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**Guidance on the Conventional Rail Locomotives and Passenger Rolling
Stock TSI**

Issue One December 2012

Guidance on the Conventional Rail Locomotives and Passenger Rolling Stock TSI

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Superseded documents

The following Railway Group document is superseded, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
GM/GN2561 issue two	All	December 2012

GM/GN2561 issue two ceases to be in force and is withdrawn as of 01 December 2012.

Supply

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Guidance on the Conventional Rail Locomotives and Passenger Rolling Stock TSI

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Part 1 Introduction

G 1.1 Purpose of this document

G 1.1.1 This document gives guidance on the Conventional Rail Locomotives and Passenger Rolling Stock Technical Specification for Interoperability (CR LOC & PAS TSI). The document provides:

- a) Advice on the application of the requirements of the CR LOC & PAS TSI in the context of the mainline railway in Great Britain.

And

- b) Advice on interpretation of points where the CR LOC & PAS TSI is not clear in its intent or where it contains incomplete or obscurely worded requirements.

G 1.1.2 This document does not replicate existing guidance published by the European Rail Agency (ERA) in either their Application Guide or Accompanying Report, see G 1.7 and G 1.8.

G 1.1.3 This document is intended to assist railway undertakings in understanding their responsibilities in relation to the CR LOC & PAS TSI. It does not constitute a recommended method of meeting any set of mandatory requirements.

G 1.2 The structure of this document

G 1.2.1 Relevant requirements from the CR LOC & PAS TSI are reproduced with a grey background in this document.

G 1.2.2 Guidance is provided as a series of sequentially numbered clauses prefixed 'G' immediately below the greyed text to which it relates.

G 1.2.3 Specific responsibilities and compliance requirements are set out in the CR LOC & PAS TSI.

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G 1.4 Approval and authorisation of this document

- G 1.4.1 The content of this document was agreed by the Great Britain (GB) CR LOC & PAS TSI mirror group on 10 September 2012.
- G 1.4.2 The content of this document was approved by Rolling Stock Standards Committee on 28 September 2012.
- G 1.4.3 This document was authorised by RSSB on 24 October 2012.

G 1.5 Structure of the CR LOC & PAS TSI

- G 1.5.1 The CR LOC & PAS TSI is divided into seven chapters. The first three chapters are informative and contain no mandatory requirements. Chapter 1, the Introduction, sets out the technical and geographical scope of the CR LOC & PAS TSI, and describes its contents. Its geographical scope is the trans-European conventional rail system as described in Annex I, Chapter 1.1 of the Directive 2008/57/EC.
- G 1.5.2 Chapter 2 defines the rolling stock subsystem and its interfaces with other subsystems.
- G 1.5.3 Chapter 3 sets out how the CR LOC & PAS TSI has covered the essential requirements for the subsystem defined in the Railway Interoperability Directive 2008/57/EC.
- G 1.5.4 Chapter 4 sets out the main technical requirements in the CR LOC & PAS TSI and is dealt with in detail in this Guidance Note.
- G 1.5.5 Chapter 5 deals with interoperability constituents (essentially components, sub-assemblies or complete assemblies of equipment intended to be incorporated into a subsystem). These Interoperability Constituents are assessed and certificated separately and then incorporated into the Rolling Stock sub-system. Guidance on the CR LOC & PAS TSI Chapter 5, interoperability constituents has been placed with the relevant technical requirements from Chapter 4, see G 2.2.
- G 1.5.6 Chapter 6 deals with the assessment of conformity of interoperability constituents and the verification of the subsystem. Guidance supporting the assessment and verification requirements has been placed with the relevant technical requirements from the CR LOC & PAS TSI Chapter 4. The assessment modules to be used for assessment of conformity and EC verification are set out in Commission Decision 2010/713/EU of 9 November 2010.
- G 1.5.7 Chapter 7 deals with implementation of the CR LOC & PAS TSI and specific cases. Guidance on the specific cases has been placed with the relevant requirements from CR LOC & PAS TSI Chapter 4, see G 2.3.

G 1.6 References to other standards

- G 1.6.1 References in the CR LOC & PAS TSI to existing standards (usually Euronorms (EN)) or other documents could be either 'strict' dated references - whereby the reference explicitly identifies a particular version of the document (for example with reference to the version number or date). Alternatively, a 'slipping' (generic) reference (that is with no explicit identification of a particular dated or version of the document) is made whereby the reference is to the version of the document in force at the time of adoption of the latest version of the CR LOC & PAS TSI in question. As far as possible, only strict references are made in the CR LOC & PAS TSI.
- G 1.6.2 In both cases, the version of the standard (or document) referred to in CR LOC & PAS TSI is the binding one. If a new version of the standard (or document) referred to in CR LOC & PAS TSI is adopted the 'old' version referred to in the CR LOC & PAS TSI is still the binding one. That is, in both cases nothing actually 'slips'.
- G 1.6.3 Where a TSI refers to an EN, standard or document, the complete EN, standard or document is mandatory. Where a TSI refers to a part of an EN, standard or document, only the parts referred to are mandatory.

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- G 1.6.4 Where an EN referred to in a TSI contains a reference to another EN, unless otherwise provided in the TSI, this second EN also becomes mandatory.
- G 1.6.5 The TSIs make no reference to standards or other relevant documents whose application is not mandatory.
- G 1.6.6 Where reference to an EN(s) is revised, the ERA has developed an 'Omnibus' (ERA/REC/07-2011/INT) procedure to make minor revisions to the published TSI. The latest version of the published TSI, incorporating any Omnibus revisions can be found on the Eur-lex website [<http://www.era.europa.eu/Document-Register/Documents/ERA-REC-07-2011-INT-Omnibus-Recommendation-accompanying-report.pdf>].
- G 1.6.7 Where Railway Group Standards (RGS) are referenced within this guidance note, for the purpose of identifying a national technical rule (NTR), a check should be made to ensure the latest published issue of the RGS is used.

G 1.7 ERA application guide to the CR LOC & PAS TSI

- G 1.7.1 The ERA and the TSI experts group prepared a 'Guide for the Application (Application Guide) of the CR LOC & PAS TSI' that has been used to inform the guidance in this document. The Application Guide can be found at [http://www.era.europa.eu/Document-Register/Documents/IU-TSI-Guide-Annex01-CR-LOC_PASS_TSI.pdf]. This document does not replicate that guidance and therefore the Guide for the Application of the CR LOC & PAS TSI should be read in conjunction with the CR LOC & PAS TSI.

G 1.8 ERA report on the CR LOC & PAS TSI

- G 1.8.1 The ERA and the TSI experts group also prepared an 'Accompanying Report' that has been used to inform the guidance in this document. The Accompanying Report can be found at <http://www.era.europa.eu/Document-Register/Documents/IU-RST-Final-report-for-final-draft-RST-TSI-Rev-2.0.pdf>. This guidance note does not replicate text from the Accompanying Report and therefore this should be read in conjunction with the CR LOC & PAS TSI.

