Pipelines, Buried Services and Undertrack Crossings

Synopsis
This document sets out the safety requirements for pipelines, buried services and undertrack crossings.

Submitted by
Anne E Blakeney
Standards Project Manager

Authorised by
Brian Alston
Controller, Railway Group Standards
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Part A

A1 Issue record

<table>
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<th>Date</th>
<th>Comments</th>
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<tr>
<td>One</td>
<td>June 2002</td>
<td>Original Document</td>
</tr>
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</table>

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

A2 Implementation of this document

The publication date of this document is 1 June 2002.

This document comes into force on 3 August 2002.

The dates by which compliance with the requirements of this document is to be achieved are set out in Part B2. Where those dates are later than the date on which this document comes into force, this is to give Railway Group members additional time to plan and commence implementation so as to achieve full compliance by the dates set out in Part B2.

This document supersedes the following Railway Group Standards, either in whole or in part as indicated:

<table>
<thead>
<tr>
<th>Railway Group Standard</th>
<th>Issue No.</th>
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<th>Date(s) as of which sections are superseded</th>
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<td>GM/RT1103</td>
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<td>Mechanical Protection and Marking of Buried Services</td>
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<td>3 August 2002</td>
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<tr>
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<td>1</td>
<td>Undertrack Crossings and Pressure Pipelines</td>
<td>All</td>
<td>3 August 2002</td>
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<tr>
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<td>1</td>
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<td>B4.3 B4.4 B4.5 *</td>
<td>3 August 2002</td>
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* Note: all other sections of GM/RT1101 are superseded by GI/RT7007.

All 3 documents, GM/RT1103, GM/RT1101 and GC/RT5171, are withdrawn with effect from 3 August 2002.

A3 Scope of Railway Group Standards

The overall scope of Railway Group Standards is set out in Appendix A of GA/RT6001. The specific scope of this document is set out in Part B2.

A4 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.
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* The Railway Group comprises Railtrack PLC, Railway Safety, and the train and station operators who hold railway safety cases for operation on or related to infrastructure controlled by Railtrack PLC.

Railtrack PLC is known as Railtrack.

A5 Health and safety responsibilities

In issuing this document, Railway Safety makes no warranties, express or implied, that compliance with all or any documents published by Railway Safety 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.

A6 Technical content

The technical content of this document has been approved by:

Haydn Peers, Principal Plant Engineer, Railway Safety
Jon Taylor, Principal Track & Structures Engineer, Railway Safety

Enquiries should be directed to Railway Safety – Tel: 020 7904 7518

A7 Supply

Controlled and uncontrolled copies of this document may be obtained from the Industry Safety Liaison Dept, Railway Safety, Evergreen House, 160 Euston Road, London NW1 2DX.
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Pipelines, Buried Services and Undertrack Crossings

Part B

B1 Purpose

This document sets out the requirements for buried services, undertrack crossings and pipelines (whether over, under or alongside the track) to the extent that they affect safe train operations and/or the movement and control of people to and from the trains.

B2 Application of this document

B2.1 To whom the requirements apply

This document contains requirements that are applicable to the duty holders of the following categories of Railway Safety Case:

a) infrastructure controller

b) station operator.

Under the Railways (Safety Case) Regulations 2000, the duty holder at a station (as defined in those Regulations) is responsible for ensuring that the requirements of Railway Group Standards are complied with. At a station, contractual arrangements (including a lease) do not of themselves relieve the duty holder of his obligations under those Regulations.

B2.2 Compliance requirements

B2.2.1 Infrastructure

The requirements of this document are mandatory for new Railtrack controlled infrastructure and for alterations to existing Railtrack controlled infrastructure for which Approval in Principle is given on or after 3 August 2002.

When Approval in Principle is given before 3 August 2002, but the infrastructure has not yet been brought into service, the design shall be reviewed and, where reasonably practicable, brought into line with the requirements of this document.

