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Level 2

Signalling Design: Module A2 - Minimum Requirements for Design Details

Endorsement and Authorisation

For endorsement and authorisation, please refer to
NR/L2/SIG/11201

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Issue record

Issue	Date	Comments
4	June 2011	Modularisation of handbook and guidance notes, contains content of former NR/GN/SIG/11701 Part N.
5	03/09/2011	Amended references due to withdrawal of NR/L3/SIG/30018

Compliance

This Module is mandatory and shall be complied with by Network Rail and its contractors if applicable from 03/09/2011.

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.

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Minimum Requirements for Design Details

The minimum requirements for each specific type of documentation are as listed below. The examples shown in Figures 1 and 3 to Figure 17 are typical and should not be taken to imply any particular requirement. (Note that they predate the change from Railtrack to Network Rail.)

1 Documentation Required for Approval in Principle

The details required to be submitted for approval in principle, in accordance with [NR/L2/SIG/11201](#), include the scheme plan and associated documentation.

1.1 Scheme Plan

A scheme plan is a scale layout plan depicting new or altered signalling systems. Where sequential commissionings are required, derivative stage scheme plans should be produced (see Section 1.8).

A scheme plan is produced to express, in a form that is readily understood by signal engineering and operations personnel, the signalling requirements of all interested parties. Network Rail should have procedures in place to control the interfaces between disciplines.

Scheme plans should fulfil the following purposes, as necessary:

- a) submission for approval in principle and Her Majesty's Railway Inspectorate (HMRI) statutory approval as described in [NR/L2/SIG/11201](#);
- b) checking interdisciplinary details associated with train operating, permanent way, civil engineering, electrification, plant and telecommunication requirements (unless covered by the location area plan);
- c) estimating and contract tendering, where applicable;
- d) compiling control tables, and other design details;
- e) providing a derivative for the production of a location area plan (see Section 4.1);
- f) deriving signal box diagrams, panel faceplates, VDU maps, fixed diagrams and maintainer's monitoring panel face plates for remote interlockings (see Section 5.1);
- g) creating the simplified layout plans required for automatic route setting; map search, sub-route and sub-overlap plans (see Section 4.13); operating notice diagrams (see Section 5.5); and safety diagrams (see Section 5.6); etc.;
- h) signal sighting (see Section 1.9);
- i) laying out new equipment on site and identifying recoveries (this is also shown on the location area plan, when available, with more engineering detail);
- j) functional and control table testing;
- k) compiling specifications of work for the fringe areas;
- l) in the case of multiple stage schemes, deriving stage scheme plans for each commissioning (see Section 1.8);
- m) producing a signalling plan for record purposes (see Section 1.2); and

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n) other purposes as necessary.

Network Rail's specific requirements should be obtained from the outline project specification (OPS) and associated documentation. All details listed in Sections 1.1.4 to 1.1.7 should be shown on the plan and, where practicable, dimensioned to the datum point. Items that are marked* should always be so dimensioned.

Part of a typical scheme plan (for part of the layout in Figure 12) is illustrated in Figure 1. See [NR/L2/SIG/11201, Module A15](#), Section 3 for layout plan convention.

1.1.1 Scheme Plan Layout

The scheme plan should be laid out in four parts, viz.:

- The single line plan of signalling, drawn to scale longitudinally, which should include items shown in Sections 1.1.4 to 1.1.7.
- The site plan, showing the geographical location of the scheme within the railway network.
- General notes applicable to the signalling scheme as a whole should be included next. In addition, the signal box notes for a new signal box should be included in full, either here, beside the signal box symbol or referenced and provided as a separate document. For signal box and general notes see Section 1.3.
- An approval and version panel explained in [NR/L2/SIG/11201, Module A10](#), forms the final leaf.

A typical layout is illustrated in Figure 2.

1.1.2 Fringe Areas

The fringe areas of the scheme might not be drawn to scale. Only relevant signalling belonging to a fringe signal box need be shown, but all fringe signalling functions that it might be necessary to show in the associated control tables should be included.

