

Information for users

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Proceed to document ►

Ref:	NR/L2/SIG/11201
Issue:	10
Date:	06/06/2015
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Level 2

Signalling Design Handbook

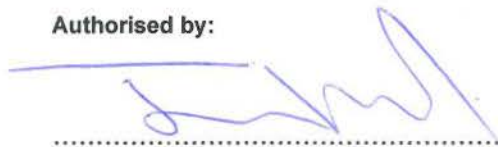
Endorsement and Authorisation

Endorsed by:



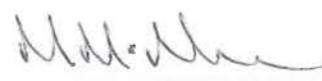
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Documents

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User information

This Network Rail standard contains colour-coding according to the following Red–Amber–Green classification.

Red requirements – *No variations, could stop the railway*

- **Red requirements shall** always be complied with and achieved.
- Red requirements shall be presented in a red box **with the word “shall” or expressed as a direct instruction**.
- Accountability for the efficacy of red requirements lies with the Professional Head/Standard Owner.
- Red requirements are monitored for compliance.
- Corrective actions shall be enforced if variations are discovered through functional checks (e.g. engineering verification visits, audit or Operations Self-Assurance).

Amber requirements – *Controlled variations, approved risk analysis and mitigation*

- **Amber requirements shall** be complied with unless variation has been approved in advance.
- Amber requirements shall be presented with an amber sidebar **and with the word “shall” or expressed as a direct instruction**.
- Accountability for the efficacy of these requirements lies with the Professional Head/Standard Owner, or their nominated Delegated Authority.
- Amber requirements are monitored for compliance.
- Variations **may** be permitted. Variations are approved by the Standard Owner or through existing Delegated Authority arrangements.
- Corrective actions shall be enforced if **non-approved** variations are discovered through functional checks (e.g. engineering verification visits, audit or Operations Self-Assurance).

Green – *Guidance*

- Guidance is based on good practice. Guidance represents supporting information to help achieve **Red** and **Amber** requirements.
- Guidance shall be presented with a dotted green sidebar **and with the word “should” (usually in notes) or as a direct instruction**.
- Guidance is **not mandatory** and is not monitored for compliance.
- Alternative solutions may be used. Alternative solutions do not need to be formally approved.
- Decisions made by a competent person to use alternative solutions should be backed up by appropriate evidence or documentation.

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Issue record

Issue	Date	Comments
1	August 2000	New Document
2	April 2001	Minor Revisions
3	December 2003	Minor Revisions
4	June 2011	Name-change & Modularisation of handbook and former guidance notes, inclusion of: RT/E/G/11710 as appendix E. Addition of modules A & B, see index on page 3 below.
5	September 2011	Amended references due to withdrawal of NR/L3/SIG/30018 & New index following the introduction of Modules in the 'X01 – X99' series.
6	December 2011	Module X21 reissued
7	March 2012	Amendment to the process for managing and undertaking non-conceptual design, affects section 7.2 & Module A1 sections 8.3; 8.3.2 & 8.3.3
8	June 2012	Changes to the X series of modules
9	Sept 2014	Incorporation of signal duty holder requirements from GK/RT0044 (1) into module B7
10	June 2015	First issue of Module X39

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 05/09/2015.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 3 (Option Selection) to continue to comply with the issue of any relevant Network Rail standards current when GRIP Stage 3 was completed and not to comply with requirements contained herein, unless stipulated otherwise in the scope of this standard.

Disclaimer

In issuing this document for its stated purpose, Network Rail makes no warranties, express or implied, that compliance with all or any documents it issues is sufficient on its own to confirm safe systems of work or operation. Users are reminded of their own duties under health and safety legislation.

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NR/L2/SIG/11201 - Index of signalling design handbook – A Modules

MODULE NUMBER & TITLE		ISSUE	Date
NR/L2/SIG/11201	Signalling Design Handbook	10	06/06/2015
Mod A1	Outline Project Specifications (OPS) for Signalling Schemes	5	03/03/2012
Mod A2	Minimum Requirements for design details	5	03/09/2011
Mod A3	Assessment of signalling Systems before Signalling Design Alterations	4	04/06/2011
Mod A4	Design Specification Guidelines	5	03/09/2011
Mod A5	Occupational Safety	4	04/06/2011
Mod A6	Safety Hazards requiring retrospective work	5	03/09/2011
Mod A7	Correlation of Signalling Records	4	04/06/2011
Mod A8	Design Record and Production control	4	04/06/2011
Mod A9	Safety System	4	04/06/2011
Mod A10	Configuration Control	4	04/06/2011
Mod A11	Operating Requirements Review	4	04/06/2011
Mod A12	Design Modifications	4	04/06/2011
Mod A13	Certification Process	4	04/06/2011
Mod A14	Source Record Updating	4	04/06/2011
Mod A15	Arrangement and Presentation	4	04/06/2011
Mod A16	Temporary Work	4	04/06/2011
Mod A17	Symbols for plans and sketches used in Signalling Applications	5	03/09/2011
Mod A18	Signalling Design Control Tables	6	04/06/2011
Mod A18/AppA	Conventions, General Notes, Dollar Notes and Signallers Route Lists	6	04/06/2011
Mod A18/AppB	RRI Signal and aspect control tables	6	04/06/2011
Mod A18/AppC	RRI point and ground frame control tables	6	04/06/2011
Mod A18/AppD	Control tables for level crossings	6	04/06/2011
Mod A18/AppE	Control tables for train warning and protection systems	6	04/06/2011
Mod A18/AppF	Control Tables For Staff Protection Systems (TOWS)	6	04/06/2011
Mod A18/AppG	Control Tables For Block Systems & Electro-mechanical	6	04/06/2011
Mod A18/AppH	SSI Control Tables	6	04/06/2011
Mod A18/AppJ	SIMIS – W Control Tables	6	04/06/2011

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MODULE NUMBER & TITLE		ISSUE	Date
Mod A19	Symbols for Signalling Circuit Diagrams	4	04/06/2011
Mod A20	Dependability	4	04/06/2011
Mod A21	Verification Process	4	04/06/2011
Mod A22	Overlapping and Parallel Signalling Design	4	04/06/2011