All sections of this document are applicable to the infrastructure controller.

Except as indicated below action to bring existing pipelines, buried services and undertrack crossings into compliance is not required.

Where it is known, or becomes known, that existing buried services, undertrack crossings or pipelines do not comply with the requirements of this document or part of document, action to bring them into compliance is required as follows:

a) when a buried service, undertrack crossing, or pipeline is modified

b) when any major component of a buried service, undertrack crossing, or pipeline is replaced.

Compliance with section B6.4.1 is required for both new and existing pipelines located above ground. Where inspection and maintenance plans are not in existence the infrastructure controller shall prepare a programme no later than 2 August 2003 to create the required inspection and maintenance plans. This programme shall be sequenced to reflect the risk presented by the pipelines. The required inspection and maintenance plans for all existing pipelines located above ground shall be in place no later than 5 August 2006.

B2.2.2 Stations

The requirements of this document are mandatory for new stations and for alterations to existing stations for which Approval in Principle is given on or after 3 August 2002.
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When Approval in Principle is given before 3 August 2002, but the infrastructure has not yet been brought into service, the design shall be reviewed and, where reasonably practicable, brought into line with the requirements of this document.

Except for sections B4.2.1, B4.2.2, B4.3.2, B4.3.4, B6.3.1, B6.3.2 and B6.3.3 each section of this document is applicable to the station operator.

Except as indicated below, action to bring existing pipelines, buried services and undertrack crossings into compliance is not required.

Where it is known, or becomes known, that existing buried services or pipelines do not comply with the requirements of this document or part of document, action to bring them into compliance is required as follows:

a) when a buried service, or pipeline is modified
b) when any major component of a buried service, or pipeline is replaced.

Compliance with section B6.4.1 is required for both new and existing pipelines. Where inspection and maintenance plans are not in existence the station operator shall prepare a programme no later than 2 August 2003 to create the required inspection and maintenance plans. This programme shall be sequenced to reflect the risk presented by the pipelines. The required inspection and maintenance plans for all existing pipelines shall be in place no later than 5 August 2006.

B2.2.3 General compliance requirements

Until the compliance date, or the date by which compliance is achieved (if earlier), the applicable requirements of the predecessor documents shall continue to be met (see Part A for details).

After the compliance date, or after the date by which compliance is achieved (if earlier), Railway Group members shall not deviate from the requirements set out in this document.

Where it is considered not practicable, or not reasonably practicable, to comply with the requirements set out in this document, authorisation not to comply shall be sought in accordance with GA/RT6001, GA/RT6004 or GA/RT6006.

B2.3 Exclusions from the application of this document

This document does not set out the requirements for:

a) surface laid cables, including cables laid immediately below rail level
b) cables in troughing parallel to the track
c) cables and services beneath platforms (see GC/RT5161)
d) track drainage and culverts.

B2.4 Related requirements and recommendations in other documents

Related requirements and recommendations are set out in the following documents:

a) GC/RT5152 Mineral Extraction and Landfill - Managing the Risk
b) GC/RT5101 Technical Approval Requirements for Changes to the Infrastructure
c) GC/RT5161 Station Design and Maintenance Requirements
d) GI/RT7001 Management of Safety Related Records of Elements of the Infrastructure
B3 Definitions

Buried services
Buried services include all cables (including surrounds or ducting) and pipelines used for the conveyance of electricity, signalling, telecommunications, gas, water, petrochemicals, effluents, etc which are below ground level. This definition does not include services that are only nominally covered by the ballast.

Depth
For the purposes of this document, depth means the vertical distance from the underside of a sleeper to the top surface of the buried service (including any surround or ducting), warning tape or undertrack crossing, or from ground level where the service is more than 1380 mm away from the edge of the nearest running rail to the top surface of the buried service or warning tape. In respect of steel sleepers, the measurement of depth is from the lowest point of the sleeper.

High voltage
Normally exceeding low voltage (see low voltage).

