Clearance to live parts	N/A	400	N/A	N/A	l)
Secondary insulation	See note	See note	See note	See note	k)
Flashover protection	See note	See note	See note	See note	k)
Passing clearance	200	200	200	200	j)
Uplift	70	150	70	70	i)
OCL construction depth	120	1000	120	120	h)
OCL construction tolerance	10	75	10	10	g)
OCL construction tolerance	75	75	75	10	g)
Contact wire sag	75	75	75	10	f)
Passing electrical clearance	200	200	200	200	e)
Track lift allowance	See note	See note	See note	See note	d)
Track tolerance	25	25	25	25	c)
Vertical track curvature	See note	See note	See note	See note	b)
Total allowances below wire height	*[375]*	*[375]*	*[375]*	*[245]*	
Height available for dynamic envelope	**4325**	**4325**	**4625**	**3955**	**a)**

Table 9 Parameters for development of gauges (typical wire heights)

Note 1: All dimensions are measured ARL (as defined in the definitions).

Note 2: The values shown in this table are based on the application of 'normal' electrical clearances in accordance with GE/RT8025. It may be possible to apply 'reduced' or 'special reduced' clearances; similarly enhanced clearances may be required at particular locations.

8.3.5 Allowance for vertical deflections of overbridges

8.3.5.1 The above calculations make no allowance for vertical deflections of overbridges under load. These can be significant, particularly for steel overbridges. An appropriate allowance should be included where necessary.

8.3.6 Allowance for pantograph gauge

8.3.6.1 The pantograph can move vertically and laterally to create an envelope above the vehicle which should have both mechanical and electrical clearance to the non-electrified infrastructure and neighbouring components of the OCL. The structure designer should ensure that the pantograph envelope is not infringed. Pantograph gauges have been established for existing rolling stock and existing designs of OCL. The High-Speed Energy TSI has a pantograph gauge for the 1600 mm Europantograph required by the High-Speed Rolling Stock TSI, together with a specific case for application on existing routes in GB.

8.4 UIC compliant structure gauges

8.4.1 The following structure gauges have been developed from UIC leaflet 505-4, providing an interference fit at the limits stated. No clearance is required.

8.4.2 The gauges shown do not include any allowance for OCL or walkway clearance. Appropriate allowances for any electrification clearances and safe access should be included where appropriate.

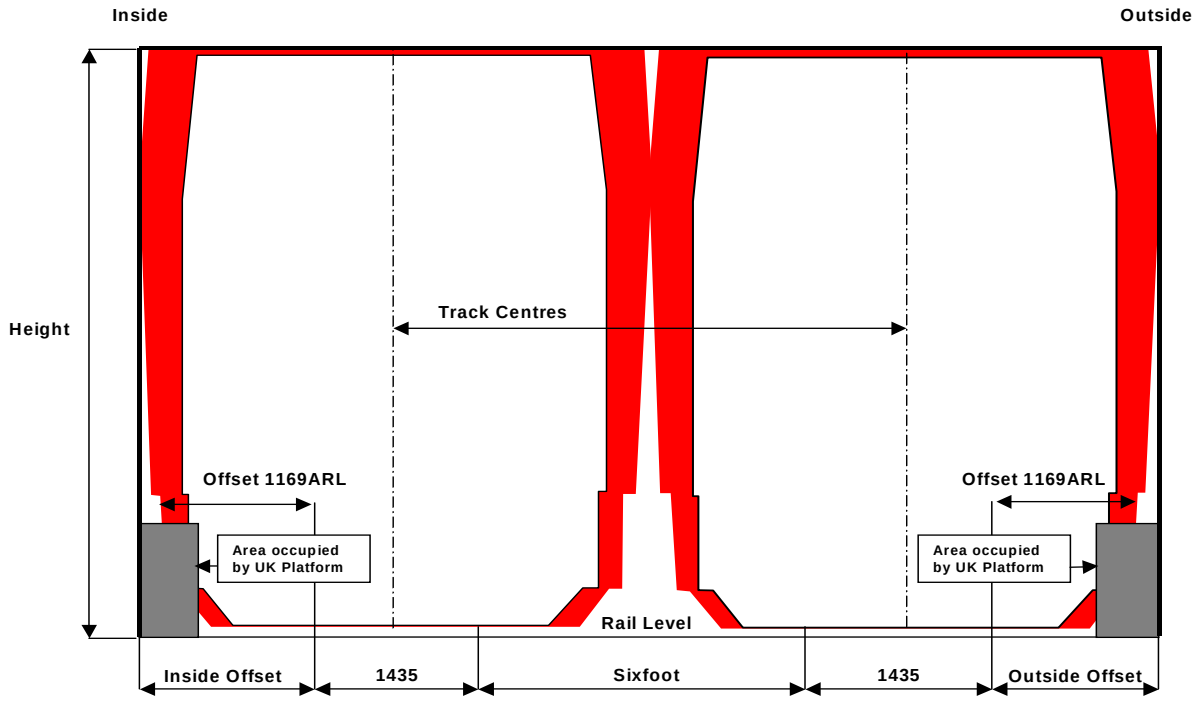


Figure 7 UIC compliant structure gauges

8.4.3 Three gauges have been developed for straight track, on a curve of 250 m radius and on a curve of 150 m radius. The following parameters have been used:

Parameter	Straight track	250 m curve	150 m curve
Radius	Tangent	250 m	150 m
Installed cant	0 mm	150 mm	150 mm
Cant deficiency	0 mm	110 mm	150 mm
UIC track quality	Poor	Poor	Poor
Gauge widening	0 mm	30 mm	30 mm
Vertical radius	Tangent	1000 m	1000 m
Line speed	79 km/h	79 km/h	57 km/h
Inside offset	1081 mm	1190 mm	1324 mm
Outside offset	1081 mm	1233 mm	1333 mm
Sixfoot	2162 mm	2423 mm	2657 mm
Track centres	3597 mm	3858 mm	4092 mm
Inside offset 1169	961 mm	1008 mm	1142 mm
Outside offset 1169	961 mm	1018 mm	1144 mm
Height GC gauge	4700 mm	4750 mm	4750 mm
Height GA/B gauge	4350 mm	4400 mm	4400 mm

Table 10 Parameters for development of gauges (for straight track)

8.4.4 For indicative purposes, a standard British platform (adjusted for curve radius) has been shown.

8.4.5 It should be noted that the gauges are asymmetric on curved track. Where less onerous track conditions apply (for instance reduced installed cant or cant deficiency) the gauges can be relaxed according to the rules given in Part 6.

8.4.6 Inside and outside offsets at 1169 mm ARL are given. This indicates the effective width required in the area of the lower structure gauge where UIC vehicles are permitted to run.

8.4.7 GA, GB and GB1 gauges share a common height and would be used where the economic case for provision of GC is not viable.

Part 9 Miscellaneous Technical Issues

9.1 Introduction

9.1.1 This part of the document deals with a number of unrelated technical issues. They are gathered in one part for convenience.

9.1.2 The methodologies and standards relating to gauging practice, and the derivation of vehicle and structure gauges have evolved over many years. There are a number of documents that although no longer current, contain important information and provide the basis for today's gauging practises. Archive copies of the documents have been produced by RSSB on behalf of the rail industry and are available in electronic format on a CD-ROM (see page 2 of this document for contact details). A brief of the content is available on RSSB's website under the title T519 Archive of Documents relating to gauging.

9.2 Calculation of overthrow on curves (infrastructure)

9.2.1 Detailed formula for the calculation of overthrow

9.2.1.1 The axles of a railway vehicle may be considered as a chord placed on curved track. The body represents an extension of this chord. As the vehicle traverses the chord, then the centre of the vehicle is thrown towards the inside of the curve, and the end of the vehicle is thrown towards the outside of the curve. The effect is greater for longer vehicles and on tighter curves. A bogie is simply a vehicle with centre throw only. Effects due to vertical curves are generally less significant than those due to horizontal curves.

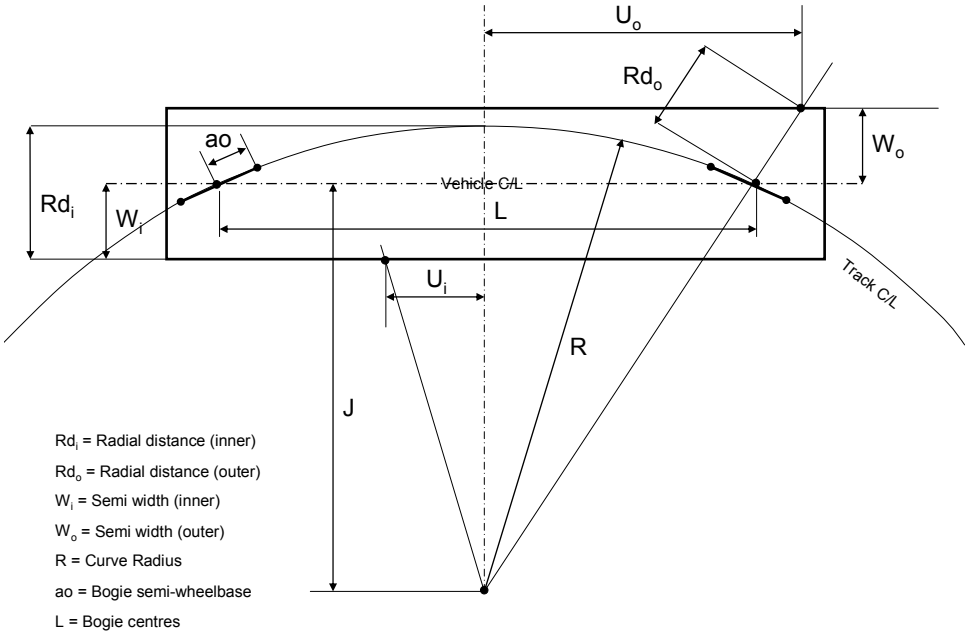


Figure 8 Diagram indicating vehicle body overthrow

9.2.1.2 Considering the above diagram, the overthrows at a point on a vehicle body are the differences between the radial distance from the track centreline to the point (Rd_o or Rd_i), and the lateral distance from the vehicle centreline to the point (W_o or W_i). This is calculated with the vehicle stationary.

9.2.1.3 Consider a vehicle with bogie centres L, and a bogie axle semi-spacing of ao (the actual axle spacing is 2 x ao).

9.2.1.4 The inner overthrow of a point U_i from the centre of the vehicle is:

$$Overthrow_{inner} = R - W_i - \sqrt{[\ U_i^2 + (J - W_i)^2\ ]}$$

9.2.1.5 The outer overthrow of a point U_o from the centre of the vehicle is:

$$Overthrow_{outer} = \sqrt{[\ U_o^2 + (J + W_o)^2\ ]} - R - W_o$$

Where $J = \sqrt{[\ R^2 - ao^2 - L^2 / 4\ ]}$

9.2.1.6 All dimensions and values should be in millimetres or metres.

9.2.2 Simplified formulae for the calculation of overthrow

9.2.2.1 GE/RT8073 uses standard simplified formulae of the form:

Throw = x / R

9.2.2.2 These formulae are consistent with the presentation used in the developing Euronorm standards for gauging. The simplifications, in extreme cases of curvature, overestimate vehicle overthrows by around 2 - 3 mm. Where such values are significant (on curves below 150 m radius) accurate formulae should be used to calculate throws.