G 1.9 Scope and Application of the CR LOC & PAS TSI

- G 1.9.1 The scope of the CR LOC & PAS TSI applies to all vehicles when operating on the Trans-European Network (TENS), as described via the Department for Transport (DfT) interoperability webpages. The TENS routes do not cover the whole of the GB mainline railway and therefore when TSI compliant vehicles are also operating off TENS routes, then national technical rules (NTRs) apply. These NTRs are typically Railway Group Standards.
- G 1.9.2 Mandatory application of the CR LOC & PAS TSI is triggered by reference to The Railways (Interoperability) Regulations (2011) (RIR 2011), the decision to apply the CR LOC & PAS TSI and / or its specific cases and / or requests for derogations from the TSI is made by the contracting entity in conjunction with the Member State (Department for Transport (DfT) in Great Britain (GB)) to the European Commission.
- G 1.9.3 Conformity assessment requirements are set out in the CR LOC & PAS TSI Chapter 6. Guidance on the conformity assessment requirements have been placed with the relevant requirement.
- G 1.9.4 The assessment modules are described in a further Commission Decision document, 'Modules for the procedures for assessment of conformity, suitability for use and EC verification to be used in the Technical Specifications for Interoperability adopted under Directive 2008/57/EC of the European Parliament and of the Council' EU Decision 2010/713/EU, available at <http://www.era.europa.eu/Document-Register/Pages/Decision-on-modules.aspx>.

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G 1.10 General commentary on guidance to the CR LOC & PAS TSI

- G 1.10.1 The initial general clauses of the CR LOC & PAS TSI describe the system and the legislation under which the CR LOC & PAS TSI was created. This guidance note should be read in conjunction with the full text of the CR LOC & PAS TSI as some information has been omitted for brevity and clarity.

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Part 2 Technical Guidance on the CR LOC & PAS TSI

G 2.1 TSI technical requirement clauses (Chapter 4)

Extract from CR LOC & PAS TSI

4 CHARACTERISATION OF THE ROLLING STOCK SUBSYSTEM

4.1 Introduction

4.1.1 General

The trans-European conventional rail system, to which Directive 2008/57/EC applies and of which the rolling stock subsystem is a part, is an integrated system whose consistency shall be verified. This consistency shall be checked in particular with regard to the specifications of the rolling stock subsystem, its interfaces in relation to the other subsystems of the Conventional Rail system in which it is integrated, as well as the operating and maintenance rules.

The basic parameters of the rolling stock subsystem are defined in the present Section 4 of this TSI.

Except where this is strictly necessary for the interoperability of the trans-European conventional rail network, the functional and technical specifications of the subsystem and its interfaces described in Sections 4.2 and 4.3, do not impose the use of specific technologies or technical solutions.

Innovative solutions, which do not fulfil the requirements specified in this TSI and/or which are not assessable as stated in this TSI, require new specifications and/or new assessment methods. In order to allow technological innovation, these specifications and assessment methods shall be developed by the process 'innovative solution' described in Section 6.

Characteristics that need to be listed in the 'European register of authorised types of vehicles' are identified in Section 4.8 of this TSI.

- G 2.1.1 The CR LOC & PAS TSI Chapter 4 sets out the main technical requirements for rolling stock and is dealt with in detail, where guidance is necessary, within the following parts of this guidance note.

4.1.2 Description of the rolling stock subject to the application of this TSI

- G 2.1.2 No GB guidance is associated with the above.

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Extract from CR LOC & PAS TSI

4.1.3 Main categorisation of the rolling stock for application of TSI requirements

A rolling stock technical categorisation system is used in the following clauses of this TSI to define relevant requirements applicable to a unit.

The technical category(ies) relevant for the unit subject to the application of this TSI shall be identified by the party asking for assessment. This categorisation shall be used by the notified body in charge of the assessment, in order to assess the applicable requirements from this TSI, and shall be stated in the certificate of "EC" verification.

The technical categories of rolling stock are the following:

- Unit designed to carry passengers
- Unit designed to carry passenger-related load (luggage, cars, etc.)
- Unit fitted with a driver's cab
- Unit fitted with traction equipment
- Electric unit, defined as a unit supplied with electric energy by an electrification system specified in the CR Energy TSI.
- Freight locomotive: Unit designed to haul freight wagons
- Passenger locomotive: Unit designed to haul passenger carriages
- Track construction and maintenance equipment (OTMs).

A unit can fall into one or several of the categories above.

- G 2.1.3 The term 'unit' as described in the CR LOC & PAS TSI is a method to describe the minimum formation of the rolling stock that can be assessed to enable placing into service. Typically this would be a locomotive, a single coach (that can be attached to other vehicles to form a train) or vehicles in a fixed formation usually with a driving cab at each end and a means of self-propulsion and that can only usually be reformed in a depot (these include formations known as a 'multiple unit').
- G 2.1.4 Both the High Speed Rolling Stock TSI and the CR LOC & PAS TSIs use km/h in a number of clauses to differentiate between requirements. Strict mathematical conversion of these figures to mph would lead to inappropriate requirements for the GB railway. For example 'speeds greater than 200 km/h' would include 125 mph which is not the intention. Table G 1 provides agreed values that should be used to convert from km/h to mph where the figures are used to differentiate requirements.

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INS, RST and ENE speed conversions	
km/h	mph
2	1
3	1
5	3
10	5
15	10
20	10
30	20
40	25
50	30
60	40
80	50
100	60
120	75
140	90
150	95
160	100
170	105
180	110
190	120
200	125
220	135
225	140
230	145
250	155
280	175
300	190
320	200
350	220
360	225

Table G 1 Speed conversions

4.2	Functional and technical specification of the subsystem
4.2.1	General
4.2.1.1	Breakdown
4.2.1.2	Open points
4.2.1.3	Safety aspect

G 2.1.5 No GB guidance is associated with the above.

4.2.2	Structure and mechanical parts
4.2.2.1	General

G 2.1.6 No GB guidance is associated with the above.

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Extract from CR LOC & PAS TSI

4.2.2.2 Mechanical interfaces

4.2.2.2.1 General and definitions

In order to form a train (as defined in 2.2) vehicles are coupled together in a way that enables them to be operated together. The coupling is the mechanical interface that enables this. There are several types of couplings:

- 'Inner' coupling (also called "intermediate" coupling) is the coupling device between vehicles in order to form a unit composed of several vehicles (e.g. a fixed rake of coaches or a trainset)
- End coupling ('external' coupling) of units is the coupling device used to couple together two (or several) units to form a train. The fitting of end coupling at the end of units is not mandatory. Where there is no coupling at any end of a unit, a device to allow a rescue coupling shall be provided at such end of the unit.

An end coupling can be 'automatic', 'semi-automatic' or 'manual'.

In the context of this TSI, a 'Manual' coupling is an end coupling system which requires (one or several) person(s) to stand between the units to be coupled or uncoupled for the mechanical coupling of these units.