Low voltage
For the purposes of this document voltages not exceeding 1000 V rms ac or 1500 V dc between conductors, 600 V rms ac or 900 V dc between conductors and earth.

Open cut method
Means that the service is laid in a trench excavated by hand or by machine and subsequently backfilled.

Pipeline
For the purposes of this document means a pipe used to transport liquids or gases that may or may not be pressurised, and which may be above or below ground level.

Undertrack crossing
Means a buried service route passing under the track(s) below the level of the underside of the sleepers or track slab. For the purposes of this document, the term excludes services laid through a bridge span or in the roadway beneath a bridge span.

B4 Planning

B4.1 Buried services
B4.1.1 Depth of buried services clear of the track
Every service shall be placed at such a depth as to avoid any damage or danger which may come about by any reasonably expected use or disturbance of the ground above the service. The minimum depth for specific buried services shall be:

- Gas: 600 mm
- Water: 750 mm
- Electricity: 450 mm
B4.1.2 Location of buried services in the vicinity of the track
No buried service shall be installed closer than 1380 mm to the edge of the nearest running rail (measured horizontally) unless its minimum depth is 900 mm below the underside of the sleepers at the point considered. Particular requirements for undertrack crossings are set out in sections B6.3.2 and B6.3.3. Particular requirements for pipelines are set out in sections B6.4.2 and B6.4.3.

Appendix B illustrates the requirements of sections B4.1.1 and B4.1.2.

B4.1.3 Common excavation of services
Where a common excavation is provided for more than one type of service, (eg gas pipes and high voltage electric cables), then a minimum clearance between the different buried service types of 300 mm shall be maintained or different buried service types shall be installed in either separate ducts or separate chambers of multi-chamber ducting.

B4.1.4 Placing of buried services
The placement of buried services shall take account of the locations of existing buried services, in particular the potential for electromagnetic interference. The requirements for electromagnetic compatibility are set out in GE/RT8015.

B4.1.5 Inspection and maintenance arrangements
A plan shall be prepared that takes account of the necessary inspection, maintenance and decommissioning arrangements to ensure the protection of the operational railway and continuity of the service. The plan shall include any requirements for monitoring and subsequent repairs necessary to ensure the continued safe operation of the railway.

B4.2 Undertrack crossings
B4.2.1 Site investigation
The infrastructure controller shall ensure that, where appropriate, a site investigation is undertaken, including the use of cable avoidance tools where appropriate, to determine the material through which any undertrack crossing is to be made, and the results of this investigation shall be used to assist in the selection of a suitable design and method of construction.

B4.2.2 Alignment and position
Where practicable, undertrack crossings shall be positioned so that they pass at right angles to the track.

Undertrack crossings shall also be positioned so that their installation, including any associated temporary work, does not affect the fitness for purpose of any adjacent track, structure or service, including any supports to the service.

If any strengthening work to an adjacent structure or service is required in order to meet these requirements, such strengthening work shall be completed before the installation of the undertrack crossing has started.

B4.3 Pipelines
B4.3.1 General requirements for installation of pipelines
In deciding on the suitability of all proposals for pipelines there shall be a documented risk assessment that shall, as a minimum, take account of the following factors:

a) risk of damage to the pipeline from derailment
b) risk to the operational railway from failure (including leakage) of the pipeline
c) risk from fire, explosion or pollution due to the presence of the pipeline
d) use of increased pressures during testing
e) access requirements for maintaining the operational railway and to maintain the pipeline
f) evacuation requirements from a disabled train

g) ground conditions

h) risk from stray electrical currents.

**B4.3.2 Conditions for installation of pipelines**
The infrastructure controller shall, in consultation with other bodies as necessary, and taking into account the risk assessment and any possible future development such as electrification, be satisfied as to the suitability of the location and alignment proposed by the pipeline user/owner before they are finalised, indicating the preferred actual location and alignment if different from that proposed.