9.3 Calculation of width reduction (vehicles)

9.3.1 Where a vehicle is to be built to a vehicle gauge, the lateral dimensions defined by the gauge should be reduced if the overall length or bogie centres exceed those specified in the gauge. Where reduced vehicle length or bogie centres are used, it is not permissible to increase lateral dimensions defined by the gauge, since the limiting gauge size is defined by straight track.

9.3.2 In the following calculations, the variables are:

A The wheelbase / bogie centres in metres

Ni The distance of the cross section being calculated from the bogie pivot / axle position (in metres) where this is inside of the wheelbase / bogie centres

N_o The distance of the cross section being calculated from the bogie pivot / axle position (in metres) where this is outside of the wheelbase / bogie centres

R The curve radius (in metres) at which the reduction should be calculated

K The overthrow allowed at the defined radius (in metres)

E_i Inner width reduction (in metres)

E_o Outer width reduction (in metres)

Formulae:

$E_i = ((AN_i - N_i^2) / 2R) - K$

$E_o = ((AN_o + N_o^2) / 2R) - K$

Note: E_i and E_o cannot be negative

Example:

Consider a vehicle to be compliant with W6a gauge, but having bogie centres of 13.5 metres and a length over headstocks of 19.092 metres

On a 200 m (R) curve, W6a allows a 0.102 m (K) overthrow

$N_i = 6.75$

$N_o = 2.796$

$E_i = ((13.5 \times 6.75 - 6.75^2) / 200 \times 2) - 0.102 = 0.0119$

$E_o = ((13.5 \times 2.796 + 2.796^2) / 200 \times 2) - 0.102 = 0.0119$

9.3.3 According to the width reduction formula, E_i at the centre would be 0.012 m and E_o at the ends would be 0.012 m. The maximum overall width of the vehicle would thus be 2.820 – 0.024 = 2.796 m.

9.4 Infrastructure measurement tolerances

9.4.1 Philosophy

9.4.1.1 GC/RT5212 provides for a reduction in clearance associated with the risk regimes of normal, reduced and special reduced clearances. This is achieved through the differentiation between clearances and tolerances, removing double counting where tolerances had previously been incorporated in clearance values.

9.4.1.2 In taking advantage of the lesser clearances permitted by GC/RT5212 than those in previous standards, it is important to note that traditionally, the accuracy of measuring structures has been included in the clearance required. Now, measuring accuracy should be taken into account when calculating clearance.

9.4.2 Defining accuracy

9.4.2.1 Measuring accuracy should be defined in a consistent, numerate manner. The value to be used in clearance calculations should be that which would be achieved in 95 per cent (two standard deviations) of cases, measuring a shape in the immediate vicinity of the rail vehicle (that is to say in the clearance zone of interest). The measuring accuracy should be that of the entire measuring system including that of the means by which the structure measurement is related to the rail datum. This should include, but it is not necessarily limited to:

a) Accuracy of the measuring equipment (scanner, etc)

b) Effect of measuring speed

c) Accuracy of the calibration

d) Accuracy of rail referencing including effects of:

i) Vehicle yaw

ii) Vehicle pitch

iii) Overthrow

iv) Flange / rail clearance

e) Environmental conditions.

9.4.2.2 Measurement accuracy should be defined by reference to the standard deviation of the system.

9.4.2.3 The example form included as Appendix O in this document may be used to describe the accuracy of any measuring system.

9.4.3 Procedure to be used where measuring accuracy is undefined

9.4.3.1 Measuring system accuracy varies considerably, and is invariably worse than the base measuring system. In the absence of such information, or a sensible engineering assessment of the technique, a value of 50 mm should be used to provide consistency with previous RGS.

9.4.4 Ageing of infrastructure measurements

9.4.4.1 GC/RT5212 states …*'in the absence of actual track movement data) that the allowance for variation in lateral alignment for the appropriate track fixity, given in section D3.3, applies cumulatively for each year since the relative positions of track and adjacent structures or tracks were measured. It is permissible to make a less conservative assumption where this can be supported by actual track movement data'.*

9.4.4.2 The purpose of this section is to ensure that the checking of the track and structure is performed at a frequency consistent with the risk of infringement, rather than according to line category as in previous standards. Thus, where clearances are large, infrequent checking is allowable. Where track position is actively controlled by datum plates, this will keep track position within the chosen fixity regime. Clearances in the reduced or special reduced category will require more frequent measurement of the track and structure relationship.

9.5 Use of the 'area reserved for items intended to come in close proximity to trains'

9.5.1 Background

9.5.1.1 The predecessor standard to GC/RT5212, GE/RT8029 set out, in Appendix B, a 'Structure gauge for areas close to the plane of the rail'. This included an area defined as being an 'area for dwarf signals, bridge girders, and other lineside equipment (conductor rail equipment, such as hook switches, is also permitted to utilise this area)'. The area extended outwards from a point 240 mm + 318 mm = 558 mm from the nearest running edge, to a height of 110 mm.

9.5.1.2 Appendix 1 of GC/RT5212 has consolidated the various areas included in the 'Structure gauge for areas close to the plane of the rail' into an area designated as an area reserved for items intended to come in close proximity to trains (for example, conductor rails and AWS magnets). This was done to simplify the standard, taking the view that it was not necessary to include the detail about what the space was used for in a standard about clearances.

9.5.1.3 However, a copy of Appendix B has been taken from GE/RT8029 and is included as Appendix Q in this document as a record of the intended use of these areas.

9.5.2 Bridge girders

9.5.2.1 Because GC/RT5212 refers to an 'area reserved for items intended to come in close proximity to trains' and bridge girders are, under usual circumstances, not intended to come in close proximity to trains, a formal reading of GC/RT5212 implies some current designs of bridges with girders which intrude into the area designated by GE/RT8029 as an 'area for dwarf signals, bridge girders, and other lineside equipment' are no longer permitted. This was not the intention, and a non-compliance pending standards change has been authorised to permit the continued use of these designs.

9.5.2.2 It should be noted that GM/RT2149 permits train builders to design a swept envelope that comes within 50 mm of the area under discussion, reducing to 25 mm 'under worst case conditions, such as suspension failure'. In view of this, attention is drawn to GC/RT5212 (section G2):

New structures shall not intrude inside the structure gauge set out in Appendix 1.

New track shall be positioned to ensure adjacent structures do not intrude inside the structure gauge set out in Appendix 1.

When designing new infrastructure, allowance shall be made for construction tolerances to ensure these requirements are met once the infrastructure has been built.

9.5.2.3 Given that trains are permitted to come close to these areas, it is particularly important to allow for construction tolerances.

9.5.2.4 GC/RC5510 (section 9.1.1) recommends that:

The provision of bridge girders in the space between tracks (the 'six-foot') should generally be avoided where this is reasonably practicable because it inhibits future operational flexibility and often makes access for future examination difficult.

9.6 The effect of side winds on gauging

9.6.1 Railway undertakings are required by GM/RT2149 to determine the swept envelopes of vehicles for side wind speeds of 0 m/s and 35 m/s, and any higher limit for particularly exposed routes identified by the infrastructure manager.

9.6.2 The infrastructure manager is required by GC/RT5212 to identify exposed routes and the side wind speed, above 35 m/s, for which additional swept envelopes are required. GC/RT5212 also requires the effect of wind on clearances, taking into consideration the swept envelopes required by GM/RT2149, to be assessed on exposed routes where reduced and special reduced structure and passing clearances are proposed.

9.6.3 Currently, there is no standard methodology for considering the effect of side winds on gauging.

9.6.4 It should be noted that GC/RT5212 only requires the effect of wind on clearances to be assessed in very limited circumstances:

a) On exposed routes

b) Where reduced and special reduced structure and passing clearances are proposed.

An 'exposed route' is defined as 'A route (or section of route) which is orientated generally in a north-south direction and which features hillsides, embankments or viaducts which are open and exposed to south-westerly winds. Examples of such routes are: West Coast Main Line north of Weaver Junction, and the Cumbrian Coast Line' (see section 6.4).

9.6.5 In practice, effect of side wind is not usually taken into account in gauging. There appears to be no documented history of gauging problems being caused by this omission.

9.6.6 The need for improved guidance in this area is recognised by RSSB and work to provide this guidance is underway.

9.7 Calculation of stepping distances

9.7.1 GM/RT2149, issue three (clause B6.3) requires that:

Footsteps for passenger use shall meet the following requirements relative to the dimensions for new platforms set out in GC/RT5161: ... The stepping distance shall, for platforms on curves with radii down to 160 m, not exceed the parameters defined in Appendix A of this document [Stepping distances].

9.7.2 This requirement is based upon the 'stepping triangle' defined in the HMRI Railway Safety Principles and Guidance (RSPG). The RSPG triangle relates to the static position of the vehicle.

9.7.3 Current practice is to calculate the stepping distance based on the doorway centreline position and overthrow. Suspension movements (eg static sway on canted track) and track positional tolerances are not considered.

9.7.4 When checking stepping distances, the above simplifications should be taken into account when comparing actual measured values with those calculated theoretically.

9.7.5 Although stepping distance calculations are defined as horizontal and vertical, there is no specific guidance in RSPG as to whether this relates to the plane of the rail or true plane. On canted track, this will reduce or increase horizontal values as vertical values increase or reduce. The diagonal value is unaffected. For the purposes of industry consistency, true horizontal and vertical distances should be used.

9.8 Track data for use in gauging calculations

9.8.1. GM/RT2149 (clause B6.7b) states that the infrastructure manager will provide track data for use in gauging calculations.

9.8.2 Where track data for gauging purposes is not provided by the infrastructure manager, it is recommended that TRACK110 (75 mph), TRACK160 (100 mph) and TRACK200 (125 mph) from the VAMPIRE® track library are used, as appropriate.

9.8.3 Work is currently being undertaken to define sections of track data that can be demonstrated to contain a wide range of typical track features, and hence will form standard track inputs for gauging purposes. However, this work is not yet complete.

9.9 Appendices B, C and D of GM/RT2149

9.9.1 Track positional tolerances do not need to be considered when calculating the swept envelope of specific equipment for comparison against appendices B, C and D of GM/RT2149.

Part 10 Requirements Relating to Gauging in the High-Speed TSIs

All the TSIs referred to are in the process of revision. This section applies to the High-Speed TSIs current in 2006. The guidance will be amended to reflect the revised TSIs once these have been published.

10.1 Introduction

10.1.1 The guidance in this section is largely intended to deal with the relationship between TSIs and RGS. This document is not a definitive source of guidance on the application of TSIs in any other respect.

10.2 High-Speed Infrastructure TSI

10.2.1 TSI route categories

10.2.1.1 The High-Speed Infrastructure TSI distinguishes between three categories of route:

a) Category I: specially built high-speed lines equipped for speeds generally equal to or greater than 250 km/h

b) Category II: specially upgraded high-speed lines equipped for speeds of the order of 200 km/h

c) Category III: specially upgraded high-speed lines which have special features as a result of topographical, relief or town-planning constraints, on which the speed is to be adapted to each case.

10.2.1.2 Category III routes are effectively upgraded lines where 'speeds of the order of 200 km/h' cannot be achieved. The inclusion of both category II and category III upgraded lines (required by the directive) confuses a general performance requirement (that is, to achieve 200 km/h) with an exemption for the case where this cannot be achieved because of site constraints. For gauging purposes, the distinction between category II and category III upgraded lines is irrelevant.

10.2.1.3 The Channel Tunnel Rail Link (CTRL) is an example of a 'specially built high-speed line' - essentially, a new line designed from the start for running high-speed passenger trains. The West Coast Main Line (WCML) is an example of a 'specially upgraded high-speed line' - an existing line which is being adapted for running high-speed passenger trains.