- Rescue coupling is the coupling device that enables a unit to be rescued by a recovery power unit equipped with a 'standard' manual coupling as per clause 4.2.2.2.3 where the unit to be rescued is equipped with a different coupling system or is not equipped with any coupling system.

- G 2.1.7 The CR LOC & PAS TSI permits alternative arrangements for vehicle end coupling systems, automatic, semi-automatic, manual and no coupling. The flow chart in Figure G 1 summarises the requirements dependent upon the coupling type selected.

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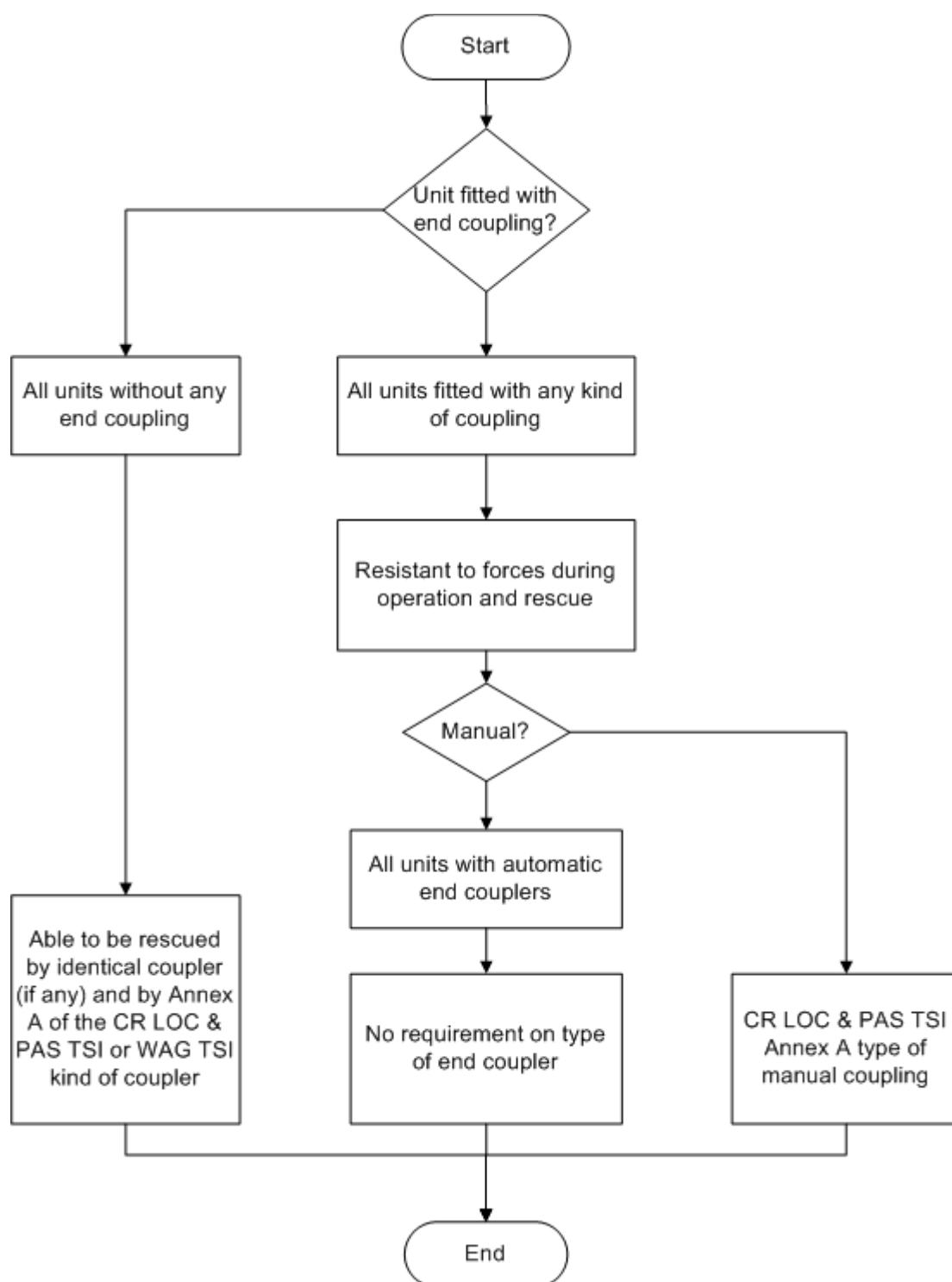


Figure G 1 Coupling system summary

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4.2.2.2.2 Inner coupling

4.2.2.2.3 End coupling

G 2.1.8 No GB guidance is associated with the above.

Extract from CR LOC & PAS TSI

4.2.2.2.4 Rescue coupling

At the ends of units not equipped with any end coupling feature, or equipped with a coupling system which is not compatible with the manual coupling system as per clause 4.2.2.2.3 of this TSI, provisions shall be made to enable the recovery of the line in case of breakdown by hauling or propelling the unit to be rescued.

G 2.1.9 The CR LOC & PAS TSI does not mandate the provision of a rescue coupler on each unit and therefore, the decision not to install a rescue coupler on-board should be made by the railway undertaking in conjunction with the infrastructure manager who, typically, has responsibility for clearing the line. In determining the provision of rescue couplers, account should be taken of the time and need to make it available.

G 2.1.10 The CR LOC & PAS TSI sets out high level requirements for the design of the rescue coupler, in addition the following points should also be considered:

- a) Allow for the range of movements when negotiation minimum radius plain and reverse curve, encountered on the GB mainline railway, without developing high suspension forces that could cause derailments. This particularly applies when using a 'swing-head' type coupler.
- b) Recognise the layout of all brackets, hoses and cables encountered on typical GB locomotives that are used for rescue purposes.
- c) Be able to withstand the loads encountered up to the determined maximum rescue speed, yet be capable of the safe lifting by personnel without injury. This limitation has the potential to lead to strength to weight conflicts. Alternatively sub-assembly arrangements of the rescue coupler could be adopted together with operational limitations on tractive effort to be applied during rescue, particularly to freight locomotives together with fatigue limits that should be stated for rescue coupler maintenance purposes.

Extract from CR LOC & PAS TSI

4.2.2.2.5 Staff access for coupling and uncoupling

To comply with this requirement, units fitted with manual coupling systems as per clause 4.2.2.2.3 shall comply with the following requirements (the 'Bern rectangle'):

- The required spaces shown in fig. A2 of Annex A shall be free of fixed parts. For this requirement the coupling gear components are in the central position laterally.

G 2.1.11 This requirement applies to all vehicles fitted with a manual coupling system and therefore the clearance requirements associated with the Berne rectangle applies. In GB, loco-hauled coaches have typically been fitted with a semi-automatic coupling system (and thus avoiding the need to meet the CR LOC & PAS TSI Berne rectangle provision.

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Extract from CR LOC & PAS TSI

4.2.2.3 Gangways

Where a gangway is provided as a means for passengers to circulate from one coach or one trainset to another, it shall not expose passengers to undue risk.