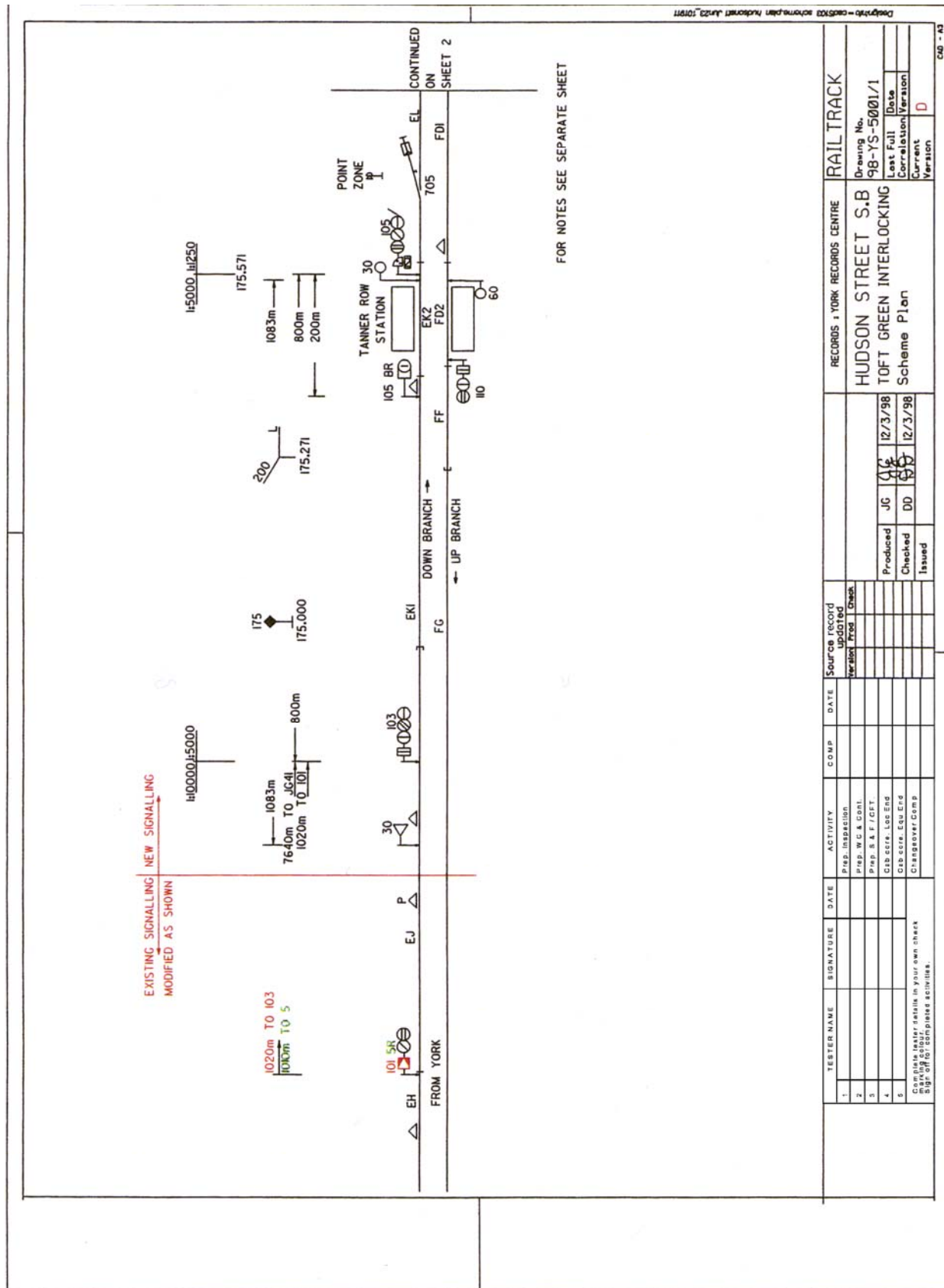


Figure 1 – Extract of Typical Scheme Plan

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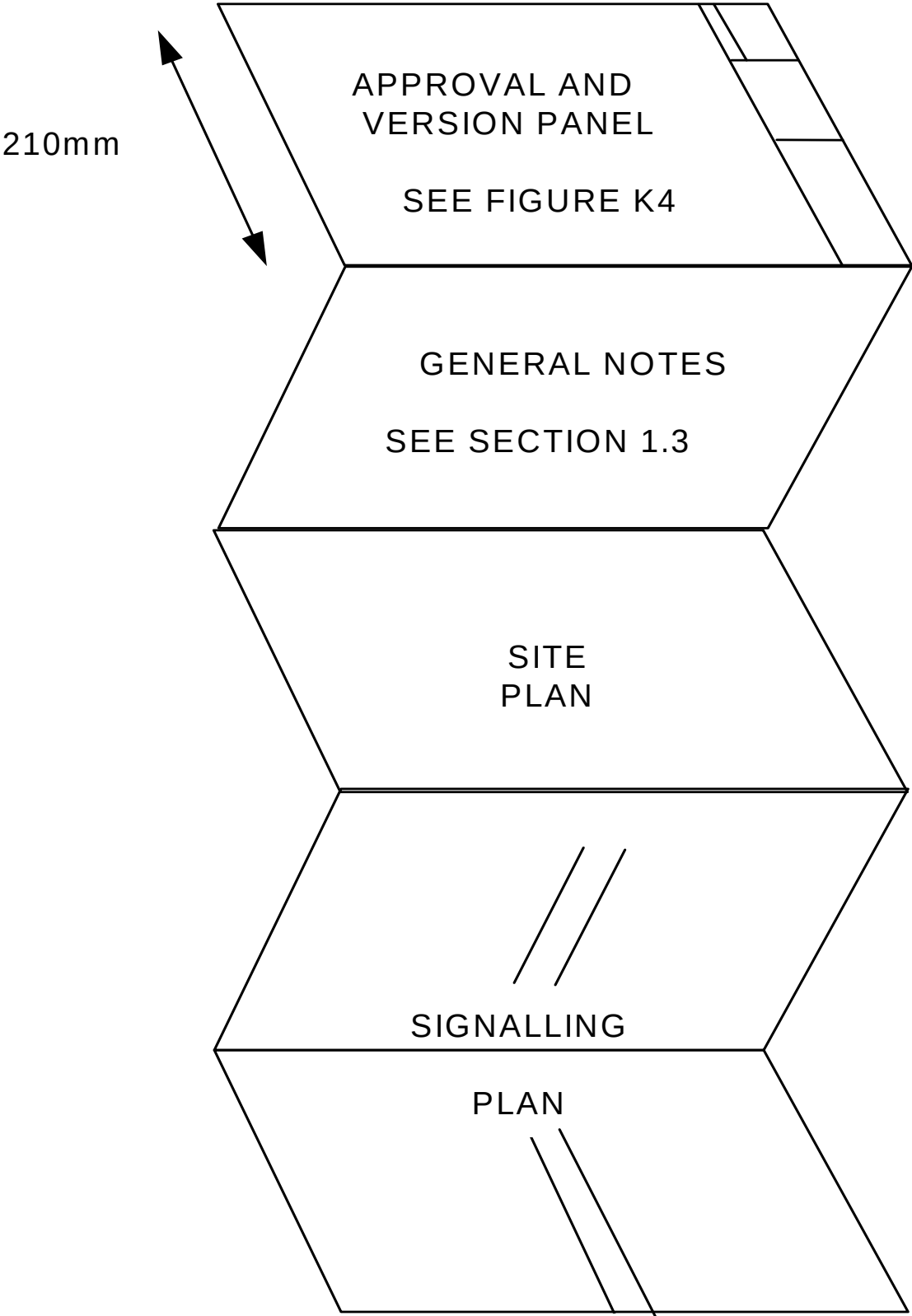