The infrastructure controller shall ensure that appropriate safety controls are imposed for the protection of the pipeline and Railtrack controlled infrastructure during the construction and subsequent life of the pipeline.

**B4.3.3 Placing of pipelines**
Unless the risk assessment (see section B4.3.1) demonstrates otherwise, the Railway Group Member shall ensure that pipelines are not attached to structures (including bridges over the railway and tunnels except for purpose built pipeline bridges) affecting the operational railway. In all cases, access for inspection and maintenance or examination of the structure shall be maintained.

**B4.3.4 Pipelines in areas of mineral extraction**
Where pipelines are proposed in areas prone to subsidence, the infrastructure controller shall ensure that an up-to-date mining stability report giving details of past mining activity and estimates of any subsidence and ground strains at the locations are obtained. The infrastructure controller shall ensure that procedures are in place to forward the mining stability report to the mining contact, as defined in GC/RT5152.

The mining contact shall be consulted to advise on the adequacy of the provisions in regard to any anticipated ground movement.

**B5 Approval in principle**
The technical approval procedures, required by GC/RT5101, shall take into account the following factors:

a) the ground conditions

b) the presence of other existing services and structures

c) the presence of any current or disused mineral extraction works

d) size, maintenance, renewal and reasonably foreseeable enlargement of the service

e) any rail traffic loading to which the service will be subjected

f) results of risk assessment carried out at a planning stage.

**B6 Design and construction**

**B6.1 General**

**B6.1.1 General requirements for design**
All buried services under the track and within 1380 mm to the edge of the nearest running rail (measured horizontally) shall be designed to be adequate to carry the imposed loading from the track. The design of temporary works shall afford adequate support to the tracks.
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B6.1.2 Access manholes, thrust and reception pits
The Railway Group member shall take into account the following points when determining the location of access manholes, thrust and reception pits:

a) access during construction and installation of the services
b) access for inspection and maintenance after completion.

The covers for access manholes, thrust and reception pits shall be designed to prevent unauthorised operation and to provide safe access for legitimate operation.

B6.1.3 Existing services and obstructions
Existing services and obstructions shall, as far as practicable, be located before commencing work on any buried service or undertrack crossing.

Buried services shall always be assumed to be present unless it is proved otherwise.

The provisions for construction of services are contained in Railway Group Standard GI/RT7003 and the associated Railway Safety Approved Code of Practice GI/RC7503 which cover safe systems of work and measures to be taken when excavating in the vicinity of pipelines and buried services.

B6.1.4 Colour coding
The colour coding for buried service, pipes and marker/warning tapes is set out in legislation. An extract for some of the principal services is given in Appendix A. Existing services do not necessarily conform to current legislation in respect of colour coding.

B6.1.5 General requirements for construction
Risks to rail traffic during construction work shall be considered and mitigation measures implemented as necessary, for example temporary speed restrictions, watchmen.

B6.2 Buried services
B6.2.1 Cables (high and low voltage)
Buried high and low voltage cables shall be protected as follows:

a) in respect of joints or terminations of a conductor, by recognised mechanical means, such as sleevings, boxing or over sheathing
b) except as stated in section B6.2.2 in respect of any other part of a conductor, by an electrically continuous metallic screen, such as steel wire armour or concentric neutral connected to earth.

This protection shall be so placed as to ensure that any tool or device likely to be used in the vicinity shall make contact with the protective screen before it can make contact with the conductor.

B6.2.2 Special protection for low voltage dc cables and signalling equipment cables
It is permissible to exempt low voltage dc cables, signalling equipment cables and cables for communication services from the requirements of section B6.2.1 b) provided, when buried, the cables are mechanically protected by means such as ducting. This means of protection shall not be provided by the cable insulation or sheathing.