10.2.2 Specific cases for upgraded lines

10.2.2.1 Section 7.3.6 of the TSI sets out a number of 'specific cases' for the British network. These specific cases relate only to 'specially upgraded high-speed lines', not 'specially built high-speed lines'. The specific cases relevant to gauging are set out below, together with some guidance on interpretation.

Platform height

Platforms used on upgraded lines in Great Britain shall have a standard height of 915 mm with a tolerance of +0/-50 mm. The platform horizontal distance (L) shall be chosen so as to make optimal use of the step positions on trains built to the UK1 loading gauge [defined in Annex M to the TSI].

10.2.2.2 The unique British platform position, combined with a standard six-foot, prevents the adoption of GC gauge in Britain.

10.2.2.3 GI/RT7016 requires the height at the edge of the platform to be 915 mm (within a tolerance of +0, -25 mm) measured at right angles to the plane of the rails of the track adjacent to the platform.

10.2.2.4 GI/RT7016 requires the platform edge to be the minimum distance from the adjacent track (within a tolerance of +15, -0 mm) consistent with the lower sector structure gauge set out in Appendix 1 of GC/RT5212.

10.2.2.5 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, -0 mm). GC/RT5212 sets out exceptions where Class 373 trains or 2.6 m wide containers are required to pass the platform. GC/RT5212 also sets out requirements where the curve radius is less than 360 m.

10.2.2.6 The RGS requirement is potentially in conflict with the TSI requirement to make optimal use of the step positions on trains built to the UK1 loading gauge. However, the TSI requirements are circular, as the Rolling Stock TSI requires 'the passenger step for those trainsets intended to serve the British Network to be optimised for the 915 mm platform height on that system'.

Structure gauge

The minimum structure gauge on upgraded lines in Great Britain shall allow passage of trains to the UK1 loading gauge [defined in Annex M to the TSI].

10.2.2.7 The TSI gives no substantial indication as to how this loading gauge should be applied. GE/GN8573, issue one (Appendix 11) presented the known information regarding the UK1 gauge (issue one), together with a set of derived rules.

10.2.2.8 A replacement for the UK1 gauge (issue one) has been developed for the next revision of the TSI. This is known as UK1 (Issue 2) gauge and defined in GE/RT8073. Appendix K of this document provides additional guidance on its application.

10.2.2.9 It should be noted that UK1 gauge is not based on Class 373/X (Eurostar) gauge.

Pantograph gauge

On existing lines upgraded for high-speed and their connecting lines, the normal height of the contact wire is 4720 mm (minimum 4170 mm, maximum 5940 mm).

10.2.2.10 This appears to be intended to be a statement of fact, rather than a mandatory requirement. The contact wire height is typically within the range quoted, but these figures should not be relied on and reference should be made to the High-Speed Energy [Electrification] TSI - see section 10.4.

Distance between track centres

The minimum nominal distance between track centres on upgraded lines in Great Britain shall be 3165 mm.

10.2.2.11 Part G of GC/RT5212 sets out requirements for new, altered and temporary infrastructure, including track intervals. These requirements could require a greater distance between track centres than the minimum set out in the TSI.

10.2.2.12 The accepted distance between track centres in Britain is 3400 mm for straight track.

10.2.3 Specially built high-speed lines

10.2.3.1 The TSI requires specially built lines to be constructed to a minimum structure gauge set on the basis of the GC reference profile (sometimes referred to as the UIC compliant gauge).

10.2.3.2 Section 8.4 discusses the development of UIC compliant structure gauges, including a structure gauge set on the basis of the GC reference profile.

10.2.3.3 The TSI also requires specially built lines to have 550 mm or 760 mm high platforms. It may however be possible to seek a derogation on the grounds of 'technical incompatibility'.

10.3 High-Speed Rolling Stock TSI

10.3.1 Vehicle loading gauge for trains running on upgraded lines

10.3.1.1 Section 7.3.1 of the High-Speed Rolling Stock TSI sets out a 'specific case for lines in Britain':

Trains designed for interoperable running on upgraded lines in Britain shall comply with 'UK1' gauge as defined in Annex C to this TSI.

10.3.1.2 Annex C of the High-Speed Rolling Stock TSI is identical to Annex M of the High-Speed Infrastructure TSI.

10.3.1.3 The TSI gives no substantial indication as to how this loading gauge should be applied. GE/GN8573, issue one (Appendix 11) presented the known information regarding the UK1 gauge (issue one), together with a set of derived rules.

10.3.1.4 A replacement for the UK1 gauge (issue one) has been developed for the next revision of the TSI. This is known as UK1 (Issue 2) gauge and defined in GE/RT8073. Appendix K of this document provides additional guidance on its application.

10.3.1.5 It should be noted that UK1 gauge is not based on Class 373/X (Eurostar) gauge.

10.3.2 Vehicle loading gauge for trains running on specially built high-speed lines

10.3.2.1 Section 4.1.4 of the High-Speed Rolling Stock TSI states:

Interoperable rolling stock shall comply with the dynamic reference contour of one of the following vehicle gauges UIC 505-1, GA, GB or GC as defined in Annex G to this TSI.

The choice of rolling stock gauge shall be made based on the routes over which the rolling stock is required to operate. The information required is defined in the infrastructure register.

10.3.2.2 Rolling stock for use in Britain is usually required to operate not just on specially built high-speed lines, but also on upgraded lines. In this case, the requirements of section 7.3.1 of the High-Speed Rolling Stock TSI will apply, rather than those of section 4.1.4 (see section 10.3.2.1 of this document).

10.4 High-Speed Energy TSI

10.4.1 Coverage and geometrical requirements

10.4.1.1 The High-Speed Energy TSI deals with electrification. Annex H of the TSI deals with geometrical requirements for OCL, geometrical requirements for pantographs, and requirements for the interaction of OCLs and pantographs.

10.4.2 Contact wire height for upgraded lines

10.4.2.1 The nominal height of contact wire for upgraded lines should be between 5000 mm and 5500 mm (with a tolerance of ±30 mm), but with dynamic 'limit values' between 4950 mm and 6200 mm. The permissible contact wire gradient in relation to the track and permissible variation of gradient should be in accordance with section 5.2.8.2 of EN 50119, version 2001.

10.4.2.2 At level crossings the contact wire height should be designed according to national directives. In Britain, the requirements for the height of the contact wire at level crossings are set out in GE/RT8025.

10.4.3 Specific cases for upgraded lines

10.4.3.1 Section 7.3.6 of the High-Speed Energy TSI states:

On the East Coast Main Line (ECML) and the West Coast Main Line (WCML) the geometry of overhead contact line and dynamic envelope are based on UK1 gauge (issue 1) and are treated as a special case. The variable contact wire height may be retained for speeds up to 225 km/h and the mean contact force will be adjusted to achieve the current collection requirements of EN 50119, version 2001, point 5.2.1.

10.4.3.2 This appears to mean that it is permissible to retain the existing variable contact wire heights on these lines.

10.4.4 Contact wire height for specially built high-speed lines

10.4.4.1 The nominal height of contact wire for specially built high-speed lines should be either 5080 mm or 5300 mm (with a tolerance of -0 mm, +20 mm). The contact wire height adopted should be defined in the 'register of infrastructure' required by the TSI. No 'non planned gradients' are permitted - that is, the contact wire should be level. It is assumed that there will be no level crossings or restricted clearances on a specially built high-speed line.

10.4.5 Pantograph gauge

10.4.5.1 It is the intention of the TSI that:

'In future high-speed, upgraded and connecting lines there should be only one type of current collector head used for all trains running on these lines. To implement this approach, all future high-speed trains will use pantographs with a 1600 mm pantograph collector head'.

10.4.5.2 Section 4.2.2.1 of the TSI states:

The infrastructure gauge shall take into account the space necessary for the passage of pantographs in contact with the overhead contact line equipment and for installation of the contact line equipment itself. The dimensions of tunnels and other structures shall be mutually compatible with the geometry of overhead contact line equipment and the dynamic envelope of the pantograph. (Annex (H.3.6) to this TSI specifies the dynamic envelope of the pantograph). The space necessary for installation of the contact line equipment shall be stipulated by the adjudicating entity. Conformity assessment shall be carried out within assessment of the infrastructure subsystem.

10.4.5.3 'Adjudicating entity' is a mistranslation from the French – it should read 'contracting entity'

10.4.5.4 Annex H.3.6 of the TSI includes a diagram showing the dimensions for the space necessary for passage of TSI compliant pantographs on interoperable lines. It notes that:

In addition to this space the infrastructure shall take account of the space necessary for installation of the contact line itself and the necessary safety clearances. The space depends on the design of individual contact line and the corresponding voltage.

Part 11 Railway Safety Principles and Guidance

11.1 Railway Safety Principles and Guidance (RSPG) were produced by HSE for use by organisations wishing to obtain approval for new or altered works, plant and equipment under the Railways and Other Transport Systems (Approval of Works, Plant and Equipment) Regulations 1994.

11.2 Railways and Other Transport Systems (Approval of Works, Plant and Equipment) Regulations 1994 (ROTS) have been revoked by the Railways and Other Guided Transport Systems (Safety) Regulations 2006 and therefore the guidance on RSPG set out in issue one of Guidance on Gauging has not been carried forward into issue two. However a copy of issue one of Guidance on Gauging is available from the withdrawn document section of www.rgsonline.co.uk if guidance on this issue is required.

Appendix A W6a Gauge – Illustrative Wagon-Load Combinations

A.1 Origin and purpose of the W6a gauge

A.1.1 W6a represents the 'standard' freight vehicle gauge with which most of the UK railway network, with specific exceptions, complies. W6a was originally published in document PO/CL527 (BR DM&EE Department, 20 September 1990) and is also considered to be an international vehicle, referenced and described in UIC leaflet 503.

A.2 Container and swapbody loads recognised as complying with W6a

A.2.1 The W6a gauge accommodates the combinations of wagon types and ISO containers or swapbody loads, as set out in table A.1 below.