Figure 2 – Typical Scheme Plan Layout

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1.1.3 Associated Information

The following ancillary information should also be provided, either on the scheme plan, or as separate documents and referenced on the scheme plan:

- a) signal box notes (Section 1.3);
- b) numbering grid (Section. 1.4);
- c) signal spacing parameters (Section 1.5);
- d) aspect sequence chart (Section 1.6); and
- e) table of signal routes (Section 1.7).

Scheme plans generally have four phases of production, as described in Sections 1.1.4 to 1.1.7.

1.1.4 Civil Engineering Features

The base plan should include the following;

- a) gradient posts* (see also Section 1.3.2.m);
- b) ¼ mileposts (or metric equivalent)* (see also Section 1.3.2.m);
- c) mileage changes*;
- d) the main route lines (generally shown straight);
- e) the permissible speed, including changes in speed*, enhanced permissible speed where appropriate and turnout speeds (see [NR/L2/SIG/30021](#) for any proposed alterations);
- f) geographical names (see [GK/RT0009](#));
- g) the accurate position of S&C (drawn in their normal lie);
- h) any additional trap points or derailleurs required (see [GK/RT0064](#));
- i) viaducts and tunnels (with lengths);
- j) bridges that affect the positioning of infrastructure* (confirming that essential detail is not obscured) - see Section 5.1.1 for information to be supplied to the signaller;
- k) station and other platforms (numbered if relevant to signalling);
- l) level crossings* (including all vehicular crossings and all other crossings with some form of protection) - see Section 5.1.1 for information to be supplied to the signaller;
- m) buffer stops*;
- n) traction substations* and, in d.c. traction areas, track paralleling (TP) huts* (neutral sections should be shown in a.c. areas with a special symbol to restrict the placing of signals in accordance with [GE/RT8037](#));
- o) limits of electrification;
- p) other adjacent railway, electric tramway, or high voltage overhead power line to highlight potential signal sighting, immunisation or track circuit problems (this also applies to railways and tramways crossing by bridge or tunnel);

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- q) site access points (both foot and vehicular);
- r) when sited, signal boxes* (with name and prefix), interlockings* and ground frames*; and
- s) reference at the extremities to any continuation sheet*.

*NOTE * These items should always be dimensioned to the datum point.*

1.1.5 Main Running Signals

The following features associated with main running signals (and stop boards on running lines) should be added:

- a) positioning* (see [GK/RT0045](#) and [GK/RT0034](#));
- b) aspect sequence details (unless given elsewhere, see Section 1.6);
- c) signal identities (see [GK/RT0045](#)), signal designations (showing normal aspect);
- d) standard signal profiles (see [GK/RT0045](#)) - these are subject to signal sighting (Section 1.9) and mechanical design (Section 4.10);
- e) table of signal routes, once signals have been numbered (unless given elsewhere, see Section 1.7); and
- f) key track section joints (defining overlaps, clearance points and standage, etc.); for further train detection requirements see Section 1.1.6d).

*NOTE * These items should always be dimensioned to the datum point.*

Where appropriate reference to "signals" should be understood in relation to movement authorities within both lineside signalling and cab signalling systems.

Guidance on the positioning of running signals will be given in [NR/L2/SIG/11201, Module B17](#).

1.1.6 General Signalling Details

The remaining details should be added, as listed in a) to h), below. Wherever practicable, these details should be independent of technology (which should subsequently be defined on the location area plan), unless aspects of the technology require agreement of operations personnel, e.g. resetting of axle counters, or details of manual point operation.

Certain facilities may be shown in tabular form where this will improve clarity.

- a) Other signals and indicators (see [GK/RT0045](#)), including:
 - I. position light signals;
 - II. other subsidiary or shunting signals;
 - III. route indicators;
 - IV. fixed red stop signals*;
 - V. exit signals from non-running lines*;

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- VI. loading/unloading indicators;
- VII. limit of shunt signals;
- VIII. stop boards* (stating the legend);
- IX. shunter's white lights; driver's crossing indicators and advance warning boards; and
- X. distant boards* permissible speed indicators* and advance warning indicators*, together with any associated permanent automatic warning system (AWS) inductors (see [GK/RT0075](#)).

b) Other facilities for signals, including:

- I. AWS inductor - simple (permanent and electro), bi-directional, directional/selective (i.e. suppressed), or permanent and any associated signs (see [GE/RT8035](#) and [GI/RT7033](#)); or other protection system devices;
- II. signal post telephone (SPT) showing the signal box prefix letters (or covered by a general note) and any diamond signs, etc. (see (e)viii));
- III. floodlights: for stop/warning boards (unless reflectorised and trains equipped with headlights), disc signals (in colour light areas) and tunnel telephones;
- IV. automatic working or replacement facilities and signals controlled by a gate box, but with telephone to the supervising signal box (or shown on the table of signal routes);
- V. any passable controlled signals, non-passable automatic signals, or single device controlled signals protecting a.c. neutral sections, etc., identified with a note;
- VI. signal replacement track section joint, dimensioned if between 0m and 5.5m beyond the signal, and last wheel replacement facility;
- VII. limit of overlap track section - for full overlaps, restricted overlaps (ROL), phantom overlaps (POL), and/or restricted phantom overlaps (RPOL), including bi-directional overlap joints;
- VIII. alternative limits of overlap afforded by swinging the overlap at facing "hinge" points;
- IX. facilities for selecting alternative routes, or overlaps;
- X. automatic train protection (ATP), tilt authorisation and speed supervision (TASS) or train control system (TCS), loops or balises;
- XI. train protection and warning system (TPWS): identification of the OSS (overspeed sensor system) or TSS (train stop system); reference to identify the associated signal, PSR, or buffer stop; set speed(s) of the OSS; line speed(s) used to calculate the positions of the OSS loops; distance from the leading edge of the OSS and/or TSS trigger loop (centre of the TSS loop pair) from the associated signal, PSR, or buffer stop; distance from the TSS trigger loop to the replacement track joint; and the separation of the OSS arming and trigger loops, in accordance with [NR/L2/SIG/10133](#), generally in tabular form.

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The TPWS exclusion code for non-fitted signals should also be shown (see [NR/L2/SIG/10137](#));

- XII. mechanical train stops (see [GE/RT8018](#));
- XIII. lever lock, block release or token release symbols;
- XIV. for specified pairs of opposing position light signals, the legend: "Opposing Locking Omitted" with an arrow to each; and
- XV. signal passed at danger (SPAD) mitigation facilities, including SPAD indicators and/or selective AWS inductors (see [GI/RT7006](#)); also signal reminder boards and countdown markers (see [GI/RT7033](#)). Any special controls should be noted on the plan or on the Table of Routes (Section 1.7.2). (Note that the abbreviation SPADI is non-preferred for a SPAD indicator, due to potential confusion with inductor.)

c) Points, including:

- I. method of operation, or by general note (or list of power points, etc.). Where applicable, the six foot point operating mechanism symbol should be shown on the side with the best provision for personnel safety, usually the cress or ten foot side. Unless the agreement of operations personnel is required, the point operating mechanism symbol may just be provided on the location area plan. Symbols may alternatively be shown on the bonding plan, particularly in d.c. traction areas where the conductor rail is required to be gapped.
- II. symbol for an independent facing point lock and, where applicable, FPL bar;
- III. operating handle location (generic symbol);
- IV. point zone (PZ) telephones;
- V. split detection (covered by a note) or separate end numbering;
- VI. electrical detection for mechanically operated points;
- VII. point switch heaters (usually covered by general note);
- VIII. switch diamonds (treated as two point ends) or swing nose crossings;
- IX. scotch blocks or derailleurs;
- X. facing trap points, with sand drag if necessary (see [GK/RT0064](#)), or run back spring controlled catch points;
- XI. self restoration of power operated trap points, derailleurs, or catch points (covered by a separate note); and
- XII. points which are clipped and padlocked out of use pending abolition or pending commissioning.

d) Train detection or block system, including:

- I. each track circuit or axle counter section extremity using the standard symbols;

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- II. clearance points and track sections less than the minimum length which thus require special controls (stating the length) (see [GK/RT0028](#));
 - III. track circuit interrupters on trap points or catch points, marked "INT R" where independently proved;
 - IV. track sections at in-section ground frames;
 - V. additional track sections for the approach release of junction signals or warning/position light aspects (see [GK/RT0045](#)), or to control an AWS inductor and/or replace a banner signal, such as on a permissive line;
 - VI. the final track section joint at the extremity of an area of continuous train detection;
 - VII. miscellaneous treadles;
 - VIII. stainless steel welded strips on lightly used crossovers or lines;
 - IX. additional track section joints for immunisation purposes or to protect dangerous goods facilities (see [NR/L2/SIG/11752](#));
 - X. limits of track sections indicated in each signal box;
 - XI. track sections or train approaching indications that are combined on the signalling display, defined by a note on the plan, stating the constituent track sections and any point or signal conditions;
 - XII. track sections that are divided for operating purposes, but indicated as one to the signaller;
 - XIII. no signaller token instruments and similar devices;
 - XIV. symbols depicting block instruments, block switch, etc. adjacent to the signal box symbol (or covered in the signal box notes); and
 - XV. track circuit actuator interference detector (TCAID) devices.
- e) Additional information in areas of semaphore signalling, or manual block (see [GK/RT0039](#)) including:
- I. symbol for power operated semaphore signals;
 - II. slot symbol for any signal worked from more than one signal box, such as a home signal combined with the starter for the box in rear; but not shown for a distant arm on the same post as a stop signal, unless (e.g. in the case of an outer distant) it is also slotted by another signal;
 - III. multiple signals to convey routing information;
 - IV. intermediate block home and distant signals (generally colour light and worked by the same lever) to improve headway, with any associated warning of train running away covered by a note;
 - V. a block release symbol on the section signal (or intermediate block home) that controls entry into the block section ahead;
 - VI. a track section for the berth of the home signal and elsewhere where the line is not clearly visible to the signaller;

