Train Detection

Synopsis
This document sets out the requirements to ensure that train detection systems provide the signalling system with adequate information regarding the position and movement of trains to permit safe control of the railway.

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Part A

Issue Record

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

Revisions in the reissued document will be marked by a vertical black line in the right hand margin adjacent to the revision.

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<tr>
<td>One</td>
<td>April 1996</td>
<td>New standard. Supersedes SSP36 and STADG14 which are cancelled.</td>
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<tr>
<td>Two</td>
<td>February 1999</td>
<td>Revised version to correct error in fouling point dimensions.</td>
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<tr>
<td>Three</td>
<td>August 2000</td>
<td>Restructuring of previous version to clarify high level requirements for Train Detection and to facilitate the transfer to Railtrack Line of associated Railway Group Standards and Codes of Practice contained in the Train Detection Handbook. Guidance material removed and transferred to GK/GN0611. Due to the restructuring of the document it was deemed inappropriate for this issue to identify revisions by a vertical black line in the adjacent margin.</td>
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Responsibilities

Railway Group Standards are mandatory on all members of the Railway Group * and apply to all relevant activities that fall into the scope of each individual’s Railway Safety Case. If any of those activities are performed by a contractor, the contractor’s obligation in respect of Railway Group Standards is determined by the terms of the contract between the respective parties. Where a contractor is a duty holder of a Railway Safety Case then Railway Group Standards apply directly to the activities described in the Safety Case.

* The Railway Group comprises Railtrack and the duty holders of the Railway Safety Cases accepted by Railtrack.

Compliance

The provisions of this document relating to signalling design are mandatory for all schemes involving provision of or alteration to train detection equipment for which the Signalling Scheme Plan is first approved, or altered and subsequently re-approved, on or after 7 October 2000.

All other provisions of this document are to be complied with from 2 December 2000.

Health and Safety Responsibilities

In issuing this document, Railtrack PLC makes no warranties, express or implied, that compliance with all or any documents published by the Safety & Standards Directorate is sufficient on its own to ensure safe systems of work or operation. Each user is reminded of its own responsibilities to ensure health and safety at work and its individual duties under health and safety legislation.

Supply

Controlled and uncontrolled copies of this document may be obtained from the Industry Safety Liaison Dept, Safety and Standards Directorate, Railtrack PLC, Railtrack House, DP01, Euston Square, London, NW1 2EE.
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Part B

1 Purpose

The purpose of this document is to set out requirements to ensure that the signalling system receives reliable, accurate, sufficient and up-to-date information regarding the position and movement of trains necessary for the safe control of the railway. The standard also addresses the requirements for the display of this information for the use of signallers and other operators.

2 Scope

The overall scope of Railway Group Standards is as specified in Appendix A of GA/RT6001.

This document contains requirements which are applicable to the duty holder of the following category of Railway Safety Case:

- Infrastructure Controller

Specifically the contents of this document apply to all infrastructure-based train detection systems. It also includes systems primarily based on fixed track equipment at the point of detection but which additionally require all trains, or certain types of train, to be fitted with train-borne equipment.

The standard excludes:

- systems of train detection based on transmission of information from the train to a remote location (e.g., as used in European Rail Traffic Management System (ERTMS) Level 3);
- train describers.

3 Definitions

Clearance Point

The minimum distance from points and crossings at which track section boundaries must be positioned, to prove that a vehicle on one track is in a position clear of a movement on the other.

Fouling Point

The position on a converging, diverging or crossing line beyond which the encroachment of any part of a vehicle would infringe the required passing clearance for a vehicle on the other line. Requirements for passing clearances are set out in GE/RT8029.

Track Interval

The distance between the running edges of the nearest rails of adjacent tracks (see GE/RT8029).

Track Section

A portion of railway track having fixed boundaries and for which the train detection system provides information on its state of occupancy.

Train Detection System

Equipment and systems forming part of or providing input to the signalling systems to detect:

- the presence or absence of vehicles within the limits of a track section; or
- that a train has reached, is passing or has passed a specific position.

Vehicle Overhang

The distance measured parallel to the rail from the centre of the outermost wheel on a vehicle to the nearest extreme end of the vehicle.
4 General Requirements of Train Detection Systems

4.1 Provision of Train Detection Systems
Train detection systems shall be provided in accordance with the requirements of this document where:

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

4.2 Operational Compatibility between Train Detection Systems and Vehicles

4.2.1 Train detection systems shall be selected, installed and maintained so as to ensure that they will correctly detect all vehicles authorised to operate over them, except as permitted by clauses 4.2.3 to 4.2.5 below.