Wagon type	ISO containers			Swapbody loads		
	Maximum load height (mm)			'S' code (see Appendix P)		
	2438 mm wide ISO	2500 mm wide ISO	2550 mm wide ISO	2500 mm wide flat top	2550 mm wide flat top	2600 mm wide flat top
FAA	2674	2639	—	S19	—	—
FCA	2405	2368	—	—	—	—
FEA	2438	2402	—	—	—	—
FFA/FGA (1016 mm)	2402	2367	—	—	—	—
FFA/FGA (1039 mm)	2379	2344	—	—	—	—
FIA	2483	2448	—	—	—	—
FKA	2603	2568	—	S12	S08	—
FLA	2720	2686	—	—	—	—
FRA	2428	2393	—	—	—	—
FSA	2436	2402	—	—	—	—
FTA	2436	2402	—	—	—	—
IFA	2483	2448	—	—	—	—
IJA	2316	2281	—	—	—	—
IKA	2603	2568	—	S11	S08	—
KAA (up to 730 mm)	2698	2663	—	S20	S17	—
KAA (825 mm)	2603	2568	—	S11	S08	—
KFA	2418	2383	—	—	—	—
KHA	2311	2276	—	—	—	—
KQA	2896	—	—	—	—	—

Table A.1 Container and swapbody loads that comply with W6a gauge

A.3 Wagons with swing motion or low track force bogies

Wagon	Bogie Type	Details
BRA	Swing motion	Bogie steel carrier with hood
BYA	Swing motion	Bogie steel carrier with hood
FCA	Swing motion	Bogie container flat
HTA	Swing motion	Bogie coal hopper
JEA	Swing motion	Bogie aggregate hopper
MBA	Swing motion	Bogie box wagon (high sided)
MCA	Swing motion	Bogie box wagon (low sided)
MDA	Swing motion	Bogie box wagon (low sided)
MOA	Swing motion	Bogie box wagon (low sided)
FLA	Low track force	Bogie container flat
HHA	Low track force	Bogie coal hopper
JFA	Low track force	Bogie aggregate hopper
JGA	Low track force	Bogie aggregate hopper
JHA	Low track force	Bogie aggregate hopper
JMA	Low track force	Bogie Coal Hopper
MJA	Low track force	Bogie box wagon (high speed)
TEA	Low track force	Bogie tank wagon

Table A.2 W6a wagons using swing motion or low track force bogies

A.4 Dynamic movements

Movement	Value
Sway at 3080 mm ARL	100 mm
Sway at 1000 mm ARL	75 mm
Upward movement	25 mm
Downward movement	75 mm

Table A.3 Dynamic movements for W6a gauge

Appendix B W7 Gauge – Illustrative Wagon-Load Combinations

B.1 Origin and purpose of the W7 gauge

B.1.1 W7 was previously known as “W6a exception gauge for 8’ 0” containers”. It was developed to accommodate 8’ 0” containers on wagons already complying with W6a gauge. W7 was originally published in document PO/CL518 (BR DM&EE Department, 3 November 1988), but was amended in PO/CL527 (BR DM&EE Department, 20 September 1990) to include additional tolerances. In this transition, some of the dimensions defining the intersection between the container load and the base W6a gauge were incorrectly stated and have been corrected in GE/RT8073.

B.2 Container and swapbody loads recognised as complying with W7

B.2.1 The W7 gauge accommodates the combinations of wagon types and ISO containers or swapbody loads, as set out in table B.1 below.

Wagon type	ISO containers			Swapbody loads		
	Maximum load height (mm)			‘S’ code (see Appendix P)		
	2438 mm wide ISO	2500 mm wide ISO	2550 mm wide ISO	2500 mm wide flat top	2550 mm wide flat top	2600 mm wide flat top
FAA	2815	2639	—	S19	—	—
FCA	2508	2368	—	—	—	—
FEA	2543	2402	—	—	—	—
FFA/FGA (1016 mm)	2515	2367	—	—	—	—
FFA/FGA (1039 mm)	2485	2344	—	—	—	—
FIA	2585	2448	—	—	—	—
FKA	2705	2568	—	S12	S08	—
FLA	2805	2686	—	S23	—	—
FRA	2535	2393	—	—	—	—
FSA	2545	2402	—	—	—	—
FTA	2545	2402	—	—	—	—
IFA	2585	2448	—	—	—	—
IJA	2441	2281	—	—	—	—
IKA	2705	2568	—	S11	S08	—
KAA (up to 730 mm)	2698	2663	—	S20	S17	—
KAA (825 mm)	2603	2568	—	S11	S08	—
KFA	2525	2383	—	—	—	—
KHA	2431	2276	—	—	—	—
KQA	2896	—	—	—	—	—

Table B.1 Container and swapbody loads that comply with W7 gauge

B.3 Wagon with swing motion or low track force bogies

Wagon	Bogie type	Details
FCA	Swing motion	Bogie container flat
FLA	Low track force	Bogie container flat

Table B.2 W7 wagons using swing motion or low track force bogies

B.4 Dynamic movements

Movement	Value
Sway at 3080 mm ARL	100 mm
Sway at 1000 mm ARL	75 mm
Upward movement	25 mm
Downward movement	75 mm

Table B.3 Dynamic movements for W7 gauge

Appendix C W8 Gauge – Illustrative Wagon-Load Combinations

C.1 Origin and purpose of the W8 gauge

C.1.1 W8 was previously known as “W6a exception gauge for 8’ 6” containers”. It was developed to accommodate 8’ 6” containers on wagons already complying with W6a gauge. W8 was originally published in document PO/CL518 (BR DM&EE Department, 3 November 1988), but was amended in PO/CL527 (BR DM&EE Department, 20 September 1990) to include additional tolerances.

C.2 Container and swapbody loads recognised as complying with W8

C.2.1 The W8 gauge accommodates the combinations of wagon types and ISO containers or swapbody loads, as set out in table C.1 below.

Wagon type	ISO containers			Swapbody loads		
	Maximum load height (mm)			‘S’ code (see Appendix P)		
	2438 mm wide ISO	2500 mm wide ISO	2550 mm wide ISO	2500 mm wide flat top	2550 mm wide flat top	2600 mm wide flat top
FAA	2906	2606	—	S45	—	—
FCA	2595	2595	—	S14	—	—
FEA	2638	2638	—	S17	S17	—
FFA/FGA (1016 mm)	2602	2602	—	S14	S14	—
FFA/FGA (1039 mm)	2591	2591	—	S11	S11	—
FIA	2673	2673	—	S21	S21	—
FKA	2793	2793	—	S34	S25	—
FLA	2898	2898	—	S44	—	—
FRA	2628	2628	—	S17	S17	—
FSA	2638	2638	—	S17	S17	—
FTA	2638	2638	—	S17	S17	—
IFA	2673	2673	—	S21	S21	—
IJA	2528	2528	—	S07	S07	—
IKA	2793	2793	—	S34	S25	—
KAA (up to 730 mm)	2888	2888	—	S43	S34	—
KAA (825 mm)	2793	2793	—	S34	S25	—
KFA	2618	2618	—	S16	S16	—
KHA	2518	2518	—	S06	S06	—
KQA	3143	—	—	—	—	—

Table C.1 Container and swapbody loads that comply with W8 gauge

C.3 Wagons with swing motion or low track force bogies

Wagon	Bogie type	Details
FCA	Swing motion	Bogie container flat
FLA	Low track force	Bogie container flat

Table C.2 W8 wagons using swing motion or low track force bogies

C.4 Dynamic movements

Movement	Value
Sway at 3080 mm ARL	100 mm
Sway at 1000 mm ARL	75 mm
Upward movement	25 mm
Downward movement	75 mm

Table C.3 Dynamic movements for W8 gauge

Appendix D W9 Gauge – Illustrative Wagon-Load Combinations

D.1 Origin and purpose of the W9 gauges

D.1.1 W9 is a continental swapbody gauge, previously known as SB1c. It defines a base wagon, and a loading gauge, for containers and swap bodies up to 2.6 m wide. W9 was originally published in document PO/CL548 (T&RS, RfD, 28 October 1993) and is also considered to be an international vehicle, referenced and described in UIC leaflet 503.

D.2 Container and swapbody loads recognised as complying with W9

D.2.1 The W9 gauge accommodates the combinations of wagon types and ISO containers or swapbody loads, as set out in table D.1 below.

Wagon type	ISO containers			Swapbody loads		
	Maximum load height (mm)			'S' code (see Appendix P)		
	2438 mm wide ISO	2500 mm wide ISO	2550 mm wide ISO	2500 mm wide flat top	2550 mm wide flat top	2600 mm wide flat top
FAA	3003	3003	—	S55	—	—
FCA	2692	2692	—	S23	S22	—
FEA	2733	2733	—	S27	S25	S355
FFA/FGA (1016 mm)	2699	2699	—	S24	S22	—
FFA/FGA (1039 mm)	2676	2676	—	S22	S20	—
FIA	2770	2770	—	S32	S30	S360
FKA	2896	2896	—	S44	S42	—
FLA	2995	2995	—	S53	—	—
FRA	2725	2725	—	S27	S25	—
FSA	2743	2743	—	S27	S25	—
FTA	2743	2743	—	S27	S25	—
IFA	2770	2770	—	S32	S30	S360
IJA	2625	2625	—	S16	S14	—
IKA	2896	2896	—	S44	S42	—
KAA (up to 730 mm)	2991	2991	—	S53	S51	—
KAA (825 mm)	2896	2896	—	S44	S42	—
KFA	2715	2715	—	S25	S23	—
KHA	2615	2615	—	S15	S13	—
KQA	3240	—	—	—	—	—

Table D.1 Container and swapbody loads that comply with W9 gauge

D.3 Wagons with swing motion or low track force bogies

Wagon	Bogie type	Details
FCA	Swing motion	Bogie container flat
FLA	Low track force	Bogie container flat

Table D.2 W9 wagons using swing motion or low track force bogies

D.4 Dynamic movements

Movement	Value
Sway at 3080 mm ARL	100 mm
Sway at 1000 mm ARL	75 mm
Upward movement	25 mm
Downward movement	75 mm

Table D.3 Dynamic movements for W9 gauge

Appendix E W9Plus Gauge – Illustrative Wagon-Load Combinations

E.1 Origin and purpose of W9Plus gauges

E.1.1 W9Plus is a marginally enlarged version of the W9 gauge, to allow S32 (2775 mm x 2550 mm wide) loads on 945 mm wagons and S45 (2905 mm x 2550 mm wide) loads on 825 mm wagons. This gauge was developed at the request of the Vehicles / Structures Systems Interface Committee.

E.2 Container and swapbody loads recognised as complying with W9Plus

E.2.1 The W9Plus gauge accommodates the combinations of wagon types and ISO containers or swapbody loads, as set out in table E.1 below.

Wagon type	ISO containers			Swapbody loads		
	Maximum load height (mm)			'S' code (see Appendix P)		
	2438 mm wide ISO	2500 mm wide ISO	2550 mm wide ISO	2500 mm wide flat top	2550 mm wide flat top	2600 mm wide flat top
FAA	3018	3018	—	S56	—	—
FCA	2707	2707	—	S24	S25	—
FEA	2748	2748	—	S28	S28	S355
FFA/FGA (1016 mm)	2714	2714	—	S25	S25	—
FFA/FGA (1039 mm)	2691	2691	—	S23	S23	—
FIA	2785	2785	—	S33	S33	S360
FKA	2911	2911	—	S45	S45	—
FLA	3010	3010	—	S54	—	—
FRA	2740	2740	—	S28	S28	—
FSA	2758	2758	—	S28	S28	—
FTA	2758	2758	—	S28	S28	—
IFA	2785	2785	—	S33	S33	S360
IJA	2640	2640	—	S17	S17	—
IKA	2911	2911	—	S45	S45	—
KAA (up to 730 mm)	3006	3006	—	S54	S54	—
KAA (825 mm)	2911	2911	—	S45	S45	—
KFA	2730	2730	—	S26	S27	—
KHA	2630	2630	—	S16	S17	—
KQA	3255	—	—	—	—	—

Table E.1 Container and swapbody loads that comply with W9Plus gauge

E.3 Wagons with swing motion or low track force bogies

Wagon	Bogie type	Details
FCA	Swing motion	Bogie container flat
FLA	Low track force	Bogie container flat

Table E.2 W9Plus wagons using swing motion or low track force bogies

E.4 Dynamic movements

Movement	Value
Sway at 3080 mm ARL	100 mm
Sway at 1000 mm ARL	75 mm
Upward movement	25 mm
Downward movement	75 mm

Table E.3 Dynamic movements for W9Plus gauge

Appendix F W10 Gauge – Illustrative Wagon-Load Combinations

F.1 Origin and purpose of the W10 gauge

F.1.1 W10 was developed to accommodate 9' 6" x 2500 mm container traffic. W10 defines only loads, not wagons. Wagons are to comply with W6a gauge and the route is to permit W6a wagons to run.