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- VII. clearing points or block overlaps defined by track section joints identified as "BOL";
 - VIII. a diamond sign for signals with berth track sections (or other means of detection, such as train waiting treadle or electric token working), but no telephone;
 - IX. depression bars;
 - X. treadle operated annunciators or train waiting indications covered by notes;
 - XI. a bell symbol and note for older types of crossing or train activated warning system;
 - XII. multiple signals worked by the same lever identified by a note arrowed to the signals and stating any selection by points;
 - XIII. signal repeaters denoted by letters on the plan, or listed in the signal box notes (not required for colour light aspects repeated);
 - XIV. symbols for intensified light, or electrically lit semaphores, or retroreflective arms covered by a note; and
 - XV. special arrangements of mechanical detection covered by notes.
-
- f) Ground frames (only where specified), including symbol for type of ground frame, number of functions and whether covered, with additional information adjacent:
 - I. ground frame name;
 - II. dimension to the datum point*;
 - III. release lever/switch number and the prefix and release number of the main signal box (if there is more than one release, each release should indicate the function concerned with an arrow);
 - IV. symbol for the telephone to the main signal box;
 - V. a slot symbol for any ground frame signals which either require a separate release from the main signal box, or have some routes controlled from the ground frame and some from the main signal box (with a suitable note in the relevant route boxes); and
 - VI. the ground frame notes (see Section 1.3).
-
- g) Level crossings (see [GK/RT0192](#), & [NR/L2/SIG/11201 Modules X01 – X99](#)), including symbols for type of protection (number and type of barriers, road lights, miniature stop lights, staff crossing white lights, etc.), with additional information adjacent:
 - I. legal name; dimension to the datum point*;
 - II. type of control (AHBC, AOCL, etc.);

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- III. symbols for telephones to the supervising or monitoring signal box (with prefix);
- IV. a note if an automatic raise or automatic lower facility is provided for MCBs;
- V. advance warning boards* and, where applicable, stop boards for OCs and TMOs;
- VI. symbols for the drivers' crossing indicators and crossing floodlights for AOCLs and ABCLs;
- VII. symbols for the level crossing advance warning boards* and AWS inductors for AOCLs and ABCLs, with cancelling indicators where necessary on bi-directional lines;
- VIII. symbols for the special speed restriction boards* for AOCLs & ABCLs, and wrong direction speed restriction boards*, where applicable, for all automatic crossings;
- IX. delineations indicating the strike-in points* for automatic crossings, stating the travelling time to the crossing at the stated permitted approach speed (or the appropriate reduced speed for AOCLs and ABCLs);
- X. inner strike-in points*, similarly, where required for an intervening station or signal, with the criteria used to calculate the attainable speed;
- XI. where not all trains stop at an intervening station, a note of stopping/non-stopping selection;
- XII. run-by treadles or track circuits at any intervening signal (intervening automatic signals generally display a red aspect);
- XIII. exit track circuit joints and treadles;
- XIV. short track sections over the crossing;
- XV. delineations indicating the train detection device* which initiates annunciator, automatic lower and/or picture switching for MCB/CCTV crossings; and
- XVI. for automatic crossings, the level crossing notes (see Section 1.3).

NOTE items (g) vi) to ix) are also required on wrong line approach tracks unless bi-directional controls are specifically excluded.

See [GI/RT7033](#) for details of signs. Guidance on level crossing design is given in [NR/L2/SIG/11201 Modules X01 – X99](#).

h) Miscellaneous facilities, including:

- I. train ready to start (TRTS) plungers, on platforms where passenger services commence;
- II. right away (RA) and close doors (CD) indicators and plungers on driver only operation (DOO) lines;
- III. alias plates and radio channel change markers for cab secure radio (CSR) or radio electronic token block (RETB);

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- IV. off indicators, for the use of operating personnel (see [GK/RT0045](#));
- V. shunter's acceptance devices or releases, provided where a shunter has no other release on incoming routes;
- VI. train arrived complete plungers, where the signaller cannot sight the tail lamp of a train leaving a block section (unless a tail lamp telephone or CCTV system is provided);
- VII. lockout devices* for personnel safety on bi-directional or depot lines, showing the number of the signal box release, and the direction locked out, where applicable (see [GK/RT0212](#));
- VIII. train activated warning systems, with the extent of the zones indicated (see [GK/RT0029](#));
- IX. buffer stop lights (see [GK/RT0045](#));
- X. miscellaneous notice boards and signs for operating purposes (see [GI/RT7033](#));
- XI. hot axle box detectors;
- XII. AWS test inductors or tripcock testers;
- XIII. other telephones at strategic points, such as tunnel mouths;
- XIV. other numbering or identification necessary; and
- XV. various delineations, such as limits of contract, limits of signalling alterations and areas of overlap with other signalling/scheme plans.

NOTE * These items should always be dimensioned to the datum point.