NR/L2/SIG/11201 - Index of signalling design handbook – B Modules

MODULE NUMBER & TITLE		ISSUE	DATE
Mod B1	Circuits - General Introduction	4	04/06/2011
Mod B2	Circuits - Conflicting Standards	4	04/06/2011
Mod B3	Circuits - General	6	06/09/2014
Mod B4	Circuits – Fusing & Looping of Signalling Circuits	4	04/06/2011
Mod B5	Circuits – Electromagnetic Compatibility of Electronic Equipment	4	04/06/2011
Mod B6	Circuits – Insulation and Earthing for Occupational Safety	4	04/06/2011
Mod B7	Interlockings – General	6	06/09/2014
Mod B8	Interlockings – Lever Frame Interlocking Guidelines	4	04/06/2011
Mod B9	Interlockings – Free-Wired Route Setting Interlocking Guidelines	4	04/06/2011
Mod B10	Interlockings – Geographical Relay Interlocking Guidelines	4	04/06/2011
Mod B11	Interlockings – Electronic Interlocking Guidelines	4	04/06/2011
Mod B12	Transmission Systems - (Cable terminations & Cable routes)	4	04/06/2011
Mod B13	Points - General	4	04/06/2011
Mod B14	Points – Point Fittings (Supplementary Information)	4	04/06/2011
Mod B15	Points – Relay Circuits	4	04/06/2011
Mod B16	Points – SSI Application	4	04/06/2011
Mod B17	Signals – General	4	04/06/2011
Mod B18	Signals – Semaphore Signals (Supplementary Information)	4	04/06/2011
Mod B19	Signals – Relay Circuits	4	04/06/2011

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MODULE NUMBER & TITLE		ISSUE	DATE
Mod B20	Signals – SSI Application	4	04/06/2011

NR/L2/SIG/11201 - Index of signalling design handbook – X Modules

MODULE NUMBER & TITLE		ISSUE	DATE
Mod X01	Level Crossings - General	1	03/09/2011
Mod X02	Level Crossings - Common Design Requirements	2	02/06/2012
Mod X10	Level Crossings - Automatic Half Barriers (AHB)	1	03/09/2011
Mod X11	Level Crossings - Automatic Barrier Crossing Locally Monitored (ABCL)	2	02/06/2012
Mod X12	Level Crossings - Automatic Open Crossing Locally Monitored (AOCL)	2	02/06/2012
Mod X13	Level Crossings - Automatic Open Crossing Locally Monitored Plus Barriers (AOCL + B)	1	03/09/2011
Mod X14	Level Crossings - Open Crossing With Additional Flashing Lights	1	03/09/2011
Mod X20	Level Crossings - Manned Gated Crossings (MG)	1	03/09/2011
Mod X21	Level Crossings - Manually Controlled Barriers With Obstacle Detector (MCB-OD)	3	02/06/2012
Mod X22	Level Crossings - Manually Controlled Barriers (MCB)	2	02/06/2012
Mod X23	Level Crossings - Manually Controlled Barriers With Closed Circuit Television (MCB-CCTV)	1	03/09/2011
Mod X24	Level Crossings - On Call Barriers (MCB-OC)	2	02/06/2012
Mod X25	Level Crossings - Wicket Gate Magnetic Locks	1	03/09/2011
Mod X30	Level Crossings - Traincrew Operated Gates (TOG)	1	03/09/2011
Mod X31	Level Crossings - Traincrew Operated Barriers (TOB)	1	03/09/2011
Mod X39	System Application Specification for Overlay Miniature Stop Light Level Crossings	1	06/06/2015
Mod X40	Level Crossings - Miniature Stop Lights (MSL)	2	02/06/2012
Mod X41	Level Crossings - User Worked Barriers	1	03/09/2011
Mod X42	Level Crossings - Power Operated Gate Openers (POGO)	1	03/09/2011
Mod X99	Level Crossings - History Of Level Crossing Protection	1	03/09/2011

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1 Purpose

This standard sets out mandatory requirements and mandates standards for the production of signalling design detail to support:

- a) safe development and design of new and altered signalling systems impacting on Network Rail controlled infrastructure;
- b) safe interfaces between all parties and systems;
- c) design details are prepared and presented clearly, accurately, consistently and unambiguously; and
- d) client's specified requirements are met and the design is fit for purpose.

2 Scope

This standard lays down the requirements for:

- a) the design of signalling works applicable to the infrastructure;
- b) the design of signalling systems, whether lineside or train-borne;
- c) the design of software and data used in programmable signalling systems; and
- d) the tools, including software, used in design.

It applies from scheme conception through to acceptance into service or, where applicable, to decommissioning and disposal.

3 Reference documentation

3.1 Railway Group Standards

GC/RT5021	Track System Requirements
GC/RT5033	Terminal Tracks - Requirements for Buffer Stops, Arresting Devices and End Impact Walls
GE/GN8537	Guidance on Signal Positioning and Visibility
GE/RT8000	Rule Book
GE/RT8018	Mechanical Trainstop Systems
GE/RT8024	Persons Working On or Near to AC Electrified Lines
GE/RT8030	Requirements for the Train Protection and Warning System (TPWS)
GE/RT8035	Automatic Warning System (AWS)
GE/RT8037	Signal Positioning and Visibility
GE/RT8106	Management of Safety Related Control, Command and Signalling (CCS) System Failures

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GE/RT8270	Assessment of Compatibility of Rolling Stock and Infrastructure
GI/RT7006	Prevention and Mitigation of Overruns - Risk Assessment
GI/RT7033	Lineside Operational Safety Signs
GK/EH V609	Safe Working Procedures for D.C. Electrified Lines
GK/ES 1683	The Design, Installation and Testing of Earthing Systems For Signalling and Telecommunications Purposes
GK/GN0802	Glossary of Signalling Terms
GK/RT0009	Identification of Signalling and Related Equipment
GK/RT0025	Signalling Control Centres
GK/RT0028	Infrastructure Based Train Detection Interface Requirements
GK/RT0029	Train Activated Warning Systems
GK/RT0034	Lineside Signal Spacing
GK/RT0038	Signing of Permissible Speeds and Speed Restrictions
GK/RT0039	Semaphore and Mechanical Signalling
GK/RT0041	Track Circuit Block
GK/RT0042	Absolute Block
GK/RT0044	Controls for Signalling a Train onto an Occupied Line
GK/RT0045	Lineside Signals, Indicators and Layout of Signals
GK/RT0051	Single Line Control
GK/RT0054	Radio Electronic Token Block
GK/RT0060	Interlocking Principles
GK/RT0061	Shunters Releases, Ground Frames, Switch Panels and Gate Boxes
GK/RT0063	Approach Locking and Train Operated Route Release
GK/RT0064	Provision of Overlaps, Flank Protection and Trapping
GK/RT0192	Level Crossing Interface Requirements
GK/RT0210	Asset Management for the Safety of Signalling and Operational Telecommunication Systems and Equipment
GK/RT0212	Signalling Lockout Systems to Protect Railway Undertaking Personnel
GL/RT1253	Mitigation of DC Stray Current Effects
GL/RT1254	Electrified Lines Traction Bonding
GM/RT2450	Qualification of Suppliers of Safety Critical Engineering Products and Services
GO/RT3215	Requirements for the Weekly Operating Notice, Periodical Operating Notice and Sectional Appendix