B6.2.3 All services other than cables (high and low voltage)
No special protection is normally required for these services. The Railway Group member shall give due consideration to the risks involved and provide additional mechanical protection, such as ducting, steel pipe, concrete troughing, plastic pipe, etc where particularly heavy loading conditions exist.
B6.2.4 Cable marking
Where required by relevant national or international standards, cables shall be indelibly marked with their rated voltage.

B6.2.5 Buried service protection
As far as practicable all buried services shall be laid incorporating warning measures to ensure that any person excavating the ground above any service receives warning of its presence. It is permitted to use protective tiles, warning tape, cable markers or other devices as appropriate, but in the absence of any other marking on non metallic services, a warning tape containing a metallic core shall be installed at least 150 mm above the service.

B6.2.6 Buried service route marking
The Railway Group member shall ensure that buried services are marked at appropriate regular intervals along the line of the service route and at any changes of the line of the route. The marker plates used for this purpose shall as a minimum describe the type of service, the position and depth of the service.

B6.3 Undertrack crossings
B6.3.1 Selection of method of construction
When selecting a method for construction of an undertrack crossing, the following shall be considered:

a) the need for measures to mitigate the effect on track alignment, both vertical and horizontal

b) the need for measures to ensure track stability taking into account the ground conditions through which the undertrack crossing is to be constructed

c) the accuracy of alignment of the proposed method of construction of the service during construction

d) effect on train services

e) the presence and location of existing services

f) the size and location of any temporary works.

B6.3.2 Open cut method
Undertrack crossings constructed by the open cut method shall be placed at a minimum depth of 900 mm.

B6.3.3 Other methods
Undertrack crossings constructed other than by the open cut method shall be placed at a minimum depth of 1800 mm below the level of the underside of the sleeper.

B6.4 Pipelines
B6.4.1 Inspection and maintenance
For pipelines located above ground there shall be an inspection and maintenance plan. In preparing the plan consideration shall be given to the factors given in section B4.3.1.

B6.4.2 Valves
Pipelines shall have valves located at intervals taking into account the risk assessment detailed in section B4.3.1, that may be operated to limit containment loss.

The location of valves shall be designed to prevent unauthorised operation and to provide safe access for legitimate operation.
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B6.4.3 Pipelines in the vicinity of, or under, the track
Generally pipelines shall be laid at a minimum depth of 1800 mm below the underside of sleepers but shall additionally take into account the risk assessment process described in section B4.3.1. It is permissible for the depth of 1800 mm to be reduced, if justified by the risk assessment, but the resultant depth shall not be less than 900 mm.

B6.4.4 Design of pipelines under slab track
In addition to section B6.4.3 the design of the slab track and the soil characteristics shall be taken into account when determining the method of construction and depth of cover of pipelines to ensure that the design assumptions made for the slab track are not invalidated by the construction and/or existence of the pipeline.

B6.4.5 Emergency contact arrangements
Emergency 24-hour contact arrangements shall be agreed before a pipeline is brought into use. The arrangements for emergency planning are set out in GO/RT3471.

B7 Inspection and maintenance

B7.1 General requirements
The Railway Group member shall ensure that the planned inspection and maintenance arrangements, required by sections B4.1.5 and B6.4.1, are implemented.

B7.2 Areas of mineral extraction
Where the Railway Group member becomes aware that mineral extraction is likely to affect a buried service or pipeline, procedures shall be in place to advise the user and/or owner of the service or pipeline.

B8 Records

B8.1 General requirements
The Railway Group member shall:

a) keep up to date records or series of plans indicating the position and depth below surface level of all known buried services and undertrack crossings showing the number, construction and configuration of ducts

b) make a copy of the whole or the relevant part of any such plan available for inspection by any person who can show reasonable cause for requiring to inspect any part of the plan

c) provide, on request, a copy of this plan or part plan to such a person

d) make arrangements to provide identification of positions of known buried services to assist in dealing with emergencies.

B8.2 Record content
Records shall include the user and/or owner of the service, point of contact and details of the buried service.