1.1.7 Site Survey Amendments

The plan should be amended to signal sighting (see [GE/RT8037](#)) or site survey requirements:

- a) amendments to signal positions* recommended by the sighting committee (subject to compliance with [GK/RT0045](#));
- b) recommended amendments to profiles, with appropriate symbols for cantilevers, gantries and wall, roof, or ground mountings (subject to compliance with [GK/RT0045](#));
- c) banner repeating signals*, co-acting signals* or off indicators recommended;
- d) recommended orientation of the SPT with any special facilities for restricted clearances or illumination;
- e) recommended amendments to permissible speed indicators for limited clearance (miniature signs);
- f) symbols for intensified light, or electrically lit semaphores and arm repeaters, or retroreflective arms covered by a note, where recommended;
- g) requirement for short range optical systems, or spreadlight or polycarbonate lenses, identified with a note;

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- h) additional road lights following level crossing site survey;
- i) any critical or sub-standard clearances at S&C should be identified and dimensioned to fouling point, with large scale (transverse and longitudinal) detail where necessary (see [GK/RT0028](#));
- j) adjustments necessary to control tables, e.g. following survey of critical clearance points;
- k) repositioning of point machines, i.e. RH or LH; and
- l) TCAID devices found to be necessary following a search for leaf fall areas.

*NOTE * These items should always be dimensioned to the datum point.*

The scheme plan as a whole should then be reviewed to confirm that neither signal spacing, headway nor other signalling considerations have been compromised.

1.2 Signalling Plan

A signalling plan is a scale layout plan, used to record, in a form that is readily understood by signal engineering and operations personnel, the current signalling facilities and identities. It is usually a derivative of the scheme plan, updated to all signalling alterations and amendments (see [NR/L2/SIG/11201, Module A14](#)).

The signalling plan should fulfil the following purposes, as necessary:

- a) general reference of all signalling functions;
- b) deriving signal box and ground frame diagrams, panel faceplates, VDU map layouts and fixed diagrams, for the use of signallers (see Section 5.1);
- c) providing additional information for signallers;
- d) informing other operations personnel;
- e) providing a plan that is acceptable to outside parties, joint enquiries, etc.
- f) enabling control tables to be read (control tables should not be issued without a signalling plan);
- g) facilitating preventative and corrective maintenance;
- h) routine and incident testing;
- i) providing a derivative for a location area plan (see Section 4.1); and
- j) generating a new scheme plan for a proposed signalling alteration (see Section 1.1).

Separate signalling plans should be provided for every signal box or interlocking, showing all signalling functions controlled, supervised or monitored from the signal box. Where applicable, the plan should be extended to include the data collection area.

In addition to the items shown on the scheme plan, certain items from the location area plan (see Section 4.1) should also be shown, such as interlocking boundaries and track section information. See Section 5.1.1 for information to be supplied to the signaller.

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Sufficient dimensioning should be provided in order to relate each sheet of the signalling plan to any adjacent sheet, or adjacent signalling plan, including signal to signal distances, where applicable. The name of each adjacent signal box should be stated, together with its prefix, where relevant, and plan number at each extremity of the plan.

(Signalling plans were regionally known as domestic diagrams, locking sketches and numbering plans.)

1.3 Signal Box Notes and General Notes

These are a list of the key features of a signal box, or signalling scheme, including any functions that are not clear from the signalling/scheme plan.

These notes are not intended to replace operations instructions for the use of signallers (see [GO/RT3215](#)) and sufficient information should be separately supplied to the Operations Manager to enable the signal box instructions to be compiled.

The term signal box notes also includes notes provided for:

- a) ground frames (including switch panels);
- b) gate boxes; and
- c) automatic level crossings.

They generally apply to the installation as a whole, rather than to individual interlockings.

1.3.1 Format

Signal box notes should be provided in one of the following forms:

- a) in full on the last sheet of the signalling/scheme plan;
- b) adjacent to the symbol on the plan (e.g. for ground frames without a diagram, or automatic level crossings without a separate plan);
- c) in extract form adjacent to the symbol on the plan (for alterations to an existing installation shown on a scheme plan);
- d) as a separate (preferably A4) document, possibly generated from a computer file (of a format agreed with the Project Engineer); or
- e) on the signal box diagram (not for new work), or ground frame diagram, as applicable.

1.3.2 Content

The following information should be included in the general notes for the signalling system or installation as a whole:

- a) constraints imposed on train operations, e.g. permitted and non-permitted types of train (see the route acceptance process described in [GE/RT8270](#));
- b) permissible speed for the route(s), with individual speeds shown on the plan;
- c) signalling design speed (where different from the permissible speed and documented in the design specification);

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- d) signal spacing curves used (see [GK/RT0075](#));
- e) maximum acceleration/deceleration data of traction units that have route acceptance, where required for determination of maximum attainable speed;
- f) design headways (non-stop and following stopping);
- g) whether new signal positions and profiles have been amended to sighting committee recommendations, or "subject to signal sighting";
- h) whether clearance points shown on the plan have been checked on site, or "subject to site survey";
- i) type of electrification;
- j) units of measurement (unless individually identified on the plan);
- k) longitudinal scale (unless individually identified on the plan);
- l) the version of signalling principles and design standards used (see [NR/L2/SIG/11201, Module A11](#), Section 4.1) in accordance with [NR/L2/SIG/11201](#);
- m) source information (signalling plan number and version and site survey date), or "subject to site survey" (note that mileposts should be surveyed - if not, an explanatory note should be added stating any assumption made, e.g. 402m apart); also source of gradient data, preferably from a recent survey;
- n) datum point used (with route if more than one); and
- o) other essential signalling information for approval in principle that is not evident from the plan.