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GS/ES 1937	Engineering specification - SSI trackside data link surge protection module
GT/TD INT100	Earthing and Equipotential Bonding of Telecommunications Equipment
HS (G) 47	Avoiding danger from underground services
RIS-1800-ENE	Rail Industry Standard for Network and Depot Interface Management - Isolation Documentation
RIS-7700-INS	Rail Industry Standard for Station Infrastructure

3.2 Network Rail Company Standards

NR/GN/CPR/401	Guidance on Contractual Health and Safety Requirements
NR/GN/ELP/27022	Design & Install of Negative Bonding & Associated Equipment for DC Electrified Lines
NR/GN/ELP/45002	The Installation of Electric Point Heating
NR/GN/SIG/CAT005	Index of Network Rail Documents relating to Signalling & Communications Equipment – Typical Circuits
NR/GN/SIG/11774	Clamp Lock Handbook
NR/GN/SIG/11821	Siting Requirements for Lineside Apparatus Housings
NR/GN/SIG/19012	SIGTAN 012 Cables and Wiring used for Signalling Systems
NR/GN/SIG/19014	SIGTAN 014 Mechanical Handbook
NR/GN/SIG/19015	SIGTAN 015 Relay Plugboard Problems
NR/GN/SIG/19016	SIGTAN 016 Westinghouse M3 Point Machine
NR/GN/SIG/19020	Signalling Equipment Technical Advice Notice (SIGTAN020) Signalling Relays
NR/GN/SIG/19254	SIGWEN 003 GEC-GS Type HW Point Machine
NR/L1/CTM/001	Competence Management
NR/L1/INF/02232	Information Security Policy
NR/L2/INI/CP1030	Working safely in the vicinity of buried services
NR/L2/EBM/STP001	Managing Network Rail Standards
NR/L2/ELP/40045	Electric Point Heating
NR/L2/HSS/020	Safety Validation of Organisational and Safety Management System Change
NR/L2/INF/02018	Standard for the Management of Safety Related Infrastructure records (formerly NR/SP/INF/02018)
NR/L2/OCS/085	Permissive Platform Working

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NR/L2/RSE/100	Network Rail Acceptance Panel processes
NR/L2/SIG/00005	Railway Signalling Cable
NR/L2/SIG/10064	General Instructions to Staff Working on S & T Equipment
NR/L2/SIG/10157	Signal Sighting
NR/L2/SIG/10160	Signal Engineering: Implementation of IRSE Licensing Scheme – Route to Competence
NR/L2/SIG/11010	Management of Signalling & Communication Systems
NR/L2/SIG/11107	Silver Migration
NR/L2/SIG/11129	Life Management of Signalling Relays, Searchlight and Electro-mechanical and Banner Signals
NR/L2/SIG/11231	Signal Maintenance Testing Handbook
NR/L2/SIG/11630	BR930 Series Pin Code Allocations and Contact Arrangements
NR/L2/SIG/17002	SSI Applications Manual Contents
NR/L2/SIG/30009	Signalling Principles Handbook
NR/L2/SIG/30014	Signalling Works Testing Handbook
NR/SIG/10663	Signal Maintenance Specifications
NR/L3/SIG/11303	Signalling Installation Handbook
NR/L3/SIG/19272	Signalling Equipment Workshop Engineering Notice (SIGWEN021) Signalling Relays
NR/L3/SIG/CAT003	Index of Network Rail Documents Relating to Signalling and Communications Equipment: Part 1 - Mechanical & Electrical Drawings
NR/PS/SIG/11755	DC Track Circuits
NR/PS/SIG/11762	Track Circuit Assister Interference Detectors
NR/SP/CIV/044	Design & Construction of Undertrack Crossings
NR/SP/ELP/21085	Specification for Design of Earthing & Bonding Systems for 25Kv AC Electrical Lines
NR/L2/ENV/015	Contract Requirements - Environment
NR/SP/ERG/24017	Control Room Design Specification, Process and Guidance
NR/SP/OHS/069	Lineside Facilities for Personnel Safety
NR/SP/SIG/02023	Requirements for TASS Infrastructure – System Design
NR/SP/SIG/10015	Rail Clamp Point Lock - Performance Spec for the Microswitch with Independent Contacts
NR/SP/SIG/10060	Vital Signalling Timer

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NR/SP/SIG/10131	Requirement Specification for 'Signals On' Controls for SSI Schemes
NR/SP/SIG/10133	Train Protection and Warning System (TPWS) Signalling Interface Design Requirements
NR/SP/SIG/10137	Train Protection and Warning System (TPWS) Selection of New Signals And Other Locations For Provision of TPWS
NR/SP/SIG/11130	Requirements for the Provision of SPAD Alarms at Signalling Control Centres
NR/SIG/11231	Signalling Maintenance Testing Handbook
NR/SP/SIG/11752	Train Detection
NR/SP/SIG/14200	Prevention and Mitigation of Overruns - Risk Assessment Tools
NR/SP/SIG/17004	Requirement Specification for the SSI Technical Terminal
RT/LS/CAT004	Index of Railtrack Documents Relating to Signalling and Communications Equipment: Part 1 - Signalling Structure Drawings
NR/GN/SIG/CAT006	Index of Railtrack Documents Relating to Signalling and Communications Equipment: Part 1 - Equipments and Systems Specifications

3.3 Network Rail Forms

QF901	Request for Handover of Source Records
QF902	Solid State Interlocking Data Requests and Returns
QF909	Authorisation to Browse
QF910	Requests for Prints of Source Records
QF911	Authorisation to Transfer a Project's Source Records for Continuance of the Project
QF915	Return of As Built Records
QF921	Electronic Systems Data and Software Requests and Returns
QF924	Integrated Electronic Control Centre Data Requests and Returns
QF925	Request for Solid State Interlocking Control Centre Identity Number