Where operation with the gangway not being connected is foreseen, it shall be possible to prevent access by passengers to the gangway.

- G 2.1.12 The key safety hazards or risks to be mitigated are finger traps and tripping hazards. A draft Euronorm prEN 16286 is under development and will be adopted in due course.
- G 2.1.13 The Persons with Reduced Mobility (PRM) TSI sets out the minimum clearway from the vehicle entrance through the vehicle. This should also apply for the minimum access size of gangways on passenger carrying rail vehicles where the passage of wheelchairs is envisaged.

Extract from CR LOC & PAS TSI

4.2.2.4 Strength of vehicle structure

The static and dynamic strength (fatigue) of vehicle bodies is relevant to ensure the safety required for the occupants and the structural integrity of the vehicles in train and in shunting operations.

- G 2.1.14 The value specified in CR LOC & PAS TSI clause 4.2.6.2.3 'head pressure pulse' should be used to simulate the effect of crossing trains. The resulting aerodynamic load should be considered in the design where relevant (for example carbody, doors and windows).
- G 2.1.15 Due to the closer track centre spacing used in GB, a specific case exists for an alternative GB head pressure pulse limit, see guidance on clause 4.2.6.2.3.

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Extract from CR LOC & PAS TSI

4.2.2.5 Passive safety

Except for units not intended to carry passengers or staff during operation and except for OTMs, this requirement is applicable to all units.

In addition, units which cannot operate up to the collision speeds specified under any of the collision scenarios below are exempted from the provisions related to that collision scenario.

Passive safety is aimed at complementing active safety when all other measures have failed.

For this purpose, the mechanical structure of vehicles shall provide protection of the occupants in the event of a collision by providing means of:

- limiting deceleration,
- maintaining survival space and structural integrity of the occupied areas,
- reducing the risk of overriding,
- reducing the risk of derailment,
- limiting the consequences of hitting a track obstruction.

To meet these functional requirements, units shall comply with the detailed requirements specified in the standard EN 15227:2008 related to crashworthiness design category C-I (as per table 1 of EN 15227:2008 Section 4), unless specified otherwise below.

The following four reference collision scenarios shall be considered:

- Scenario 1: A front end impact between two identical units,
- Scenario 2: A front end impact with a freight wagon,
- Scenario 3: An impact of the unit with a large road vehicle on a level crossing,
- Scenario 4: An impact of the unit into a low obstacle (e.g. car on a level crossing, animal, rock etc.).

These scenarios are described in table 2 of Section 5 of EN 15227:2008.

Within the scope of the present TSI, table 2 application rules are completed by the following:

- The application of requirements related to scenarios 1 and 2 to heavy haul locomotives used only for freight operations and fitted with centre couplers conforming to the Willison (e.g. SA3) or Janney (AAR standard) principle which are intended to operate on the CR TEN lines is an open point.
- The assessment of conformity of locomotives with central cabs with the requirements related to scenario 3 is an open point.

The present TSI specifies crashworthiness requirements applicable within its scope; therefore, Annex A of EN 15227:2008 shall not apply. The requirements of Section 6 of EN 15227:2008 shall be applied in relation to the above given reference collision scenarios.

To limit the consequences of hitting a track obstruction, the leading ends of locomotives, power heads, driving coaches and trainsets shall be equipped with an obstacle deflector. The requirements with which obstacle deflectors shall comply are defined in EN 15227:2008 §5 table 3 and Section 6.5.

- G 2.1.16 The CR LOC & PAS TSI uses the term passive safety; in GB this is more commonly known as the vehicle structural crashworthiness. GB standards, in particular GM/RT2100, deal with both vehicle structural crashworthiness and also interior passive safety. This aspect is addressed further in the CR LOC & PAS TSI in section 4.2.2.5.

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- G 2.1.17 The CR LOC & PAS TSI clause 4.2.2.5 contains a number of open points with respect to heavy haul freight locomotives with centre couplers and also locomotives with centre cabs. To fill these open points, GM/RT2100 is the NTR notified for this purpose.

Extract from CR LOC & PAS TSI

4.2.2.6 Lifting and jacking

Except for OTMs (mobile railway infrastructure construction and maintenance equipment), this clause applies to all units.

Provisions concerning the lifting and jacking of OTMs are specified in Annex C, clause C.2.

It shall be possible to safely lift or jack each vehicle composing the unit, for recovery purposes (following derailment or other accident or incident), and for maintenance purposes.

It shall also be possible to lift or jack any end of the vehicle (including its running gear) with the other end resting on the remaining running gear(s).

To this purpose, designated and marked lifting/jacking points shall be provided.

The geometry and location of the lifting points shall be compliant with Annex B.

Marking of lifting points shall be made by signs compliant with Annex B.

The structure shall resist to the loads specified in EN 12663-1:2010 (section 6.3.2 and 6.3.3).

In particular, proof of the capacity of the vehicle body to resist lasting deformations and fractures may be demonstrated by calculations or by testing, according to the conditions set up in clause 9.2.3.1 of EN 12663-1:2010.

- G 2.1.18 CR LOC & PAS TSI Annex B contains a number of open points with respect to the marking of lifting and jacking points. To fill these open points, GM/RT2100 is the NTR notified for this purpose. A draft Euronorm (prEN 16404) is being drafted to fill this Open Point and when available, should be considered.
- G 2.1.19 BS EN 12663-1:2010 sets out the strength requirements associated with lifting and jacking. GB experience has determined that it is appropriate to include a safety factor to address the local load conditions in the vicinity of the lifting point particularly when lifting vehicles in a derailment scenario. GM/RT2100 requires a safety factor of 2 to be applied.
- G 2.1.20 CR LOC & PAS TSI Annex B also contains an open point applicable to the location and geometry of the jacking point. To fill the open point, GM/RT2100 is the NTR notified for this purpose.

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Extract from CR LOC & PAS TSI

4.2.2.7 Fixing of devices to car body structure

To reduce the consequences of an accident, fixed devices including those inside the passenger areas, shall be attached to the car body structure in a way that prevents these fixed devices becoming loose and presenting a risk of passenger injuries or lead to a derailment. To this aim, attachments of these devices shall be designed according to section 6.5.2 of the EN 12663-1:2010 for categories defined in clause 4.2.2.4 above.

7.5.2.1 Additional requirements for security reason

The interior of vehicles interfacing with passengers and train crew should provide protection of the occupants in the event of a collision by providing means of:

- minimising the risk of injury due to secondary impact with such furniture and interior fixtures and fittings
- minimising those injuries that may preclude subsequent escape

Pending the revision of this TSI Member States may use national rules to cover such risks. In any case this shall not prevent the access of TSI compliant rolling stock operating across Member State borders onto their national network.

G 2.1.21 The issue of interior passive safety was introduced into the CR LOC & PAS TSI drafting process by GB and discussed in the ERA working party. European research has supported the GB view on the importance of interior passive safety.

