

S1036 A3

Presentation of Engineering Drawings

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1 Purpose

The purpose of this standard is to define the minimum requirements for the appearance of engineering Drawings.

2 Scope

This standard applies to all formally issued Drawings depicting London Underground's (LU) engineering assets.

The majority of Drawings will be produced using Computer Aided Design (CAD). However, this standard applies only to the final appearance of Drawings (i.e. their content). There is a separate standard (S1037) covering CAD data requirements and how Drawing files are structured. The TfL CAD system will be configured, where appropriate to enable the requirements in this standard for internal users, but this standard applies whatever the method of production of the Drawing.

This standard contains examples of generic Drawings as attachments (section 10). Further, discipline-specific, example Drawings can be found in the reference documents listed in the table below:

Document No.	Title
R0583	Production of civil engineering Drawings
R0584	Production of power asset Drawings
R0585	Production of rolling stock Drawings
R0586	Production of signalling Drawings
R0587	Production of stations Drawings
R0588	Production of telecommunications Drawings
R0589	Production of track Drawings
R0590	Production of survey Drawings
R0591	Production of Infrastructure Protection Drawings

3 Requirements

3.1 Generic Drawing requirements

- 3.1.1 Engineering Drawings shall conform to British Standards defined within BS8888. This standard sets out the additional requirements specific to LU.

Note: The function of BS 8888 is to draw together, in an easily accessible manner, the full complement of international standards relevant to the preparation of technical product specifications.

- 3.1.2 Requirements for the structure of Computer Aided Design (CAD) data in the production of Drawings are defined within [S1037](#) 'Computer Aided Design (CAD) Data'.

Drawing Sheets

- 3.1.3 Drawing sheets shall conform to BS EN ISO 5457.
- 3.1.4 Drawings shall be produced on the smallest sheet permitting the necessary clarity.
- 3.1.5 Drawing sheets shall be selected from the main ISO-A series below:
- a) ISO A0 841mm x 1189mm
 - b) ISO A1 594mm x 841mm
 - c) ISO A2 420mm x 594mm
 - d) ISO A3 297mm x 420mm
 - e) ISO A4 210mm x 297mm.
- 3.1.6 Elongated sizes shall be avoided if possible. Where elongated sheet sizes are required, they shall be formed by combining the dimensions of the short side of an A-size with the dimensions of the long side of one or more larger A-sizes.
- 3.1.7 The Drawing space within the sheet shall be divided into fields in order to permit easy location of details, additions, revisions, etc. on the Drawing.
- 3.1.8 Drawing sheets shall state clearly the following information:
- a) date Drawing published/plotted
 - b) Drawing Definition file ID
 - c) LU's copyright statement
 - d) name of individual who published/plotted the Drawing
 - e) pen table used to publish/plot Drawing
 - f) sheet size
 - g) TfL Security Classification.

General tolerances

- 3.1.9 General tolerances shall conform to BS EN 22768.
- 3.1.10 General tolerances shall be stated as the nominal dimension with tolerance (not as upper and lower limits), e.g. 50 +/-0.2 and not 50.2/49.8.

Lettering

- 3.1.11 Lettering within Drawings shall conform to BS EN ISO 3098.
- 3.1.12 Lettering shall be written in sentence case using TrueType Arial font.














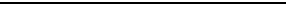
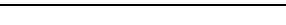
Line types and line widths

- 3.1.13 Line types and line widths shall conform to BS EN ISO 128-20.
- 3.1.14 Line widths shall be selected from the following list:

- a) 0.13 mm
- b) 0.18 mm
- c) 0.25 mm
- d) 0.35 mm
- e) 0.5 mm

- f) 0.7 mm
- g) 1 mm
- h) 1.4 mm
- i) 2 mm.

3.1.15 The following pre-approved line types shall be used:

Ref	Symbol	Description	Standard
a)		continuous line	BS EN ISO 128-20
b)		dashed line	BS EN ISO 128-20
c)		dashed spaced line	BS EN ISO 128-20
d)		long-dashed dotted line	BS EN ISO 128-20
e)		long-dashed double-dotted line	BS EN ISO 128-20
f)		long-dashed triplicate-dotted line	BS EN ISO 128-20
g)		dotted line	BS EN ISO 128-20
h)		long-dashed short-dashed line	BS EN ISO 128-20
i)		long-dashed double short-dashed line	BS EN ISO 128-20
j)		dashed dotted line	BS EN ISO 128-20
k)		double-dashed dotted line	BS EN ISO 128-20
l)		dashed double-dotted line	BS EN ISO 128-20
m)		double-dashed double-dotted line	BS EN ISO 128-20
n)		dashed triplicate-dotted line	BS EN ISO 128-20
o)		double-dashed triplicate-dotted line	BS EN ISO 128-20

3.1.16 The width of a line shall be constant throughout the whole line.

3.1.17 Line types and widths shall be selected by the author to enable the published Drawing to be plotted/printed on both colour and greyscale devices, without loss of meaning.

3.1.18 Non-standard line types shall be approved and documented by the respective profession head and added to the respective profession Design Library prior to use.

Scales


3.1.19 Scales shall conform to BS EN ISO 5455.

- 3.1.20 The chosen scale for a Drawing shall depend upon the complexity of the object to be depicted and the purpose of the representation. In all cases, the selected scale shall be large enough to permit easy and clear interpretation of the information depicted.
- 3.1.21 The scale and the size of the object, in turn, shall decide the size of the Drawing sheet.
- 3.1.22 Details too small for complete dimensioning in the main representation shall be shown adjacent to the main representation in a separate detail view (or section) which is shown at a larger scale.
- 3.1.23 The table below shows the recommended scales for Drawings:

Category	Recommended Scales		
Enlargement scales	20:1	50:1	10:1
	2:1	5:1	
Reduction scales	1:2	1:5	1:10
	1:20	1:50	1:100
	1:200	1:500	1:1000
	1:2000	1:5000	1:10000

Title blocks

- 3.1.24 Sheet sizes A0 to A3 shall be used in landscape orientation only and the location of the title block shall be situated in the bottom right-hand corner of the Drawing space.
- 3.1.25 A4 sheets may be used in landscape or portrait orientation and the title block shall be situated in the bottom right-hand corner when used in landscape orientation, or the shorter (bottom) part of the Drawing space when used in portrait orientation.
- 3.1.26 Title blocks sheets shall state clearly the following information:
- a) project
 - b) location
 - c) Asset Classification
 - d) owner
 - e) suitability
 - f) purpose of Issue
 - g) title
 - h) document number
 - i) revision.
- 3.1.27 Suppliers company logos or sub-contractor information are not permitted within title blocks or any other part of the Drawing.
- 3.1.28 Where Drawings form part of a set, the part number and total number of Drawings shall be included within the title, e.g. Drawing 2 of 4
- 3.1.29 The following diagram shows the approved title block:

Project PROJECT_NAME	Title TITLE_1	
Originator ORIGINATOR	TITLE_2	
Location LOCATION	TITLE_3	
Asset Classification ASSET_CLASS	TITLE_4	
Lifecycle LIFECYCLE	 Transport for London	
Suitability SCODE SUITABILITY		
	Drawing Number DRAWING_NUMBER	Rev. REV

Drawing issue history

3.1.30 Drawings shall clearly identify the following information for each major revision:

- revision (major)
- purpose of issue
- name of Author
- created date
- name of Approver
- approval date
- name of Authoriser
- authorisation date.

3.1.31 Names shall be inserted using the Convention first initial and surname, for example 'John Smith' would be 'J Smith'

3.1.32 The following diagram shows the approved Drawing issue box:

SECURITY	REV9	DATE9	PURPOSE9				
			DRAWN9	T.CHECKED9	T.APPRVD9	P.APPRVD9	ATHRISED9
	REV8	DATE8	PURPOSE8				
			DRAWN8	T.CHECKED8	T.APPRVD8	P.APPRVD8	ATHRISED8
	REV7	DATE7	PURPOSE7				
			DRAWN7	T.CHECKED7	T.APPRVD7	P.APPRVD7	ATHRISED7
	REV6	DATE6	PURPOSE6				
			DRAWN6	T.CHECKED6	T.APPRVD6	P.APPRVD6	ATHRISED6
	REV5	DATE5	PURPOSE5				
			DRAWN5	T.CHECKED5	T.APPRVD5	P.APPRVD5	ATHRISED5
	REV4	DATE4	PURPOSE4				
			DRAWN4	T.CHECKED4	T.APPRVD4	P.APPRVD4	ATHRISED4
	REV3	DATE3	PURPOSE3				
			DRAWN3	T.CHECKED3	T.APPRVD3	P.APPRVD3	ATHRISED3
	REV2	DATE2	PURPOSE2				
			DRAWN2	T.CHECKED2	T.APPRVD2	P.APPRVD2	ATHRISED2
	REV1	DATE1	PURPOSE1				
			DRAWN1	T.CHECKED1	T.APPRVD1	P.APPRVD1	ATHRISED1
	Rev	Date	Purpose / Description				
			Drawn	T. Checked	T. Approved	P. Approved	Authorised

Notes

3.1.33 Notes of a general nature shall, wherever practicable, be grouped together within the notes section and not distributed over the Drawing.

- 3.1.34 If additional notes of a general nature are required, an additional notes block can be created in a suitable location within the Drawing space.
- 3.1.35 Notes of a general nature shall be numbered sequentially.
- 3.1.36 Notes relating to specific details shall appear near the relevant feature, but not so near as to crowd the view.
- 3.1.37 Underlining of notes is not recommended. Where emphasis is required, larger characters shall be used.

Safety, health and environmental information box

- 3.1.38 Designers shall provide information that other project team members are likely to need to identify and manage the remaining risks. This shall be project specific, and concentrate on significant risks which may not be obvious to those who use the design.

Note: Providing generic risk information about the prevention of falls is pointless, because competent contractors will already know what needs to be done, but if the design gives rise to a specific and unusual fall risk which may not be obvious to contractors, designers shall provide information about this risk.

- 3.1.39 Designers shall provide information about aspects of the design that could create significant risks during future construction work or maintenance
- 3.1.40 Information shall be brief, clear, precise, and in a form suitable for the users. This shall be achieved using the following residual risk log so that the notes are immediately available to those carrying out the work
- 3.1.41 The following diagram shows the approved safety, health and environmental information box:

CONSTRUCTION RISKS	MAINTENANCE / CLEANING RISKS	DEMOLITION / ADAPTATION RISKS
In addition to the hazard/risks normally associated with the type of works detailed on this drawing take note of the above It is assumed that all works on this drawing will be carried out by a competent contractor working where appropriate, to an appropriate method statement		
SAFETY HEALTH AND ENVIRONMENTAL INFORMATION BOX		

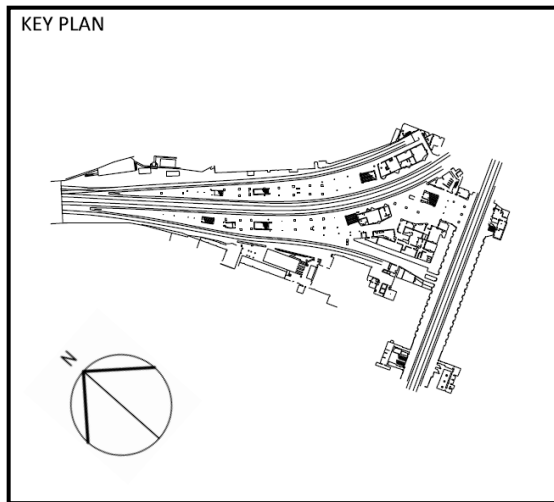
Key plan

- 3.1.42 A key plan shall comprise, as required, of one of the following figures:

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- a) schematic site plan with area, arrow indicating north, building, part of building, etc. marked
- b) schematic plan of building with area, part, etc. indicated or
- c) schematic section through building with floor plan, direction of view, etc. indicated.

3.1.43 The following diagram is an example of a key plan:



Sections

3.1.44 Sections shall conform to the following standards:

- a) BS ISO 128-40 Basic Conventions for cuts and sections and
- b) BS ISO 128-50 Basic Conventions for representing areas on cuts and sections.
Projections

3.1.45 Projections shall conform to the following standards:

- a) BS ISO 5456-2 Orthographic representations and
- b) BS ISO 5456-3 Axonometric representations.
Views

3.1.46 Views shall conform to the following standard:


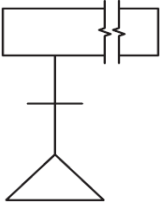
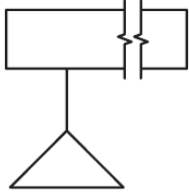
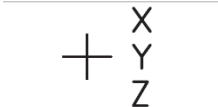


- a) BS ISO 128-30 Basic Conventions for views.
Symbols


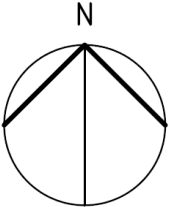
3.1.47 Symbols shall conform to BS 8541-2

3.1.48 Drawings shall contain a legend of all Symbols used within the Drawing.

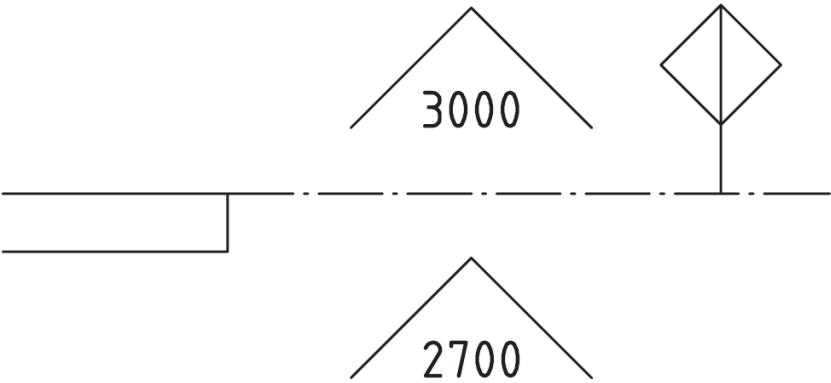
Datums, levels and orientation

3.1.49 Symbols to be used for datums, levels and orientation

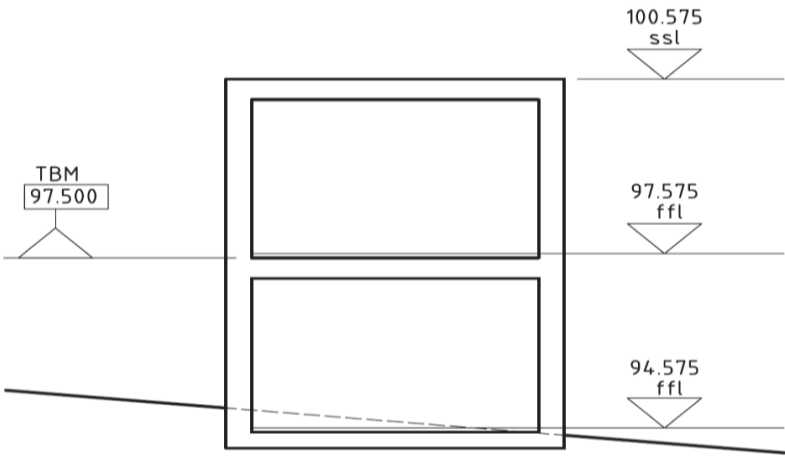
Ref	Symbol	Description	Standard
a)		bench mark	BS 8541 (1.101)
b)		datum on plans	BS 8541 (1.102)
c)		datum on cuts, sections, elevation	BS 8541 (1.103)
d)		level on plans	BS 8541 (1.104)
e)		level on cuts, sections, elevations	BS 8541 (1.105)
f)		ceiling height above ffl on plans	BS 8541 (1.106)

g)		ceiling heights in plan	BS 8541 (1.107)
h)		North point	BS 8541 (1.108)

