Railway Group Standard
GKRT0028
Issue: Three
Date: September 2016

Infrastructure Based Train Detection Interface Requirements

Synopsis

This document specifies the infrastructure based train detection system parameters that are necessary to support technical compatibility with GB legacy rail vehicles.

Published by RSSB

Infrastructure Based Train Detection Interface Requirements

Issue Record

Issue	Date	Comments
One	April 2010	Original document.
Two	December 2014	This document has been amended under project 12/034 to support industry in design of clearance points to be compliant with the CCS TSI and the harmonised parameters specified in ERA/ERTMS/033281 'Interfaces Between Control-Command and Signalling Trackside and Other Subsystems'.
Three	September 2016	This document has been amended under project 15/002 to ensure that the requirements are within the scope of NTRs and that the standard is correctly aligned with the CCS TSI.

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

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

Superseded Documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
GKRT0028 issue two Infrastructure Based Train Detection Interface Requirements	All	03/12/2016
GKGN0628 issue two Guidance on Infrastructure Based Train Detection Interface Requirements	All	03/12/2016

Supply

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

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Contents

List of Figures

Part 1 Purpose and Introduction

1.1 Purpose

1.1.1 This document sets out the interface requirements between rail vehicles and infrastructure based train detection systems, including the track section parameters needed for their compatibility.

1.2 Introduction

Application of Train Detection Systems

1.2.1 Train Detection Systems are provided where:

a) The safe operation of the signalling system is dependent on accurate and up-to-date information on the position and movement of trains.
b) Information on the position and movements of trains is required for the control of level crossings, staff warning systems or other systems associated with the safety of train operations.
c) It is necessary for the signaller or other operator to know the position of trains for the safe operation of the railway.

1.2.2 There are three standards that contain requirements relevant to infrastructure based train detection systems:

a) ERA/ERTMS/033281 (CCS TSI Index 77) which sets out the harmonised requirements related to compatibility of train detection systems with other subsystems.
b) This document, which sets out the National Technical Rules (NTRs) for the Great Britain (GB) mainline railway.
c) RIS-0728-CCS, which sets out further requirements and guidance including those for calculating the fouling point and clearance point.

Principles

1.2.3 This document sets out NTRs for the mainline railway in GB. Compliance with NTRs is required under the Railways Interoperability Regulations 2011 (as amended).

1.2.4 The NTRs in this document set out requirements to maintain compatibility between existing subsystems and/or vehicles that do not conform to the requirements in TSIs and new, upgraded or renewed subsystems and/or vehicles conforming to TSIs.

Structure of this document

1.2.5 This document sets out a series of requirements that are sequentially numbered.

1.2.6 This document also sets out the rationale for the requirement. The rationale explains why the requirement is needed and its purpose. Where relevant, guidance supporting the requirement is also set out in this document by a series of sequentially numbered clauses and is identified by the letter 'G'.

1.2.7 The national rules relating to relevant TSI parameters have been identified together with the relevant clause from the TSI.

Related requirements in other documents

1.2.8 The following Railway Group Standards contain requirements that are relevant to the scope of this document:

GMRT2173	Requirements for the Size of Vehicles and Position of Equipment
GMRT2466	Railway Wheelsets

Supporting documents

1.2.9 The requirements in RIS-0728-CCS support the requirements in this document.

1.3 Approval and Authorisation

1.3.1 The content of this document was approved by Control Command and Signalling (CCS) Standards Committee on 07 July 2016.

1.3.2 This document was authorised by RSSB on 26 July 2016.

Part 2 Track Section Critical Dimensions

2.1 Minimum length of a train detection section

Guidance

G 2.1.1 The minimum length of a train detection section 'L' in Figure *1 Track Circuit Dimensions* on page 14 is set out in CCS TSI index 77 section 3.1.2.1 (ERA/ERTMS/033281), which allows a maximum axle-to-axle distance of 20 m.

G 2.1.2 The minimum length of a train detection section needs to be compatible with the maximum distance between the axles at either end of a vehicle, so that a vehicle cannot physically straddle a train detection section.

G 2.1.3 The strategy adopted by the GB mainline railway is to provide train detection infrastructure that is compliant with the CCS TSI.

2.2 Maximum length of gaps in train detection

2.2.1 Where continuous train detection is required, any gap in the provision of effective detection of vehicle axles shall not exceed 2.6 m.