B9 Abandonment or change of use

B9.1 Abandonment of an existing service
Where there is a proposal to abandon a buried service the Railway Group member shall, as far as is practicable, remove the buried service.

Where it is not practicable to remove a pipeline it shall be purged to remove all toxic, flammable or hazardous substances and consideration shall be given to:

a) maintenance of cathodic protection
b) filling the void with a compacted, incompressible and inert material to prevent future collapse.

Where a pipeline is severed within the confines of Railtrack controlled infrastructure, it shall be permanently capped at the point(s) of discontinuity.

The infrastructure controller shall obtain confirmation from the user and/or owner that all required actions have been carried out, accurate records exist and that suitable and audible inspection and maintenance arrangements have been made to protect the railway.

**B9.2 Change of use for a new service**

The Railway Group member shall endeavour to ensure that no change of use of a buried service within the scope of this document is made without prior agreement between the Railway Group member and the service provider.
Appendix A

Colours of pipes and marker/warning tapes

The following colours and marker/warning tapes are consistent with legislation current at the time this document was published. Railway Group members are responsible for satisfying themselves that the list remains current.

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<thead>
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<th>Colour</th>
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<td></td>
<td>Pipe</td>
</tr>
<tr>
<td></td>
<td>Marker/Warning Tape</td>
</tr>
<tr>
<td>Gas</td>
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<td>Yellow with black legend</td>
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<tr>
<td>Water</td>
<td>Blue</td>
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<tr>
<td></td>
<td>Blue</td>
</tr>
<tr>
<td>Electricity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yellow with black legend</td>
</tr>
<tr>
<td>Telecomms</td>
<td></td>
</tr>
<tr>
<td>(including fibre optic cables)</td>
<td>Yellow or white with blue company legend</td>
</tr>
<tr>
<td>Cable TV and local telecomms</td>
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<tr>
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<td>Green on yellow with appropriate logo</td>
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Appendix B

Diagrammatic representation of location and depths of buried services

- **Pipelines in the vicinity of or under the track (unless reduced by risk assessment)**: 1380 mm
- **Undertrack crossings - open cut method**: 900 mm
- **Undertrack crossings - other than open cut method**: 1800 mm
- **Water**: 750 mm
- **Gas**: 600 mm
- **Electricity and communications**: 450 mm
- **Gas**: 600 mm
- **Water**: 750 mm
- **Undertrack crossings**: 1380 mm
Pipelines, Buried Services and Undertrack Crossings

References

Railway Group Standards and other Railway Group Documents

GA/RT6001  Railway Group Standards Change Procedures
GA/RT6004  Temporary Non-Compliance With Railway Group Standards
GA/RT6006  Derogations from Railway Group Standards
GE/RT8015  Electromagnetic Compatibility between Railway Infrastructure and Trains
            (planned to be issued in October 2002)
GC/RT5101  Technical Approval Requirements for Changes to the Infrastructure
GC/RT5152  Mineral Extraction and Landfill - Managing the Risk
GC/RT5161  Station Design and Maintenance Requirements (to be superseded by
            GI/RT7014)
GI/RC7503  Recommendations for Management of Construction Work in the Operational
            Railway Environment
GI/RT7001  Management of Safety Related Records of Elements of the Infrastructure
GI/RT7003  Management of Construction Work in the Operational Railway Environment
GI/RT7014  Station Design and Maintenance Requirements (expected to be published in
            April 2003)
GL/RT1253  Mitigation of DC Stray Current Effects
GO/RT3471  Incident Response Planning


Other References

Electricity at Work Regulations 1989
Electricity Supply Regulations 1988

Further Reference Material

Railway Group Standards

GI/RT7007  Low Voltage Electrical installations
GI/RC7607  Recommendations for Low Voltage Electrical installations

Other References

HSG 47  Avoiding danger from underground services
NJUG Publication No.4  The identification of small buried mains and services
NJUG Publication No.7  Recommended positioning of utilities, mains and plant for new works