3.1.50 Application at change of suspended ceiling level at bulkhead





3.1.51 Application for datum and levels on section

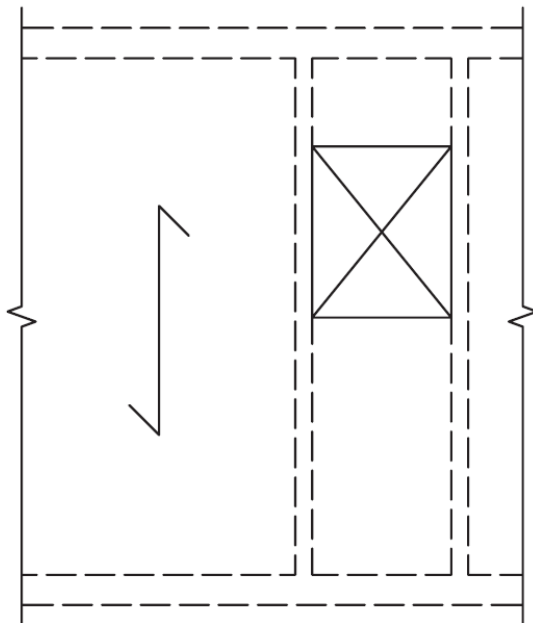


Indication of planes and voids

3.1.52 Symbols to be used for the indication of planes and voids

Ref	Symbol	Description	Standard
		direction of span, floor or roof structure	BS 8541 (1.20 1)
		opening in ceiling/floor/wall/etc.	BS 8541 (1.20 2)

3.1.53 Application on plans – example of a floor with lift well opening

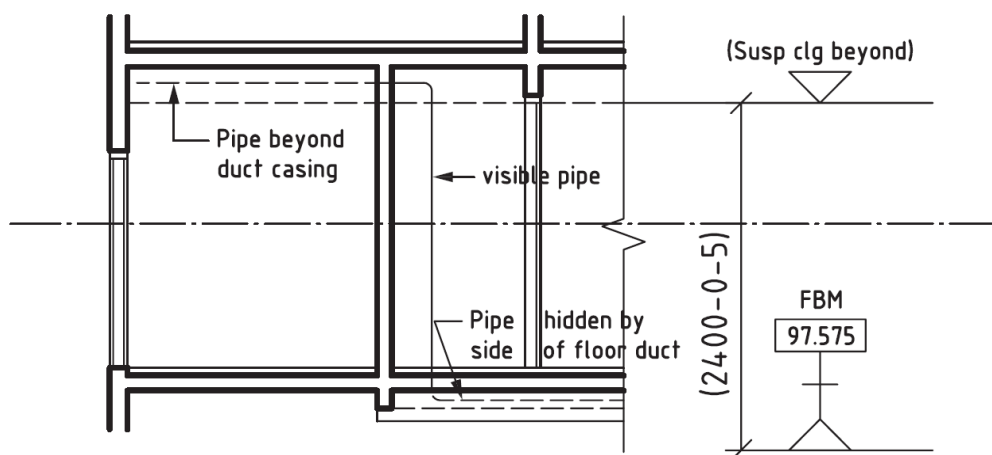


Conventions for indicating zones

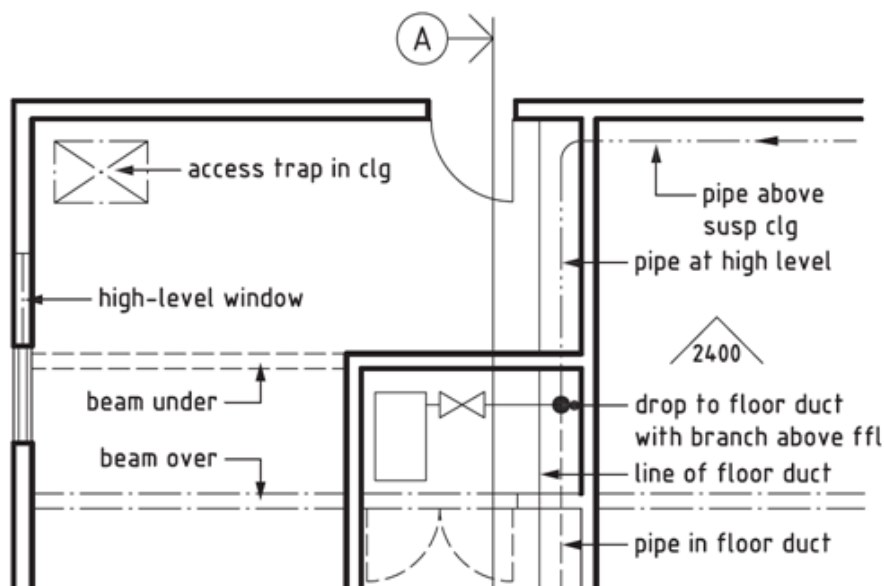
3.1.54 Symbols to be used for indicating zones.

Ref	Symbol	Description	Standard
a)	— — — — —	Behind cutting plane, hidden	BS 8541 (1.301)
b)	— — — — —	behind cutting plane, visible	BS 8541 (1.302)
c)	— — — — —	beyond cutting plane, visible	BS 8541 (1.303)
d)	— — — — —	beyond cutting plane, hidden	BS 8541 (1.304)

3.1.55 Application on sections (A-A on plan)

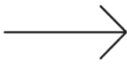

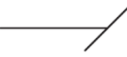
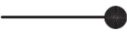
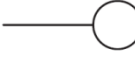
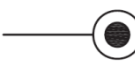


3.1.56 Application on plans



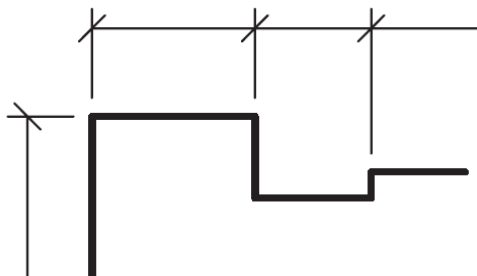
Dimensions

3.1.57 Symbols to be used for termination of dimension lines

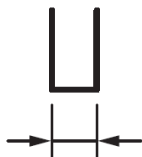
Ref	Symbol	Description	Standard
a)		Open arrowhead	BS 8541 (1.401)
b)		Closed arrowhead	BS 8541 (1.402)
c)		Oblique stroke	BS 8541 (1.403)
d)		Dot	BS 8541 (1.404)
e)		Circle	
f)		Common datum point for running dimensions	BS 8541 (1.406)

3.1.58 Only one termination shall be used on a set of Drawings.

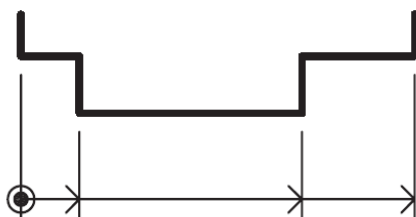
3.1.59 Application of dimensions



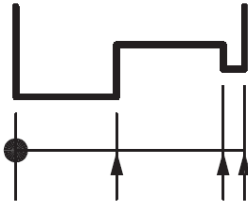
3.1.60 Application of small dimensions



3.1.61 Application of running dimensions



3.1.62 Application of small running dimensions



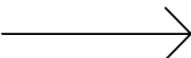

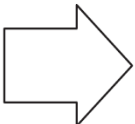
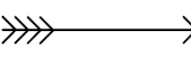
Referencing/cross-referencing

3.1.63 Symbols to be used for referencing/cross-referencing

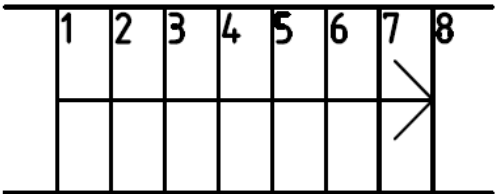
Ref	Symbol	Description	Standard
a)		to note, from within outline	BS 8541 (1.601)
b)		to note, from outline	BS 8541 (1.602)
c)		to detail, on same Drawing	BS 8541 (1.603)
d)		to detail, on another Drawing	BS 8541 (1.604)
e)		to another Drawing	BS 8541 (1.605)
f)		termination of cutting plane	BS 8541 (1.607)
g)		detail tag	BS 8541 (1.609)
h)		detail tag, view title and scale	BS 8541 (1.610)
i)		to section, on another Drawing	BS 8541 (1.611)
j)		to elevation, on another Drawing	BS 8541 (1.612)
k)		to call out, on another Drawing	BS 8541 (1.613)

Steps and gradients

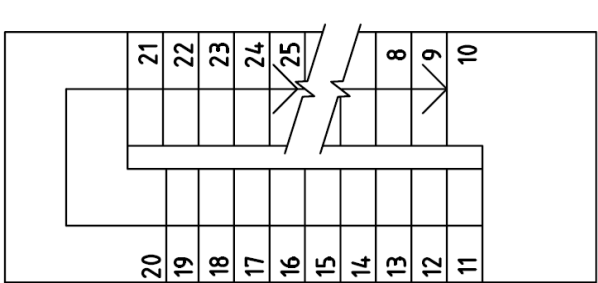
3.1.64 Symbols to be used for steps and gradients

Ref	Symbol	Description	Standard
a)		direction of RISE, ramp/stair/steps	BS 8541 (1.801)
b)		direction of FALL, ramp/stair/steps	BS 8541 (1.802)
c)		direction of FALL, natural drainage	BS 8541 (1.803)
d)		direction of FALL, watercourse	BS 8541 (1.804)

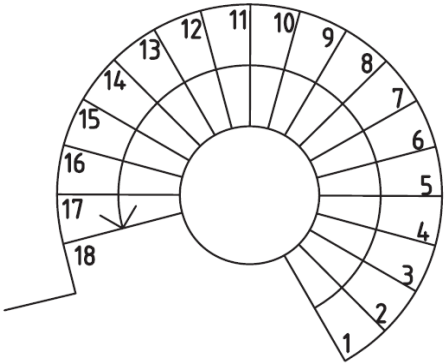
3.1.65 Application on straight stairs/steps



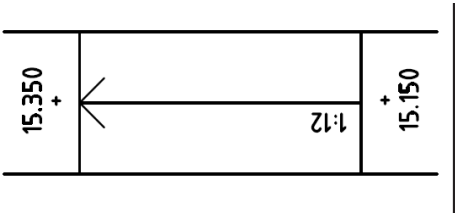
3.1.66 Application on dog leg stairs



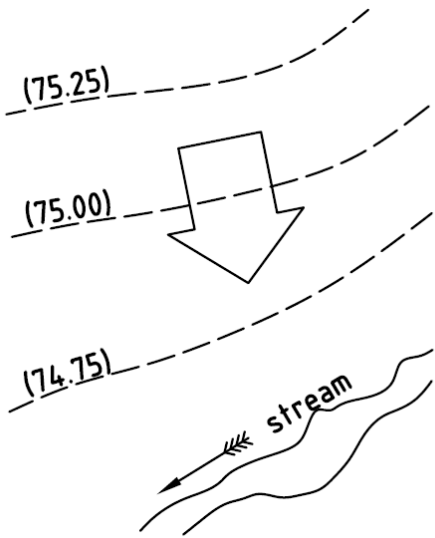
3.1.67 Application on helical stairs



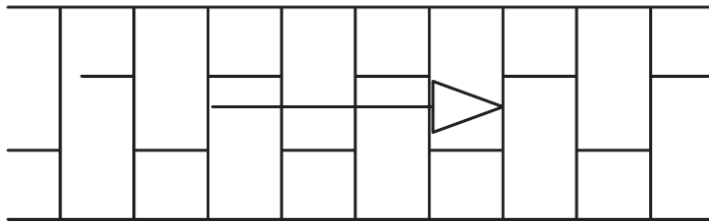
3.1.68 Application on ramps



3.1.69 Application on ground surveys



3.1.70 Application on sloping paving



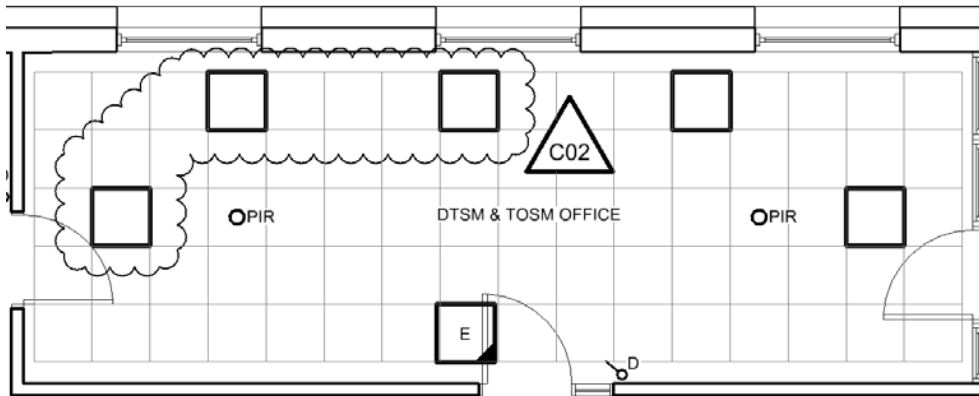
Alterations and demolitions

3.1.71 Symbols to be used for alterations and demolitions

Ref	Symbol	Description	Standard
a)	-----	removal of part	BS 8541 (1.901)
b)		removal of area	BS 8541 (1.902)
c)		infilling opening	BS 8541 (1.903)
d)		making good after removal of part	BS 8541 (1.904)
e)		making good after forming opening	BS 8541 (1.905)
f)		making good to surface	BS 8541 (1.906)
g)		sealing off	BS 8541 (1.907)
h)		removal of part alternative for manual Drawings	BS 8541 (1.908)

Use of revision clouds

- 3.1.72 Revision clouds, together with a Revision Triangle, shall be used to show changes to contractually issued Drawings (i.e. with revision code C02, C03, etc.).
- 3.1.73 Clouds shall not be used in As-Built drawings.
- 3.1.74 The cloud must be placed around the content that has been altered and a revision triangle placed next to the cloud showing the current revision number. See image below:




- 3.1.75 Any clouds from previous revisions shall be removed
- 3.1.76 The cloud must be placed such that all Drawing content remains legible.
- 3.1.77 When identifying changes to text, the cloud shall be placed around the full note rather than individual words.
- 3.1.78 The Revision History field in the Drawing border must be updated to show the change.
- 3.1.79 If the whole Drawing has changed, do not use a cloud. The Revision History will suffice.