G 2.1.22 In accordance with CR LOC & PAS TSI clause 7.5.2.1, GM/RT2100 is the NTR notified for this purpose.

4.2.2.8 Staff and freight access doors

G 2.1.23 No GB guidance is associated with the above.

Extract from CR LOC & PAS TSI

4.2.2.9 Mechanical characteristics of glass (other than windscreens)

Where glass is used in glazing (including mirrors), it shall be either laminated or toughened glass which is in accordance with a relevant national or international standard with regard to the quality and area of use, thereby minimising the risk to passenger and staff being injured by breaking glass.

G 2.1.24 This is a hidden open point in the CR LOC & PAS TSI. GM/RT2100 and, for on-track machines (OTMs) only GM/RT2400, are the NTRs notified for this purpose.

Extract from CR LOC & PAS TSI

4.2.2.10 Load conditions and weighted mass

For OTMs, different load conditions (minimum mass, maximum mass) may be used, in order to take into account optional onboard equipment.

G 2.1.25 BS EN 15663:2009 was developed for passenger carrying vehicles and therefore there are no mass definitions applicable to OTMs. Typically, the definition 'design mass in working order' should be used in GB to determine route availability (RA number) in accordance with GE/RT8006.

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Extract from CR LOC & PAS TSI

4.2.3 Track interaction and gauging

4.2.3.1 Gauging

The kinematic reference contour with its associated rules describes the outer dimensions of the unit; it shall be within one of the reference profiles GA, GB or GC (according to clause 4.2.2 of the CR INF TSI). The assumed sway (or flexibility) coefficient for the gauge calculation shall be justified by calculation or measurements as set out in EN 15273-2:2009.

For electric units, the pantograph gauge shall be verified by calculation according to clause A.3.12 of EN 15273-2:2009 to ensure that the pantograph envelope complies with the mechanical kinematic pantograph gauge which in itself is determined according to Annex E of CR ENE TSI, and depends on the choice made for the pantograph head geometry: the two permitted possibilities are defined in clause 4.2.8.2.9.2 of this TSI.

The voltage of the power supply is considered in the infrastructure gauge in order to ensure the proper insulation distances between the pantograph and fixed installations.

The pantograph sway as specified in clause 4.2.14 of CR Energy TSI and used for the mechanical kinematic gauge calculation shall be justified by calculations or measurements as set out in EN 15273-2:2009.

Specific case UK for Great Britain 7.3.2.3

Gauging (4.2.3.1)

("P") Units designed to operate on the GB network shall remain within the kinematic gauge defined in the clause CR INF TSI 7.6.12.2.

With respect to kinematic gauge, the assessment of compliance shall be in accordance with the methodologies set out in notified National Technical Rules.

For upgraded and renewed lines, pantographs of vehicles used in Great Britain shall remain within the gauge defined in notified national technical rules.

- G 2.1.26 Because of the need to exploit the maximum available gauge on the GB infrastructure, limited clearances are exploited. The more generous clearances provided by the method set out in BS EN 15273-3:2009 do not enable an economic solution and therefore, a GB specific case exists.
- G 2.1.27 The GB specific case references the NTRs to enable the use of alternative gauging methodologies (including absolute gauging and comparative gauging) not contained in BS EN 15273-3:2009. For the determination of the size of rolling stock and the method of determining compatibility with the mainline railway infrastructure, GM/RT2149 is the NTR notified for this purpose.

Guidance on the Conventional Rail Locomotives and Passenger Rolling Stock TSI

Extract from CR LOC & PAS TSI

4.2.3.2 Axle load and wheel load

4.2.3.2.1 Axle load parameter

The axle load is an interface between the unit and the infrastructure. The axle load is a performance parameter of the infrastructure specified in clause 4.2.2 of the CR INF TSI and depends on the Category of Line. It has to be considered in combination with the axle spacing, with the train length and with the maximum allowed speed for the unit on the considered line.

The following characteristics to be used as an interface to the infrastructure shall be part of the general documentation produced when the unit is assessed, and described in clause 4.2.12.2:

- The mass per axle (for each axle) for the 3 load conditions (as defined and required to be part of the documentation in clause 4.2.2.10).
- The position of the axles along the unit (axle spacing).
- The length of the unit.
- The maximum design speed (as required to be part of the documentation in clause 4.2.8.1.2).

Use of this information at operational level for compatibility check between rolling stock and infrastructure (outside the scope of this TSI):

The axle load of each individual axle of the unit to be used as interface parameter to the infrastructure has to be defined by the Railway Undertaking as required in clause 4.2.2.5 of the CR OPE TSI, considering the expected load for the intended service (not defined when the unit is assessed). The axle load in load condition 'design mass under exceptional payload' represents the maximum possible value of the axle load mentioned above.

- G 2.1.28 Rolling stock load conditions in the CR LOC & PAS TSI are used for many different purposes, related mainly to rolling stock design and its interface to infrastructure. For design purposes, load conditions as set out in BS EN 12663-1:2010 are referred to throughout the CR LOC & PAS TSI. The load conditions are, for example, used to define dimensioning criteria for structural strength of the carbody, passive safety, running gear, traction and braking performance.
- G 2.1.29 When it comes to the interface with infrastructure, the load carrying capacity of infrastructure gives the limiting value of the axle load that the rolling stock should respect. This load is required to be the maximum load the infrastructure will be subject to. In Annex E of Conventional Rail Infrastructure TSI (CR INF TSI) the limiting values used in the design of infrastructure is given as a combined parameter of speed / axle load with load models (axle spacing, unit length) as set out in BS EN 15528:2008.
- G 2.1.30 For GB, the method to demonstrate compatibility between rolling stock and the infrastructure, in particular when operating over underline bridges, is set out in GE/RT8006. The CR INF TSI contains a specific case to mandate the use of GE/RT8006 thus avoiding the need to re-assess all bridges in accordance with BS EN 15528:2008.

4.2.3.2.2 Wheel load

- G 2.1.31 No GB guidance is associated with the above.

Guidance on the Conventional Rail Locomotives and Passenger Rolling Stock TSI

Extract from CR LOC & PAS TSI

4.2.3.3 Rolling stock parameters which influence ground based systems

4.2.3.3.1 Rolling stock characteristics for the compatibility with train detection systems

The set of characteristics the rolling stock is compatible with shall be recorded in the rolling stock register as defined in clause 4.8 of this TSI.

G 2.1.32 The set of parameters in order to be compatible with train detection systems, such as track circuits, axle counters and loop systems, have been identified in the CR LOC & PAS TSI with references to the Control, Command and Signalling (CCS) TSI for each parameter and type of train detection system and their characteristics. The rolling stock / control command and signalling interface requirements relating to train detection have been removed from the CCS TSI and replaced by a separate document referenced as Index 77. Index 77 is also being incorporated into the revised CCS TSI.