4.2.2 Authority to operate over a route, in accordance with the provisions of Railway Group Standard GO/RT3270, shall be given only for those vehicles which are capable of reliably actuating the train detection systems on the route, except as permitted by clauses 4.2.3 to 4.2.5 below.

4.2.3 It is permissible for the Infrastructure Controller to authorise the operation of vehicles which are not inherently capable of reliably actuating the train detection systems on a route, but which are fitted with train-borne equipment to ensure reliable operation of train detection (eg, track circuit actuators). In such cases, the Infrastructure Controller shall:

- ensure that access is restricted to rolling stock which is fitted with the appropriate equipment;
- be satisfied that the train operator has adequate arrangements to maintain the equipment in working order;
- be satisfied that the train operator has adequate arrangements in place to ensure that in-service failures of the train-borne equipment are promptly detected.

4.2.4 It is also permissible for the Infrastructure Controller to authorise the operation of vehicles which are not capable of reliably actuating the train detection systems on the route in the following circumstances:

- vehicles requiring to use the route for transfer between other routes where they are permitted to operate or for access to/from a depot: such movements shall be on an occasional basis only and each movement shall be individually authorised by the Infrastructure Controller;
- self-propelled on-track machines which cannot be relied upon to actuate train detection systems, operated in accordance with the operating procedures for such machines;
- on-track machines which cannot be relied upon to actuate train detection systems, coupled within a train to other vehicles which are capable of reliably actuating the train detection systems, such that the train as a whole will be reliably detected;
- vehicles being used within a possession for engineering purposes;
- vehicles under test prior to engineering acceptance.
When vehicles which are not capable of reliably actuating the train detection systems are to be operated on a route in the circumstances described above, the Infrastructure Controller shall ensure that suitable operating procedures are applied to safeguard the movement of such vehicles.

4.2.5 Under abnormal conditions (e.g., poor railhead conditions), it is not always possible to guarantee reliable detection of vehicles which are, under normal conditions, permitted to operate on the route. The Infrastructure Controller shall ensure that suitable operating procedures are applied to safeguard the movement of any vehicles which are permitted to operate in such conditions.

4.3 Integrity and Reliability of Train Detection Systems

4.3.1 The reliability with which train detection systems detect and indicate the presence, absence or passage of trains shall be consistent with the overall safety performance targets for the signalling system of which they form part, taking account of:

- the purposes for which the train detection information is required to be used and the possible consequences of an error in that information;
- any additional features within the signalling system which provide safeguards in the event of incorrect operation of the train detection equipment;
- any train-borne equipment provided to achieve (or assist in the achievement of) reliable actuation of the train detection systems (e.g., track circuit actuators).

4.3.2 Train detection systems shall be designed, applied and maintained in a manner which minimises the risk to trains, the public and railway staff, from failure of:

- the train detection system;
- the means of communication of train detection information to the interlocking equipment or other systems;
- associated power supplies.

4.3.3 When any significant change in the volume, speed or type of rail traffic is proposed, or there is a change in any other factor that could affect the safe operation of train detection systems, the Infrastructure Controller shall review the train detection arrangements to ensure that the integrity of the application is maintained.

4.4 Suitability of Train Detection Systems

4.4.1 The means of train detection, and the method of communication of train detection information to the interlocking equipment or other systems, shall be suitable for the purposes for which the train detection information is required to be used. In selecting a suitable system, the following factors shall be considered:

- the requirements of the signalling system and/or the signaller for train detection information;
- the length of track sections over which detection is required;
- the level of accuracy and detail of train position information required for the safe operation of the railway;
- permanent way layouts and associated critical dimensions (see Appendix A);
- requirements for the control of level crossings and train activated warning systems;
- the need for any directional and/or speed information.

4.4.2 The train detection system shall be compatible with the traction and rolling stock authorised to operate over the line. This shall include:
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• compatibility with vehicle parameters required to ensure correct operation of the train detection equipment, including vehicle wheelbase, bogie length, wheel profile, wheel/rail contact and vehicle overhang;
• electromagnetic compatibility.

4.4.3
The train detection system shall be suitable for the conditions in which it is to be installed and operated. Consideration shall be given to the following, insofar as they are relevant to safety:

• environmental conditions;
• compatibility with electrification systems (where present);
• compatibility with other infrastructure systems;
• compatibility with infrastructure maintenance and renewal processes.