Drawings containing ordnance survey information

- 3.1.80 Transport for London (TfL) is licensed to use ordnance survey mapping data under the Public Sector Mapping Agreement (PSMA), the terms and condition of that licence and a guide to using OS data can be found on the ordnance survey website.
- 3.1.81 Suppliers required to use OS data shall hold a valid OS contractor license.
- 3.1.82 To achieve compliance with the terms of the licence, when using OS mapping data in LU Drawings, it is necessary to acknowledge crown copyright in the OS data and use a watermark to indicate LU as the publisher of any electronic output. Details of the form of words to acknowledge crown copyright are defined in the style guide from the ordnance survey website, which may vary with the passage of time.
- 3.1.83 The copyright statement shall read "© crown copyright and database rights [year of supply] ordnance survey [licence number]".

3.2 Civil engineering Drawings

- 3.2.1 The guidance within this reference document applies to Drawings produced by LU, or on behalf of LU by its suppliers relating to the following Asset Classifications:
- a) bridges and structures;
 - b) deep tube tunnels;
 - c) pumping systems;
 - d) drainage and
 - e) earth structures.
- Asset location plans
- 3.2.2 Asset location plans convey the location of civil engineering assets, usually using an ordnance survey map as a background (see [R0583](#), section 7.1).
- 3.2.3 Asset location plans indicate assets such as:
- a) track locations
 - b) relations to the existing surface features
 - c) stations
 - d) building locations
 - e) surrounding streets
 - f) site contours and
 - g) surrounding structures.
- General notes
- 3.2.4 General notes conveys information regarding standards, material properties, welding details to be adopted for the asset (see R0583, section 7.2).
- General arrangements
- 3.2.5 General arrangements convey outline views in plan, elevation or section of the asset (see R0583, section 7.3).
- Construction Drawings
- 3.2.6 Construction Drawings shall convey not only the information with regard to layout and associated information for construction of the asset, but also shall identify safety, health and environmental information table with risk ID number corresponding to the CDM risk register indicated by hazard yellow triangle (see [R0583](#), section 7.4).
- 3.2.7 An example of the risk table is presented below.

Safety, Health and Environmental Information		
Risk ID Numbers Correspond to Risk Register reference. See Risk Register xxxx.XXXXX.xxxxx		
	Risk ID XXXX	Definition

Detail Drawing

- 3.2.8 Detailed Drawings convey information of either a component part or a complete asset in detail, showing the design, location, composition and correlation of the elements and materials shown, to enable construction to be carried out (see R0583, section 7.5).

Fabrication Drawing

- 3.2.9 Fabrication Drawings convey how an asset is to be constructed or assembled (see R0583, section 7.6).

Assembly Drawing

- 3.2.10 Assembly Drawings convey the component parts and how they are assembled to become an item (see R0583, section 7.7).

Installation Drawings

- 3.2.11 Installation Drawings convey method of installation of the intended structure/component including tolerances required with interfaces to the structure/component. This is of particular importance with respect to installations of major structural components such as bridge replacements and must be included in the construction and tender package but may be omitted for minor structures (see R0583, section 7.8).

Schematic Drawing

- 3.2.12 Schematic Drawings convey the components of a system at a diagrammatic level of detail, to aid the consumer in understanding the interior makeup of a system (see R0583, section 7.9).
- 3.2.13 Schematic Drawings are not drawn to scale

Bar bending schedule


- 3.2.14 Bar bending schedules convey information on how reinforcing bars shall be bent and cut for use in reinforced concrete (see R0583, section 7.10).
- 3.2.15 Whilst classified as a Drawing it is primarily tabular information

As built Drawing

- 3.2.16 As-Built Drawings convey the constructed asset after all testing, commissioning and snagging is complete (see [R0583](#), section 7.11).
- 3.2.17 As-Built Drawings shall be verified against what is actually constructed prior to approval.
- 3.2.18 As-Built Drawings shall state clearly as part of the Drawing notes the design loads for the structure. Where different parts of the structure have different loading requirements, this will be indicated graphically by either colour coding or hatching as appropriate to identify design loading on differing parts thereon (see [R0583](#), section 7.12).

3.2.19 As-Built Drawings shall state all residual risk information remaining post construction (see 3.1.38-41). In particular, this shall highlight any maintenance requirements which would not otherwise be obvious (e.g. hidden critical elements, prestressed element including the prestress load etc.). The location of hidden elements shall be identified by means of an orange hazard triangle on the effected element with the risk associated presented in tabular form in the Drawing.

3.2.20 A generic form of the risk table to be filled in and included is presented below:

Maintenance Risks	
Risk ID Numbers Correspond to Risk Register reference. See Risk Register xxxx.XXXXX.xxxxx	
 Risk ID XXXX	Definition

Abbreviations

3.2.21 These abbreviations have been approved for use within civil engineering Drawings

General

Abv.	Description	Abv.	Description
AOD	Above Ordnance Datum	ISO	International Standards Organisation
ASB	Asymmetrical Beams	LC	Lamp Column
ATD	Above Tunnel Datum	NTS	Not to scale
BLK	Blockwork	OSBM	Ordnance Survey Bench Mark
BRK	Brickwork	PCC	Pre Cast Concrete
BM	Bench Mark	PST	Pre Stressed Concrete
CI	Cast Iron	RC	Reinforced Concrete
CRS	Centres	SFL	Structural Floor Level
DIA	Diameter	SOL	Setting Out Line
EA	Equal Angles	SOP	Setting Out Point
EL	Existing Level	TEES	Tee cut from UB or UC
FFL	Finished Floor Level	UA	Unequal Angles
GL	Ground Level	WL	Water Level
GWL	Ground Water Level	VER	Vertical
HOR	Horizontal		

Reinforced concrete

Abv.	Description	Abv.	Description
AB	Alternate bars	IF	Inner face
ABR	Alternate bars reversed	NF	Near face
ABS	Alternate bars staggered	OF	Outer face

Abv.	Description	Abv.	Description
B	Bottom	PFC	Parallel Flange Channels
EF	Each face	T	Top
FF	Far face		

Structural steelwork

Abv.	Description	Abv.	Description
ASB	Asymmetrical Beams	UA	Unequal Angles
EA	Equal Angles	UB	Universal Beam
PFC	Parallel Flange Channels	UBP	Universal Bearing Piles
RSJ	Rolled Steel Joist	UC	Universal Column
TEES	Tee cut from UB or UC		

Drainage

Abv.	Description	Abv.	Description
BIG	Back Inlet Gully	MDPE	Medium Density Polyethylene
CI	Cast Iron	MH	Manhole
CL	Cover Level	PVC	Polyvinyl Chloride
CP	Catch Pit	RE	Roding Eye
DI	Ductile Iron	RWP	Rain Water Pipe
GRP	Glass Reinforced Plastic	SG	Salt Glazed Clay
IC	Inspection Chamber	UPVC	Unplasticised Polyvinyl Chloride
IL	Invert Level	UTX	Under Track Crossing
IT	Interceptor Trap	VC	Vitrified Clay

Earthworks

Abv.	Description	Abv.	Description
A	Aluvium	KC	Kimmeridge clay
B	Brickearth	LC	London Clay
BB	Bagshot Beds	LG	Lambeth Group
CB	Claygate Beds	TG	Terrace Gravel
GT	Glacial Till	UG/G	Upper greensand or gault clay
CWF/CH	Clay with flints over chalk, or chalk	GSC/CH	Glacial sand & gravel over chalk, or chalk

3.2.22 If additional abbreviations are required, their definition shall be clearly identified on the Drawing within the Drawing legend.

3.3 Power Drawings

Sketch

- 3.3.1 A 'sketch' shows how systems might achieve the intended results. They are typically layouts indicating basic proposals, location of main items of plant, CMS routes electrical distribution within any housing or building in such detail as to illustrate the incorporation of the power assets within and their proposed operation. They shall only be used for any 'Approval in Principle' submission.

Sketch schematic

- 3.3.2 Line diagrams indicating main items of plant and their interrelationships in such detail as to illustrate the incorporation of the engineering services within the project as a whole.
- 3.3.3 The power discipline is directly responsible for the production of three types of these Drawings, all of which are controlled Drawings published internally company wide on the intranet.

- **The LU 415V AC distribution network**

The 415V AC distribution network schematic details feeder cable designations, cable sizes and ratings, cable joints. The schematic also distinguishes incoming supply points between substations, transformer rooms and LU dedicated supplies. (see [R0584](#), section 7.1).

- **The LU 630V DC distribution network**

The 630V DC distribution network and sectionalisation schematic details line section reference numbers, traction substation rectifier capacity and feeding direction, 630V system normally open points, controlled switches, manual switches and escalator supplies (see [R0584](#), section 7.2).

- **LU line specific DC sectionalisation schematics**

The line specific DC sectionalisation schematics details independent line specific substations, normally open points, bleed resistor connection points, TVR connection points, TED connection points, Track coupling huts and track paralleling huts (see [R0584](#), section 7.3).

Note: Any changes required to these Drawing shall be submitted to the power Drawing control team as instructed on the power intranet pages. Details of responsible persons can be found in section 4 of this document.

Traffic Controller's Diagrams

- 3.3.4 A Traffic Controller's Diagram (TCD) shows, in the form of a layout plan, the Signalling and power layout of an area under the control of a particular signalling controller. They show signal and traction power arrangements and information on which section, or sections, need to be switched off in order to isolate traction current in that particular area. This Drawing type is maintained in the Signalling domain, but the custodianship and approval of the power aspects of these Drawing resides in the power asset area.

Note: Any changes to the power diagrams on the TCDs shall be submitted to the TCD CAD production team and approved by an accredited member of the Power section.
The approved power Symbols can be found in a controlled way on the intranet..

HV AC 22kV, 11kV and 630V single line diagrams

- 3.3.5 The power discipline has oversight of the HV AC 22kV, 11kV and 630V single line diagrams that are produced by UKPN. These schematics show details of HV transformer sizes and ratings, busbar ratings, auxiliary transformer sizes and ratings, switchgear sizes and ratings, protection relay types, current and voltage transformer ratio's and normally open points.
- 3.3.6 The Drawings are grouped geographically at or between substations and main national grid sites. The Drawings then follow the distribution of power down-stream to the traction substation and passenger station substation distribution points along the LU HV AC network.

Note 1: The Symbols used when creating these Drawing can be found in R0584 section 7.4. however the power section does not create these Drawings and only approves the system design of the installation.

Note 2: Any proposed changes or corrections to these Drawings must be submitted in writing to UKPN, however any changes will in all likelihood be part of a major power upgrade undertaken by UKPN itself and the schematics will be updated as part of that project.

Detailed schematic

- 3.3.7 Line diagrams describing the interconnection of components in a system or within an example of power plant equipment showing the engineering and operation principles.
- 3.3.8 The Power section requires the production of several different internal discipline Drawing types. These Drawings are provided by equipment manufacturers and external installation contractors and are listed by power discipline type below:
- a) HV AC capital equipment
 - b) DC trackside equipment
 - c) LV AC distribution equipment and switchgear Drawings.

Technical design Drawing

- 3.3.9 A technical design Drawing shows the extent of the services installations.

Installation Drawings

- 3.3.10 A Drawing based on the detailed design Drawing or co-ordinated working Drawing with the primary purpose of defining that information needed by the tradesmen on site to install the works.

Manufacturers' Drawings

- 3.3.11 Drawing prepared by a manufacturer, fabricator or supplier for a particular project, and which is unique to that project. Examples include, transformer, rectifiers, switchgear panels and associated internal wiring, pre-fabricated plant, customised plant and equipment.

Builders' work information

- 3.3.12 Builders' work information Drawing shows the provisions required to accommodate the engineering services which significantly affect the design of the building structure, fabric and external works. They can include Drawings (or schedules) of work to be carried out by building trades, and required to be costed at the design stage, such as plant bases. They include all openings (or other provisions) which significantly affect structure, fabric or external works, the minimum dimension of which needs to be agreed among the project team.

Builders' work details

- 3.3.13 A builders work details Drawing shows the requirements for building works necessary to facilitate the installation of the engineering services. Builders' work details carry forward and confirm or refine the structurally significant items from the builders' work information, and also introduce new items that are not structurally significant, such as plinth dimensions for the actual plant items ordered. Unless agreed otherwise, the following builders' work details could be marked out on site:
- a) holes less than the threshold dimension agreed by the team
 - b) cable cleat support fixing details
 - c) openings that are best cut into blockwork and partitions.

Record Drawings

- 3.3.14 Drawing showing the building and services installations as installed at the date of practical completion.

Drawing content for HV AC capital equipment

- 3.3.15 The Drawings shall include all the functional components that make the system work, such as wiring, busbars, fans, control devices, protection devices, wiring terminals, electrical switchgear and components including auxiliary contacts, operator interfaces and security.
- 3.3.16 The Drawings shall include all inter-equipment wiring schematics for the proposed power system installation.
- 3.3.17 Symbols and line Conventions shall be in accordance either with a recognised standard, such as ISO or BS1635, or a supplied legend.

- 3.3.18 For all UK Power Networks (UKPN) installations the UKPN agreed Symbols shall be used.
- 3.3.19 The Drawings shall be labelled with appropriate busbar ratings, fuse sizes, switchgear ratings and switchgear operation types.
- 3.3.20 All equipment and cables shall be labelled on all Drawings.
- 3.3.21 All power capital equipment detailed schematics shall include full dimensions of the transportation assembly and the final configuration, the transportation weight and final weight (when filled with Oil for example) and the designated lifting and jacking points.
- 3.3.22 All power capital equipment detailed schematics shall include the rating, class and cooling type (e.g. ONAN)
- 3.3.23 All power capital equipment detailed schematics shall include cable entry and cable bushing detailed positions. The designated earthing point or earth bar shall be shown along with all equipment internal earthing measures.
- 3.3.24 For auxiliary, control, indication, metering and protection wiring schematics a grid/component referencing system shall be used to indicate terminations between alternate schematic sheets and between different equipment types. All relays, CT's, meters and contactors shall be referenced with the total number of contacts available and any wiring shall be labelled using the BSEN and railway group standard prefixes and suffixes.
- 3.3.25 For inter-equipment, auxiliary, control and protection wiring schematics a full point to point wiring termination list shall be included.
- 3.3.26 The Drawings shall indicate components which have a sensing, control or measurement function. All components shall be listed on the Drawing together with their Drawing reference and manufacturer and serial numbers.
- 3.3.27 A plan and elevation of all switchroom freestanding switchgear and wall mounted panels shall be included.
- 3.3.28 A typical HV AC project Drawing deliverable list shall include:
- a) switchgear general arrangements and schematic (HV, LV and DC – including bleed resistors and MITS panels (or SCADA RTU's) where applicable)
 - b) substation layout Drawings (depicting footprints of plant relative to the building, with dimensions included)
 - c) cable route and containment Drawings.
 - d) cable termination details (cable to switchgear)
 - e) cable joint details (joint construction & joint bay support-work)
 - f) RTU & marshalling cabinet GA's (internal and external)
 - g) battery charger GA and schematics including battery distribution boards.
 - h) battery/monobloc layout and connection Drawings
 - i) transformer rectifier GA's, circuit diagram and schematics.