1.3.3 Typical Mechanical Signal Box

The following information is typically required for a small mechanical signal box, unless it appears in some other form on the signalling plan, table of signal routes, or numbering grid:

- a) whether elevated, platform, or ground mounted frame;
- b) total number of levers;
- c) identities of spare levers, spaces, fixed levers (normal or reverse) and levers worked for interlocking purposes;
- d) identity of any other function not shown on the plan;
- e) whether illuminated diagram provided (or if more than one);
- f) statement if non-block post;
- g) type of block on each line and whether Welwyn control provided;
- h) if track circuit block, type of emergency communication to adjacent block posts and method of describing trains;
- i) if block post, whether block closing switch provided;
- j) statement if absent switch provided (for level crossing purposes);

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- k) list of arms, slots and lamps repeated (semaphore only) with any groupings or special conditions;
- l) list of track sections indicated;
- m) list of electrically lit semaphore signals;
- n) list of signals working automatically when lever reversed;
- o) list of automatic signals with signaller's replacement devices;
- p) list of any replacement indications that do not prove signals alight;
- q) list of automatic signals with signal post replacement switches;
- r) list of mechanically detected points (and if detected in one position only);
- s) list of electrically detected points (unless power operated);
- t) method of power operating points, where applicable, or list of points operated by each method;
- u) if power operated, location of point handle and/or crank handle for the use of operating personnel in emergency, and release where applicable;
- v) whether FPLs stand normally out or in (usually out);
- w) list of points with switch heaters provided and whether switching is automatic or timed;
- x) list of electrically lit gate lamps provided, where applicable;
- y) list of any controlled power operated barriers and state whether CCTV supervision and/or emergency local control is provided;
- z) list of any automatic barriers monitored;
- aa) list of any movable bridges indicated;
- bb) conditions incorporated into train approaching indications, where applicable;
- cc) list of signals with telephones;
- dd) list of points with telephones;
- ee) units of measurement and datum point (usually taken from the centre of the signal box); and
- ff) other essential signalling information that is not evident from the plan.

1.3.4 Typical Power Signal Box

The following information is typically required for a large electrical or electronic signal box, unless it appears in some other form on the signalling plan or table of signal routes:

- a) type of signalling control and display system provided (including number of electronic workstations, where applicable);
- b) type of block on each line, type of emergency communication to next signal boxes and whether train describers provided;

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- c) type of remote control provided for each interlocking area and whether failure alarm and/or override/all-signals-on facility; where separate signal group replacement control is required, the allocation of signals to each group (see [NR/L2/SIG/10131](#));
- d) list of through routes set to work automatically when override initiated, where applicable;
- e) list of junctions with selective override facilities;
- f) list of stations with automatic platform working;
- g) whether train operated route release is provided, or list of interlockings so equipped;
- h) whether automatic route setting is provided, or list of interlockings so equipped;
- i) list of interlockings with maintainer's monitoring panels;
- j) statement if replacement devices are provided for all automatic signals not ordinarily operated from the signal box, or list those so equipped;
- k) statement if all replacement indications prove signals alight, or list those that do not;
- l) list any automatic signals with signal post replacement switches;
- m) list of signals grouped for filament failure indication (or filament failure and power failure indication);
- n) statement if telephones are provided at all colour light stop signals with the appropriate prefix (two illuminated telephones for tunnel signals, where applicable) and at all ground frames;
- o) method of power operating points, where applicable, or list of points operated by each method;
- p) list any mechanically operated points, e.g. at ground frames;
- q) list any points provided with split detection and show ends grouped for indication purposes;
- r) list any self restoring points and whether a failure alarm is given;
- s) list any points requiring manual restoration (with alarm given);
- t) location of point handle and/or crank handle for the use of operating personnel in emergency;
- u) statement if all worked points are provided with switch heaters, or list those so equipped, identified to switching areas, and whether switching is automatic or timed;
- v) list any controlled power operated barriers and state whether CCTV supervision and/or emergency local control is provided;
- w) list any automatic barriers monitored;
- x) list any movable bridges indicated;
- y) list any lockout devices provided;

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- z) list any incident detectors and state the emergency controls so imposed;
- aa) conditions incorporated into train approaching indications, where applicable;
- bb) statement if all relay rooms are fitted with intruder alarms;
- cc) units of measurement and datum point (usually taken from the centre of each interlocking);
- dd) whether SPAD detection provided and the allocation of signals to each SPAD sub-area (see [NR/L2/SIG/11130](#)); and
- ee) other essential signalling information that is not evident from the plan.

1.3.5 Typical Ground Frame

The following information is typically required on the ground frame diagram (or on the signalling plan if the ground frame does not require a diagram):

- a) whether elevated, platform, or ground mounted frame;
- b) whether lever frame or switch panel;
- c) whether shut inside facilities provided;
- d) whether diagram provided (statement if illuminated);
- e) list of track sections indicated (only with non-illuminated diagram);
- f) list of mechanically detected points (and if detected in one position only);
- g) list of electrically detected points (unless power operated);
- h) method of power operating points, where applicable;
- i) whether FPLs stand normally in or out (usually in);
- j) list of points with switch heaters provided;
- k) distance from the ground frame to the releasing signal box; and
- l) units of measurement and datum point (usually taken from the centre of the ground frame).