G 2.1.33 The CR LOC & PAS TSI requirement is for a declaration where the rolling stock complies with the criteria set out in Index 77. It is only those criteria where compliance is demonstrated which are to be recorded in the European Register of Authorised Types of Vehicles (ERATV). Rolling stock is permitted to be non-compatible with the Index 77 train detection specification. However, there remains the requirement to demonstrate compatibility with all those train detection systems over which the vehicles will operate. Compliance with a NTR, if available, would be a means of demonstrating compatibility where it can also be demonstrated that the infrastructure is compatible with a reciprocal rule. GE/RT8270 sets out the process for demonstrating compatibility.

Extract from CR LOC & PAS TSI

4.2.3.3.1.1 ROLLING STOCK CHARACTERISTICS FOR COMPATIBILITY WITH TRAIN DETECTION SYSTEM BASED ON TRACK CIRCUITS

- Vehicle geometry
- Vehicle design
- Isolating emissions

G 2.1.34 Vehicle characteristics for compatibility with a train detection system based on track circuits on existing GB mainline railway are set out in the following standards:

- a) Vehicle geometric spacing of wheelsets covered by compliance with GK/RT0028.
- b) Vehicle design requirements for the electrical resistance of wheelsets covered by compliance with GM/RT2466.
- c) Isolating emission compatibility of sanding systems covered by compliance with GM/RT2461.

Guidance on the Conventional Rail Locomotives and Passenger Rolling Stock TSI

4.2.3.3.1.2 ROLLING STOCK CHARACTERISTICS FOR COMPATIBILITY WITH TRAIN DETECTION SYSTEM BASED ON AXLE COUNTERS (1)

- Vehicle geometry
- Wheel geometry
- Vehicle design
- EMC

- G 2.1.35 Vehicle characteristics for compatibility with a train detection system based on axle counters on existing GB mainline railway are set out in the following standards:
- a) Vehicle geometric spacing of wheelsets covered by compliance with GK/RT0028.
 - b) Wheel geometric requirements covered by compliance with GM/RT2466.
 - c) Vehicle design – wheel materials covered by compliance with GM/RT2466.
 - d) Vehicle design – metal free spaces around wheels – no GB requirements.
 - e) Electromagnetic compatibility (EMC) interference levels for eddy current or magnetic track brakes – no GB requirements.

4.2.3.3.1.3 ROLLING STOCK CHARACTERISTICS FOR COMPATIBILITY WITH TRAIN DETECTION SYSTEM BASED ON LOOP EQUIPMENT

- G 2.1.36 No GB guidance is associated with the above.

Extract from CR LOC & PAS TSI

4.2.3.3.2 Axle bearing condition monitoring

The range of working temperature of the axle bearing is an open point.

Note: See also clause 4.2.3.5.2.1 regarding axle boxes.

- G 2.1.37 A target zone has been specified in the CR LOC & PAS TSI corresponding to the area detailed in BS EN 15437-1:2009. GE/RT8014 is the NTR notified for this purpose.
- G 2.1.38 The alarm trigger levels of axle bearing condition monitoring are an open point because the levels are dependent on the type of bearing (working temperature) used and the way it is monitored by the trackside system. Typically in GB this is measured by the differential temperature across each axle. There is no mandatory requirement contained in GE/RT8014 relating to alarm trigger levels and this issue should be addressed through discussion with the infrastructure manager for routes falling within the scope of the CR LOC & PAS TSI over which vehicles are planned to operate.
- G 2.1.39 The range of the working temperatures of the axle bearing is an open point in the CR LOC & PAS TSI. It should be noted that CR LOC & PAS TSI clause 4.2.3.5.2.1 mandates that 'temperature limits reached in service shall be defined and recorded in the technical documentation'. With this information the infrastructure manager (providing the service of lineside detectors) can check the adequacy of the temperature alarm levels of lineside detectors for that particular rolling stock. The limit of the outside temperature of the axle box should be extrapolated from the axle bearing temperature working range. Such data should form part of any route compatibility assessment required by GE/RT8270.
- G 2.1.40 CR LOC & PAS TSI clause 4.2.3.5.2.1 also applies to units fitted with on-board detection equipment (information to be used for the definition of on-board alarm levels).

Guidance on the Conventional Rail Locomotives and Passenger Rolling Stock TSI

Extract from CR LOC & PAS TSI

4.2.3.4 Rolling stock dynamic behaviour

4.2.3.4.1 Safety against derailment running on twisted track

The unit (or vehicles composing the unit) shall be designed to ensure safe running on twisted track, taking into account specifically the transition phase between canted and level track and cross level deviations. The compliance with this requirement shall be verified by the procedure defined in clause 4.1 of EN 14363:2005.

For OTMs safety against derailment when running on track twists is permitted to be proved by an approved calculation method. If this is not possible, tests according to the requirements of EN 14363:2005 shall be carried out.

For running on track twists the testing conditions according to EN 14363:2005, clause 4.1 apply for machines with bogies as well as with individual wheel sets.

Specific case UK for Great Britain 7.3.2.5 (4.2.3.4)

Rolling stock dynamic behaviour

("P") The limitations to the use of Method 3 set out in EN 14363:2005 clause 4.1.3.4.1 are not applicable for rolling stock that is intended for national use on the UK mainline network only.

This specific case does not prevent the access to the national network to TSI compliant rolling stock.

- G 2.1.41 The limitation imposed on Method 3 in BS EN 14363:2005 clause 4.1.3.4.1 for the demonstration of derailment resistance when running on twisted track, is not applicable to GB. GB has extensive experience of applying Method 3 to a range of vehicle, bogie and wheelset configurations. This specific case is a relaxation of the limitations imposed by the CR LOC & PAS TSI and is therefore not a barrier to interoperability.
- G 2.1.42 There are three alternative methods described in BS EN 14363:2005 clause 4.1 for the demonstration of derailment resistance when running on twisted track and any one of the three provides evidence of compliance.

Extract from CR LOC & PAS TSI

4.2.3.4.2 Running dynamic behaviour 4.2.3.4.2 b) Requirements

In order to verify the running dynamic characteristics of a unit (running safety and track loading), the process sets out in EN 14363:2005 clause 5 and in addition for tilting trains in EN 15686:2010 shall be followed, with the amendments expressed below (in this clause and its sub clauses). The parameters described in clauses 4.2.3.4.2.1 and 4.2.3.4.2.2 shall be assessed using criteria defined in EN 14363:2005.

- G 2.1.43 The CR LOC & PAS TSI mandates that rolling stock is tested for its running dynamic behaviour according to the procedures set out in BS EN 14363:2005. Limit values for running safety include the transverse track shifting forces, quotient of the transverse and vertical forces of the wheel, the instability criterion and, in addition, the overturning criterion applicable to tilting trains (and other trains operating with higher than normal cant deficiency).
- G 2.1.44 The CR LOC & PAS TSI prescribes that the process set out in BS EN 14363:2005 clause 5 is followed in order to verify the running characteristics of rolling stock.