3.4 Standards And Application Standards

BR 817	Electro Hydraulic Power Equipment for Point Operation
BR 818	Self Supporting Aerial Electric Cable for Railway Signalling (Metric Units)

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BR 819	Earthing & Bonding of Telecommunications Cable Sheats Separate Screening Conductors & Associated Lineside Equipment in A.C. Electrified Areas
BR 880	Specification for Aluminum Cored Insulated Cables for Railway Signalling Power Supplies
BR 901	Specification for Flasher Unit Level Crossing Road Signals
BR 902	Specification for Electrical Requirements of High Voltage Electric Point Machines for Railway Signalling Purposes
BR 903	Electrical Requirements for Standard Colour Light Signals
BR 923	Specification for Moving Iron Direct Current Polar Line Relays for Railway Signalling
BR 925	Specification for Electro-Magnetic Indicator for Railway Signalling
BR 967	Railway Signalling Apparatus: Environmental Conditions
BR 991	Flashing Signal Aspect Control Unit
BR 998	Electric Point Detectors
BR 1612	Specification for renovation and construction of cable routes
BR 1615	Relocatable Equipment Buildings for S&T Use
BR 1820	Spec for earthing and bonding of separate screening conductors and associated lines
BR 1822	Steel/Polymer Laminate Tape And Oversheath For Plastic Sheathed Cables
BR 1844	110 volt, 100 watt heater for clamp lock
BR 1901	Solid State Interlocking Lineside Points module
BR 1902	Specification for solid state interlocking lineside signal module
BR 1904A	Solid Sate Interlocking Data Link Module Mkiii
BR 1905A	Solid Sate Interlocking Multiprocessor Module (Mkii)
BR 1906	Solid state interlocking long distance terminal
BR 1908	Solid state interlocking panel processor module (MK11)
BR 1911	Solid state interlocking processor memory module Mk11
BR 1921	Interlocking a panel multiplex system with a solid state interlocking
BR 1932	Twin data link type polyethylene insulated and polyethylene sheath
BR 1974	Multicore railway signalling cables with re-formed terminations

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BR 1975	Clamp Lock Disconnection Box for use with Pre-formed terminated cable
BR 1990	Specification For Preparation of EPROMs for Railway Signalling Applications
BR 1992	Specification for Orange Polyethylene Pipe Used for signalling cable protection
BR 3006	Environmental Specification For Solid State Interlocking Equipment In Trackside Location Casks Part 1- Electrical Environment
BR 13422	50Hz Single Phase AC Electrification, Immunisation of Signalling and Telecommunications Systems Against Electrical Interference
SSI 8003	SSI Applications manual
SSI 8150	SSI Software Record
SSI 8505	SSI Data Procedures

3.5 British And European Standards

BS 469	Specification for electric lamps for railway signalling
BS 561	Specification for alternating-current line relays double-element 3-position (for railway signalling)
BS 581	Specification for electrically-driven point-operating machines for railways
BS 714 (1950)	Specification. Cartridge fuse-links for use in railway-signalling circuits
BS 1745	Specification for alternating-current relays for railway signalling: track relays (double-element, 2-position), line relays (single-element, 2-position)
BS 2754	Protection against electric shock. Live working
BS 3506	Specification for unplasticized PVC pipe for industrial uses
BS 4778	Quality vocabulary. Availability, reliability and maintainability terms. Guide to concepts and related definitions
BS 5760	Reliability of systems, equipment and components
BS 6004	Electric cables. PVC insulated, non-armoured cables for voltages up to and including 450/750 V, for electric power, lighting and internal wiring
BS 7430	Code of practice for earthing
BS 7645	Code for designation of colours
BS 7671	Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition

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BS 8888	Technical product specification: Specification for defining, specifying and graphically representing products
BS ISO 80000-1	Quantities and units
BS ISO/IEC 90003	Software Engineering - Guidelines for the application of ISO 9001:2000 to computer software
BS EN ISO 9001	Quality management systems. Requirements
BS EN 50121-1:2000	Railway applications. Electromagnetic compatibility. General
BS EN 50121-4:2000	Railway applications. Electromagnetic compatibility. Emission and immunity of the signalling and telecommunications apparatus
BS EN 50122-1	Railway applications. Fixed installations. Protective provisions relating to electrical safety and earthing
BS EN 50122-2	Railway applications. Fixed installations. Electrical safety, earthing and the return circuit. Provisions against the effects of stray currents caused by d.c. traction systems
BS EN 50126	Railway applications. The specification and demonstration of reliability, availability, maintainability and safety (RAMS)
BS EN 50128	Railway applications. Software for railway control and protection systems
BS EN 50129	Railway applications. Safety related electronic systems for signalling
BS EN 50160	Voltage characteristics of electricity supplied by public electricity networks
BS EN 60297-3-101: 2004	Mechanical structures for electronic equipment. Dimensions of mechanical structures of the 482,6 mm (19 in) series. Subracks and associated plug-in units
BS EN 60529	Degrees of Protection Provided by Enclosures
BS EN 60617	Graphical symbols for diagrams
BS EN 61082	Preparation of documents used in electrotechnology
BS EN 61386-1	Specification for conduit systems for cable management. General requirements
BS EN 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems
BS EN ISO 9001	Quality management systems. Requirements
DD ENV 50129	Railway applications. Safety related electronic systems for signalling
EHQ/CP/S/030	Preparation of Isolation Diagrams And Instructions For A.C Electrified Lines

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3.6 Legislation

1983c16	Level Crossing Act 1983 (amended by SI 1997/487)
96/48/EC	Directive on the interoperability of the trans-European high-speed rail system
2001/16/EC	Directive on the interoperability of the trans-European conventional rail system
HS (G) 47	Avoiding danger from underground services
SI 1994/157	Railways and Other Transport Systems (Approval of Works, Plant and Equipment) Regulations 1994
SI 1994/3140	Construction (Design and Management) Regulations 1994 (amended by SI 2000/2380)
SI 1997/487	Level Crossing Regulations 1997
SI 1999/3242	Management of Health and Safety at Work Regulations 1999
SI 2000/2380	Construction (Design and Management) (Amendment) Regulations 2000
SI 2002/1166	Railways (Interoperability) (High-Speed) Regulations 2002

3.7 Guidance

L59	HSE/HMRI Guide to the Approval of Railway Works, Plant and Equipment
Hazards Forum	Safety-related systems. Guidance for engineers

4 Definitions

Terms and definitions are provided in Appendix E

A glossary of general signalling terms is given in [GK/GN0802](#). Where no definition is included in Appendix E, that given in [GK/GN0802](#) should be used.