4.4.4
In determining the type of system to be used, any secondary safety benefits and/or disbenefits shall also be considered.

4.5 Outputs from Train Detection Systems
4.5.1
Outputs from the train detection system shall be presented as defined states (eg, track section occupied or clear; vehicle present or no vehicle present at a specific location).

4.5.2
Transitions between these defined states shall not give rise to unsafe conditions. The train detection system and/or the associated signalling systems shall be designed so as to ensure that no permanent or transient unsafe effects or misleading indications can result from any change of state in response to the presence or movement of a train.

5 Additional Requirements for Train Detection Systems Used to Prove that a Track Section is Clear of Trains

5.1 Output States
Where a train detection system is provided for the purpose of proving that a section of track is clear of rail vehicles, the state of each track section shall be presented as clear or occupied. An occupied output state shall be given by the train detection system whenever all or part of the track section is detected as being occupied by a vehicle.

5.2 Continuity of Train Detection
Where the safe operation of the signalling system is dependent upon continuity of train detection, there shall be no loss of detection at boundaries between track sections. Where a track section is divided into portions (eg, track circuits through switches and crossings), there shall be no loss of detection of vehicles passing between different portions of the track section. (See Appendix A.)

5.3 Detection of Intentionally Derailed Vehicles
Where a track section contains trap points or other means provided intentionally to derail unauthorised movements, the train detection system shall ensure that the track section is maintained in an occupied state following derailment of a vehicle until it has been established that the line is clear.

5.4 Minimum Length of Track Sections
The train detection system shall be designed such that no track section can be detected as clear while straddled by any vehicle authorised to use the line. Where the train detection system does not inherently provide this feature, this
requirement shall generally be achieved by ensuring that track sections exceed a specified minimum length. (See Appendix A.)

5.5 Passing Clearances
Train detection systems for proving the track clear shall be applied so as to ensure that acceptable passing clearances as specified in GE/RT8029 are maintained at all points and crossings and converging tracks, taking account of any line curvature and the maximum vehicle overhang of permitted vehicles.

Where a track section contains points and/or crossings, train detection provision shall at minimum extend to all applicable clearance points. (See Appendix A.) It is permissible for train detection controls within the interlocking to be conditional upon the position of points provided there is no risk of a vehicle standing foul and remaining undetected.

6  Indications to Signallers and other Operators

6.1 Provision of Indications to Signallers
Where the railway is divided into fixed track sections for the purpose of train detection, the state of each track section or group of sections shall be indicated to the signaller as either clear or occupied.

Train detection equipment provided solely for the control of local independent systems (such as level crossings, train activated warning systems and ground frames) need not be indicated to the signaller provided that:

• the train detection equipment is not used to control the operation of points and signals which are operated by the signaller, and
• there is a suitable means for any failure to be notified to the signaller or user.

6.2 Provision of Indications for other Operators
Other operators (eg, level crossing keepers) shall be provided with train detection indications to the extent necessary for them to perform their duties safely.

6.3 Clarity and Accuracy of Indications
The indication system shall be designed and maintained so as to minimise the risk of misinterpretation of the indications of the train detection system by the signaller or other operator.

The train detection information provided shall be of sufficient accuracy and detail, and updated sufficiently frequently, that the signaller or other operator can safely control the movement of trains, including, so far as is reasonably practicable, during periods of failure.
Appendix A

Track Section Critical Dimensions

This appendix defines requirements relating to the critical dimensions of track sections. The dimensions shown are related to corresponding rail vehicle parameters (vehicle overhang and axle spacings) as stated below. Where vehicles which do not conform to these parameters are authorised to operate, the track section dimensions specified in this appendix may not be applicable and the Infrastructure Controller shall determine appropriate revised dimensions to be used.

A.1 Passing Clearance

In order to meet the requirements of section 5.5, the limits of track sections which are required to prove clearance shall be determined in accordance with sections A.2 and A.3.

A.2 Fouling Points

The fouling point shall be determined as follows:

a. on lines where the nominal track interval is 1970mm between running edges, the fouling point in a converging, diverging or crossing line is located where the distance between adjacent tracks is 1970mm measured between the running edges of the rails at right angles to the line from which clearance is being determined;

b. on lines which become parallel with a separation of less than 1970mm between running edges, the fouling point is located where the lines first become parallel and meet the clearance requirements applicable to that line (as permitted by GE/RT8029);

c. on lines where the nominal track interval is greater than 1970mm, the fouling point shall be defined so as to provide normal passing clearances as specified in GE/RT8029 between two vehicles of the maximum width authorised to operate on the route.