- j) inter equipment wiring schedule
- k) auxiliary or signalling supply transformer GA's and schematic diagrams.
- l) protection logic diagram (modular diagram depicting the protection logic links between plant items/protective schemes)
- m) lighting layout Drawings depicting circuit ID, switch locations and emergency lighting arrangements.
- n) small power layout Drawings.
- o) earthing and lightning protection layout Drawings.
- p) fire detection and protection layout Drawings.
- q) LV DNO supply arrangements where applicable.

Drawing content for DC equipment

- 3.3.29 The Drawings shall include all the functional components that make the system work, such as control wiring, busbars, control devices, wiring terminals, DC switchgear, DC cables, DC track fuses, methods of secure isolation and operator interfaces.
- 3.3.30 The Drawings shall include all inter-equipment wiring schematics for the proposed DC system installation.
- 3.3.31 A DC section Drawing showing the extent of the impact of the installation shall be provided.
- 3.3.32 The detailed schematic shall also include a full materials list, including:- make, manufacture, weight, size (if not dimensioned within the schematic), are all applicable combustible material tests (i.e. toxic fume, flammability temperature and fume visibility index) to the BSEN standard.
- 3.3.33 Symbols and line Conventions shall be in accordance either with a recognised standard, such as ISO or BS1635, or a supplied legend.
- 3.3.34 The Drawings shall be labelled with appropriate busbar ratings, fuse sizes, cable sizes, cable to track lug types, DC switchgear ratings and DC switchgear operation types.
- 3.3.35 DC equipment detailed schematics shall include full dimensions of the transportation assembly and the final configuration. The transportation weight and final weight and the designated lifting points.
- 3.3.36 DC equipment detailed schematics shall include cable entry positions. The designated earthing point or earth bar shall be shown along with all equipment internal earthing measures.
- 3.3.37 All equipment and cables shall be labelled on all Drawings.
- 3.3.38 Any AC to DC earthing segregation incorporated into the equipment shall be shown on the equipment and wiring schematics.

- 3.3.39 Cable containment and routing Drawings shall be given taking into account the larger bending radii and unit length weights of DC cable.
- 3.3.40 For Control wiring schematics a grid/component referencing system shall be used to indicate terminations between alternate schematic sheets and between different equipment types. All relays and contactors shall be referenced with the total number of contacts available and any wiring shall be labelled using the BSEN and railway group standard prefixes and suffixes.
- 3.3.41 For inter-equipment wiring schematics a full point to point wiring termination list shall be included
- 3.3.42 The Drawings shall indicate components which have a sensing, control or measurement function. All components shall be listed on the Drawing together with their Drawing reference and manufacturer and serial numbers.
- 3.3.43 A typical DC track equipment project Drawing list shall include:
- a) track plan with topographical details and a full Pway alignment including P&C, sleepers, crossing nose and IBJ details. The DC equipment shall be designed into this background information. Conductor rail size, type, ramp size, and insulator positions are all required to be shown
 - b) for tunnel sections a track elevation is required showing DC equipment and CMS and route height
 - c) a detailed civil engineering installation Drawing showing concrete pad details, cable route posts and cable route CMS fixing details
 - d) a detailed track clearance Drawing showing vertical and horizontal dimensions to the equipment from the nearest rail's running edge. The Drawing needs to show all track radii in the vicinity of the equipment and the corresponding track versines.
 - e) a detailed DC cable Drawing showing positive and negative cable routes and conductor rail connection positions and cable lug types
 - f) where substation feeder DC cables are being installed cable route plan and elevation Drawings are to be provided showing all cable transverses with the required civils details including any firestopping details
 - g) for modifications to existing DC switchgear busbars cable connection dropper detailed Drawing shall be included with the provision for toroid installation if required
 - h) where applicable LV AC cable routes and remote control panel positions are to be shown in plan and elevation Drawings
 - i) full wiring schematic for any control circuits
 - j) full point to point wiring termination list for all inter equipment connections
 - k) where a 230V supply is required a switchroom to DC equipment cable route Drawing is to be shown including an elevation view of the switchroom distribution board being used

- l) where DC equipment utilises a 230V supply a LV AC block diagram showing the switchroom incoming supply and distribution board through to the AC ancillary equipment within the DC system is to be shown together with cable sizes and protection ratings and types
- m) an earthing and bonding Drawing of the DC system to be installed shall be included together with any earthing segregation, separation, or gapping of AC circuits and equipment as required.

Drawing content for LV AC distribution equipment and switchgear

- 3.3.44 The Drawings shall include all the functional components that make the system work, such as wiring, busbars, protection devices, wiring terminals, electrical switchgear and components including auxiliary contacts and operator interfaces.
- 3.3.45 A plan and elevation of all switchroom freestanding switchgear and wall mounted panels shall be included.
- 3.3.46 The Drawings shall include all inter-equipment wiring schematics for the proposed power system installation.
- 3.3.47 Symbols and line Conventions shall be in accordance either with a recognised standard, such as ISO or BS1635, or a supplied legend.
- 3.3.48 All LV AC transformer detailed schematics shall include full dimensions of the transportation assembly and the final configuration. The transportation weight and final weight (when filled with Oil for example) and the designated lifting and jacking points.
- 3.3.49 All transformer detailed schematics shall include the rating, class and cooling type (e.g. ONAN).
- 3.3.50 The Drawings shall be labelled with appropriate busbar ratings, fuse sizes, ACB size, mccb size, rcbo size, cable sizes, switchgear ratings and switchgear operation types.
- 3.3.51 All equipment and cables shall be labelled on all Drawings.
- 3.3.52 All equipment detailed schematics shall include cable entry positions. The designated earthing point or earth bar shall be shown along with all equipment internal earthing measures.
- 3.3.53 For protection and metering wiring schematics a grid/component referencing system shall be used to indicate terminations between alternate schematic sheets and between different equipment types. All relays, CT's, meters and contactors shall be referenced with the total number of contacts available and any wiring shall be labelled using the BSEN and railway group standard prefixes and suffixes.
- 3.3.54 For inter-equipment protection and metering wiring schematics a full point to point wiring termination list shall be included
- 3.3.55 The Drawings shall indicate components which have a sensing, control or measurement function. All components shall be listed on the Drawing together with their Drawing reference and manufacturer and serial numbers.

- 3.3.56 A full distribution circuit single line diagram (showing protection relays shall be included in the Drawing pack.
- 3.3.57 An LV block diagram revision of the LV circuits within the LU infrastructure affected shall be included.
- 3.3.58 A switchroom panel plan and panel layout detailed schematic shall be included.
- 3.3.59 Any switch interlocking shall be fully displayed and described on any LV AC power detailed schematic Drawing.

Drawing content for technical design Drawing

- 3.3.60 The main features shall be as follows:
 - a) plan layouts shall be to a scale of at least 1:100
 - b) show the extent and type of services terminals visible within the occupied space.
 - c) show approximate locations of horizontal and vertical CMS runs
 - d) show plant and distribution system sizes, particularly those affecting spatial allocation, while acknowledging that these may need some adjustment and refinement in the preparation of the detailed design Drawings and equipment schedules.
- 3.3.61 Electrical containment (CMS) shall be represented by single line layouts as required to demonstrate that the routes indicated are feasible. Symbols and line Conventions shall be in accordance either with a recognised standard, such as ISO or BS1635, or a supplied legend.
- 3.3.62 Technical design Drawings are required to be produced to RIBA stage E. These Drawings shall show how space within risers and service zones is allocated to ductwork (using calculated, but still approximate, duct sizes), pipework (showing the number of pipes to be accommodated but only approximate diameters including insulation), and cabling (showing the size of electrical containment rather than individual cables).

Drawing content for installation Drawings

- 3.3.63 Allowances shall be made for inclusion of all supports and fixings necessary to install the works.
- 3.3.64 The Drawing shall make allowances for installation details provided from manufacturers' Drawings.
- 3.3.65 Allowances shall be made for plant and equipment. This includes any alternatives to the designer's original specified option that have been chosen.
- 3.3.66 Where no co-ordinated working Drawings have been produced, the installation Drawing shall include co-ordination.

Drawing content for record Drawings

- 3.3.67 The Drawings shall be to a scale not less than that of the installation Drawings.

- 3.3.68 Locations of all the capital plant power equipment and components installed including ducts, cables, busbars, plant items, pumps, fans, control devices, terminals, electrical switchgear and components, security and fire sensors and control equipment shall be shown.
- 3.3.69 The Drawing shall be labelled with appropriate cable sizes, cable identifications and equipment ratings.
- 3.3.70 The Drawings shall have marked on them positions of access points for operating and maintenance purposes.
- 3.3.71 The Drawings shall not be dimensioned unless the inclusion of a dimension is considered necessary for location.

Abbreviations

- 3.3.72 The following table lists the abbreviations taken from S1622 which can be used on production Drawings:

Abv.	Description	Abv.	Description
DAOL	Direct Acting Overcurrent	MITs	SCADA Multiplexer
CT	Current Transformer	VT	Voltage Transformer
RCTIS	Remote controlled section switch	VCB	Vacuum Circuit Breaker
EF	Earth Fault	OC	Over Current
AVR	Automatic Voltage Regulation	CB	Circuit Breaker
TCH	Track Coupling Hut	TPH	Track Paralleling Hut
TVR	Track Voltage Recorder	TED	Traction Earth Detector
MCT	Metering Current Transformer	BZCT	Bus Zone Current Transformer
PCT	Protection Current Transformer	TCT	Translay Current Transformer

- 3.3.73 If additional abbreviations are required, which are not declared in S1622 Glossary of terms and abbreviations, their definition shall be clearly identified in the legend.

3.4 Rolling stock Drawings

- 3.4.1 Requirements for rolling stock drawings are defined in the LU standard [S2180](#) 'Passenger Rolling Stock', sections A3.5.7 and A3.5.8. Consequently they do not need to be duplicated in this standard.

3.5 Signalling Drawings

Traffic Controllers Diagrams (TCD)

- 3.5.1 TCDs convey, in the form of a layout plan, the signalling layout of an area under the control of a particular signalling controller.
- 3.5.2 TCDs show signal and traction power arrangements and information on which section, or sections, need to be switched off in order to isolate traction current in that particular area.

3.5.3 The detail within the Drawing shall include where appropriate:

- | | |
|---|------------------------------------|
| a) colour lights | i) point heaters |
| b) position lights | j) buffer stops |
| c) fixed red lights | k) sand drags |
| d) fibre optic and disc signals | l) arrestors |
| e) train-stops not associated with a signal | m) 'Train ready to start' plungers |
| f) current rail gap indicators | n) stop boards |
| g) illuminated signs | o) low negative shoe detectors |
| h) all points | p) track circuit interrupters |
| | q) platform numbers. |

Note: Whilst this Drawing type is maintained in the Signalling domain, the custodianship and approval of the power aspects of these Drawing resides in the Power Asset area.

Traffic circular Drawings

3.5.4 Traffic circular Drawings convey the new layout of the signalling, following planned works, to accompany the text where necessary.

Note: When complete, traffic circular Drawings are included within the published traffic circular.

Bonding plans

3.5.5 Bonding plans convey an overview of all the bonding arrangements of the track circuits within a particular area (e.g. between Points 6815 – 8825).

3.5.6 Bonding plans show each block section, bonding over points, section and continuous rails and each track circuit name.

Code looping plans

3.5.7 Code looping plans convey the detail of the electrical looping arrangements of the same area covered by its corresponding bonding plan.

Scale plans

3.5.8 Scale plans convey geospatially accurate placement of track layout, signals, points, track circuit boundaries and overlaps.

3.5.9 Scale plans shall show fixed structures, such as bridges, that impact on signal sighting.

3.5.10 Scale plans shall show the positions of signal cabins and signalling equipment rooms.

3.5.11 Scale plans shall show a continuous dimension that links track, signalling and fixed structures that are physically identifiable and measurable.

- 3.5.12 Gradient change positions shall be shown where appropriate, but are not to be included in the continuous dimension as the provision or position of gradient posts cannot be guaranteed.
- 3.5.13 Each road shall have a continuous dimension.
- 3.5.14 Dimensions, critical to the signalling system, shall be shown separately from the continuous dimension so that they are easily identified.
- 3.5.15 The length of signal overlaps, position of timing sections and rail circuit connections are typical of the dimensions that are critical to the signalling system.
- 3.5.16 Scale plans shall be produced at a scale of 1:500.

Scheme plans

- 3.5.17 Scheme plans convey the same information as a scale plans, but are not required to spatially accurate or dimensioned.
- 3.5.18 Scheme plans shall be produced as a straight line and may be drawn to a horizontal scale as appropriate.

Circuitry Drawings

Note: Scheme Plans are known historically as Straight Line Plans.

- 3.5.19 Circuitry Drawings convey the equipment in a given location, for example:
 - a) station equipment rooms;
 - b) trackside cabinets;
 - c) relay rooms;
 - d) relocateable equipment buildings; or
 - e) Interlocking machine rooms.
- 3.5.20 Circuitry Drawings shall show the circuit detail and all its elements but shall not include mechanical detail.

Schedule Drawings

- 3.5.21 Schedule Drawings convey various equipment types, functions & sub functions, number of wires & the equipment's mounting location.
- 3.5.22 Examples of schedule Drawings include:
 - a) a 'relay schedule' is a tabular presentation of the relay base identifying its name, function, location within the relay rack, the manufacturers part number, function of each contact and the wire count of each terminal
 - b) a 'fuse bay schedule' (also know as 'analysis') is a site specific tabular presentation of fuses grouped by fuse type, showing fuse number, type of fuse, function of the fuse, sheet number of the associated circuit and wire counts of both ends of the fuse

- c) A 'wall termination rack' is a site specific tabular presentation of incoming and outgoing terminations showing terminal number, left and right side connection (e.g. in/out) wire count, function and sheet number

Plate rack Drawings

- 3.5.23 Plate rack Drawings convey the available switching connections to connect or disconnect circuits such that pre-commissioning installation and testing can be carried out.
- 3.5.24 Plate rack Drawings shall show the number of the plate rack, its function and wire count on each of the terminals A, B or C & sheet number.

Auto strip Drawings

- 3.5.25 Auto strip Drawings convey a straight line representation of an automatically signalled area showing signals and track circuits that do not contain any points or crossings.
- 3.5.26 Auto strip Drawings are not produced to scale.

Note: Schedule Drawing, Plate Rack Drawings and Auto Strip Drawings may be included in the contents of a 'Bookwiring' – an amalgam of Drawings and other information for a specific area.

Abbreviations

- 3.5.27 These abbreviations have been approved for use on signalling Drawings.
- 3.5.28 If additional abbreviations are required, their definition shall be clearly identified on the Drawing within the Drawing legend.