F.1.2 W10 was developed as a suite of dynamic swept envelopes to provide absolute gauging according to local conditions of cant, curvature and speed. The W10 gauge is a derivative of this swept envelope suite which describes the maximum movements allowed for W10 loads. It is usual to use the W10 swept envelope suites to provide dynamic absolute gauging for routes, as this provides optimal clearances. The W10 swept envelope suites are dynamic computer models whose application is beyond the scope of this document.

F.2 Release history

F.2.1 The original W10 (described here as issue 0) was never formally released, but was used for initial gauge clearance work on the West Coast Main Line. Issue one was released as W10, but was later developed into W12. Issue 2 was released, and now forms the definitive W10 gauge. Issue three was produced, and used on a limited scale, to assess the effects of removing higher deck wagons from the suite. Issue 3 is not an authorised gauge.

F.3 Container and swapbody loads recognised as complying with W10

F.3.1 The W10 gauge accommodates the combinations of wagon types and ISO containers or swapbody loads, as set out in table F.1 below.

Wagon type	ISO containers			Swapbody loads		
	Maximum load height (mm)			'S' code (see Appendix P)		
	2438 mm wide ISO	2500 mm wide ISO	2550 mm wide ISO	2500 mm wide flat top	2550 mm wide flat top	2600 mm wide flat top
FEA	2896	2896	—	S44	—	—
FIA	2896	2896	—	S44	—	—
FKA	2896	2896	—	S44	—	—
FSA	2896	2896	—	S44	—	—
FTA	2896	2896	—	S44	—	—
IFA	2896	2896	—	S44	—	—
IKA	2896	2896	—	S44	—	—
KFA	2896	2896	—	S44	—	—

Table F.1 Container and swapbody loads that comply with W10 gauge

F.4 Benchmark vehicles for W10

F.4.1 The following vehicle/load combinations have been used to define W10:

	Status	**Superseded**	**Superseded**	**W10**	**Superseded**
	Name				
	GE/GN8573 issue 1	**W10 issue 0**	**W10 issue 1**	**W10 issue 2**	**W10 issue 3**
	Version name		**W10B W10W W12**	**W10FU**	**W10-**
	Generic flat top load	9’ 6” x 2500	9’ 6” x 2600	9’ 6” x 2500	9’ 6” x 2500
Wagon	**Description**				
IKA	Megafret (Remafer)	✓	✓	✓	✓
FSA	2nd Gen. Freightliner	✓	✓	✓	✓
IFA	Multifret single and twin	✓	✓	✓	✓
KFA	Tiphook UK	✓	✓	✓	(note)
KAE	Babcock Mega 3	—	✓	—	—
FFA	1st Gen. Freightliner	—	✓	—	—
FLA	PD Lowliner	—	✓	—	—
IFB	Transfesa	—	✓	—	—
FCA	Thrall (Naco Bogies)	—	✓	—	—
FKA	Europa Flat	—	—	✓	✓
FIA	Eurotwin UIC RIV	—	—	✓	✓
FTA	2nd Gen. Freightliner	—	—	✓	✓

Table F.2 Vehicle–load combinations used to define W10

F.4.2 The green column is the accepted current W10.

F.4.3 The aliases refer to:

W10B = ‘Big box’

W10W = ‘Wide’ (became W12)

W10FU = ‘Freight upgrade’

W10- = Excludes wagons with >980 mm deck height

Note: The KFA wagon has a 1000 mm nominal deck height. However, this wagon has BR twistlock fastenings (with a tolerance of ±6 mm) rather than UIC spigots (which have a tolerance of ±12.5 mm). Accordingly, the load width is effectively 13 mm narrower at full height. This keeps the load within the envelope occupied by other wagons in the suite. Its removal makes only minimal difference.

F.5 Wagons with swing motion or low track force bogies

Wagon	Bogie type	Details
FCA	Swing motion	Bogie container flat
FLA	Low track force	Bogie container flat

Table F.3 W10 wagons using swing motion or low track force bogies

F.6 Dynamic movements

Movement	Value
Sway at 3080 mm ARL	100 mm
Sway at 1000 mm ARL	75 mm
Upward movement	25 mm
Downward movement	75 mm

Table F.4 Dynamic movements for W10 gauge

Appendix G W11 Gauge – Illustrative Wagon-Load Combinations

G.1 Origin and purpose of the W11 gauge

G.1.1 W11 was developed to accommodate 9' 6" x 2550 mm container traffic. W11 defines only loads, not wagons. Wagons are to comply with W6a gauge and the route is to allow W6a wagons to run. W11 was developed at the request of the Vehicles / Structures Systems Interface Committee. It was defined in document TNLRVSSIC0002 issue 3.

G.1.2 W11 was developed as a dynamic swept envelope to provide absolute gauging according to local conditions of cant, curvature and speed. The W11 gauge is a derivative of this swept envelope which describes the maximum movements allowed for W11 loads. It is usual to use the W11 swept envelope to provide dynamic absolute gauging for routes, as this provides optimal clearances. The W11 swept envelope is a dynamic computer model whose application is beyond the scope of this document. Document LR6665001D001B (Produced for Vehicle / Structures System Interface Committee by Laser Rail Ltd) describes the W11 kinematic envelope.

G.2 Container and swapbody loads recognised as complying with W11

G.2.1 The W11 gauge accommodates the combinations of wagon types and ISO containers or swapbody loads, as set out in table G.1 below.

Wagon type	ISO containers			Swapbody loads		
	Maximum load height (mm)			'S' code (see Appendix P)		
	2438 mm wide ISO	2500 mm wide ISO	2550 mm wide ISO	2500 mm wide flat top	2550 mm wide flat top	2600 mm wide flat top
FSA	2916	2916	2896	S46	S44	—
FTA	2916	2916	2896	S46	S44	—
KFA	2896	2896	2896	S44	S44	—

Table G.1 Container and swapbody loads that comply with W11 gauge

G.3 Wagons with swing motion or low track force bogies

G.3.1 There are no wagons with swing motion or low track force bogies approved within the W11 gauge.

G.4 Dynamic movements

Movement	Value
Sway at 3080 mm ARL	75 mm
Sway at 1000 mm ARL	25 mm
Upward movement	25 mm
Downward movement	75 mm

Table G.2 Dynamic movements for W11 gauge

Appendix H W12 Gauge – Illustrative Wagon-Load Combinations

H.1 Origin and purpose of the W12 gauge

H.1.1 W12 was developed to accommodate 9' 6" x 2600 mm container traffic. W12 defines only loads, not wagons. Wagons are to comply with W6a gauge and the route is to also permit W6a wagons to run.

H.1.2 W12 was developed as a composite dynamic swept envelope to provide absolute gauging according to local conditions of cant, curvature and speed. The W12 gauge is a derivative of this composite swept envelope which describes the maximum movements allowed for W12 loads. It is usual to use the W12 composite swept envelope provide dynamic absolute gauging for routes, as this provides optimal clearances. The W12 composite swept envelope is a dynamic computer model whose application is beyond the scope of this document. Document ITLR/T8328/001 (Produced for Railtrack, now Network Rail Infrastructure, by Interfleet Technology Ltd) describes the W12 kinematic envelope.

H.2 Release history

H.2.1 Issue one was produced as a swept envelope suite, and issues two and three were produced as composite swept envelopes. Issue three was developed to acknowledge the effect of removing the FAA wagon (longest) from the suite, since this wagon is a small part of the total GB wagon fleet. Issue three is not an authorised gauge.

H.3 Container and swapbody loads recognised as complying with W12

H.3.1 The W12 gauge accommodates the combinations of wagon types and ISO containers or swapbody loads, as set out in table H.1 below.

Wagon type	ISO containers			Swapbody loads		
	Maximum load height (mm)			'S' code (see Appendix P)		
	2438 mm wide ISO	2500 mm wide ISO	2550 mm wide ISO	2500 mm wide flat top	2550 mm wide flat top	2600 mm wide flat top
FAA	3188	3188	—	S73	S73	S398
FCA	2877	2877	—	S42	S42	S367
FFA/FGA (1016 mm)	2884	2884	—	S43	S43	S368
FFA/FGA (1039 mm)	2861	2861	—	S40	S40	S365
FIA	2955	2955	—	S50	S50	S375
FKA	3080	3080	—	S62	S62	S392
FSA	2920	2920	—	S46	S46	S371
FTA	2920	2920	—	S46	S46	S371
IFA	2955	2955	—	S50	S50	S375
IJA	2810	2810	—	S35	S35	S350
IKA	3080	3080	—	S62	S62	S392
KAA (up to 730 mm)	3170	3170	—	S71	S71	—

KAA (825 mm)	3075	3075	—	S62	S62	—
KFA	2900	2900	—	S44	S44	S369
KHA	2800	2800	—	S34	S34	S359

Table H.1 Container and swapbody loads that comply with W12 gauge

H.3.2 Wagon–load combinations highlighted in orange extend into the lower sector, and may only be used on routes where this combination has been approved above a level of 700 mm ARL.

H.4 Benchmark vehicles for W12

H.4.1 The following have been used to define W12:

	Status	**Superseded**	**W12**	**Superseded**
	Name			
	GE/GN8573 issue 1	**W12 issue 1**	**W12 issue 2**	**W12 issue 3**
	Version name		With FAA	Without FAA
	Generic flat top load	9’ 6” x 2600	9’ 6” x 2600	9’ 6” x 2600
Wagon	**Description**			
FCA	Thrall (Naco Bogies)	✓	✓	✓
KAE	Babcock Mega 3	✓	✓	✓
FIA	Eurotwin UIC RIV	✓	✓	✓
IFA	Multifret single and twin	✓	✓	✓
IKA	Megafret (Remafer)	—	✓	✓
FKA	Europa Flat	—	✓	✓
FAA	EWS Container Carrier	—	✓	—
FFA	1st Generation	—	✓	✓
FGA	1st Generation	—	✓	✓
FFA	2nd Generation	✓	✓	✓
FGA	2nd Generation	✓	✓	✓
FSA	2nd Gen. Freightliner	✓	✓	✓
FTA	2nd Gen. Freightliner	✓	✓	✓
KFA	Tiphook	✓	✓	✓
IJA	Unilog 60’	—	✓	✓
KHA	Tiphook 60’	—	✓	✓
	PD T25 Nominal	—	✓	✓
	Thrall Eurospine	✓	—	—
AAE	Megafret	✓	—	—
IFB	Transfesa	✓	—	—

Table H.2 Vehicle–load combinations used to define W12

H.4.2 The green column is the accepted current W12.

H.5 Dynamic movements

H.5.1 The coordinates for gauge incorporating dynamic movements for this gauge have been derived from the composite dynamic envelope (case 1573) which has been adjusted for overthrow and effective track position.

Appendix I C1 Gauge – Vehicle Gauge for Coaching Stock

I.1 Origin and purpose of the C1 gauge

I.1.1 C1 is the basic coaching stock gauge of British Railways. It existed in two forms, covering 64' and 57' vehicles. C1 gauge is defined in drawing CCE 891-61 issue D.

I.1.2 Only the 64' vehicle gauge has been included in GE/RT8073, since all routes now cleared for C1 gauge relate to this gauge. 57' vehicles are compliant with the 64' gauge.