Safety terms are also defined in [GK/GN0802](#).

5 Compliance

The design parameters and type approval processes concerning individual items of equipment used in the systems are dealt with in [NR/L2/RSE/100](#).

Where the guidelines given in the standards referenced, are not complied with an application for authority for non-compliance with this standard ([NR/L2/SIG/11201](#)) shall be sought.

The procedure for submitting such applications is detailed in [NR/L2/EBM/STP001](#).

Alternative proposals shall deliver the same or better level of safety integrity.

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5.1 Conformity of Presentation

Signalling works shall be designed to this standard, except where existing design details conform to previous standards of presentation and the partial use of this standard would result in confusing information being presented.

In such cases, the previous standards of presentation, format, symbols and units should be used where appropriate. Conformity of presentation to this standard shall be considered if the design details are redrawn. It shall be documented in the design standard which design details are to be redrawn in conjunction with the project.

5.2 Conformity to Technical Standards

The standards to which the works are designed shall be documented at each scheme phase. Generally the control and approval document is the scheme plan. As a minimum, the appropriate signalling principles and design standards shall be recorded at the date of scheme plan approval.

Guidelines are given in [NR/L2/SIG/11201 - Module A11](#).

The alteration of existing installations that conform to previous technical standards is considered in [GK/GN0802](#).

5.3 Changes to Standards

When a new or amended Railway Group Standard or Company Standard is issued after the scheme plan has been approved for detailed development, Network Rail shall determine whether that standard is to be applied. The reasons for not implementing a change shall be logged on the design standard, or supplement thereto.

Where current standards cannot be complied with, for any reason, a formal derogation shall be obtained in accordance with [NR/L2/EBM/STP/001](#).

When a new or amended Railway Group Standard or Company Standard specifies retrospective action, an implementation plan shall be added to the design standard, or supplement thereto.

Retrospective work is considered further in [NR/L2/SIG/11201 - Module A6](#).

6 Competence and Responsibilities

6.1 Design Authority Qualification

Supplier qualification shall be in accordance with [GM/RT2450](#).

All signalling design work shall take place within a management system compliant with [BS EN ISO 9001](#), or similar.

Network Rail shall be satisfied that the design authority is competent and will allocate adequate resources to perform its responsibilities under the Construction (Design

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and Management) Regulations 1994, as described in [NR/L2/INI/CP0047](#) and [NR/GN/CPR/401](#).

6.2 Interface Management

Network Rail shall control interfaces between design authorities in accordance with section 9. Relationships between design authorities shall be defined in the design standard.

The design authority shall have in place processes for managing interfaces between authorities, disciplines, functions and sub-contractors so as to confirm a safe and timely flow of information. These shall pay particular attention to the controls necessary to mitigate those risks over which there is otherwise no direct check.

Guidelines on the interdisciplinary checks necessary in the preparation of design details are given in [NR/L2/SIG/11201 – Module A2](#).

The approval for construction process (see Section 10.6) shall confirm that the appropriate checks have been undertaken.

Design processes shall interface with the construction and testing procedures given in [NR/L3/SIG/11303](#) and [NR/L2/SIG/30014](#), respectively. In particular, the design shall facilitate a safe method of construction (see Section 17) and independent validation that the system performs to the client's requirements and the design standard, i.e. it shall be constructable and testable.

The design authority shall be reasonably satisfied that any sub-contractors employed are competent in the appropriate field and will allocate adequate resources to perform their responsibilities. In order to bear the responsibility for works performed by its sub-contractors, the design authority shall confirm an adequate level of verification and validation of the works.

For the control of system interfaces, see Section 14.

6.3 Competence of Personnel

All work shall be undertaken by, or under the close direction of, personnel who have documented proof of competence, in accordance with [NR/L1/CTM/001](#) and who have been authorised to undertake the work. The necessary competence management systems are described in [NR/L1/CTM/001](#).

A register of competent designers, together with their initials and fields of competence, shall be maintained by the design authority and be available for inspection by Network Rail.

6.4 Competence Requirements for Correlation Staff

Staff engaged to undertake correlation activities shall be further trained and assessed as competent to perform the tasks detailed in [NR/L2/SIG/11201 – Modules A3 & A7](#).

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6.5 Design Producer Responsibility

A clearly presented functional design, accurately reflecting the client's requirements, shall be produced by a designer, known as the producer. Producers shall check their own design, correct any errors revealed and certify it, before passing it to an independent checker, together with any supporting documentation, such as calculations and/or safety analysis. The process is described in Section 8.

6.6 Design Checker Responsibility

Checking shall be carried out by a designer, known as the checker, who shall remain independent of the production for the particular design throughout the design process. All design details produced shall be certified by the checker before issue. The process is described in Section 8.3.

6.7 Responsible Design Engineer

A single responsible design engineer shall be appointed for each project, or series of commissionings, to confirm that all stages of design and development is directed and checked by competent personnel and is compliant to the specified requirements, including the appropriate level of safety and dependability.

Prior to issue of design details, the responsible design engineer shall approve the design for construction, in accordance with Section 10.6

NOTE That a responsible design engineer, appointed in connection with a design contract, may also be the contractor's responsible engineer.

6.8 Responsibility of All Personnel

It is the responsibility of all personnel to be vigilant and to advise the appropriate authority of any deficiency observed that might compromise the safety of the signalling system or of personnel.

7 Signalling Scheme Conception

The initial phases of a signalling scheme, associated with any new or altered signalling system, shall include the following, to a degree commensurate with the extent and type of work proposed:

7.1 Client Remit

The sponsor's requirements shall be stated in a brief to enable the outline project specification to be prepared. This will generally be specified in terms of train operations and dependability (see Section 19).

7.2 Outline Project Specification (OPS) or Equivalent Documentation

This shall be prepared by a person deemed technically competent by the project manager. The process is detailed in [NR/L2/SIG/11201 – Module A1](#), which shall be

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followed to a degree commensurate with the size and complexity of the works proposed.

Alternatively, in the case of non-conceptual work, a design remit shall be used (see [NR/L3/SIG/30075/Form A](#)).

Feasibility studies, where required, shall generally be undertaken at this phase.

7.3 Scheme Plan

A scheme plan shall be developed from the client remit and OPS, or equivalent, by means of the processes described in this Standard, in order to obtain approval in principle for the scheme, in accordance with Section 10.3. The scheme plan may be omitted where no change to the existing signalling plan is proposed.