General

Abv.	Description	Abv.	Description
AAR	Association of American Railroads	IR	Inner Rail
ACG	Autodriver Command Generator	IRJ	Insulated Rail Joint
ARCH	Architectural	JCT	Junction
ARS	Automatic Route Setting	JN	Junction
B/B	Bus Bar	L	Level
B/J	Block Joint	LG	Length
BD	Braking Distance	LRCL	Long Range Colour Light Signal
BHP	Brake Horse Power	LT	Light
BKT	Bracket	MAN	Manual
BKTS	Brackets	MAS	Multiple Aspect Signalling
BO	Bottom of	NB	North Bound
BoT	Board of Trade	NE	North End

Abv.	Description	Abv.	Description
BOT	Bottom	O/L	Overlap
BR	Brass	OR	Outer Rail
BS	Buffer Stop	P&C	Points and Crossings
C/C	Centre to Centre	PD	Position Detector
C/L	Centre Line	PIMS	Passenger Information Management System
C/W	Complete With	PMS	Project Material Schedule
CALC	Calculation	PR	Pair
CHKD	Checked	PSR	Permanent Speed Restriction
CI	Cast Iron	PT	Point Tips
COL	Current On Line Indicator	PTI	Positive Train Identification
CON	Concentric	R	Radius (also see RAD)
CP	Clearing Point	R/R	Relay Room
CSC	Centralised Signalling Control	RAD	Radius (also see R)
CSDE	Correct Side Door Enabled	RI	Railway Inspectorate
CTB	Combined Termination Box	RI	Route Indicator
CTC	Centralised Traffic Control	RIC	Reinforced Concrete
DC	Direct Current	S/L	Stores List
DIA	Diameter	S&C	Switches and Crossings
DIMS	Dimensions	SB	Signal Box
DMI	Dot Matrix Indicator	SB	South Bound
DML	Detail Material List	SC	Speed Check
DOT	Direction of Travel	SC	Station Controller
DN	Down (Direction)	SCP	Station Controller's Panel
E	Eastbound	SDG	Siding
EB	East Bound	SE	South End
ELCP	Emergency Local Control Point	SIG	Signalling
EPH	Electric Point Heater	SM	Stop Mark
EQ	Equal	SP	Sighting Point
FFL	Finished Floor Level	SRCL	Short Range Colour Light Signal
FPL	Facing Point Lock	T/S	Timing Section
FP	Fouling Point	TAI	Train Arrival Indicator
GA	General Arrangement	TB	Track Boundary
GND	Ground	TC	Track Circuits
GPL	Ground Position Light	TCD	Traffic Controller's Diagram
GRAD	Gradient	TD	Train Description
H	High or Height	TDB	Track Disconnection Box
H/SP	Headway or Sighting Point	TOR	Top of Ramp

Abv.	Description	Abv.	Description
HP	Headway Point	TS	Train Stop
HSE	Health and Safety Executive	TSR	Temporary Speed Restriction
HV	High Voltage	UIC	Union
HW	Hand Worked	UP	Up (Direction)
HW	Headway	WB	West Bound
IECC	Integrated Electronic Control Centre	YY	Double Yellow

Signalling written circuit and wiring diagram Drawings. (Signalling A-Z)

When letter is used as a prefix		When letter is used as last letter	
Abv.	Description	Abv.	Description
A	Approach; Automatic	B	Block Instrument
B	Block; Bolt	C	Contact
C	Checking or proving; Coding	E	Electric Lamp (Illuminating); Earth
D	Clear (Green); Decoding	F	Fogging Apparatus
E	Light; Heat (Externally Applied); Emergency; or Earth	f	Fuse
F	Fog	G	Signal Apparatus, including Light Signals
G	Signal	g	Lightning Arrestor
H	Caution (Yellow)	H	Capacitor
HH	Preliminary Caution (Double Yellow)	I	Inductor
J	Time (Delayed Action)	J	Rectifier
K	Indicating or Detecting	K	Indicator (Visual)
L	Locking; Left	L	Lock
M	Marker; Magnetic	M	Motor
N	Normal	N	Release; Hand-operated Switch; Push Button or Key
O	Retarder	O	Resistor
P	Repeating	P	Latch Lever or Trigger Contact
Q	Treadle or Bar	Q	Local Coil of Double-element Relay
R	Reverse; Right; Danger (Red)	R	Relay or Contactor (Line or Track Element of Double-element Relay)
S	Stick	T	Transformer; Transmitter
T	Track Circuit	t	Terminal
U	Route (Aspect displayed to be shown in brackets)	U	Train Description Apparatus (for Route Indicating)
V	Trainstop	V	Trainstop Apparatus
W	Points	W	Points Operating Apparatus
X	Audible Indicator (Bell, Horn, etc) Level or Highway Crossing	X	Audible Indicator (Horn, Bell, etc)
Y	Slotting or Disengaging	Y	Disengaging Apparatus

When letter is used as a prefix		When letter is used as last letter	
Abv.	Description	Abv.	Description
Z	Special (to be explained on plan)		
Up	Up (Direction of Traffic)		
Dn	Down (Direction of Traffic)		

Electrical supply

Abv.	Description
B (or +)	Connection by an individual wire to the busbar or supply terminal of a direct current system (positive side).
N (or -)	Connection by an individual wire to the busbar or supply terminal of a direct current system (negative side).
BN	Connection by an individual wire to the busbar or supply terminal of a direct current system at an intermediate point.
+VE	Positive
-VE	Negative
BX	Alternating current supply
NX	Neutral Supply

Line abbreviations

Abv.	Description	Abv.	Description
BLOO	Bakerloo	JUB	Jubilee
CENT	Central	MET	Metropolitan
DIST	District	NTH	Northern
DLR	Docklands Light Rail	PICC	Piccadilly
ELL	East London Line	VIC	Victoria
H&C	Hammersmith & City	W&C	Waterloo & City

3.6 Station and premises

3.6.1 This section applies to Drawings produced by LU, or on behalf of LU by its Suppliers relating to the following Asset Classifications:

- a) electrical systems;
- b) fire systems
- c) lifts and escalators
- d) mechanical systems and
- e) premises (including line-side and staff facilities buildings).

General requirements

3.6.2 Limits and fits shall be in accordance with BS EN 20286-2 and preferably be from the primary series.

3.6.3 Fits may be stated by means of the ISO letter coding or by stating the equivalent dimensional tolerance.

- 3.6.4 The Symbols used for fire protection Drawings shall comply with BS 1635.
- 3.6.5 Shafts and holes shall be drawn to the nominal diameter.
- 3.6.6 Third angle projection is preferred for all L&E Drawings.
- 3.6.7 All new design work and new equipment shall be in SI units. In some circumstances this may not be appropriate. The following points define any exceptions:
- a) procurement of spare parts using existing Imperial based Drawings - The Drawings shall continue to be Imperial units
 - b) when a Drawing undergoes a minor change and is re-issued, the Drawing would normally remain in Imperial units
 - c) when a Drawing is re-drawn or a new Drawing generated for an existing asset, the Drawing shall be re-drawn in metric units but some interfacing dimensions and systems such as Imperial screw threads may have to be retained. An engineering judgement shall be taken on issues of this nature
 - d) high value spares procurement (i.e. for advertisement in the OJEU) - within budgetary and time constraints and fitness for purpose considerations, every endeavour shall be made to ensure Imperial Drawings are converted to metric dimensions
 - e) Imperial threads may be specified where an existing mating component also uses an Imperial thread. Imperial equivalents may be shown in brackets after the metric dimension where a cross-reference is likely to be made to an existing Imperial Drawing.

Block diagrams

- 3.6.8 Block diagrams convey the main items of equipment, or plant, and their interrelationships, in such detail as to illustrate the incorporation of the engineering equipment within the project as a whole (see [R0587](#), section 7.1).

Detailed design Drawings

- 3.6.9 Detailed design Drawings convey sufficient information, of either a component part or a complete asset, to enable construction or installation to be carried out (see [R0587](#), section 7.2).
- 3.6.10 Detail design Drawings show the design, location, composition and correlation of the assets and materials shown.
- 3.6.11 Detail design Drawings shall include all manufacturing details, including material, dimensional tolerances, welding, heat treatments, surface finishes, testing requirements, views and parts list necessary to manufacture the component.
- 3.6.12 Notes shall be included to cover any particular processes, clarifications or requirements applicable to the component.
- 3.6.13 Plan views shall be commensurate to the layout detail (e.g. platforms 1:100, 2m x 2m room 1:20) and accompanied by cross-sections.

Schematic Drawings

- 3.6.14 Schematic Drawings convey the key elements of an asset and its interaction with other assets (see [R0587](#), section 7.3).
- 3.6.15 Schematic Drawings shall include all the functional components that make the system work such as final circuit details, ducts, pipes, cables, busbars, plant, pumps, fans, valves, control devices, switchgear, fire and security sensors.
- 3.6.16 Schematic Drawings are not drawn to scale.

Arrangement Drawings

- 3.6.17 Arrangement Drawings shall contain a parts list consisting of the following items:
 - f) item number
 - g) description (or material)
 - h) part number (or Drawing number) if available and
 - i) total number of parts (per assembly).
- 3.6.18 All items on the Drawing shall be identified with a leader line, "balloon" and number, (corresponding to the items list number).
- 3.6.19 If a parts list forms a separate sheet to its Drawing it shall clearly identify which Drawing it is related to and the Drawing shall identify the document number of the parts list.

Fabrication Drawings

- 3.6.20 Fabrication Drawings shall convey all construction details including welding and inspection.
- 3.6.21 Notes shall be included to cover all safety requirements, including lifting points, safe working loads etc.

As-Built Drawings

- 3.6.22 As-Built Drawings convey the constructed asset after all testing, commissioning and snagging is complete. (see R0587, section 7.4).
- 3.6.23 As-Built Drawings shall be verified against what is actually constructed prior to approval.

Station layouts

- 3.6.24 Station layouts convey the general layout of stations, typically in plan view. (see R0587, section 7.4 & 7.5).
- 3.6.25 Station layouts show information relating to rooms, platforms, stairs, ticket halls, gate-lines, circulating areas and other features of the operational premises.
- 3.6.26 Station layouts are published at ISO A3 and therefore they are often geometrically inaccurate, not to scale and incomplete.

Note: Station layouts were originally created as a base upon which compliance fire plans, fire precaution plans and approval plans can be produced. However, due to the demand, they have been produced as a separate Drawing set and must be used for information only.

Compliance Fire Plans (CFP)

- 3.6.27 CFPs convey what fire precaution measures are taken at each sub-surface station and where individual exemptions to certain parts of the “Fire Precautions (Sub-surface Railway Stations) (England) Regulations” have been granted. (see R0587, section 7.6 & 7.7)
- 3.6.28 Due to the unique environment and circumstances that LU operates in, the specific structure and content of a CFP has been agreed between LU and the LFEPA Transport Fire Safety Team.
- 3.6.29 CFPs are published at ISO A3 and therefore they are often geometrically inaccurate, not to scale and incomplete.

Note: a) CFPs are legally binding documents that enable LU to comply with current fire legislation and regulations. They are also used to form part of LU’s Fire Risk Assessment(s).
b) CFPs are approved by the LFEPA and printed copies are held in LFB boxes on each station for emergency purposes.

CFP approval plans

- 3.6.30 CFP approval plans convey proposed changes, taken from design proposals, to the current CFP that have been approved by the LFEPA.
- 3.6.31 The areas affected by the proposed changes are identified by the use of a cloud.
- 3.6.32 Only the clouded area on the plan is under LFEPA approval.

Fire Precaution Plans (FPP)

- 3.6.33 FPPs convey what fire precaution measures are taken at each non sub-surface stations and other operational premises. (see [R0587](#), section 7.8 & 7.9).
- 3.6.34 CFPs are published at ISO A3 and therefore they are often geometrically inaccurate, not to scale and incomplete.

Note: a) FPP’s are used to form part of LU’s Fire Risk Assessment(s).
b) FPP’s are approved by LU only and printed copies are held in either the Station Control Room or Stations Supervisors Office for emergency purposes.

FPP approval plans

- 3.6.35 FPP approval plans convey proposed changes, taken from design proposals, to the current FPP that have been approved by LU.
- 3.6.36 The areas affected by the proposed changes are identified by the use of a cloud.
- 3.6.37 Only the clouded area on the plan is under LU approval.

Stations & premises abbreviations

- 3.6.38 These abbreviations have been approved for use on stations and premises Drawings.
- 3.6.39 If additional abbreviations are required, their definition shall be clearly identified on the Drawing within the Drawing legend.

Abv.	Description	Abv.	Description
AC	Alternating current	LV Trans	Low voltage transformer 110 V (55V-0-55V)
APP (CFP)	Approval plan for a station that has a compliance fire plan	MCB	Miniature circuit breaker
APP (FPP)	Approval plan for a station that has fire precaution plan	MH	Manhole
C	Compartmentation	N/S	Newspaper stand fixed
CFP	Compliance fire plan	N/S N	Newspaper stand notional
CEPs	Central emergency power supply	PDEL	Passenger door exit limit
CER	Communication equipment room	OLBI	Off line battery inverter
CG	Collapsible gate	POM	Passenger Operation Machine
CPC	Circuit protective conductor	PSCA	Prospective short circuit current
D	Detection system	PVAL	Pedestal validator
DC	Direct current	QBM	Queue buster machine
DNO	Distribution network organisation	RCD	Residual current device
DS	Domestic sprinklers	RVP	Rendezvous point
E	Exemption	R1	Resistance of line conductor of a distribution final circuit
ELI	Earth loop impedance	R2	Resistance of a circuit protective conductor (CPC) of a distribution final circuit
FCP	Fire control panel	S	Stretcher
FMSV	Fire main stop valve	S/BIN	Sand bin
FPP	Fire precaution plan	SEP	Separation
FR	Fire resistance	SER	Signal equipment room
F/S	Fuse switch	SID No.	Station area identification No.
GLA	Gate line attendant	SLO	Station layout

Abv.	Description	Abv.	Description
HP	Help point	SMV	Sprinkler main valve
KLS	Keep locked shut	SOR	Station Operation Room
LED	Light emitting diode	SPK	Sprinklers
LFB	London Fire Brigade	SR	Switch room
LP	Lamp post	SWA	Steel wire armour
LS	Low smoke	SUP	Suppression (by type)
L&E	Lifts and escalator section	UTB	Used ticket bin
LSOH	Low smoke zero halogen cable	WF	Water fog
LTG	Lighting	TNC-S	Three phase distribution system with a combined protective and neutral conductor
LU	London Underground	TP&N	Three phase and neutral
LV	Low voltage	Ze	External part of system earth loop impedance
		Zs	System earth loop impedance

Stations & premises references

Document No.	Title
BS 499-1	Welding terms and Symbols Part 1: Glossary for welding, brazing and thermal cutting
BS ISO 128-24	Technical Drawings – General principles of presentation Part 24: Lines on mechanical engineering Drawings
BS ISO 128-34	Technical Drawings – General principles of presentation Part 34: Views on mechanical engineering Drawings
BS ISO 128-44	Technical Drawings – General principles of presentation Part 44: Sections on mechanical engineering Drawings
BS ISO 14617-7	Graphical Symbols for diagrams Part 7: Basic mechanical components
BS EN 20286-2	ISO system of limits and fits Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts
BS 8888	Technical product documentation and specification
BS 8451-2	Library objects for architecture, engineering and construction Part 2: Recommended 2D Symbols of building elements for use in building information modelling
BS 1635	Graphic Symbols and abbreviations for fire protection Drawings

3.7 Telecommunications Drawings

3.7.1 General Arrangement (GA) Drawing.

- 3.7.2 GA Drawings show, in plan view or reflected ceiling position, the arrangements of the rooms, platforms etc of one floor of a station, or building. (see [R0588](#), section 7.1).
- 3.7.3 GA Drawings are used to show telecommunications equipment and its relationship to partitions, doors, windows, tracks, platforms and other features.
- 3.7.4 General arrangement Drawings are either:
- a) 1:100 at A1 for large areas (platforms etc) or
 - b) 1:50 at A1 for small areas (ticket halls and passage ways etc).