Rationale

G 2.2.2 This requirement is relevant to CCS TSI basic parameter 4.2.10 - Track-Side Train Detection systems.

G 2.2.3 Gaps longer than 2.6 m could result in the loss of detection of a complete vehicle with a short wheelbase. The minimum vehicle wheelbase is set out in GMRT2173.

Guidance

G 2.2.4 Gaps in the provision of train detection can arise because of the difficulties in providing some forms of train detection through certain types of track layout, for example, the inability to provide track circuiting through complex pointwork or at level crossings.

G 2.2.5 If the length of a gap in train detection exceeds 2.6 m, a vehicle with the minimum wheelbase can sit wholly within the gap, therefore becoming undetected.

Part 3 Track Section Dimensions for Track Circuit based Train Detection

3.1 Physical stagger between Insulated Rail Joints (IRJs)

3.1.1 The maximum stagger between a pair of Insulated Rail Joints (IRJs) shall not exceed 2.6 m.

Rationale

G 3.1.2 This requirement is relevant to control command and signalling technical specification for interoperability (CCS TSI) basic parameter 4.2.10 - Track-Side Train Detection systems.

G 3.1.3 The length of the maximum stagger between a pair of insulated rail joints ('S' in Figure *1 Track Circuit Dimensions* on page 14) is specified for compatibility with the minimum vehicle wheelbase of 2.6 m. If the stagger between a pair of IRJs is greater than 2.6 m, then the vehicle might not be detected by the track circuit based train detection system.

Guidance

G 3.1.4 If a stagger exceeds 2.6 m, a vehicle with the minimum wheelbase can sit wholly within the stagger, therefore becoming undetected.

G 3.1.5 The minimum vehicle wheelbase is set out in GMRT2173.

G 3.1.6 Where work is to be undertaken on a non-electrified line that has been identified for future electrification, taking account of *3.2 The maximum stagger of IRJs on electrified lines* on page 8 would reduce the likelihood of future compatibility issues.

3.2 The maximum stagger of IRJs on electrified lines

3.2.1 Where the insulated (track circuit) rails overlap at a track circuit termination or transposition in electric traction areas, the stagger shall not exceed 2.1 m.

Rationale

G 3.2.2 This requirement is relevant to CCS TSI basic parameter 4.2.10 - Track-Side Train Detection systems.

G 3.2.3 Maintaining continuous contact between the rail vehicle and the traction return infrastructure prevents:

a) A rail vehicle becoming electrically live.
b) Damage to the train detection infrastructure.

Guidance

G 3.2.4 Electric traction return bogies on legacy rail vehicles can have a wheelbase as short as 2.1 m.

G 3.2.5 Certain types of track circuits have IRJs in one rail, while the other rail is used for traction return purposes. In locations where the rails are transposed and there is a stagger between the transposition IRJs, the stagger should not exceed the minimum wheelbase of electric traction return bogies.

G 3.2.6 This is to prevent the axles of a traction return bogie from standing within a transposition joint, which would isolate the bogie from the traction return system, potentially introducing a large current into

the track circuit rail. This can cause damage to the track circuit, and re-enter the rail vehicle via a bogie which is not bonded to the traction return infrastructure, which could make the vehicle electrically live.

G 3.2.7 It may not be the case that all bogies on an electric multiple unit are bonded to the traction return circuit on the train.

3.3 The minimum distance between pairs of IRJs

3.3.1 For all staggered pairs of IRJs

3.3.1.1 The distance between the nearest joints of a staggered pair of IRJs and the next nearest IRJ shall not be less than 11 m.

Rationale

G 3.3.1.2 This requirement is relevant to CCS TSI basic parameter 4.2.10 - Track-Side Train Detection systems.

G 3.3.1.3 Where a track circuit transposition occurs, single axles are not detected as they pass through the transposition. Where two transpositions occur within the same track section, a vehicle would not be detected if all the axles of that vehicle were located within the transpositions.

G 3.3.1.4 Detection of a single axle can be lost at any transposition. Staggered joints are therefore positioned at least 11 m apart, to provide technical compatibility with the maximum axle spacing of non-bogied vehicles, as set out in GMRT2173.

Guidance

G 3.3.1.5 The distance between the nearest joint of a staggered pair of IRJs and the next nearest IRJ is denoted as 'D' in Figure *2 Loss of detection of a long wheelbase non-bogied vehicle* on page 14.