I.2 Dynamic movements

Movement	Value
Sway at 3080 mm ARL	175 mm
Sway at 1000 mm ARL	50 mm
Upward movement	32 mm
Downward movement	101.5 mm

Table I.1 Dynamic movements for C1 gauge

Appendix J C1 (Appendix A) Gauge – Vehicle Gauge for Coaching Stock

J.1 Origin and purpose of the C1 (Appendix A) gauge

J.1.1 C1 (Appendix A) gauge was intended to provide a base gauge for (nominal) 20 m rolling stock with air spring suspension. C1 (Appendix A) gauge is defined by drawing C-A0-39 (BR CM&EE Dept. 8 April 1974).

J.1.2 This gauge is an extension of the original C1 gauge for passenger vehicles (Appendix H). C1 Appendix A extends into the 'frangible' zone of C1. Any 'frangible' items in C1 (Appendix A), such as door handles and handrails, are to be recessed.

J.1.3 The gauge applies to vehicles of 19,354 mm over headstocks with 14,173 mm bogie centres.

J.1.4 Two families of vehicle have been built to C1 (Appendix A) gauge: the PEP derived stock (Classes 313, 314, 315, 507 and 508), and the Mark III multiple unit.

J.1.5 No routes are known to have been cleared to C1 (Appendix A) gauge.

J.2 Dynamic movements

Movement	Value
Sway at 3080 mm ARL	204 mm
Sway at 1000 mm ARL	102 mm
Upward movement	30 mm
Downward movement	150 mm

Table J.1 Dynamic movements for C1 (Appendix A) gauge

Appendix K UK1 (Issue 2) Gauge – Vehicle Gauge Defined in High Speed TSIs

K.1 Origin and purpose of UK1 (Issue 2) gauge

K.1.1 UK1 (Issue 2) defines a gauge for the trans-European high speed rail system as defined in the High-Speed Technical Specification for Interoperability (TSI). It was commissioned by the Vehicle / Structures Systems Interface Committee and was described in document TNLRVSSIC0003, Issue 2.

K.1.2 GE/RT8073 incorporates UK1[A] (lower sector) and UK1[B] (upper sector) vehicle gauges defined in TNLRVSSIC0003 Issue 2.

K.1.3 TNLRVSSIC0003 Issue 2 also defined a UK1[D] gauge, being that which *could* theoretically be developed from back-calculating a gauge from the UK TENs network infrastructure gauge. Being ephemeral, this gauge has no place in GE/RT8073.

K.2 Release history

K.2.1 UK1 (Issue 2) gauge supersedes the original UK1 gauge which was never formally approved and has no relevance to gauging on the British infrastructure. For interest, the reader is directed to GE/GN8573, issue one.

K.2.2 UK1 gauge is not the same as Class 373/X (Eurostar) gauge. The behaviour of the Class 373/X (Eurostar) (Class 373 vehicle rake) in relation to the defined static gauge is a complicated relationship defined by MSER42. This is described in Appendix N.

K.3 Dynamic movements

Movement	Value
Sway at 3080 mm ARL	100 mm
Sway at 1000 mm ARL	100 mm
Upward movement	100 mm
Downward movement	100 mm

Table K.1 Dynamic movements for UK1 (Issue 2) gauge

Appendix L Locomotive gauge – Vehicle Gauge for Locomotives

L.1 Origin and purpose of locomotive gauge

L.1.1 Locomotive gauge is a vehicle gauge for locomotives. Not all locomotives comply with locomotive gauge. It was originally defined on drawing L-A1-1806 (BR CM&EE Dept. 12 March 1970) updated to issue B (13 August 1970).

L.1.2 Overthrow gauge is derived from the broken line of L-A1-1806, representing the maximum overthrow contour on a 200 m curve. Accordingly, the gauge line has been set back from the original drawing by 102.5 mm. This is to allow standard overthrow formulae to be applied to curves of any radius when checking clearances.

L.1.3 Maximum build gauge represents the maximum building contour of L-A1-1806.

L.1.4 Locomotives may be built to the maximum build gauge, subject to not exceeding the overthrow gauge when adjusted for curve overthrow.

L.1.5 The lower sector gauge has been extracted from the original gauge drawing, and defined as dynamic. This maintains a consistency between this gauge and other gauges, such as C1.

L.2 Corrections applied

L.2.1 The dimensions for the locomotive gauge referred to in GE/RT8073 issue two, have been converted from the original drawing in imperial units to a resolution of 0.5 mm. Previous issues of the gauge have used approximations for some values.

L.3 Dynamic movements

L.3.1 The dynamic gauge line shown in GE/RT8073 has been derived from a theoretical analysis of 9 UK locomotives, at up to 150 mm cant and at their maximum speed. Locomotives analysed were classes 253, 58, 86-0, 86-2, 86-3, 87, 89, 90 and 92. Movements included were 2.12 standard deviations, excluding wind loading.

L.3.2 From this analysis, the following dynamic movements were derived:

Movement	Value
Sway at 3090 mm ARL	150 mm
Sway at 1300 mm ARL	75 mm
Upward movement	20 mm
Downward movement	20 mm

Table L.1 Dynamic movements for locomotive gauge

L.4 Clearance calculations

L.4.1 It is necessary to provide clearances to both overthrow gauge (including dynamic movements) and maximum build gauge (including dynamic movements). Due to different profiles defined by the original gauge lines with and without overthrow, individual points on each gauge become significant at different curve radii.

Appendix M C3 and C4 Designation

M.1 Requirement for C3 (and C4) designation

M.1.1 GM/TT0404 (now withdrawn) required passenger coaches to display either a C1 or C3 designation. This is no longer a requirement in GM/RT2459, which replaced GM/TT0404.

M.2 Standards defining C3 designation

M.2.1 C3 is a designation for the Mark III passenger coach, which is a 23 m vehicle. A C3 gauge has never been defined, and represents an ambiguous term.

M.2.2 Where gauging to C3 is specified, a combination of Mark II and Mark III coaches should be used.

M.3 Standards defining C4 designation

M.3.1 C4 is a designation for the Class 390 Tilting Electric Multiple Unit. C4 gauge refers to the original Alstom body build (static) gauge, and should not be used for gauging.

M.3.2 Where gauging to C4 is specified, it is necessary to use the Alstom approved ClearRoute™ dynamic model (KE8c).

Appendix N Class 373/X (Eurostar) Gauge

N.1 Standards defining Class 373/X (Eurostar) gauge

N.1.1 The Class 373/X (Eurostar) gauge is for gauging routes used by Class 373 vehicles. It should not be confused with UK1 gauge (see Appendix L), which does not define Class 373/X (Eurostar) vehicles.

N.2 Class 373/X (Eurostar) gauge

N.2.1 The Class 373/X (Eurostar) gauge is defined in report MSER 42. It is a swept envelope defined by curve radius, speed and installed cant which can be calculated using either the equations defined in MSER 42 or authorised computer software.

N.2.2 This document defines the swept envelope to be applied for specific combinations on speed, curvature and installed cant. In addition, variations for Class 373/1 (Three Capitals stock) and 373/2 (Regional stock) are defined, together with certain relaxations that may be applied when operating on 'good track'.

N.2.3 'General Gauging Procedure for Class 373 Trains', Mechanical Systems Engineer Report MSER 42, issue one, 24 February 1995 was published by:

European Passenger Service
Mechanical Systems Engineer
Room 47, Derwent House
Railway Technical Centre
London Road
Derby DE2 8UP

N.2.4 Copies of MSER 42 may be obtained from Eurostar (UK) Ltd.

N.3 Guidance on application to the infrastructure

N.3.1 The swept envelope should be calculated using either the equations defined in MSER 42 or authorised computer software.

N.3.2 It should be noted that Class 373/1 (Three Capitals) and Class 373/2 (Regional) trains have different swept envelopes, as a result of the 373/2 vehicle having a modified airbag skirt.

N.3.3 It should also be noted that Class 373/X (Eurostar) vehicles have different speed-related characteristics (KSpeed) on a particular route in Britain, based upon higher than normal track quality. MSER 42 defines good track as being (the then upgraded) East Coast Main Line (Engineer's Line Reference ECM), which may no longer be appropriate. It is recommended that the default KSpeed parameter should be used in the absence of qualitative measures to justify use of the higher track quality value.

N.3.4 Being a vehicle swept envelope, which includes curve overthrow and dynamic movements, it is applied using the concept of 'effective position of the track'. Normal, reduced and special reduced clearance values are as stated in GC/RT5212.

N.3.5 Infrastructure gauging should be performed using the absolute gauging methodology with appropriate clearances and infrastructure tolerances.

N.3.6 The vehicle has retractable steps, and stepping distances should be calculated using MSER 42.

N.3.7 Similarly, MSER 42 defines a situation with the vehicle moving (slowly) with authorised plug doors open, where the vehicle does not conform to the gauge. Such situations should be analysed according to MSER 42.

N.4 Lower sector structure gauge defined in GC/RT5212

N.4.1 The lower sector structure gauge defined in GC/RT5212 contains a modified formula for width reduction on structures passed by Class 373/X (Eurostar) vehicles.

For straight track and curved track with a radius ≥ 360 m, X = 760

For curved track with a radius < 360 m but ≥ 160 m, X = 688 + (26000 / R)

Where R is the curve radius in metres and X is in mm

N.4.2 The formula quoted gives the following results for selected radii:

Radius (m)	X (mm)
360	760
300	775
250	792
200	818
160	851

Table N.1 Lower sector structure gauge offsets for Class 373/X (Eurostar) routes

N.5 Guidance on application by railway undertakings

N.5.1 The Class 373 vehicle is built to conform to the gauging requirements defined in MSER 42.

N.6 Notes

N.6.1 BASS Design Guide 501 has been used to define the Class 373 vehicle. Commercial restrictions exist on the use of this vehicle for comparative gauging.

Appendix O Structure Profile Measurement Accuracy – Example Form

Structure profile measurement accuracy form	**Page one**
General	
Candidate system:	
Date:	
Description of measuring principle:	
Description of rail location principle:	
Description of positioning system:	
Date:	
Locational datum defined by (measuring system):	
Locational datum measurement accuracy standard deviation:	
Datum point measuring system:	
Datum point measuring system accuracy standard deviation:	
Notes: Locational accuracy is the maximum error in positioning the vehicle that may develop between synchronisations of the distance measured by the vehicle and the true distance travelled. The latter may not correspond to the distances marked on the railway network (for example mileposts). The measurement should be on a range of normal track geometries if this may affect the results. The measuring method used to determine the true distance travelled should be stated, together with its accuracy, if known. Measurement accuracy should be established with reference to a series of datum points distributed across the potential measuring area. At least 10 points should be used. These should be measured using an accurate measuring system, of stated accuracy. The datum points should be measured as accurately as possible, the measuring method described, and the accuracy (defined by this methodology) should be stated, if known.	

Table O.1 Structure profile measurement accuracy form (continued below)

Structure profile measurement accuracy form	**Page two**
Accuracy statement - stationary	
Total system accuracy standard deviation (mm):	
Accuracy statement – slow speed	
Measuring speed (km/h):	
Total system accuracy standard deviation (mm):	
Longitudinal sampling interval (mm):	
Longitudinal sample length (mm):	
Accuracy statement – maximum speed	
Measuring speed (km/h):	
Total system accuracy standard deviation (mm):	
Longitudinal sampling interval (mm):	
Longitudinal sample length (mm):	

Notes:

Total system accuracy relates to the aggregation of accuracy of the measuring system and its relationship to the rails. For systems where the structure and rail measurements are not integrated, the measuring system accuracy should be adjusted for rail positioning effects including (but not exhaustively) possible effects of vehicle stability, wheel profile, geometry, yaw and pitch. The set of datum points should be measured by the candidate system at least 5 times, the error for each point being calculated as the distance between the actual point (defined by accurate measurement) and the measured point. The standard deviation of these errors should be calculated. The accuracy of measurements by the candidate system should not be adjusted for the reference system accuracy.