Note: On a multi discipline projects, GA Drawings are produced premises.

CCTV cone Drawing

- 3.7.5 CCTV cone Drawings show camera coverage for all new cameras. (see [R0588](#), section 7.2)
- 3.7.6 CCTV cone Drawings shall be at the same scale as the corresponding GA Drawing.

System schematic Drawing

- 3.7.7 A System schematic Drawing shows equipment location, equipment quantities, equipment types & models, inter-system interfaces and intra-system interfaces. These Drawings are not to scale. (see [R0588](#), section 7.3).

Symbol sheet

- 3.7.8 Symbol sheet Drawings show the graphical representation and description of telecommunication Symbols.(see [R0588](#), section 7.5).

Fixing/bracket detail Drawing

- 3.7.9 Fixing/bracket detail Drawings show the fixing, fastening and bracketry arrangements for an equipment installation. (see [R0588](#), section 7.4).

Stage work Drawings and arrangements

- 3.7.10 Stage work Drawings and arrangements show all stages of staged work implementation, temporary arrangements, and temporary interface detail.
- 3.7.11 Stage work Drawings and arrangements are stage specific versions of the main design Drawings listed above.

Station elevation Drawings

- 3.7.12 Station elevation Drawings show the accurate position of telecommunication equipment.

Note: On a multi discipline projects, station elevation Drawings are produced by premises.

Station control point equipment layout Drawings

- 3.7.13 Station control point equipment layout Drawings show the accurate position of equipment and consoles.

Note: On a multi discipline projects, station elevation Drawings are produced by premises.

Cable Management System (CMS) design Drawings

- 3.7.14 Cable management system design Drawings show where the existing CMS is to be reused and where the new CMS will be provided, its size and type.

Equipment cabinet rack-face layout Drawings

- 3.7.15 Equipment cabinet rack-face layout Drawings show the accurate layout of equipment, annotated with equipment identifiers and rack positions.
- 3.7.16 Equipment cabinet rack-face layout Drawings are to be at a scale of 1:5 for both front and back layout.

Equipment cabinet wiring schematics

- 3.7.17 Equipment cabinet wiring schematics show all interconnections, terminations (and termination type) and external interfaces within the cabinet, annotated with cable identifiers and equipment identifiers.
- 3.7.18 Equipment cabinet wiring schematics shall not be to scale.
- 3.7.19 Rack equipment shall show power consumption and heat generation calculation.

Communications equipment room Drawing

- 3.7.20 Communications equipment room Drawings show telecommunications equipment cabinets and the auxiliary equipment layout in plan view, indicating its entry points.

Interface detail Drawings

- 3.7.21 Interface detail Drawings show accurate details of specific interfaces between all equipment supplied and where interfaces exist between third parties and the telecommunications contractor's equipment.
- 3.7.22 Interface detail Drawings shall provide low level detail including terminal numbers, cable core colours and cable identification tags.
- 3.7.23 Where junction boxes have been installed, the Drawings shall detail the connectivity within the intersection to the same level of detail required by the production of interface detail Drawings.

As-Built general arrangement Drawing

- 3.7.24 As-Built GA Drawings show the building and services installations as installed at the date of practical completion. (see R0588, section 7.6).

- 3.7.25 As-Built information shall be verified against what is actually installed prior to approval.

As-Built Termination Drawing

- 3.7.26 As-Built termination Drawings show the particular equipment, its termination arrangements (including termination types), wire types and their colours. (see [R0588](#), section 7.7).
- 3.7.27 As-Built information shall be verified against what is actually installed and reconfirmed with site installation photo prior to approval.

As-Built cable routing detail Drawing

- 3.7.28 As-Built cable routing detail Drawing show the specific routing of each cable installed, cables routes, node points and cable risers for all communication systems cabling. (see [R0588](#), section 7.8).
- 3.7.29 As-Built information shall be verified against what is actually installed and reconfirmed with site installation photo prior to approval.

Note: On a multi discipline projects, As-Built cable routing detail Drawings are produced by premises electrical design section.

As-Built plan view & elevation Drawings

- 3.7.30 As-Built plan view and elevation Drawings show the accurate position of equipment, complete with identification tags, within a station.
- 3.7.31 As-Built plan view and elevation Drawings shall be annotated with pertinent information to enable the equipment to be maintained, for example:
- c) precise locations of junction boxes
 - d) special access requirements
 - e) references to the maintenance manual for detail of terminations and
 - f) assembly & disassembly instructions etc.

As-Built system schematics

- 3.7.32 As-Built system schematics show an accurate representation of the system architecture and high level equipment connectivity within a station.
- 3.7.33 The location of equipment shall be clearly marked i.e. CER, Platform 1, Platform 2, Ticket Hall, Station Control Point, Ticket Office etc.

As-Built plan cable run Drawings

- 3.7.34 As-Built plan cable run Drawings show accurate details of specific cable routes for each cable installed within a station, with exception of those confined solely within CER or Station Control Point.
- 3.7.35 As-Built plan view and elevation Drawings shall be annotated with pertinent information to enable the cabling infrastructure to be maintained.

- 3.7.36 Tables shall be included on the Drawing referring to the telecoms cables passing through each major containment junction or node.

Telecommunications abbreviations

Abv.	Description	Abv.	Description
CAM	Camera	OP	Output
CCTV	Closed Circuit Television	OPO	One Person Operation (CCTV)
CER	Communications Equipment Room	OTU	Outstation Transmission Unit (existing Plessey Rack equipment)
CLK	Clock	PA	Public Address
DDF	Digital Distribution Frame	PA/VA	Public Address/Voice Alarm
DVR	Digital Video Recorder	PAM	Passenger Awareness Monitor
DVA	Digital Voice Announcer	PHP	Passenger Help Point
EDNE	Emergency Do Not Enter Display	POM	Passenger Operated Machine
EOL	End of Line Resistor	RM	Radio Microphone
FM	Fireman's Microphone	SAP	Station Announcement Point
GPS	Global Positioning Satellite	SMS	Station Management System
GUI	Graphical User Interface	SMC	Station Masters Console
HMI	Human Machine Interface	SPT	Signal Post Telephone
IDA	Intruder Detection Alarm	THEID	Ticket Hall Electronic Information Display
IP	Input	TMD	Train Mass Detector
LAN	Local Area Network	TTCCTV	Track to Train CCTV
MDA	Monitor Display Assembly	VEID	Visual Electronic Information Display

- 3.7.37 If additional abbreviations are required, their definition shall be clearly identified on the Drawing within the Drawing legend.

Telecommunications references

Document No.	Title
BS 8888	Technical product documentation and specification
BS 8451-2	Library objects for architecture, engineering and construction Part 2: Recommended 2D Symbols of building elements for use in building information modelling

3.8 Track Drawings

Site plan (general)

- 3.8.1 Site plans convey the general arrangement of track, which may include track components and track formation at various stages of the project. (see [R0589](#), section 7.1).

3.8.2 Site plans shall also show any adjacent stations to the job site and other relevant features such as junctions, bridges, embankments and cuttings.

3.8.3 Site plans shall clearly show the following items:

- a) north point
- b) location of the Ordnance Survey bench marks and/or TBMs and
- c) survey control stations with grid co-ordinates to the London Survey Grid.

Stage plan (general)

3.8.4 Stage plans convey the final detailed design for the progressive phases of the installation of track layouts (see R0589, section 7.2).

3.8.5 Stage plans shall also identify and detail all relevant components and assets that will be affected by the design.

Component Drawing (general)

3.8.6 Component Drawings convey the relevant information to manufacture a component, including material and specification detail. (see [R0589](#), section 7.3).

3.8.7 Component Drawings shall include the following where appropriate:

- a) instructions on installation and site deployment of specific components
- b) material specifications or references
- c) manufacturing tolerances or references
- d) surface finishes
- e) part numbers
- f) references to relevant European, British and LU standards.

Track installation drawings

3.8.8 In addition to 3.1.2, individual stage plans, numbered consecutively from stage 0, shall be produced for each stage involving changes to track layout.

3.8.9 Track installation stage plans shall include the following where appropriate:

- a) a line diagram to convey the track layout and the traffic facilities available including train berthing lengths and length of sidings available during the stage
- b) existing track, track laid in previous stages and track to be laid during that stage
- c) clear tabulated statements, describing briefly the traffic facilities available during the particular stage and
- d) a clear statement of the work to be carried out at the changeover.

Feasibility drawings

3.8.10 Feasibility Drawings shall convey proposed additions/changes to track layout. (see [R0589](#), section 7.4).

3.8.11 Horizontal alignment Drawings shall include the following where appropriate:

- a) proposed horizontal curve radii (including whether curves are left or right handed)
- b) proposed six feet
- c) proposed clearances to lineside features (such as platforms)
- d) LCS chainage
- e) maximum line speeds
- f) rail lengths.

3.8.12 Vertical alignment Drawings shall include the following where appropriate:

- a) existing and proposed rail levels at significant locations i.e. ends of vertical curves
- b) vertical intersection points and alongside platforms
- c) overhead clearances to bridges
- d) LCS chainage
- e) significant features i.e. junctions, bridges
- f) rail lengths.

3.8.13 Junction design Drawings shall include the following where appropriate:

- a) running rail
- b) curvature
- c) crossing type
- d) switch type
- e) overall lengths of units, e.g. turnouts, diamonds, switch diamonds, etc
- f) dimensions such as toe to nose, nose to knuckle as required including those across six feet
- g) maximum line speeds.

Track realignment drawings

3.8.14 Track realignment Drawings shall convey proposed horizontal and vertical realignments of existing track.

3.8.15 Horizontal alignment Drawings shall include the following where appropriate:

- a) existing and proposed cants at every survey station
- b) platform clearances (heights and offsets) where approved
- c) location of any junctionwork
- d) survey station numbers and the distance between survey stations
- e) site kilometreages or LCS chainage as appropriate
- f) transition lengths, including location of the ends of transition
- g) six or ten foot at every survey station
- h) lineside clearance offsets and height of obstructions at every survey station
- i) proposed cant gradients
- j) rate of gain of cant and cant deficiency at every survey station
- k) curve radii.

3.8.16 Vertical alignment Drawings shall include the following where appropriate:

- a) existing and proposed cants at every survey station
- b) platform clearances (heights and offsets) where approved
- c) location of any junctionwork
- d) survey station numbers and the distance between survey stations
- e) TBM values

- f) gradients expressed as 1 in N and/or as a percentage
 - g) vertical curve radii
 - h) table of existing and proposed rail levels for both rails
 - i) table of lifts and lowers for both rails
 - j) LCS chainage
 - k) overhead structure clearances.
- Telecommunications abbreviations

3.8.17 These abbreviations have been approved for use on signalling Drawings.

3.8.18 If additional abbreviations are required, their definition shall be clearly identified on the Drawing within the Drawing legend.

Abv.	Description	Abv.	Description
AS	Adjustment switch	ASP	Asset Plate
BHR	Bull Head Rail	BJ	Block Joint
BBJ	Bonded Block Joint	BOR	Bottom Of Ramp
CC	Traction Current Cable Connection	CBin	Chipping Bin
CCTV	Closed Circuit Television	CPit	Catch Pit
CR	Check Rail	ExpJ	Expansion Joint
FBR	Flat Bottom Rail	FP	Fouling Point
FS	First Sleeper	FTR	Forged Transition Rail
HTP	Horizontal Transition Plaque	IC	Inspection Cover
J	Rail Joint	Jumbo	Jumbo Lubricator
KP	Kilometre Post	Lad	Ladder
LCB	Limited Clearance Board	LGT	Longitudinal Timber
LP	Lamp Post	LPTU	Low Profile Tuning Unit
LS	Last Sleeper	LTT	Last Through Timber
LWR	Locked Wheel Ramp	MH	Man Hole
MP	Metre Plaque (With distance)	MRP	Maximum Rail Level Plate
NRS	Noise Reduction Screen	OOG	Out Of Gauge Rail
OPO	One Person Operation Unit	OBM	Ordnance Bench Mark
PAV	Points Auxiliary Valve	PED	Conductor Rail Pedestal
P+M	Pneumatic Lubricator	RGI	Rail Gap Indicator
SChair	Safety Chair	SCC	Signal Cable Connection
TBM	Temporary bench mark	TOR	Top Of Ramp
TS	Train Stop	VTP	Vertical Transition Plaque
W	Weld		

3.9 General requirements

Conductor and running rails

3.9.1 In addition to the site plan general requirements, conductor and running rails Drawings shall include the following where appropriate:

- a) rail sections
- b) rail lengths
- c) dimension from ramp ends to switch toes
- d) common crossing noses and intersection points of obtuse crossings
- e) conductor rail gap dimensions
- f) safety blocks
- g) overlap
- h) direction of running
- i) loading detail
- j) dimensions from one end of the conductor rail to the centre of the anchor site
- k) fiddle backs
- l) cut outs for the switch secondary drives
- m) wooden covers over point mechanisms in splayless layouts
- n) modification to chairs and baseplates
- o) conductor rail packing required on 'two-levelled' layouts
- p) conductor rail anchors
- q) ramps and ramp lengths
- r) out of gauge rail
- s) jumper cables
- t) safety block positions
- u) de-icing baths
- v) protection planking
- w) site welds
- x) lineside features such as platforms, signals, kilometre posts, overhead bridges, manholes and cross-track walkways
- y) expansion switches
- z) lift fishplates.

3.9.2 Junctions

3.9.3 Where Drawings convey information relating to junctions, the following information shall be included where appropriate addition to the site plan general requirements, timber bridge Drawings shall include plans, longitudinal sections and material schedules.

3.9.4 Timbers and sleepers:

- a) type of sleepers used e.g. concrete, hardwood, softwood
- b) non-standard screw spike lengths and positions
- c) timber length and spacing (e.g. switches and crossings and either side of rail joints)
- d) base plate timber offset for clamp lock mechanisms
- e) location of new or existing or repositioned timbers and sleepers
- f) extended length timbers or sleepers (e.g. hand worked mechanisms)
- g) out of gauge conductor rails or train stops
- h) short timbers required for clearance to catch pits or tunnel iron
- i) special chamfers to timber and sleeper ends
- j) timber and sleeper positions in relation to tunnel ribs, joint sleepers.

3.9.5 Running rails

- a) rail section and grades

- b) type of rail i.e. stock, switch, point, splice, wing, closure or check rails
- c) section and wear of existing rail where new rails connect
- d) where existing rails have to be cut to suit new crossing legs or switch fronts
- e) rail lengths to nearest mm
- f) 'cut from' rails with at least 300mm additional length
- g) twist rails with the locations and hand of the twist
- h) rail sections either side of joint where section changes.