G 3.3.1.6 Where the stagger is less than 1.6 m, detection of a bogie will not be lost.

3.3.2 Where IRJ Stagger exceeds 1.6m

3.3.2.1 The distance between the nearest joints of two staggered pairs of IRJs, where the stagger of both pairs exceeds 1.6 m, shall not be less than the harmonised maximum axle spacing between adjacent axles of vehicles, as set out in section 3.1.2.1 of ERA/ERTMS/033281.

Rationale

G 3.3.2.2 This requirement is relevant to CCS TSI basic parameter 4.2.10 - Track-Side Train Detection systems.

G 3.3.2.3 Where a staggered pair of IRJs exceeds 1.6 m, a bogie of the minimum permissible wheelbase, as set out in GMRT2173, can sit wholly within the stagger, and would not be detected. Two such staggered pairs are therefore positioned at a distance greater than the maximum axle spacing for bogied vehicles.

Guidance

G 3.3.2.4 Figure *3 Loss of detection of a bogied vehicle* on page 14 shows the loss of detection of a bogied vehicle when 'D' is less than the maximum axle spacing of a bogied vehicle, where the stagger 'S' is greater than 1.6 m.

3.4 The minimum distance between a pair of IRJs and the boundary of a track section

3.4.1 For all staggered pairs of IRJs

3.4.1.1 A track circuit transposition joint shall not be positioned within 11 m of an IRJ that defines the boundary of a train detection section, unless the CCS system is configured to maintain the route locking for that train detection section until it is confirmed that the section is clear.

Rationale

G 3.4.1.2 This requirement is relevant to CCS TSI basic parameter 4.2.10 - Track-Side Train Detection systems.

G 3.4.1.3 Detection of a single axle can be lost at any track circuit transposition joint. A non-bogied vehicle would not be detected if one axle is in the transposition and the other end of the vehicle is in the adjacent train detection section.

G 3.4.1.4 Train detection is achieved if staggered pairs of joints are positioned to provide technical compatibility with the maximum axle spacing of non-bogied vehicles, as set out in GMRT2173.

G 3.4.1.5 At some locations it is not feasible to be technically compatible with the maximum axle spacing of non-bogied vehicles. In this instance alternative methods of controlling the hazard of loss of train detection can be applied.

Guidance

G 3.4.1.6 Alternative methods for controlling the hazard of loss of train detection include:

a) Train detection sequencing controls, for example maintaining track circuits occupied until the adjacent track circuit(s) have become occupied and cleared again.
b) Interlocking controls, for example, route locking.

G 3.4.1.7 The shortest distance between a staggered pair of IRJs and the boundary of a track section is denoted as 'E' in Figure *1 Track Circuit Dimensions* on page 14.

3.4.2 Where IRJ Stagger exceeds 1.6m

3.4.2.1 The distance between a track circuit transposition joint and an IRJ that defines the boundary of a train detection section shall not be less than the harmonised maximum spacing between adjacent axles of vehicles, as set out in section 3.1.2.1 of ERA/ERTMS/033281, unless the CCS system is configured to maintain the route locking for that train detection section until it is confirmed that the section is clear.

Rationale

G 3.4.2.2 This requirement is relevant to CCS TSI basic parameter 4.2.10 - Track-Side Train Detection systems.

G 3.4.2.3 Detection of a bogie can be lost at a track circuit transposition joint where the stagger exceeds the minimum bogie wheelbase set out in GMRT2173. A bogied vehicle would not be detected if one bogie is in the transposition and the other end of the vehicle is in the adjacent train detection section.

G 3.4.2.4 Train detection is achieved if staggered pairs of joints are positioned to provide technical compatibility with the maximum spacing of adjacent axles of bogied vehicles set out in ERA/ERTMS/033281.

G 3.4.2.5 At some locations it is not feasible to be technically compatible with the maximum spacing of adjacent axles of bogied vehicles. In this instance, alternative methods of controlling the hazard of loss of train detection can be applied.

Guidance

G 3.4.2.6 Alternative methods for controlling the hazard of loss of train detection include:

a) Train detection sequencing controls, for example maintaining track circuits occupied until the adjacent track circuit(s) have become occupied and cleared again.
b) Interlocking controls, for example, route locking.

G 3.4.2.7 The shortest distance between a staggered pair of IRJs and the boundary of a track section is denoted as 'E' in Figure *1 Track Circuit Dimensions* on page 14.