Where the extent and type of work proposed is sufficiently restricted and it is stated in the OPS or PIF, a scheme plan extract or dimensioned sketch may be used.

The standards to which the works are to be designed shall be referenced on the scheme plan (or associated documentation), in accordance with Section 5.2.

Where applicable, stage scheme plans shall be derived from the approved scheme plan before producing the engineering details, and, where required for approval, shall be submitted at a subsequent phase.

Guidelines on the minimum content of the scheme plan (and associated documentation) and considerations associated with stage scheme plans are given in [NR/L2/SIG/11201 – Module A2](#).

7.4 Site Surveys

Where practicable, a recent milepost and gradient survey shall be obtained as a basis for the scheme plan.

The sighting of lineside signs, signals and indicators shall be undertaken as soon as practicable following scheme approval, in accordance with [GE/RT8037](#). The likely resulting amendments to the scheme plan are described in [NR/L2/SIG/11201 – Module A2](#).

Equipment likely to be affected by the proposed work shall be examined by a competent signal engineer who shall make an assessment of any factors which might introduce special risks during the execution of the work. The process is detailed in [NR/L2/SIG/11201 – Module A3](#).

Other site surveys, where necessary, shall generally be undertaken at this phase.

7.5 Design Specification

Following scheme plan approval, it is appropriate to commence the design specification phase.

A design specification shall be produced for signalling works to satisfy the client's requirements. The design specification shall be subject to acceptance by Network Rail. It shall originate from the OPS or equivalent.

The design specification shall consider the following:

Items (a) to (d) are mandatory for statutory approval purposes.

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- a) project description and extent of works (including policy on redundant asset recovery);
- b) the standards to which the works are to be designed;
- c) proposed timescales (including those for the supply of closure lists to the tester in charge and the completion of final records);
- d) the different means to be used to assure safety (and the interfaces in a hybrid approach), such as risk assessment, together with any mitigation or control measures arising (see Sections 17 and 18);
- e) any safety cases or type approval required for new systems or equipment (see Section 18.3);
- f) any relevant information from the design specification of the existing installation;
- g) assurance of competent and adequately resourced personnel (see Section 6);
- h) relationships between design authorities, as well as interfaces with other authorities, disciplines, functions and sub-contractors (see Section 6.2);
- i) the extent of correlation required, together with any responsibilities for subsequent updating and remedial action (see Section 7.7);
- j) any factors identified in an assessment of the proposed works (see [NR/L2/SIG/11201 – Module A2](#));
- k) stagework and testing strategies, for constructability and testability;
- l) environmental considerations;
- m) train operating requirements;
- n) dependability requirements (see Section 19);
- o) other design parameters and assumptions, such as permissible speeds, headway, type of electrification, etc. (see [NR/L2/SIG/11201 – Module A2](#));
- p) design production methodology (see Section 8.2), including arrangements for record updating and any redrawing necessary;
- q) any requirement for overlapping or parallel design, with the necessary control measures (see Section 9);
- r) any special control measures or relaxations granted for the special cases described in Section 15, such as whether all previously designed works have been commissioned, and, if not, the means of controlling any discrepancies arising;
- s) design check recording methodology (see Section 9);
- t) means of applying configuration control, particularly to software systems (see Section 14);
- u) responsibilities for collating documentation to be submitted for Network Rail approval and statutory approval (see Section 10);
- v) system interfaces (see Sections 14.6 and 14.8);

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- w) other information necessary to enable the control tables and engineering details to be compiled from the scheme plan; and
- x) method of controlling and authorising changes to the project, including changes to the client's requirements, scheme plan and design specification, etc.

As the scheme progresses, a log of significant changes or variations to the scheme shall be appended to the design specification, together with the date and reason for each change. Decisions taken with respect to the implementation of changed standards (see Section 5.3) shall be similarly recorded. "Significant" change shall be defined in the design specification. (The concept is used further in Sections 10.5, 10.6, 11.1, 11.2, 18.3.2 and 18.4.)

Guidelines on the production method, acceptance and format of the design specification are given in [NR/L2/SIG/11201 - Module A4](#).

A copy of the current accepted design specification shall be held by Network Rail. It shall subsequently be retained in the health and safety file.

In the special cases described in Section 15.2, where the extent and type of work proposed is sufficiently restricted, a recognised method statement may be used in lieu of a design specification.

7.6 Health and Safety Documentation

This section applies where the signalling works fall within the scope of the Construction (Design and Management) Regulations. Guidelines are given in [NR/L2/SIG/11201 - Module A5](#).

7.6.1 Health and Safety Plan

A health and safety plan shall be adequately developed by the principal contractor and accepted by Network Rail, before construction work commences on site. It shall include, as a minimum, the following items from a health and safety perspective:

- a) project description and proposed timescales;
- b) assurance of competent and adequately resourced personnel, with roles and responsibilities;
- c) any relevant information from an existing health and safety file;
- d) review of the major safety and environmental hazards, including any factors identified in an assessment of the proposed works (see [NR/L2/SIG/11201 – Module A3](#));
- e) hazard identification relating to each element of the work, together with any hazards to be eliminated or risk control measures to be designed (see Section 17);
- f) additional safety information to enable a competent contractor to put appropriate precautions in place, including personal protective equipment and warning devices (see Section 17); and
- g) safety arrangements for the project, including method statements and site rules, access points, permissible train speeds, procedures for the safe

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operation of plant, control of hazardous substances, fire safety, electrical safety, etc.

7.6.2 Health and Safety File

At appropriate phases of the scheme, the design authority shall contribute to a health and safety file that is compiled by the planning supervisor and retained for the life of the installation. The following information shall typically be submitted for inclusion or reference on the file:

- a) the design specification;
- b) the design records, together with explanations of unusual design features;
- c) the standards to which the works are designed (see Section 5.2);
- d) known safety hazards that have been addressed and those that have not been addressed (see [NR/L2/SIG/11201 – Module A6](#));
- e) decisions based on risk assessment, with reference to any specific safety cases (see Section 18);
- f) evidence that the signalling system depicted on the engineering details consists of approved sub-systems and equipment working within their application criteria (see [NR/L2/RSE/100](#));
- g) operating manuals and procedures;
- h) maintenance manuals and procedures; and
- i) any other information on risks to be managed during operation, maintenance, or future works on the completed infrastructure.