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- G 2.1.45 BS EN 14363:2005 requires different procedures for testing, these are:
- a) For new types of rolling stock, which have not yet been subject to testing, the requirement is to perform a complete on-track test.
 - b) For rolling stock of a similar type previously subject to testing as described in a), a partial test is permitted.
 - c) If the criteria set out in BS EN 14363:2005 are met, a dispensation from testing is permitted. In this case, CR LOC & PAS TSI open points regarding test track are not applicable; this applies in those member states where the 'initial acceptance' (as defined in BS EN 14363:2005) has been used.
- G 2.1.46 There are two methodologies for performing complete or partial on-track tests. These are the normal and simplified measuring methods and are as follows:
- a) The normal method requires measurement of track forces, using load measuring wheels.
 - b) The simplified method requires measurement of lateral axle box forces or measurement of accelerations only. The choice of the parameters to be measured depends on fulfilment of the criteria set out in BS EN 14363:2005.
- G 2.1.47 The test conditions set out in BS EN 14363:2005 Annex C deal with track geometry and track quality. The requirements for track geometry define the straight and curved track sections on which the rolling stock has to be tested, including required combinations of test speed and curve radii. It is recognised that it is difficult to meet all the requirements and conditions set out in BS EN 14363:2005 for the running dynamic testing of rolling stock, therefore:
- a) Open points are declared in the CR LOC & PAS TSI for the test conditions and the test track quality.
 - b) Amendments concerning the requirement to test on two different rail inclinations and some of the assessment criteria are introduced in the CR LOC & PAS TSI. The CR LOC & PAS TSI permits testing of rolling stock on only one rail inclination if the testing procedure includes partial tests with equivalent conicities as specified in the CR LOC & PAS TSI and the instability criterion is met.
 - c) The CR LOC & PAS TSI allows for the assessment criteria Y/Q to be evaluated by an alternative statistical method.
 - d) The Yqst criterion (quasi-static guiding force) has been defined differently in the CR LOC & PAS TSI, taking into account the mean curve radii.
- G 2.1.48 In order to fill the open points, GM/RT2141 is the NTR notified for this purpose. It should be noted that the open point applies specifically to the test conditions and the test track quality, but not the method of assessment of the gathered data. Traditionally, GB has specified within GM/RT2141, Appendix D 'representative' track that is towards the lower end of the range of track conditions experienced on the GB mainline railway which would typically include testing over sections of jointed track. A number of work streams are underway within Europe to resolve the issue of definitive requirements for track quality for on-track testing. This includes the EU funded DynoTrain research project and work in CEN Technical Committee 256 Working Group 10, Vehicle Track Interaction (CEN TC 256 WG10).

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- G 2.1.49 The analysis method of BS EN 14363:2005 is statistical and therefore requires a minimum number of track sections (lengths as set out in BS EN 14363:2005) for the statistics to be valid. BS EN 14363:2005 specifies four test zones:
- a) Zone 1 straight track (defined as cant deficiency < 40 mm).
 - b) Zone 2 large radius curves (maximum speed and maximum cant deficiency - no radius range specified).
 - c) Zone 3 small radius curves (radii from 400 m to 600 m).
 - d) Zone 4 very small radius curves (radii from 250 m to 400 m radius).
- G 2.1.50 The analysis is carried out separately in each zone and therefore a number of sections are required to be available for each zone.
- G 2.1.51 GB has not in the past required testing on small radius curves and the number of such curves on the mainline railway is low. Testing on zone 3 or zone 4 is therefore not needed for 'representative' track in GB.
- G 2.1.52 The speeds and cant deficiencies required are an open point and therefore the tolerance ranges given for zone 1 and zone 2 in BS EN 14363:2005 can be widened as long as the conditions continue to be 'representative'.
- G 2.1.53 Where rolling stock of a similar design exists that meets the requirements of GM/RT2141, the general interpretation is that the on-track element is permitted to be omitted due to the previous design having been tested over the GB representative track.
- G 2.1.54 The track loading limit values are the quasi-static guiding forces, the quasi-static vertical wheel force and the maximum vertical wheel force. These are the main actions on the track, which has to withstand these loads. The safety and track loading limit values are only evaluated when performing a full test with instrumented wheelsets. The running safety in the simplified method is assessed using accelerometers or displacement detectors.
- G 2.1.55 The methodology for gathering data of vehicle responses to running over a range of track conditions traditionally used in GB is different to that set out in BS EN 14363:2005. The GM/RT2141 methodology uses an alternative assessment the 'peak counting' approach (commonly known as the 'freight acceptance curve'). The approach used in BS EN 14363:2005 is a mean distribution assessment.

Extract from CR LOC & PAS TSI

4.2.3.4.2 Running dynamic behaviour (continued) 4.2.3.4.2 b) Requirements

In addition to the requirements concerning the test report given in clause 5.6 of EN 14363:2005, the test report shall include information on:

- The track quality on which the unit was tested on, recorded by the monitoring of a consistent set of some of the parameters set out in EN 13848-1:2003 / A1:2008, the selected set of parameters depending on available measurement means.

- G 2.1.56 This CR LOC & PAS TSI requirement specifies the format of the track quality data. The test report should include the data regarding the track geometric quality as described in BS EN 13848-1:2003+A1:2008 together with the method used to collect this data.

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G 2.1.57 Where it is necessary to perform an on-track test in order to verify the running characteristics of the rolling stock, the track quality the tests are performed on has to be recorded in the test report. This information is made available in the technical documentation. When a National Safety Authority (NSA) authorises the placing in service of the rolling stock, the NSA can request that the relevant infrastructure manager and railway undertaking consult the information in order to deduce if further checks are necessary or if the rolling stock is compatible with the conditions which can be expected to be experienced on the specific network.

G 2.1.58 The Network Rail track recording vehicles routinely measure and record various parameters for the majority of the GB mainline railway. This data should be suitable for inclusion in the test report. The relevant parameters (see BS EN 13848-1:2003+A1:2008) are suggested as:

- a) 1/8 mile (~200 m) standard deviations for 35 m top and alignment for lengths including the selected track sections.
- b) Any level 2 exceedences in the relevant sections (noting that track far outside the normal can be excluded from the analysis).

Note: BS EN 13848:2003+A1:2008 uses the wavelength range from 3 m to 25 m however the Network Rail data is from 3 m to 35 m. There is an approximate scale factor in BS EN 14363:2005 Annex C to adjust for this difference and it should be shown in the test report which range is reported.

G 2.1.59 It should not be necessary to make a special track recording run as long as data is available within a reasonable timescale of the tests (before or after) and no significant track maintenance has been carried out and no significant deterioration would be expected.

4.2.3.4.2.1	LIMIT VALUES FOR RUNNING SAFETY
4.2.3.4.2.2	TRACK LOADING LIMIT VALUES

G 2.1.60 No GB guidance is associated with the above.

4.2.3.4.3	Equivalent conicity
4.2.3.4.3.1	DESIGN VALUES FOR NEW WHEEL PROFILES

G 2.1.61 No GB guidance is associated with the above.