Part 4 Application of this Document

4.1 Scope

4.1.1 The requirements of this document apply to infrastructure based train detection systems.

4.1.2 The requirements of this document apply when the parameters for track section dimensions for infrastructure based train detection systems are affected.

4.1.3 Where the modification or upgrade of the infrastructure is not related to infrastructure based train detection systems and the nature of the modification or upgrade provides a reasonable opportunity to bring the infrastructure into conformity, then the requirements of this document applicable to the alteration apply.

4.1.4 Action to bring existing infrastructure based train detection into compliance with the requirements of this document is not required.

4.1.5 The requirements of this document apply when:

a) An infrastructure based train detection system is modified.
b) An infrastructure based train detection system is renewed as a whole.

4.1.6 All the requirements in this document apply to infrastructure managers.

4.2 Exclusions from scope

4.2.1 Systems of train detection based on transmission of information from the train to a remote location, for example as used in the European Rail Traffic Management System (ERTMS) Level 3.

4.2.2 The application of train detection solely for train describers.

4.3 General compliance date

4.3.1 The requirements in this document are to be complied with from 03 December 2016, except as specified in exceptions to general compliance date. Where the dates specified in exceptions to the general compliance date are later than the above date, this is to allow sufficient time to achieve compliance with the specified exceptions.

4.4 Deviations

4.4.1 Where it is considered not reasonably practicable to comply with the requirements of this document (including any requirement to comply with a TSI requirement referred to in the application of this document), permission to comply with a specified alternative should be sought in accordance with the deviation process set out in the Railway Group Standards Code.

4.4.2 In the case where TSI compliance is required for a new, renewed or upgraded vehicle or structural subsystem, the derogation process to be followed is set out in the Railways (Interoperability) Regulations 2011 (as amended).

4.5 Exceptions to general compliance date

4.5.1 There are no exceptions to the general compliance date specified in *4.3 General compliance date* on page 12.

4.5.2 If, at the time the requirements in this document are to be complied with, a project is at an advanced stage of development, having regard to the impact that a change in technical specification would have on the project, it is permissible to continue to meet the equivalent requirements in the Railway Group Standards applying before these requirements are to be complied with.

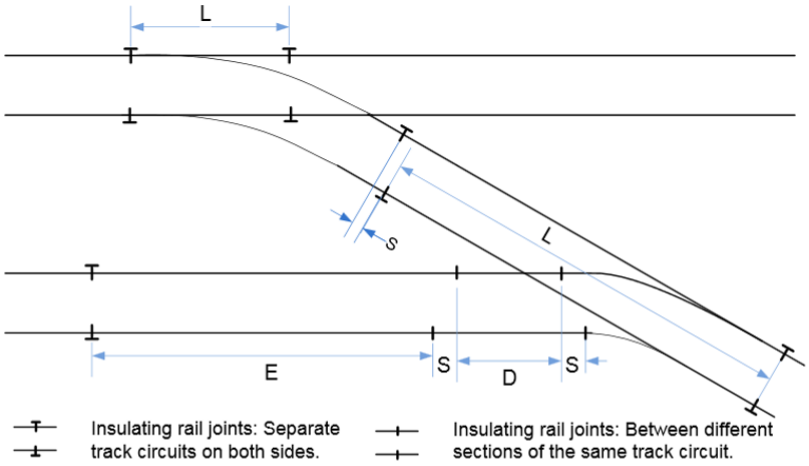
4.5.3 If the project requires an authorisation for placing into service, a decision to continue to meet the equivalent requirements in the Railway Group Standards applying before these requirements are to be complied with, this should be discussed with the Office of Rail and Road (ORR).

4.6 Health and safety responsibilities

4.6.1 Users of documents published by RSSB are reminded of the need to consider their own responsibilities to ensure health and safety at work and their own duties under health and safety legislation. RSSB does not warrant that compliance with all or any documents published by RSSB is sufficient in itself to ensure safe systems of work or operation or to satisfy such responsibilities or duties.