3.9.6 Check rails

- a) lengths
- b) check blocks
- c) check block centres
- d) non-standard check flares
- e) transition arrangement between flat bottom and bullhead check rails.

3.9.7 Joints

- a) joints
- b) lift plate values
- c) junction fishplates
- d) junction lift plate values
- e) tight joints in diamonds.

3.9.8 Crossings

- a) construction of crossing i.e. fabricated, semi-welded, cast monobloc or cast centre block
- b) type of crossing i.e. common, obtuse, left or right hand splice or parallel wing
- c) crossing angles, expressed as 1 in N to one decimal place and decimals of degrees
- d) length of crossing legs
- e) overall lengths of wing rails
- f) crossing block positions
- g) crossing blocks designations
- h) non-standard drillings for crossing blocks to accommodate alignment and non-standard timber positions
- i) spreads at leg ends running edge to running edge
- j) spreads dimensioned from the crossing nose.

3.9.9 For non-standard crossing angles, the following point and splice rail details

- a) blunt nose to point and splice rail 'sets'
- b) blunt nose to splice rail at rail head
- c) the distance from the blunt nose to the point of divergence of the two separate rails (blunt nose to vee).

3.9.10 Points

- a) type of switch such as AV, BV, or CV
- b) type of mechanisms such as clamplock (for FB junctionwork)
- c) four foot layout or handworked
- d) any required secondary drives

- e) stock rail fronts
- f) stock and switch rail length
- g) type of switch drilling
- h) any special switch drilling
- i) stock rail set
- j) switch toes in relation to tunnel ribs
- k) point number indicated next to toes
- l) type of point heating
- m) a clear ballast bed to accommodate the clamplock mechanism on ballasted switches
- n) an empty bed to accommodate the clamplock mechanisms on tube switches.

3.9.11 Components

- a) locked wheel ramps
- b) slipper runs
- c) heel blocks and designation
- d) sole plate insulation
- e) CV block bolt centres (dimensioned from appropriate rail ends, both for the check rail and running rail).

3.9.12 Base plates and chairs

- a) base plate or chair designations (or both)
- b) base plate and chair centres
- c) any short base plates for slipper runs and conductor rail splays
- d) degree of any offset of base plate(s) from centre line of timbers.

3.9.13 Clearances

- a) adjacent line side equipment, reduced clearances, reduced passing clearances.

3.9.14 Geometry

- a) six foots longitudinally related to specific points i.e. noses, toes, lead offsets, lead lengths (switch tip to blunt nose) to nearest mm
- b) switch radii
- c) turnout radii
- d) tangents points (marked with 'dumb-bell') and equivalent radii
- e) tangent points dimensioned to nearest blunt nose
- f) toe or intersection point of obtuse crossing
- g) overall dimensions of the layout to provide continuity from one end to the other including all dimensions between crossings in diamonds
- h) relationships between new and existing and switch toes or crossings noses or both, for triple intersections and slips
- i) knuckle to running edge dimensions.

3.9.15 General

- a) table of V_e , V_m and line speeds through the layout
- b) standard reference Drawings
- c) existing switch positions

- d) fouling points dimensioned from common crossing noses
- e) arrows indicating the direction of running to and from the nearest station or siding
- f) road directions and numbers
- g) site features such as bridges, platforms, cables runs, signal equipment and manholes to show how the new layout fits into the existing environment
- h) details of any removals of junction work and replacement by plain line
- i) positions of tunnel ribs
- j) key
- k) wooden covers over point mechanisms in splayless layouts
- l) walkways
- m) LCS plates.

3.9.16 Timber Bridges

3.9.17 In addition to the site plan general requirements, timber bridge Drawings shall include plans, longitudinal sections and material schedules.

3.9.18 Plans shall show the following information, where appropriate:

- a) ballast retaining walls
- b) through bolts and centres
- c) tie rods and centres
- d) transom sizes (dimensions and centres)
- e) positive blocks and centres
- f) location(s) of any additional insulators required each side of bridge
- g) slews
- h) proposed horizontal geometry
- i) baseplate/chair designations and centres
- j) longitudinal timbers including designations
- k) special fixings for lineside equipment such as trainstops
- l) step up stools
- m) positive insulator stools
- n) setting out details, including offsets for longitudinal timbers on curves
- o) details of longitudinal timbers on curves (cross section)
- p) details of chamfering of timbers to accommodate curvature
- q) details of longitudinal timbers on pan decks (cross section)
- r) details of fixing longitudinal timbers to steelwork
- s) including brackets and hardwood packings
- t) detail of arrangements where longitudinal timber depths alter
- u) detail of arrangements where sleepers are used (on top of longitudinal timbers)
- v) details of timber strutting
- w) details of hardwood wedges for cleat packing
- x) side packings
- y) details of deck waterproofing after removal of timbers prior to their replacement.

3.9.19 Longitudinal sections shall show the following information, where appropriate:

- a) direction of running
- b) survey station number
- c) bridge location
- d) existing and proposed rail levels
- e) existing and proposed platform heights

- f) distance from datum to start of longitudinal timbers
- g) tough number as applicable to site
- h) cross beam levels as applicable to site
- i) slews
- j) horizontal geometry
- k) applied cants and cant gradients
- l) vertical gradient and curve geometry
- m) calculated train speeds.

3.9.20 Material schedules shall show the following information, where appropriate:

- a) softwood transoms
 - b) positive insulating stools (softwood if appropriate)
 - c) tie rods
 - d) chairs
 - e) baseplates
 - f) screwspikes
 - g) ferrules
 - h) hardwood wedges
 - i) hardwood packings
 - j) level adjustment packings
 - k) longitudinal timbers
 - l) bolts
 - m) washers and locknuts
 - n) retaining brackets
 - o) step up stools
 - p) positive blocks.
- Sidings and depots

3.9.21 In addition to the site plan general requirements, timber bridge Drawings shall include plans, longitudinal sections and material schedules.

3.9.22 Plans shall show the following information, where appropriate:

- a) track
- b) siding track centres
- c) curve radii
- d) toes of switches
- e) crossings and angles
- f) point numbers
- g) fouling points - dimensioned from common crossing noses and road numbers
- h) berthing lengths
- i) train arrestors
- j) buffer stops
- k) main site features - building outlines with descriptions e.g. signal boxes, washing plant, depot building, lighting towers, signal bridges, cable bridges, footbridges, subways, toes and tops of banks and retaining walls, roadways, walkways, drains and cable duct locations
- l) adjoining running lines
- m) LU land boundaries
- n) LCS plates.

Depot pit road and depot wash road

3.9.23 In addition to the site plan general requirements, timber bridge Drawings shall include plans, longitudinal sections and material schedules.

3.9.24 Plans shall show the following information, where appropriate:

- a) Track gauge
- b) rail arrangement including lengths (and blockjoints where relevant)
- c) rail joining details
- d) rail fastening system
- e) types of baseplate
- f) detail of baseplate holding down arrangements into concrete
- g) pit including outline of aprons
- h) steps
- i) access ways between pits and cross sections
- j) track details through apron
- k) details of flangeway arrangements (keep plates) including flares
- l) material behind railhead
- m) joint arrangements - new/existing rail
- n) track details at edge of apron, including sleeper centres and conductor rail ramps
- o) existing and proposed rail levels and alignment
- p) baseplate locations
- q) existing rail fixing and supports
- r) alterations to concrete around running rail
- s) construction materials such as grout and grouting details
- t) pea gravel
- u) granite chippings and asphalt
- v) schedule of materials (as required)
- w) running rail
- x) check rails
- y) baseplates
- z) rail end clips
- aa) fishplates (including type, complete with all fishbolts, nuts and washers)
- bb) screwspikes (whether galvanised or not)
- cc) nylon ferrules
- dd) bolts
- ee) nuts
- ff) washers
- gg) mild steel plates
- hh) tie rods
- ii) distance pieces
- jj) sleepers
- kk) siding track centres.

Safety considerations

3.9.25 In the absence of clearly defined requirements for the preparation of track and plant Drawings, there is a risk they may be prepared to inadequate or out of date standards. The result may be that components are assembled or manufactured

incorrectly, leading to possible sub-standard conditions which may have adverse affects.

Track references

Document No.	Title
BS 376-1	Railway signalling Symbols Part 1: Schematic Symbols
BS 376-2	Railway signalling Symbols Part 2: Wiring Symbols and written circuits
BS 8888	Technical product documentation and specification
BS 8451-2	Library objects for architecture, engineering and construction Part 2: Recommended 2D Symbols of building elements for use in building information modelling

3.10 Survey Drawings

Survey plan Drawing

- 3.10.1 Survey plan Drawings (general arrangement) convey a top down view of the ground to show detail of all physical objects drawn to scale. (see [R0590](#), section 7.1)
- 3.10.2 Survey plan Drawings shall be arranged such that North is in the upper portion of the sheet. However, for many Drawings, in particular those associated with track or assets aligned to track, a different orientation may be preferable.
- 3.10.3 Drawings depicting assets of a fixed geographical nature shall include a north point.

Survey elevation Drawing

- 3.10.4 Survey elevation Drawings convey the vertical elements as a direct projection to a vertical plane. (see [R0590](#), section 7.2)

Survey section Drawing

- 3.10.5 Survey section Drawings convey the frontal projection of any detail that is arbitrarily cut by a vertical plane or a system of planes. A section also characterises the form and configuration of a structure. (see [R0590](#), section 7.3)

Survey abbreviations

- 3.10.6 The following abbreviations have been approved for use within survey Drawings:

Abv.	Description	Abv.	Description
AS	Adjustment switch	LGT	Longitudinal timber
ASP	Asset plate	LP	Lamp post
BBJ	Bonded block joint	LP	Lamp post
BH	Borehole	LPTU	Low profile tuning unit
BHR	Bull head rail	LS	Last sleeper
BJ	Block joint	LTT	Last through timber
BOL	Bollard	LWR	Locked wheel ramp

Abv.	Description	Abv.	Description
BOR	Bottom of ramp	MH	Manhole
BT	British Telecom cover	MP	Marker plate
BWF	Barbed wire fence	MRP	Maximum rail level plate
BWK	Brickwork	MT	Mercury Telecom cover
CATV	Closed circuit TV	NRS	Noise reduction screen
CBin	Chipping bin	OBM	Ordnance bench mark
CC	Traction current cable connection	OHC	Overhead cable
CCTV	Closed circuit television	OHP	Overhead pipe
CLF	Chainlink fence	OOG	Out of gauge rail
CM	Cable marker	OPO	One person operation unit
Col	Column	OSBM	Ordinance Survey Bench Mark
CP	Catch pit	P+M	Pneumatic lubricator
CPC	Catch pit clearance	PAV	Points auxiliary valve
CPit	Catch pit	PB	Post box
CR	Check rail	PED	Conductor rail pedestal
DIA	Diameter	RFID	Radio frequency ID tag
DK	Drop kerb	RGI	Rail gap indicator
DP	Down pipe	RSJ	Rolled steel joist
ED	Electrical duct	RW	Retaining wall
EJB	Electricity junction box	RWP	Rain water pipe
ExpJ	Expansion Joint	SCC	Signal cable connection
FBR	Flat bottom rail	SChair	Safety chair
FH	Fire hydrant	Stn	Station Survey point
FIG	Feed into ground	SV	Stop valve
FP	Fouling point	SVP	Soil vent pipe
FRL	Fixed red light	SW	Storm water
FS	First sleeper	TB	Telephone box
FTR	Forged transition rail	TBM	Temporary bench mark
FW	Foul water	TJB	Telephone junction box
G	Gully	TL	Traffic light
GV	Gas valve	TOK	Top of kerb
HTP	Horizontal transition plaque	TOR	Top of ramp
IC	Inspection cover	TP	Telephone pole
IRF	Iron railing fence	TS	Train stop
J	Rail joint	VP	Vent pipe
Jumbo	Jumbo lubricator	VTP	Vertical transition plaque
KO	Kerb outlet	W	Weld
KP	Kilometre post	WKH	Water key hole
Lad	Ladder	WM	Water meter
LB	Litter bin	WV	Water valve
LCB	Limited clearance board		

- 3.10.7 If additional abbreviations are required, their definition shall be clearly identified on the Drawing within the Drawing legend and they shall not conflict with any abbreviations in the above table.

General requirements

- 3.10.8 Surveyed levels and chainages shall be expressed in metres.
- 3.10.9 Coordinates shall be expressed in metres.
- 3.10.10 Linear dimensions shall be expressed in millimetres.
- 3.10.11 Dimension witness lines shall begin slightly offset from the point to which they refer.
- 3.10.12 Dimension lines shall be terminated with arrowhead.

3.11 Infrastructure Protection Drawings

- 3.11.1 Infrastructure Protection is responsible for ensuring the correct and proper division of operational assets within LU and with other neighbouring railway companies and providing basic asset location information to outside parties.
- 3.11.2 This section applies to Drawings related to operational asset ownership and maintenance boundaries produced by Infrastructure Protection.

Site Specific Engineering Arrangement (SSEA)

- 3.11.3 SSEAs summarise the agreements and demarcation statements prepared pursuant to the Transport Act 1962 and the reversioning of the land and property interests of the British Transport Commission in the London Transport and British Railways Boards.
- 3.11.4 SSEAs consist of the following three types of Drawings, each depicting various levels of detail, to show ownership and maintenance boundaries together with schedules containing additional information about specific assets.
- a) Key Plan – showing the location of each 1:1250 plan within the set overlaid on a geographical representation of the relevant Underground line. The scale of the Key Plan is determined on a ‘best fit’ basis. (see [R0591](#), section 7.1).
 - b) 1:1250 Plan – showing the extents of the relevant land and property within a section of Underground line using a 1:1250 Ordnance Survey map as a background. (see R0591, section 7.2).
 - c) Detail Plan - showing details too small to be shown adequately at a scale of 1:1250 or showing assets above or below ground level and which cannot be identified on the standard 1:1250 plans. (see R0591, section 7.3).
- 3.11.5 Property Schedules and Plans (PSP)
- a) Under the PPP Contracts, LU’s land and property assets were leased to maintenance contractors (Infracos) on a line-by-line basis. The PSP formed the basis of those leases.
 - b) The PSPs continue to be used to define the operational railway boundary and the land and property maintained by LU (Asset Performance Delivery) and Tube Lines respectively.

- c) The PSPs consist of plans depicting by coloured shading the operational land and property allocated for maintenance purposes to each maintainer together with schedules containing additional information about specific assets.

Infrastructure Protection abbreviations

- 3.11.6 The following abbreviations have been approved for use within Infrastructure Protection Drawings:

Abv.	Description	Abv.	Description
LU	London Underground Limited	NR	Network Rail
B	Bakerloo line	LNE	London North Eastern AMT
C	Central	LNW	London North Western AMT
D	District	SN	Southern AMT
J	Jubilee	WN	Western AMT
M	Metropolitan	AMT	Asset Management Territory
N	Northern	BRB	British Railways Property Board
P	Piccadilly	EPS	European Passenger Services
V	Victoria		

- 3.11.7 If additional abbreviations are required, their definition shall be clearly identified on the Drawing within the Drawing legend.

4 Responsibilities

4.1 Drawing authors

- 4.1.1 Compliance with this standard and with the relevant discipline-specific Design Reference Guide (see section 3.1.1).