A.3 Clearance Points

The track section clearance point shall generally be not less than 4880mm further from the crossing nose or point of convergence than the fouling point.

A track section clearance point is permitted to be less than 4880mm from the fouling point where it can be demonstrated that the clearance requirements of GE/RT8029 can still be met for all trains authorised to operate on the route.

The 4880mm dimension which is used to determine the position of the clearance point is based on a maximum vehicle overhang from the wheel centre of the first/last axle on a vehicle to the end of the vehicle of 3226mm. Where vehicles with a greater overhang are permitted to operate, it shall be demonstrated that the clearance requirements of GE/RT8029 are met for all trains authorised to operate on the route.

A.4 Minimum Length of Track Sections

In order to meet the requirements of section 5.4, it is necessary to ensure that no track section can be detected as clear while straddled by a vehicle. Where detection of a track section as occupied depends on detection of a vehicle within the track section (eg, track circuits) the minimum length of track section shall be 18.3m, in order to prevent a vehicle bridging a short track section and consequently providing a false clear condition.

Care shall be taken to ensure that this requirement is met for all paths through each track section.
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If the minimum length cannot be achieved, the Infrastructure Controller shall either:

• ensure that alternative safeguards are provided to prevent the track section showing clear when a vehicle is standing over it; or
• demonstrate by risk assessment that the risk arising from loss of detection of a vehicle is negligible.

The dimension quoted above assumes a maximum spacing between adjacent axles of 17.51m.

A.5 Maximum Length of Gaps in Continuous Train Detection

In order to meet the requirements of section 5.2, it is necessary to ensure that, where continuity of train detection is required, there is no loss of detection of vehicles within a track section or at boundaries between track sections.

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

The dimension quoted above assumes a minimum vehicle wheelbase of 2.6m.

A.6 Insulated Rail Joints in Track Circuits

Where practicable, insulated rail joints (IRJs) at the termination of track circuits, or at a transposition within a track circuit, shall be positioned in each rail so that they are opposite to each other.

Where a physical stagger between a pair of IRJs is unavoidable the maximum stagger shall not exceed 2.6m, in order to comply with the requirements of section A.5.

Where the insulated rails overlap at a track circuit termination or transposition in electric traction areas, the stagger shall be limited to a distance which ensures that motor bogies do not become isolated from the traction return path.

In order to prevent false clearance of a track section when a long wheelbase non-bogie vehicle is passing into or out of the section, a track circuit transposition joint shall not be positioned within 11m of an insulated rail joint (IRJ) which defines the boundary of a track section, unless occupation of the adjacent track section will maintain any required locking.

Where the stagger of the transposition joints exceeds 1.6m, in order to prevent false clearance of the track section when a bogie vehicle is passing into or out of the section, the distance between the nearest joint of the staggered pair and the IRJ which defines the boundary of the track section shall not be less than 18.3m, unless occupation of the adjacent track section will maintain any required locking.

In order to avoid loss of detection of a long wheelbase non-bogie vehicle, the distance between the nearest joint of a staggered pair of IRJs and the next nearest IRJ shall not be less than 11m.

In order to avoid loss of detection of a bogie vehicle, the distance between the nearest joints of two staggered pairs of IRJs, where the stagger of both pairs exceeds 1.6m, shall not be less than 18.3m.

If the stipulated minimum distances cannot be achieved the Infrastructure Controller shall either:

• ensure that special controls are provided within the signalling system to prevent the track section showing clear when a vehicle is standing over it; or
• demonstrate by risk assessment that the risk arising from loss of detection of a vehicle is negligible.
The dimensions quoted above assume a minimum vehicle wheelbase of 2.6m, a minimum bogie wheelbase of 1.6m, a maximum spacing between adjacent axles of 17.51m, and a maximum axle spacing for non-bogie vehicles of 11m.

**A.7 Identification and Recording of Critical Dimensions**

Where the positioning of a clearance point or other track section boundary is critical, such positions shall be clearly identified. This includes all cases where:

- clearance point is less than 4880mm from the fouling point; or
- the passing clearance measured at the fouling point is less than the normal passing clearance specified in GE/RT8029.

The Infrastructure Controller shall ensure that a suitable means is implemented to record the position of the track section boundary and to ensure that any subsequent track alterations do not infringe the required clearance or otherwise result in an unsafe condition.
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