7.7 Correlation

Before any alterations are made to the design of a signalling system a check shall be made to confirm that the system correlates accurately with the records which will form the basis of the design alterations. Any deficiencies found shall be investigated. The process is detailed in [NR/L2/SIG/11201 - Module A7](#).

The design authority shall confirm correlation is undertaken before construction work commences on site, unless the design records bear a recent correlation date for the current version. The other circumstances in which a waiver may be obtained from the Route Asset Manager (S&T) are given in [NR/L2/SIG/11201 - Module A7](#).

Correlation working copies shall be obtained from the current master record (or, where work is in progress and it is agreed in the design specification to allow parallel processes, from a production copy).

7.7.1 Scope

The scope of the proposed correlation, together with any responsibilities for subsequent updating and remedial action, shall be agreed in the OPS, or equivalent, and design specification.

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Guidance on defining the scope of correlation, in terms of the level of detail and method of correlating the different functional elements, is given in [NR/L2/SIG/11201 - Module A7](#).

Where part of a record sheet requires to be correlated, correlation shall be undertaken on the whole sheet, unless otherwise agreed in the design specification. This does not apply to sheets containing analysis (e.g. of fuses, contacts, cable cores or transmission channels), where correlation may be limited to the function(s) concerned.

7.7.2 Correlation Records

All inconsistencies discovered shall be recorded and shall be verified by independent checking.

The authority performing the correlation shall confirm that:

- a) any deficiencies identified are investigated;
- b) maintenance records on site are temporarily endorsed and certified with any corrections;
- c) the source records and any production copies affected by the correlation process are corrected to the correlation copies;
- d) updated security copies are supplied to the records custodian; and
- e) updated maintenance records are provided within an appropriate timescale.

Where the whole of a sheet has been correlated and updated with any necessary corrections, the date correlated and the updated version shall be entered in the 'last full correlation' field on the title block of the source record.

8 Design Process

The design authority shall have in place a process for preparing complete sets of production design details. The methodology to be used for each commissioning shall be stated in the design specification.

The scheme plan shall be developed from the client remit and OPS or equivalent. Control tables and engineering details shall be produced, in turn, from an approved scheme plan and design specification.

The complete range of design details is defined in [NR/L2/SIG/11201 - Module A2](#).

8.1 Design Objectives

The design shall seek to achieve the following objectives:

- a) clear, accurate, consistent and unambiguous presentation;
- b) compliance with the referenced standards (see Section 5.2);

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- c) compliance with the client's requirements, as reflected in the design specification (see Section 7.5);
- d) complete control of design documentation (see Section 14);
- e) an appropriate level of safety (see Sections 17 and 18);
- f) completeness (see [NR/L2/SIG/11201 - Module A2](#));
- g) facilitation of construction (including stagework) and testing; and
- h) a functional design that is fit for purpose.

The presentation and convention to be used is given in Section 16.

8.2 Production Process

Production of alterations shall generally be undertaken on the medium for production, which is either the source record, or a copy of the source record. Production shall only commence when:

- a) the source record has been updated to any commissioning modifications for any alteration due to be commissioned prior to the alteration concerned, unless the relaxation given in Section 9.1(a) is used; and
- b) a security copy has been made, where necessary to record the current state of the infrastructure between each commissioning.

The source record itself shall only be altered when approval in principle has been received and there is an assurance that the commissioning will take place.

There is no restriction on the creation of source records for new work, as distinct from alterations to existing installations.

8.3 Verification and Validation Process

The checker and producer are required to adopt a systematic approach to the checking process, so as to confirm that the design objectives (see Section 8.1) are achieved. In particular the checker and producer are to take into account the guidance in [BS EN 61508](#) on validation and verification and the Hazards Forum's: Safety-related systems: Guidance for engineers.

The independent check shall be rigorous and comprehensive, and place no reliance on the testing process revealing any residual errors. It shall include the following features:

- a) first principles are used;
- b) any assumptions made are justified;
- c) hazards are identified and the associated risks controlled;
- d) calculations and/or functional safety analysis are performed where appropriate;
- e) appropriate check and/or error recording processes;
- f) new work and interfaces are 100% checked;

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- g) existing installations are 100% checked in the relevant areas of circuitry or data altered;
- h) any copying of earlier designs, or use of standard computer aided design (CAD) cells, are treated as new work; and
- i) certification is provided in accordance with Section 11.

The checker and producer are required to adopt a systematic approach to documenting the checking and error reporting processes in an auditable manner. The methodology to be used shall be stated in the design specification.

8.4 Correspondence with Source Records

Design details shall only be submitted for acceptance or approval for construction when the source records are in the possession of the responsible design engineer (see Section 10). The source records shall remain in the possession of the responsible design engineer until the final records are completed.

A relaxation is available for minor alterations where Section 15.2, cases (b) or (c), apply.

8.5 Design Guidelines

Guidelines on the production process and methodology, including the medium for production, are given in [NR/L2/SIG/11201 - Module A8](#).

Guidelines on the checking process, including the documentary evidence, are given in [NR/L2/SIG/11201 - Module A21](#).

9 Overlapping and Parallel Design

9.1 Overlapping Alterations

Special controls shall be implemented where it is necessary to relax the design process to allow successive stages or alterations to follow in close succession, in the same signal box area. Production, updating and version control shall be strictly applied in accordance with Sections 8.2, 13.2 and 14, respectively, except as follows:

- a) the production of a subsequent alteration may be commenced as soon as any common source records have been updated in anticipation of the previous commissioning, provided that the same responsible design engineer has been appointed to oversee all overlapping alterations and security copies have been taken where necessary for record purposes;
- b) source records may be updated as soon as an alteration has been checked, provided that the same responsible design engineer has been appointed to oversee all overlapping alterations and security copies have been taken where necessary for production purposes.

The responsible design engineer shall be appointed by the design authority before the design of the first alteration is commenced.

If commissioning dates have not already been defined, the responsible design engineer shall nominate an assumed order in which the commissionings are to be

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treated, with reference to the draft staging and testing strategy, and tester in charge, if appointed.

The alterations shall be designed on this basis. If the nomination proves incorrect, each alteration shall be modified as necessary to allow for the new commissioning order. The latest planned commissioning order shall be stated in the design specification, or supplement thereto.

This process will be facilitated by arranging simple interfaces between each alteration and agreeing the usage of spare fuses, cable cores and relay bases, etc.

Where (due for instance to the proximity of multiple overlapping alterations, or limitations on competence of the design authority) it is not practicable for one design authority to be responsible for all work, Network Rail shall appoint a responsible design engineer to oversee all work, co-ordinate the roles of the individual responsible design engineers, and manage their conflicting requirements in accordance with this Standard.