Appendix A Track Circuit Dimension Diagrams

Appendix A.1



Dimension	Description
D	Distance between the nearest joints of two staggered pairs of IRJs
E	Distance between a staggered pair of IRJs and the boundary of a track section
L	Effective length of a track circuit
S	Length of stagger between a pair of IRJs

Figure 1: Track Circuit Dimensions

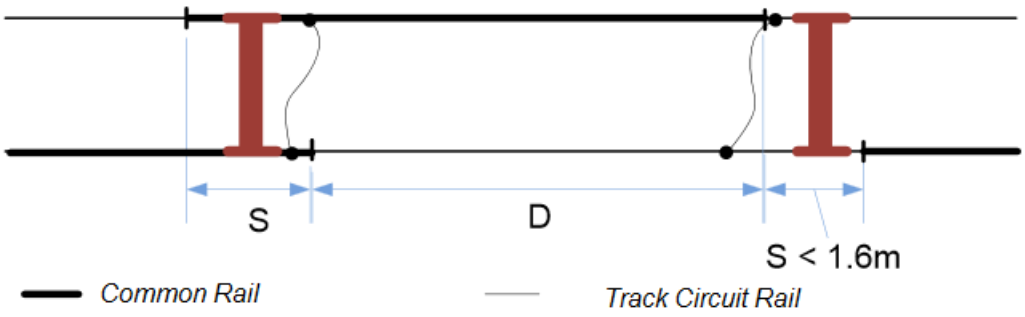


Figure 2: Loss of detection of a long wheelbase non-bogied vehicle

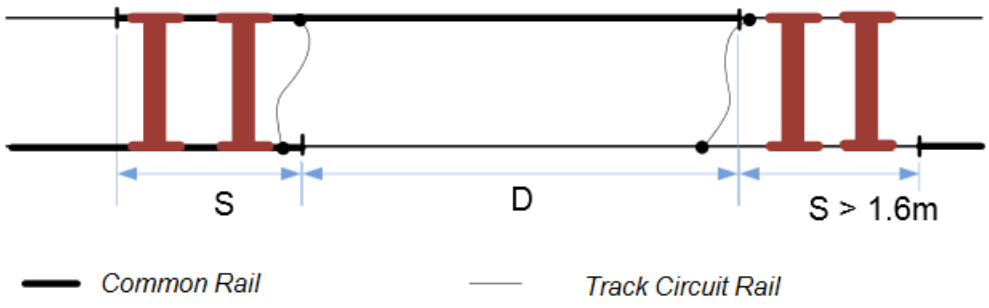


Figure 3: Loss of detection of a bogied vehicle

Definitions

Insulated Rail	The rail of a single rail track circuit that is fitted with IRJs to separate adjacent track circuits.
Insulated Rail Joint (IRJ)	Insulated rail joints (IRJs) join rails together mechanically but not electrically.
Single Rail (SR)	A track circuit arrangement where only one rail (the insulated rail) has IRJs to separate the track circuits. The other rail (the common rail) is electrically continuous for traction return purposes.
Stagger	The longitudinal distance between two Insulated Rail Joints that constitute a pair, measured along the track.
Track Circuit	A type of train detection system that detects the presence or absence of a rail vehicle within a defined section of track, by means of the electrical circuit created between the running rails by one or more wheelsets.
Track Section	A portion of railway track having fixed boundaries and for which the train detection system provides information on its state of occupancy, which can be made up of one or more train detection sections (for example, track circuit or axle counter sections).
Train Detection System	Equipment and systems forming part of, or providing input to, the signalling systems to detect, either: • The presence or absence of vehicles within the limits of a track section • That a train has reached, is passing, or has passed a specific position
Transposition Bond	A jumper cable provided where track circuit polarities and / or traction return rails change sides across a pair of IRJs, or transposition joints.
Transposition Joint	An insulated rail joint (IRJ), where transposition bonds are used to transpose the traction and / or track circuit rails.

References

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

RGSC 01	Railway Group Standards Code
RGSC 02	Standards Manual

Other References

CCS TSI	Control-Command and Signalling TSI, Decision No. 2012/88/EU amended by 2012/696/EU and 2015/14/EU (OJ L51, 23.2.2012, p1 amended by L311, 10.11.2012, p3 and L3, 7.1.2015, p44)
BS EN 50617-1	Railway applications — Technical parameters of train detection systems for the interoperability of the trans-European railway system. Part 1: Track circuits
ERA/ERTMS/033281	Interfaces between CCS track-side and other subsystems
GMRT2173	Requirements for the Size of Vehicles and Position of Equipment
GMRT2466	Railway Wheelsets
RIS-0728-CCS	Infrastructure Based Train Detection Systems.