Extract from CR LOC & PAS TSI
4.2.3.4.3.2 IN-SERVICE VALUES OF WHEELSET EQUIVALENT CONICITY

The “in-service values of the track conicity” is an open point in the CR infrastructure TSI; therefore, the “in-service values of wheelset conicity” is an open point in this TSI.

This clause is excluded from the assessment made by a notified body.

When a unit is operated on a given line, the equivalent conicity in-service values shall be maintained considering the specified limits for the unit (see clause 4.2.3.4.3) and local conditions of the network.

G 2.1.62 The wheel rail interface is fundamental for the running safety of a rail vehicle. The dynamic behaviour, especially the stability and the wheel rail forces, are driven by the equivalent conicity which depends on wheel and rail profiles as well as on the track gauge, the distance between the flange datum points and the rail inclination.

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- G 2.1.63 Design values are specified for the interface equivalent conicity of both wheel profile and track parameters, but the behaviour of this interface changes during the wheelset lifetime due to wear of wheel and rail profiles. Therefore the interface has to be controlled by adequate maintenance measures on both infrastructure and rolling stock. Therefore for GB, GM/RT2466 is the NTR notified for this purpose. This technical rule contains wear limits for wheel profiles.
- G 2.1.64 The maintenance plan should set out the railway undertaking's or entities in charge of maintenance (ECM's) procedures for maintaining wheelsets and wheel profiles. The procedures should take account of the conicity ranges for which the vehicle is designed (see CR LOC & PAS TSI clause 4.2.3.4.3).
- G 2.1.65 Wheelsets should be maintained to ensure (directly or indirectly) that the wheelset conicity remains within the approved limits for the vehicle. This is demonstrated when the wheelset is modelled passing over the representative samples of track test conditions (simulated by calculation) specified in the CR LOC & PAS TSI Table 3 which are relevant considering local conditions of the network.
- G 2.1.66 Normal GB practice is to monitor wheelsets in service for flange height and thickness and use these measurements, together with wheelset mileage, to manage (indirectly) the equivalent conicity for a given combination of vehicle and route.
- G 2.1.67 If required then sample rail profile measurements can be requested from Network Rail in order that equivalent conicity calculations of in-service conditions can be made.
- G 2.1.68 In all cases, if ride instability is reported, the railway undertaking should model the measured wheel profiles and distances between active faces of the wheels over the representative sample of track test conditions. These are specified in the CR LOC & PAS TSI Table 2 and Table 3 which enables a check for compliance with the maximum equivalent conicity at which the vehicle is designed and certified to be stable.
- G 2.1.69 If the wheelsets comply with the maximum equivalent conicity at which the vehicle is designed and certified to be stable, the CR INF TSI requires the infrastructure manager to check the track for compliance with the requirements set out in the CR INF TSI.
- G 2.1.70 If both vehicle and track comply with the requirements of the CR LOC & PAS TSI and CR INF TSI, a joint investigation by the railway undertaking and the infrastructure manager should be undertaken to determine the reason for the instability.

4.2.3.5 Running gear

4.2.3.5.1 Structural design of bogie frame

- G 2.1.71 No GB guidance is associated with the above.

Extract from CR LOC & PAS TSI

4.2.3.5.2 Wheelsets

For the purpose of this TSI, wheelsets are defined to include main parts (axle and wheels) and accessories parts (axle bearings, axle boxes, gearboxes and brake discs). The wheelset shall be designed and manufactured with a consistent methodology using a set of load cases consistent with load conditions defined in clause 4.2.2.10 of this TSI.

4.2.3.5.2.1 MECHANICAL AND GEOMETRIC CHARACTERISTICS OF WHEELSETS

Mechanical behaviour of axles:

In addition to the requirement on the assembly above, the demonstration of compliance for mechanical resistance and fatigue characteristics of the axle shall be based on EN 13103:2009 clauses 4, 5 and 6 for non-powered axles, or EN 13104:2009 clauses 4, 5 and 6 for powered axles.

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- G 2.1.72 In GB, the application of GM/RT2466 mandates the application of a consistent suite of standards for the design, construction and maintenance of railway wheelsets. The CR LOC & PAS TSI mandates the application of a number of ENs, and therefore, all vehicles that fall within the scope of the CR LOC & PAS TSI are required to meet the requirements of the applicable ENs. There exists a set of CEN developed standards defining the running gear in a consistent way: BS EN 13260:2009+A1:2010 and BS EN 13261:2009+A1:2010 for wheelsets, BS EN 13262:2004+A1:2010 and BS EN 13715:2006 for wheels, BS EN 13103:2009+A1:2010 and BS EN 13104:2009+A1:2010 for axles, BS EN 12080:2007+A1:2010, BS EN 12081:2007+A1:2010 and BS EN 12082:2007+A1:2010 for axle bearings and axle boxes.
- G 2.1.73 The wheel has been identified as an interoperability constituent (IC). Compliance with the requirements set out in CR LOC & PAS TSI clause 5.3.2 is deemed to be met by compliance with the referred clauses of BS EN 13979-1:2003+A2:21011. The CR LOC & PAS TSI clause 6.1.2.1 sets out the applicable assessment modules to demonstrate conformity.
- G 2.1.74 The assessment of the IC wheel comprises of several potential stages:
- a) The first stage of the process is to perform a mechanical strength calculation and to evaluate against residual stress limit values.
 - b) The second stage, a bench test, is performed only when the residual stress determined by the mechanical strength calculation in stage one exceeds the residual stress limit values.
 - c) There is potentially a final third step to check the thermo-mechanical aspect, but under the condition that the wheel is intended to be used with tread brakes and wheel mounted brake discs.
 - d) The full scale fatigue testing is required for the validation of the wheel material. This is only mandated by the CR LOC & PAS TSI when major changes are introduced in the process at the manufacturer of the material for the wheel or the wheel manufacturer changes the supplier of the material.
- G 2.1.75 Only forged and rolled wheels are covered by the current published ENs. An open point exists regarding the criteria to be used for assessment of other types of wheels. GM/RT2466 is the NTR notified for this purpose.
- G 2.1.76 The CR LOC & PAS TSI mandates geometric dimensions for wheelsets. This provides a link to the CCS TSI to address two aspects. These are:
- a) Detect ability of the train by train detection systems.
- And
- b) Compatibility with axle bearing condition monitoring equipment.
- G 2.1.77 The CR LOC & PAS TSI and CCS TSI interface requirements relating to train detection have been removed from the CCS TSI and replaced by a separate reference document Index 77. Index 77 is being incorporated into the revised CCS TSI. Currently Index 77 is written as a specification of target system(s) for train detection system(s) (track circuits, axle counters, loop equipment, sanding). Not all characteristics identified are required to be met for the safe operation of rolling stock on a line equipped with a particular train detection system. Therefore the CR LOC & PAS TSI only mandates the recording of the rolling stock characteristics in the ERATV, it does not mandate compliance with the requirements of Index 77.