4.2 Profession heads

- 4.2.1 Setting and maintaining the requirements in the discipline-specific sections of this document, as per their professional discipline.

5 Person accountable for the document

Name	Job title
John Park	Principal Engineering leader – Digital Engineering

6 Definitions

Term	Definition	Source
As-Built Drawing	A Drawing used to record the as constructed, manufactured or installed situation.	Jargon Buster
Asset Class	highest level of classification of London Underground's Engineering Assets	Jargon Buster
Convention	accepted way of Drawing an item which may have the nature of a representation, a simplified representation or a Symbol	Jargon Buster

Design Library	CAD file containing standardised resources for placement within other CAD files – for example; line styles, Symbols and Drawing sheets etc.	Jargon Buster
Drawing	Document used to present graphic information	Jargon Buster
Drawing Definition	CAD file used for the purpose of producing a Drawing which has the main graphical content, including the Drawing border, attached as reference files and which contains only annotation and dimensioning as 'live' content.	Jargon Buster
Symbol	graphic device without scale used: a) on a Drawing to indicate the occurrence and/or location of an item; b) in an annotation to indicate one or more of the attributes of an item	Jargon Buster

7 Abbreviations

Abbreviation	Definition
BS	British Standard
CAD	Computer Aided Design
EN	European Norm
ISO	International Standards Organisation
LU	London Underground

8 References

8.1 British Standards

Document No.	Title
BS 8888	Technical product documentation and specification
BS EN ISO 5457	Technical product documentation – Sizes and layout of Drawing sheets
BS EN ISO 7200	Technical product documentation – Data fields in title blocks and document headers
BS EN ISO 3098-0	Technical product documentation – Lettering Part 0: General requirements
BS EN ISO 5455	Technical Drawings – Scales
BS EN ISO 128-20	Technical Drawings – General principles of presentation Part 20: Basic Conventions for lines
BS ISO 128-30	Technical Drawings – General principles of presentation Part 30: Basic Conventions for views
BS ISO 128-40	Technical Drawings - General principles of presentation

Document No.	Title
	Part 40: Basic Conventions for cuts and sections
BS ISO 128-50	Technical Drawings - General principles of presentation Part 50: Basic Conventions for representing areas on cuts and sections
BS 8451-2	Library objects for architecture, engineering and construction Part 2: Recommended 2D Symbols of building elements for use in building information modelling
BS EN ISO 5456-2	Technical Drawings – Projection methods Part 2: Orthographic representations
BS EN ISO 5456-3	Technical Drawings – Projection methods Part 3: Axonometric representations

8.2 LU management system documents

Document No.	Title
R0583	Production of Civil Engineering Drawings
R0584	Production of Power Asset Drawings
R0585	Production of Rolling Stock Drawings
R0586	Production of Signalling Drawings
R0587	Production of Stations Drawings
R0588	Production of Telecommunications Drawings
R0589	Production of Track Drawings
R0590	Production of Survey Drawings
R0591	Production of Infrastructure Protection Drawings
S1037	Computer Aided Design (CAD) Data
S2180	Passenger Rolling Stock

9 Document history

Issue No.	Date	Changes	Author
A1	January 2017	New standard for the production of Drawings produced as per change No. 04764.	John Park
A2	May 2022	Updated drawing borders and title blocks. Change No. CR-16008.	John Park
A3	July 2022	Minor changes to image size in section 3.1.71 and text in section 3.1.73, as per change request CR-16310.	John Park

10 Attachments

10.1 Generic Drawing examples

10.1.1 Blank Drawing Sheet

[illegible]

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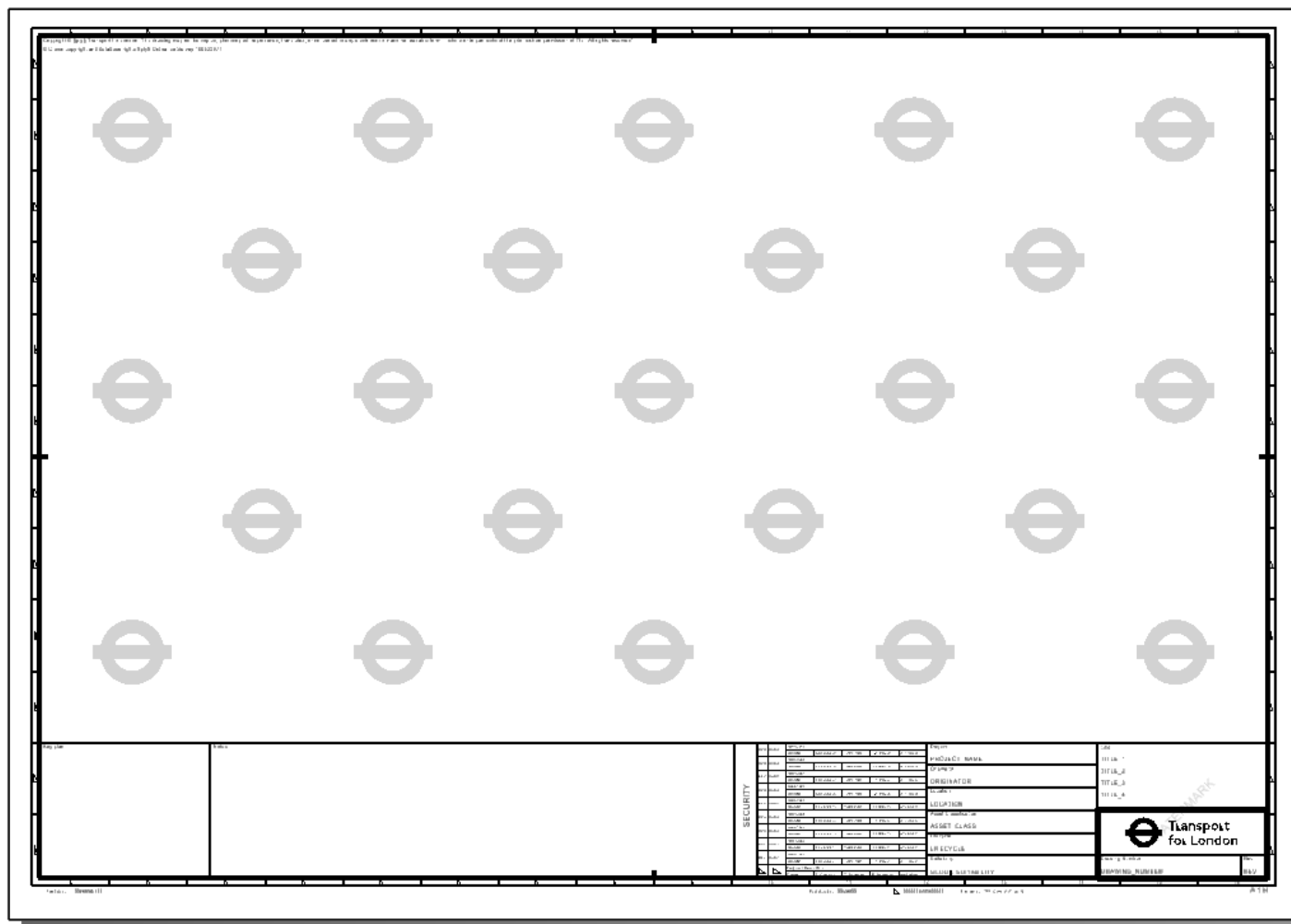
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MAYOR OF LONDON

Transport for London

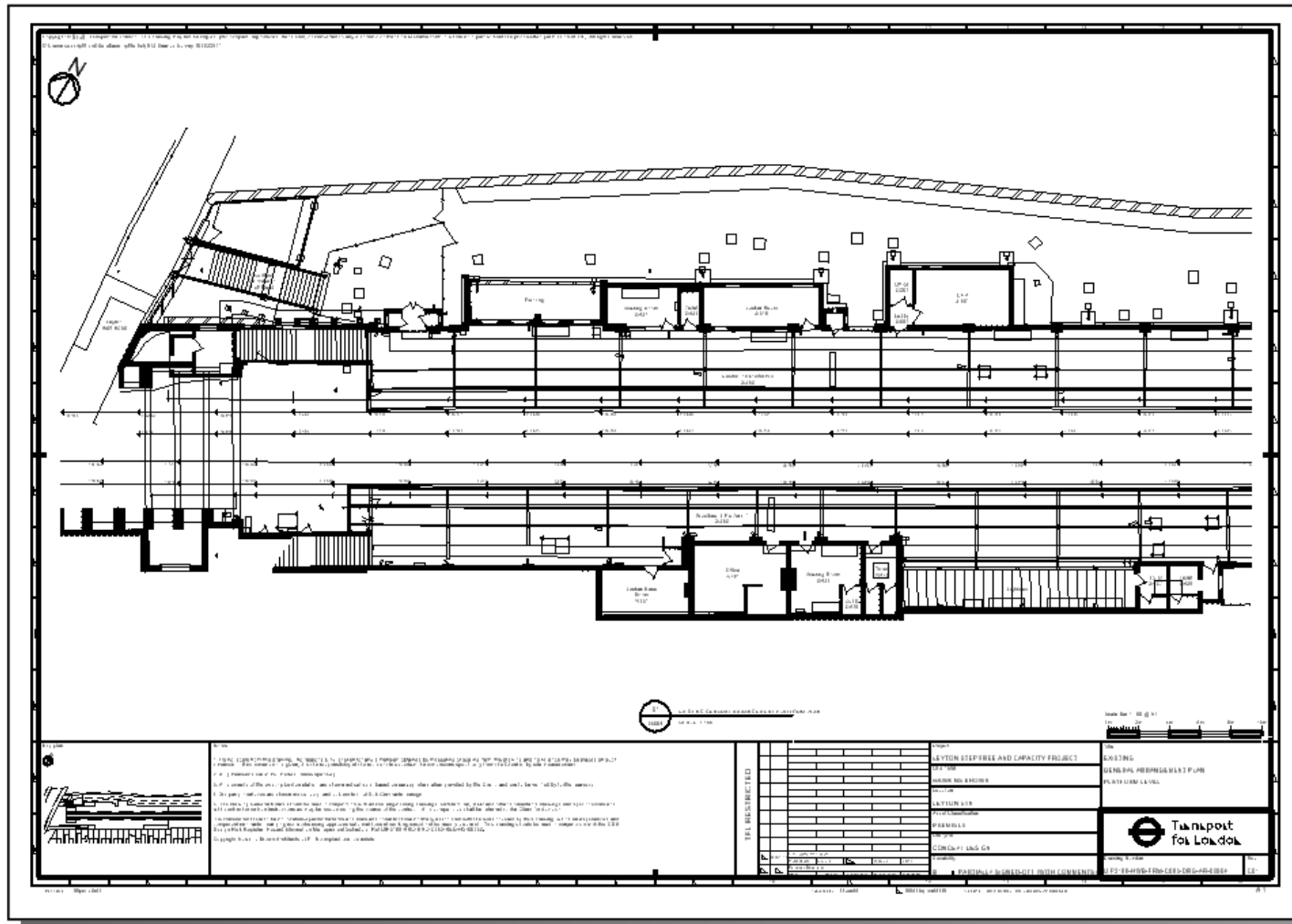


10.1.2 Blank Drawing sheet with OS watermarks



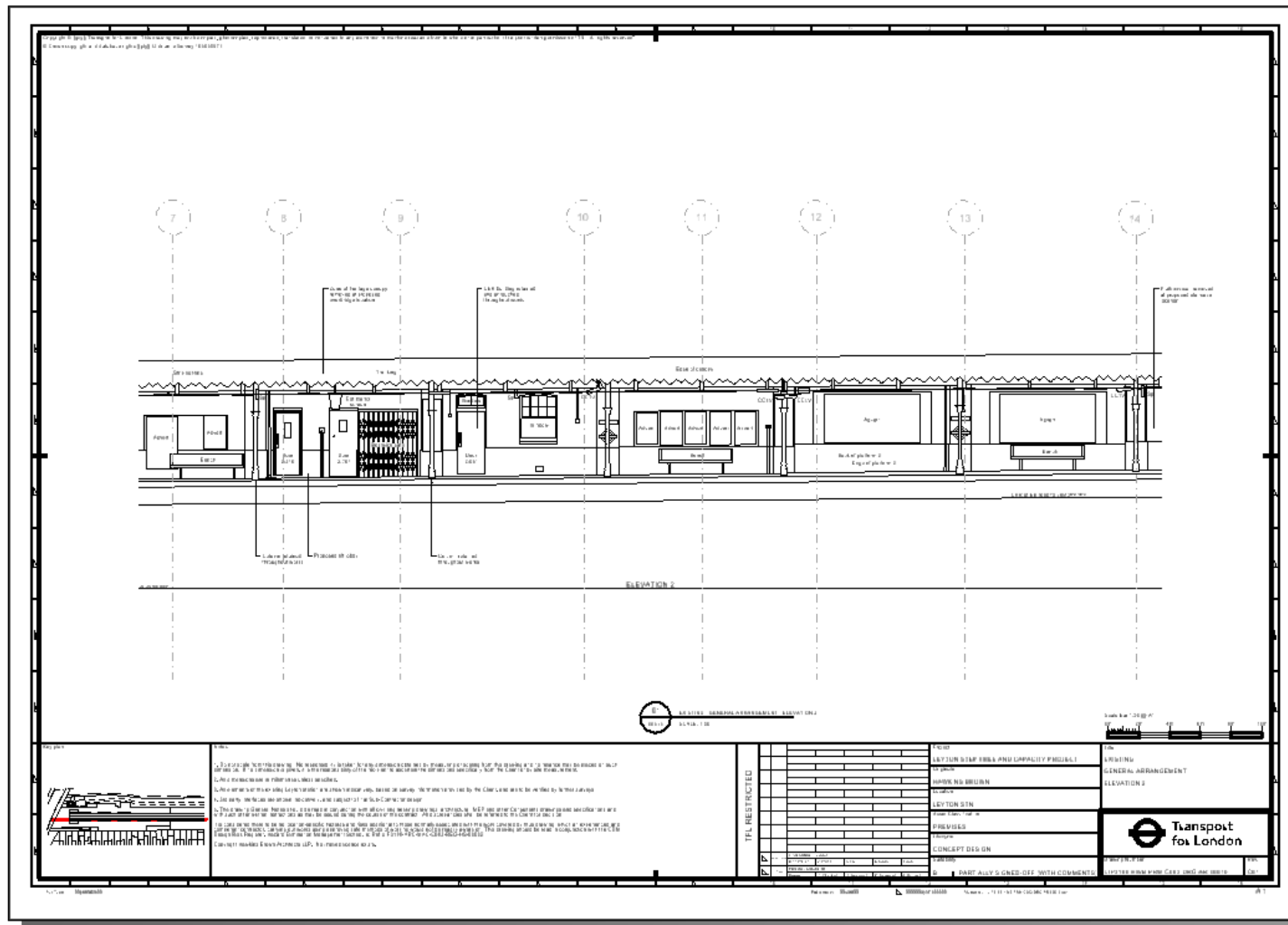
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10.1.3 Sample plan Drawing



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10.1.4 Sample elevation Drawing



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