Longitudinal sampling interval is the positional frequency of taking measurements on the move. In the case of a scanner system, for instance, this would be the helix pitch at the defined speed. Longitudinal sample length is the length of the 'snapshot'. In the case of laser scanners, this would be the beam diameter, if less than the sampling interval. In the case of continuous (integrating) systems, the longitudinal sample length would equal the sampling interval.

Table O.1 Structure profile measurement accuracy form (continued from above)

Appendix P Freight Load Unit Heights and Profile Codes

P.1 Purpose

P.1.1 The following table is included to facilitate the gauging of freight loads. The dimensions relate to swapbody loads ('S' coded) and ISO containers. It is important to note that nominal dimensions differ between these types of load.

P.2 Notes

P.2.1 It should be noted that UIC 'S' code load heights are defined by the top corner of the load. The coordinates of the gauge then define a line sloping vertically upwards at an angle of 7 degrees.

P.2.2 Edge height refers to the height measured in relation to the vehicle deck.

Max edge height (H) (mm)	Max edge height (H) (ft/inches)	Max 'S' code for 2550 mm wide swapbody	Max 'S' code for 2551 to 2600 mm wide swapbody	Corresponding ISO container height
2455	8' 0 3/4"	S00	S330	—
2465	8' 1"	S01	S331	—
2475	8' 1 1/2"	S02	S332	—
2485	8' 2"	S03	S333	—
2495	8' 2 1/4"	S04	S334	—
2505	8' 2 3/4"	S05	S335	—
2515	8' 3"	S06	S336	8' 3" (2515)
2525	8' 3 1/2"	S07	S337	—
2535	8' 3 3/4"	S08	S338	—
2545	8' 4 1/4"	S09	S339	—
2555	8' 4 1/2"	S10	S340	—
2565	8' 5"	S11	S341	—
2575	8' 5 1/2''	S12	S342	—
2585	8' 5 3/4''	S13	S343	8' 6'' (2591)
2595	8' 6 1/4"	S14	S344	—
2605	8' 6 3/4"	S15	S345	—
2615	8' 7"	S16	S346	—
2625	8' 7 1/2"	S17	S347	—
2635	8' 7 3/4"	S18	S348	—
2645	8' 8 1/4"	S19	S349	—
2655	8' 8 1/2"	S20	S350	—
2665	8' 9"	S21	S351	8' 9" (2667)
2675	8' 9 1/2"	S22	S352	—
2685	8' 9 3/4"	S23	S353	—
2695	8' 10 1/4"	S24	S354	—

Table P.1 Freight load dimensions (continued below)

Max edge height (H) (mm)	Max edge height (H) (ft/inches)	Max 'S' code for 2550 mm wide swapbody	Max 'S' code for 2551 to 2600 mm wide swapbody	Corresponding ISO container height
2705	8' 10 1/2"	S25	S355	—
2715	8' 11"	S26	S356	—
2725	8' 11 1/4"	S27	S357	—
2735	8' 11 3/4"	S28	S358	9' 0" (2743)
2745	9' 0 1/4"	S29	S359	—
2755	9' 0 1/2"	S30	S360	—
2765	9' 1"	S31	S361	—
2775	9' 1 1/4"	S32	S362	—
2785	9' 1 3/4"	S33	S363	—
2795	9' 2"	S34	S364	—
2805	9' 2 1/2"	S35	S365	—
2815	9' 3"	S36	S366	—
2825	9' 3 1/4"	S37	S367	—
2835	9' 3 3/4"	S38	S368	—
2845	9'4"	S39	S369	—
2855	9' 4 1/2"	S40	S370	—
2865	9' 5"	S41	S371	—
2875	9' 5 1/4"	S42	S372	—
2885	9' 5 3/4"	S43	S373	—
2895	9' 6"	S44	S374	9' 6" (2896)
2905	9' 6 1/2"	S45	S375	—
2915	9' 6 3/4"	S46	S376	—
2925	9' 7 1/4"	S47	S377	—
2935	9' 7 3/4"	S48	S378	—
2945	9' 8"	S49	S379	—
2955	9' 8 1/2"	S50	S380	—
2965	9' 8 3/4"	S51	S381	—
2975	9' 9 1/4"	S52	S382	—
2985	9' 9 1/2	S53	S383	—
2995	9' 10"	S54	S384	—
3005	9' 10 1/2"	S55	S385	—
3015	9' 10 3/4"	S56	S386	—
3025	9' 11 1/4"	S57	S387	—
3035	9' 11 1/2"	S58	S388	—

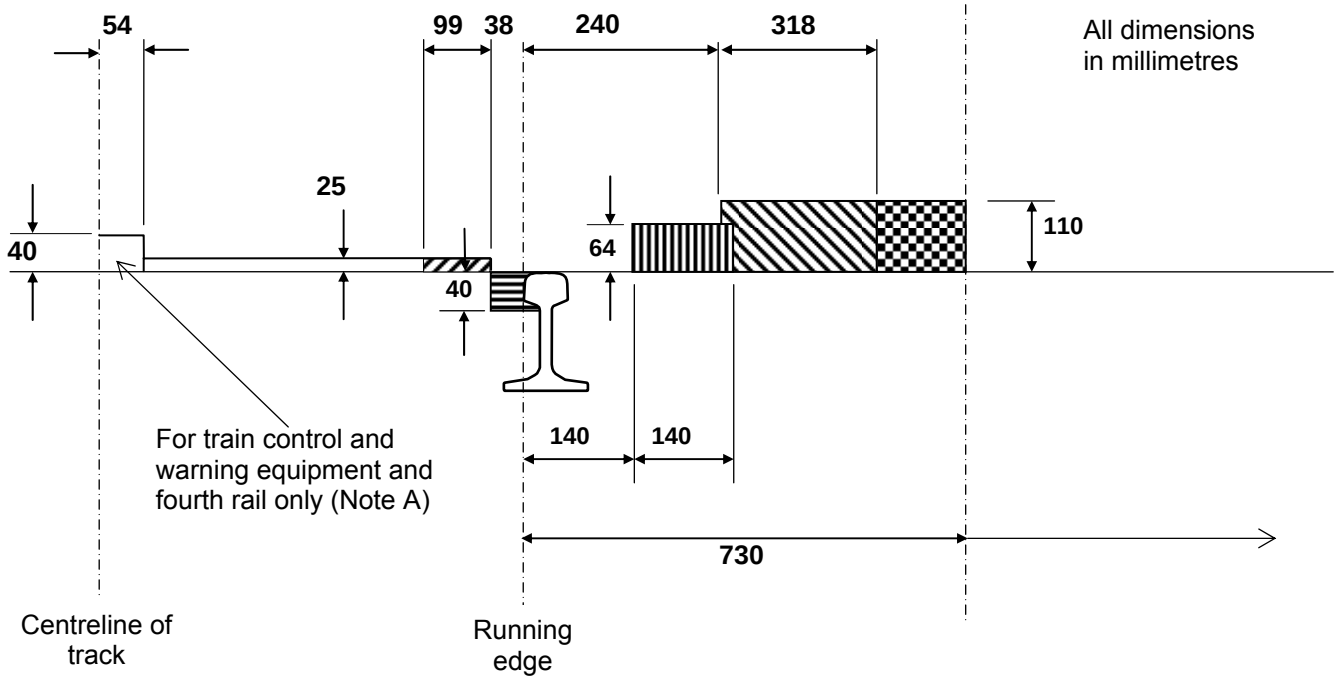
Table P.1 Freight load dimensions (continued from above)

Max edge height (H) (mm)	Max edge height (H) (ft/inches)	Max 'S' code for 2550 mm wide swapbody	Max 'S' code for 2551 to 2600 mm wide swapbody	Corresponding ISO container height
3045	10' 0"	S59	S389	10' 0" (3048)
3055	10' 0 1/4"	S60	S390	—
3065	10' 0 1/2"	S61	S391	—
3075	10' 1"	S62	S392	—
3085	10' 1 1/2"	S63	S393	—
3095	10' 1 3/4"	S64	S394	—
3105	10' 2 1/4"	S65	S395	—
3115	10' 2 1/2"	S66	S396	—
3125	10' 3"	S67	S397	—

Table P.1 Freight load dimensions (continued from above)

Appendix Q The Purpose and Use of the Component Areas of the Lower Sector Structure Gauge

This appendix originally appeared as Appendix B in GE/RT8029, issue one (now withdrawn). This gauge is complementary to the lower sector vehicle gauge defined in section 4. This appendix is referenced in section 9.5 of this document.



Area for conductor rail equipment, guard boards and APC magnets.

Area for check rails.

Area for guard rails, (except where trains fitted with non-retractable shoes for electric current collection operate).

Area for wheel flanges.

Area for dwarf signals, bridge girders, and other lineside equipment (conductor rail equipment, such as hook switches, is also permitted to utilise this area).

Figure Q.1 Structure gauge for areas close to the plane of the rails

Note A
For lines electrified on the fourth rail system the fourth rail equipment extends to 40 mm above plane of the rails. On other lines equipment close to the centre line of the track should not extend more than 25 mm above plane of the rails.

General notes
Except for that area designated for wheel flanges, locations below the plane of the rails are available for infrastructure.

Some major structures may have arrangements, particularly derailment protection (guard) rails, which do not conform to this appendix.

Lines fitted with train stop equipment (for example, Mersey Rail; joint running with London Underground Limited) have equipment which is outside the gauge when in the raised position. GE/RT8018 contains details of train stops, that is to say the position which causes the brakes to be applied.

Definitions

Absolute gauging

Absolute gauging of a vehicle is a full assessment of clearances on a section of track between the vehicle and fixed infrastructure, and between the vehicle and vehicles on adjacent tracks.

Altered infrastructure

Infrastructure subject to alteration. This term does not refer to infrastructure that has been altered at some time in the past.

ARL

Abbreviation for 'above rail level', measured perpendicularly to the plane of rails.

Cant deficiency

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

Cant excess

The extent by which the cant on curved track exceeds that required for the gravitational component acting parallel with the plane of the rails to exactly counterbalance the centrifugal forces acting on a vehicle in the same plane. It equates to a negative value of cant deficiency.

Clearance

The minimum calculated distance between vehicles and fixed structures or between two vehicles on adjacent tracks.

Comparative gauging

The process of comparing the swept envelopes of a vehicle new to a route, with the swept envelopes of a vehicle or vehicles which have been demonstrated to be able to use the proposed route.

Composite swept envelope

A composite swept envelope of a range of vehicles and notional loads, calculated by normal means. W12 gauge is an example of a composite swept envelope. The process of outlining the component profiles is known as a Boolean Union.

Cross level error

The difference between designed cross level (or cant) and that which exists. For the purposes of calculation of dynamic envelopes, half of the error is assumed to be continuous or static which results in physical displacement of the vehicle, and half of it is discrete or dynamic which results in additional roll.

Dynamic cross level error

The dynamic component of cross level error is that part which excites dynamic roll movement in a vehicle.

Dynamic envelope

A description of the suspension movements of a vehicle under the full range of operating conditions for example, speed, cant deficiency, and cant excess. The dynamic envelope is an input into the calculation of swept envelope.

It should be noted that a dynamic envelope is not a swept envelope, with which it is often confused.