Further controls relating to overlapping alterations are given in [NR/L2/SIG/11201 - Modules A12 & A14](#).

9.2 Parallel Processes

Where it is desired to run phases of a project concurrently rather than consecutively, in order to meet compressed timescales, special controls shall be implemented by the responsible design engineer to confirm the integrity of the processes.

A risk assessment shall be used to determine suitable and sufficient control measures to reduce risks so far as is reasonably practicable. These shall be stated in the design specification, or supplement thereto.

9.2.1 Processes Run Concurrently

Processes that affect more than one alteration shall not be run in parallel, except as permitted in Section 9.1.

Examples of processes associated with a single alteration that could be run in parallel, with appropriate control measures, include:

- a) the production of control tables before scheme plan approval;
- b) the production of engineering details before the control tables are checked;
- c) the production of engineering details before site surveys are undertaken;
- d) correlation to production copies whilst work is in progress;
- e) pre-wiring apparatus housings before the engineering details are approved for construction;
- f) record updating before the commencement of construction;
- g) commencing work on site before a 'letter of no objection to proposals' is received; and
- h) other parallel processes not expressly prohibited by this Standard.

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9.2.2 Special Controls

Examples of additional controls include:

- a) a tracking system to confirm that modifications generated by one process are updated in all concurrent processes;
- b) use of controlled multiple sets of modification sheets to update all overlapping alterations, instead of revising individual drawings;
- c) enhanced lines of communication between the design, construction and testing functions; and/or
- d) a means of recovery should the amount of rework escalate out of control.

9.2.3 Suitability of Parallel Processes

The benefits of running parallel processes decline rapidly as the following situations are approached:

- a) the time spent on assessing the risks and devising and implementing additional controls outweighs the time saved by process compression;
- b) it is likely that the amount of rework generated by a change in one process (requiring rework in all the concurrent processes) will outweigh the time saved by process compression.

Parallel processes shall not be used unless the safety risk resulting from the above considerations is as low as reasonably practicable (e.g. unless the business cost of not compressing timescales is grossly disproportional to the safety cost of doing so).

Parallel processes may only be used where the safety risk of delaying commissioning by applying consecutive processes is greater than the safety risk due to the reduced integrity of concurrent processes.

See [NR/L2/SIG/11201 - Module A9](#), for an example of the risk calculations required.

10 Approval and Acceptance

10.1 Principle

Signalling works and systems shall undergo suitable processes to demonstrate that they are safe, dependable and fit for purpose in the particular application and environment in which they are to be used, before they are taken into service. Specifically, they shall conform to the principle for approval laid down in the Grip Manual, and comply with the Railways and Other Guided Transport Systems (Approval of Works, Plant and Equipment) Regulations 1994 for statutory approval.

10.2 Scheme Phases

Processes shall be in place for the content of each of the following phases to be agreed with all necessary bodies, so as to achieve the above principle:

- a) scheme plan (approval in principle);

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- b) design specification, for acceptance by Network Rail (see Section 7.5);
- c) stage scheme plan (where required for approval);
- d) engineering details (approval for construction);
- e) testing and commissioning strategy (see [NR/L2/SIG/30014](#)); and
- f) the completed works (statutory approval).

10.3 Approval in Principle (Design Authority and Network Rail)

Scheme plan approval shall denote approval in principle for the scheme.

All signalling works, including stagework, require approval in principle, except for the following:

- a) maintenance works;
- b) like-for-like replacements with approved equipment that do not reduce standards of safety; and
- c) other works that result in no change to the signalling plan or associated documentation.

Network Rail shall record the approval status of the scheme in the approval and version panel on the scheme plan (see [NR/L2/SIG/11201 - Module A10](#)).

10.3.1 Responsible Design Engineer's Role

The scheme plan and ancillary information (see [NR/L2/SIG/11201 - Module A2](#)) shall be initially approved by the responsible design engineer in confirmation that the following items are complete:

- a) the appropriate standards to be used in Section 10.2 (d) have been referenced (see Section 5.2);
- b) the scheme plan has been designed and signed by a competent person (see Section 6.4); and
- c) the scheme plan has been checked and signed by a competent person who is sufficiently independent (see Section 6.5).

The approval copy shall then be signed by the responsible design engineer.

10.3.2 Network Rail's Role

The documentation shall subsequently be submitted to Network Rail for approval. Network Rail shall review the scheme plan to confirm that:

- a) the proposed scheme is feasible, meets the requirements of the remit and the OPS or equivalent, and is therefore fit for purpose; and
- b) the safety of railway operations and safe interworking are in place, having reviewed the proposed signalling facilities using the requirements given in [NR/L2/SIG/11201 - Module A11](#).

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The approval copy shall then be signed for Network Rail production, i.e. for the operation of trains and signal boxes (including compatibility with trains that have route acceptance), and for Network Rail local infrastructure, i.e. for infrastructure compatibility and policy (all disciplines).

10.3.3 Project Approval (Network Rail)

The project manager is required to compile a project safety case for approval by Network Rail at certain scheme phases. This is to demonstrate that changes to the infrastructure are designed to maintain or improve the safety of railway operations. The following signalling documentation shall be made available to the project manager for this purpose:

- a) the health & safety plan and health & safety file (see Section 7.6);
- b) any risk assessment reports and similar documentation not included in the above (see Section 18.2); and
- c) contractors' safety cases.

10.4 Acceptance of Engineering Details (Network Rail)

Network Rail shall have in place procedures for the acceptance of engineering details, including significant modifications, before construction commences.

10.5 Approval for Construction (Design Authority)

All engineering details depicted on the approval and issues record (AIR), and any other significant modifications, require approval for construction.

Before the engineering details are issued for construction purposes (or data installation), the engineering details shall be approved by the responsible design engineer in confirmation that the following items are complete:

- a) the scheme plan has been approved by Network Rail (see Section 10.3.2);
- b) the engineering details are in conformity with the design specification (see Section 7.5) and the testing and stagework strategy;
- c) the original design parameters and assumptions stated in the design specification are still valid;
- d) the engineering details have been designed and signed by a competent person (see Section 6.4);
- e) the engineering details have been checked and signed by a competent person who is independent (see Section 6.5);
- f) the interdisciplinary engineering details have been additionally checked and signed by nominated responsible engineers/managers in each relevant discipline;
- g) the source records are in the possession of the responsible design engineer;