1.3.6 Typical Automatic Level Crossing

The following information is typically required on the automatic level crossing signalling plan:

- a) type of level crossing control e.g. AHBC, AOCL, MSL, etc.;
- b) protection provided, e.g. power operated half barriers;
- c) whether trains are required to stop;
- d) whether cattle-cum-trespass grids are provided;
- e) whether another train coming (ATC) controls are provided;
- f) any non-standard operation of audible warning devices and whether a tone change is provided for ATC;

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- g) statement if the audible warning output is reduced between certain hours;
- h) crossing road length;
- i) minimum warning period in seconds;
- j) statement if local control unit is provided;
- k) monitoring signal box in which barriers are indicated (for AHBC) or in which the crossing equipment failure is indicated (for MSL) and to which the telephone(s) are connected;
- l) distance from the monitoring signal box to the level crossing, or the crossing mileage (for unsupervised crossings);
- m) permissible speed (at both the crossing and the strike-in, if different);
- n) braking parameters used for crossing speed boards, where applicable;
- o) maximum acceleration data of traction units that have route acceptance, where required for determination of maximum attainable crossing speed, e.g. where a station intervenes;
- p) rail sighting distances to the crossing (for AOCL or ABCL);
- q) failed alarm time; and
- r) units of measurement and datum point(s).

1.4 Numbering Grids

These are one or two dimensional grids listing all numbers or letters that have been used to identity signals, points, releases and track sections at a signal box.

Numbering grids are used to assist in numbering and lettering signalling functions on the scheme plan and provide the sequencing rationale required by [GK/RT0009](#). This should provide unique identities over a complete signal box area, or a larger area possibly encompassing a network management centre. The numbering grids should be kept up to date to guard against any subsequent alterations resulting in the duplication of identities.

The grid may take various forms, such as:

- a) a two dimensional grid (preferably on the signalling/scheme plan for the interlocking) listing the first digit in vertical columns and the second digit in horizontal rows;
- b) a one dimensional grid along the bottom of a signalling plan; or
- c) a separate (preferably A4) sheet, possibly generated from a computer database or spreadsheet (of a format agreed with the Project Engineer).

For signal boxes with more than one interlocking, the interlocking identity may be included on the grid. For network management centres, the signal box prefix may be used as part of the unique identities.

For lever frames, spare levers, spaces and fixed levers should be identified, unless this information is provided elsewhere.

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1.5 Signal Spacing Parameters

These are a tabular representation of the parameters that influence the relative positioning of signals, which satisfy the requirements of [GK/RT0075](#) to keep certain signal spacing records.

Signal spacing parameters may be used to determine optimum signal positions on the scheme plan. They may also be used as a reference document when sighting signals initially, but should be kept up to date to confirm any subsequent alterations maintain signal spacing, headway and other requirements.

Any unusual features, such as deficient headway, use of a permanent speed restriction to obtain signal spacing, excessive over-spacing, or sites with combinations of steeply rising and falling gradients should be recorded and agreed by the Route Asset Manager S&T.

(Signal spacing parameter sheets were regionally known as signalling statistics, service braking tables, braking distance charts and signal braking calculations.)

1.5.1 Format

They may take various forms, such as:

- a) a single (preferably A4) sheet for each signal;
- b) a table for a number of signals;
- c) a portion of line (up or down) on each sheet with aspect sequences shown;
- d) combined with the signalling/scheme plan, aspect sequence chart, or signal sighting notes; or
- e) a printout from a computer database or spreadsheet (of a format agreed with the Project Engineer).

1.5.2 Content

- a) The following data should be recorded for each signal:
 - I. post to post distances;
 - II. total distance between first caution and signal at red;
 - III. average gradient over the above distance, and gradient used to determine signal spacing in cases where [GK/RT0075](#) requires an additional allowance to be provided;
 - IV. maximum speed for which spacing is available;
 - V. percentage over-spaced at permissible speed;
 - VI. information of the derived speed at the first caution (where permissible speed is not used);
 - VII. overlap at signal;
 - VIII. any non-standard aspect sequences, such as consecutive YY or approach control; and

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- IX. headway for following stopping and non-stop trains at each signal (if relevant). Alternatively, headway may be separately tabled, perhaps using a simulation program.

The opportunity should be taken to check that the gradient information shown on the scheme plan is correctly plotted from the source used and is up to date, particularly where features or alignments have changed. (This source should be defined in the general notes. See Section 1.3.2.m.)

- b) The following information is required for the line:
- I. signal spacing curve used (from [GK/RT0075](#));
 - II. permissible speeds obtained from the sectional appendix, at the time of signal spacing (these may only be changed in accordance with [NR/L2/SIG/30021](#));
 - III. headway requirement for each section of line (where specified); and
 - IV. maximum acceleration/deceleration data of traction units that have route acceptance, where required for determination of maximum attainable speed, e.g. in automatic level crossing regulation (at the time of signal spacing).

This information should be given in the general notes if the signal spacing parameters are combined with the signalling/scheme plan.

1.6 Aspect Sequence Charts

These are charts showing the sequence of signal aspects for each state of the signalling system.

A diagrammatic representation of the aspects which may be displayed by each signal, aligned with the corresponding aspects displayed by consecutive signals.

Aspect sequence charts are used to confirm that all aspect sequences are in accordance with [GK/RT0045](#). They may be used to compile control tables and should be kept up to date to help confirm any subsequent alterations maintain correct aspect sequences. They are required for aspect sequence testing and are generally issued with the signalling/scheme plan.

The chart may take various forms, such as:

- a) a portion of line (up or down) on each sheet with aspect sequences shown;
- b) combined with the signalling/scheme plan and/or signal spacing parameters;
- or
- c) a printout from a computer spreadsheet (of a format agreed with the Project Engineer).

The content should follow the example given in Figure 3. Any notes used should be explained on the chart.