Dynamic gauge

The maximum envelope relative to the effective track position that a vehicle is permitted to occupy at up to its maximum speed and cant deficiency. The dynamic gauge includes effects of loading and vehicle tolerances and allowances but requires adjustment to include the effects of a geometric overthrow of the particular cross-section on curved track. Unless specifically stated wheel / rail clearances are taken account of elsewhere. See also 'static gauge'.

Effective position of the track

A position that the track could credibly occupy in relation to structures or an adjacent track at some point within its maintenance cycle, giving the smallest clearances. Compare with 'maintained position of the track'.

Established suspension

A suspension which has traditionally been used for vehicles conforming to a particular standard vehicle gauge, and whose characteristics have been used by the infrastructure manager to demonstrate that a route is clear for the particular standard vehicle gauge.

Exposed route

A route (or section of route) which is orientated generally in a north-south direction and which features hillsides, embankments or viaducts which are open and exposed to south-westerly winds. Examples of such routes are: West Coast Main Line north of Weaver Junction, and the Cumbrian Coast Line.

Frangible

Items which, when struck in the direction of travel, fail in a manner that does not create a risk of injury to people on board or in the vicinity of the vehicle.

Fixed datum

A reference monument fixed to a structure which allows the relative position of the track and structure to be checked.

Freight vehicle gauge

A vehicle gauge only applicable to freight wagons and rail mounted maintenance machines. See also 'vehicle gauge'.

GA, GB, GB1 and GC Gauges

Reference profiles defined in the UIC 505 and 506 series of leaflets. The profiles are also referenced in the high speed TSIs. See also 'reference profile'.

Gauge

Used to refer to a vehicle gauge or structure gauge where the context makes it clear which is meant. See 'vehicle gauge' and 'structure gauge'.

Gauge extension

An incremental addition to a previously defined gauge.

Infrastructure

For the purpose of this document, track and structures in combination. Compare with 'structure'.

ISO

International Standards Organisation.

Load

For the purposes of this document, a load is defined as the physical size of the payload carried by a wagon.

Loading gauge

Originally a gauge used to define the maximum permissible vehicle loading dimensions. Used as a synonym for 'vehicle gauge' in the high speed TSIs. See 'vehicle gauge'.

Low track force bogie

A bogie designed to reduce imposed track forces.

Lower gauge

That part of the vehicle gauge for items adjacent to low-lying structures, such as platforms, with a requirement for proximity. The lower gauge falls within the lower sector, but does not necessarily extend to 1100 mm above the plane of the rails. See also 'upper gauge'.

Lower sector

The area up to and including 1100 mm above the plane of the rails. See also 'upper sector'.

Maintained position of the track

The position in which the track should be placed during maintenance. Compare with 'effective position of the track'.

New infrastructure

Infrastructure other than that which already exists.

Normal clearance

A clearance between a structure and a vehicle or between passing vehicles which does not require specific controls on the position of the track, but which does require the relative locations of structures and adjacent tracks to be monitored and maintained.

Overthrow

A geometric projection of a vehicle when on curved railway track.

Pantograph sway

The lateral and roll displacements of the pantograph position relative to the centre line of the track in response to the dynamic effects of vehicle sway, overthrow at the pantograph location, pantograph mounting tolerances and lateral flexibility.

Passing clearance

The minimum calculated distance between the swept envelopes of two specific types of rail vehicle as they pass on adjacent tracks at nominated speeds, taking account of appropriate track tolerances and accuracy of measurement.

Plane of the rails

An imaginary surface coplanar with the top of both rails of a track.

Reduced clearance

A clearance, less than a normal clearance, which requires special measures to maintain tracks relative to adjacent tracks and structures. Only the infrastructure manager can approve or authorise the use of reduced clearances.

Reference profile

An intermediate profile between a vehicle gauge and a structure gauge, defining limits that a vehicle should conform to in a limited range of operating conditions. UIC GC gauge is an example of a reference profile.

Route

The physical path of a journey to be undertaken by a vehicle or a collection of vehicles, where the path is comprised of a number of track sections, each of which has individually defined characteristics.

Route availability

The assessed capacity of a route to carry the vertical static and dynamic loads of rail vehicles or the static load characteristic of a rail vehicle type expressed as a route availability (RA) number as set out in GE/RT8006.

Section of track

Track bounded by identified limits such as junctions, terminals or points at which there is a significant change in traffic flow or permissible speed.

Side wind

A wind of constant velocity, impinging on the vehicle perpendicularly to the direction of travel.

Special reduced clearance

A clearance, less than a reduced clearance, which requires a specific risk assessment to be undertaken and the implementation of appropriate controls to demonstrate that risks have been reduced to as low as reasonably practicable (ALARP). Only the infrastructure manager can approve or authorise the use of special reduced clearances.

Static cross level error

The steady state component of cross level error is that part which imparts a simple roll displacement movement in a vehicle.

Static gauge

The maximum envelope relative to the effective track position that a vehicle is permitted to be built to, or loaded to, at a particular cross-section. The static gauge requires adjustment to include the effects of a geometric overthrow of the particular cross-section on curved track. Unless specifically stated wheel / rail clearances are taken account of elsewhere. See also ‘dynamic gauge’.

Structure

An element of the infrastructure adjacent to, or crossing over, a railway track. So far as this document is concerned ‘structures’ include, but are not limited to:

a) Train control and communications equipment (for example, signals)

b) Station platforms

c) OCL equipment supporting structures at earth potential, but excluding insulators

d) Civil engineering structures such as retaining walls, tunnels and bridges

e) Other isolated structures

f) Temporary works.

Compare with ‘infrastructure’.

Structure clearance

The minimum calculated distance between a structure and the swept envelope of a specific type of rail vehicle passing at nominated speeds, taking account of appropriate track tolerances and accuracy of measurement.

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.

Swapbody

A particular type of demountable load attached to a rail vehicle by fastenings.

Swept envelope

A cross-sectional profile, taken at right angles to the track, enclosing all dynamic movements, static deflections and overthrows of all points along the surface of the vehicle, that can reasonably be expected to occur under the appropriate range of operating conditions as it sweeps past a theoretical track location. A family of swept envelopes is required to define a vehicle's behaviour on a route.

The swept envelopes referred to within this document exclude the effects of track tolerance and rail sidewear previously included in dynamic envelopes developed under GM/RT2149 issue one, or earlier documents.

Swept envelope suite

An overlay of the swept envelopes of a range of vehicles. W10 gauge is an example of a swept envelope suite.

Swing motion bogie

A specific type of bogie design.

Technical Specification for Interoperability

Technical Specifications for Interoperability (TSIs) are mandatory standards forming part of the implementation of the European Interoperability Directives.

Track fixity

The degree to which a track is restrained from movement in any direction. Fixity can be different laterally and vertically, and can be asymmetric.

Track interval

The distance between the running edges of the nearest rails of adjacent tracks, measured 14 mm below the plane of the rails.

UIC

International Union of Railways (Union Internationale des Chemins de Fer). The role of UIC is to promote cooperation between railways at world level and to carry out activities to develop international transport by rail. The UIC publishes standards, regulations and recommendations to facilitate international traffic.

Upper gauge

That part of the vehicle gauge for items above low-lying structures, which are not constrained by a requirement for proximity. The upper gauge falls within the upper sector, but may extend below 1100 mm above the plane of the rails. See also 'lower gauge'.

Upper sector

The area above 1100 mm above the plane of the rails. See also 'lower sector'.

VAMPIRE®

VAMPIRE® is an acronym for Vehicle dynAmic Modelling Package In a Railway Environment. It is one example of a number of railway vehicle dynamic packages available that allow a virtual model of any rail vehicle to be run over real measured track geometry.

Vehicle gauge

The maximum envelope that a vehicle conforming to the gauge is permitted to occupy statically and dynamically, which prescribes maximum permissible vehicle and loading dimensions, certain suspension displacements, and certain curve overthrow limitations (for example, W6a).

Vehicle profile

The static cross-sectional envelope of a vehicle (and its payload).

Width reduction

A reduction to the width of a vehicle gauge that is applicable to vehicles with a longer wheelbase than the reference vehicle on which the gauge is based. Width reduction compensates for the greater overthrows on curves due to the longer wheelbase than those already accommodated by the standard gauge.

References

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

Documents referenced in the text

RGSC 01	The Railway Group Standards Code
Railway Group Standards	
GC/RT5021	Track System Requirements
GC/RT5203	Infrastructure Requirements for Personal Safety in Respect of Clearances and Access
GC/RT5212	Requirements for Defining and Maintaining Clearances
GC/RT5204	Structure Gauging and Clearances (withdrawn document)
GE/RT8006	Interface between Rail Vehicle Weights and Underline Bridges
GE/RT8018	Mechanical Trainstops Systems
GE/RT8025	Electrical Protective Provisions for Electrified Lines
GE/RT8029	Management of Clearances and Gauging (withdrawn document)
GE/RT8034	Maintenance of Signal Visibility
GE/RT8073	Requirements for the Application of Standard Vehicle Gauges
GE/RT8270	Assessment of Compatibility of Rolling Stock and Infrastructure
GI/RT7003	Management of Construction Work in the Operational Railway Environment
GI/RT7014	Infrastructure Requirements at Stations
GI/RT7016	Interface between Station Platforms, Track and Trains
GK/RT0037	Signal Positioning and Visibility
GM/RT2000	Engineering Acceptance of Rail Vehicles
GM/RT2100	Structural Requirements for Railway Vehicles
GM/RT2149	Requirements for Defining and Maintaining the Size of Railway Vehicles
GM/RT2456	Structural Requirements for Windscreens and Windows on Railway Vehicles
GM/RT2457	Structural Requirements for Doors and Gangways on Railway Vehicles
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HS(G)153/2	Railway Safety Principles and Guidance Part 2, Section A, Guidance on the Infrastructure, Health and Safety Executive (HM Railway Inspectorate)
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2002/733/EC	Technical specification for interoperability relating to the energy subsystem of the trans-European high-speed rail system referred to in Article 6(1) of Directive 96/48/EC ['High Speed Energy TSI']
2002/735/EC	Technical specification for interoperability relating to the rolling stock subsystem of the trans-European high-speed rail system referred to in Article 6(1) of Directive 96/48/EC ['High Speed Rolling Stock TSI']
MSER 42	General Gauging Procedure for Class 373 Trains, Mechanical Systems Engineer Report no 42, issue one 1995
	UIC Gauging Principles, David M Johnson, Laser Rail Ltd
UIC 503	Continental wagons running in Great Britain – General conditions (reference profile, axle-load, etc) for the acceptance, in international traffic with Great Britain, of 2-axle and bogies wagons registered with other UIC Railways
UIC 505-1	Railway transport stock – Rolling stock construction gauge
UIC 505-4	Effects of the application of the kinematic gauges defined in the 505 series of leaflets on the positioning of structures in relation to the tracks and of the tracks in relation to each other
UIC505-5	Basic conditions common to Leaflets 505-1 to 505-4 – Notes on the preparation and provisions to these leaflets
UIC 506	Rules governing application of the enlarged GA, GB and GC gauges
	C1 drawings
	C1 (Appendix A) drawings
ITLR/T8328/001	Interfleet Technology report
TNLRVSSIC0002	W11 gauge, issue 3 authorised by Vehicle/Structures System Interface Committee
TNLRVSSIC0003	UK1 gauge, issue 3 authorised by Vehicle/Structures System Interface Committee
LR6665001D001B	Laser Rail Ltd Kinematic Envelope Drawing