

Category 1 Standard

S1037 Computer Aided Design (CAD) Data

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1 Purpose

- 1.1 The purpose of this standard is to define requirements for data contained within, and meta-data associated with, Computer Aided Design (CAD) files.

2 Scope

- 2.1 This standard applies to CAD data and meta-data captured, created or generated by LU, or on behalf of LU by its Suppliers.

3 Requirements

3.1 General requirements

- 3.1.1 CAD files shall be delivered in Bentley's v8i DGN file format.
- 3.1.2 Designs that have been developed using other CAD file formats, shall:
- a) have layers, line-types, line-weights, fonts and colours mapped to those fully compatible with Bentley's v8i DGN file format; and
 - b) use seed-files, supplied by LU, to translate between the different file formats
- 3.1.3 Ownership of the data contained within CAD files shall be clear (see 3.13.2).
- 3.1.4 CAD files meta-data, defined within 3.2.9 shall be displayed in both electronic and printed form.
- 3.1.5 Where CAD layers (see 3.12) are required, but not supplied by LU, these shall be added to the contracted organisation's library.
- 3.1.6 Each contracted organisation is responsible for the entire content of their CAD files.
- 3.1.7 Each contracted organisation is responsible for ensuring their CAD files are compliant with this standard.

3.2 CAD File requirements

- 3.2.1 CAD file requirements shall apply to model files, composite models and drawing definition files.
- 3.2.2 Document numbers shall be assigned following the CAD file naming convention (see 3.11).
- 3.2.3 CAD files shall carry the meta-data, 'Created', to identify the author at each revision.
- 3.2.4 CAD files shall carry the meta-data, 'Approved', to identify the approver at each revision.
- 3.2.5 CAD files shall carry the meta-data, 'Authorised', to identify who has accepted each revision, on behalf of LU.



- 3.2.6 Custom line styles shall use a scale factor of 1 (one) and be delivered to LU within a design library file.

Notes: i. Design Library File is synonymous with Bentley's DGNLib (used to centralise various design file parameters).

- 3.2.7 Geometry, representing the fixed geographical location of an asset, shall use the London Survey Grid (LSG) height datum of 100m below Newlyn.

Notes: i. Newlyn is the mean sea level (MSL) calculated from observation taken at Newlyn, Cornwall and used as the official basis for height calculation.

- 3.2.8 Elements of no or unknown height shall have a Z Value of 999m

- 3.2.9 A tag shall be placed in each CAD file containing the following mandatory file meta-data:

	Field	Clause
a)	Project	3.13.1
b)	Owner Organisation	3.13.2
c)	Asset Class	3.13.3
d)	Location (LCS Level 1) / Level	3.13.4
e)	Suitability	3.7.2
f)	Revision	3.7.3
g)	TfL Security Classification	3.8
h)	Drawing Number	3.2.2
i)	Created (Author)	3.2.3 / 4.1
j)	Approved	3.2.4 / 4.2
k)	Authorised	3.2.5 / 4.3
l)	Title	3.3.1/ 3.4.1

Notes: i. Tags containing fields for the mandatory file meta-data will be supplied by the Client.

3.2.10 Additional mandatory meta-data shall be captured against the CAD file (but not placed within the file), as shown in the table below:

	Field	Clause
a)	Level	3.13.4
b)	Type (of information)	3.13.5
c)	Organisational Role	3.13.6
d)	Number	3.13.9
e)	Pathway Project Code (supplied by Client)	N/A
f)	Lifecycle Stage	3.6
g)	Grid Reference System	3.3.5

3.2.11 Should CAD files pass through an environment that cannot track meta-data (MS Windows, CD, email etc) then the mandatory file meta-data shall be delivered with the associated CAD files, within an approved import / export spreadsheet.

3.2.12 CAD files shall have file settings set to the values shown below:

	Setting	Value
a)	2D Global Origin offset from Design Plane Centre (excludes Drawing Definition files (DR))	-214748.3648, -214748.3648
b)	3D Global Origin offset from Design Plane Centre (excludes Drawing Definition files (DR))	-214748.3648,-214748.3648, 0
c)	Resolution	10000 per Distance Metre
d)	Working units - Accuracy	0.1234
	Spatial Data	
e)	Working units - Master units	Metres (label m)
f)	Working units - Sub units	Millimetres (label mm)
	Non-Spatial Data	
g)	Working units - Master units	Millimetres (label mm)
h)	Working units - Sub units	Millimetres (label mm)

3.3 Model file requirements

- 3.3.1 All model files (including Composite Models) shall be given a title to identify the contents, captured as file meta-data.
- 3.3.2 Model files (including Composite Models) shall contain a single model design only.
- 3.3.3 Spatial data, contained within a model file, shall be associated with:
- a) one asset classification (see 3.13.3);
 - b) a documented level (see 3.13.4), using 'Z' (multiple levels) for data spanning more than one level; and
 - c) a documented location (LCS Level 1) (see 3.13.4), using the general line code for linear assets spanning more than one location



- 3.3.4 Elements shall be placed in the model file at a scale of 1:1.
- 3.3.5 Graphical elements which represent the physical location of assets shall be coordinated to the London Survey Grid (LSG).
- 3.3.6 All references within Model Files shall have display turned off when issued to LU.

Notes:

- i. For guidance on drawing composition, see 3.4 and 7.1
- ii. For London Survey Grid requirements, see S1-026

3.4 Drawing definition requirements

- 3.4.1 All drawing definition files shall be given a title to identify the contents, captured as file meta-data.
- 3.4.2 Drawings shall be composed through the use of a 'Drawing Definition File', which contains only the relevant annotation, dimensions etc; with all design information attached as reference file(s), via a composite model (with the exception of schematics and details) (see 7.1).
- 3.4.3 Drawing definition CAD files shall contain a single drawing definition only.
- 3.4.4 Drawing borders shall be referenced in the sheet model at a scale of 1:1.
- 3.4.5 Annotation, dimensioning etc. shall be placed on presentational CAD layers as defined in 3.13.8.
- 3.4.6 Dimensions shall be associative for all 'drawn to scale'.
- 3.4.7 Non-displaying references shall be detached prior to being issued to LU.

Note:

- i. Wherever possible (e.g. for 'drawn to scale' design drawings), dimensioning should be associative. Indicative or not to scale dimensions should have, 'NTS' placed next to them.

3.5 Presentational requirements

- 3.5.1 True Type Arial fonts shall be used.
- 3.5.2 Text shall be written in sentence case.
- 3.5.3 Text height shall conform to BS EN ISO 3098.
- 3.5.4 All measurements (dimensions, volumes, weights etc) shall be expressed using units based on the metric system (international system of units, SI).



- 3.5.5 Scales used on drawings shall conform to BS EN ISO 5455, preferred scales shown below:

Recommended Metric Scales		
1:2	1:5	1:10
1:20	1:50	1:100
1:200	1:500	1:1000
1:250	1:5000	1:1250
1:2000		1:10000
1:2500		

- 3.5.6 Terms and abbreviations not defined in S1-622 shall be clearly defined on the associated drawing sheet.
- 3.5.7 Drawing sheets shall state clearly the following information:
- | | |
|-------------------------|--------------------------------|
| a) Asset Classification | g) Purpose of Issue |
| b) Drawing number | h) Revision |
| c) File name | i) Scale(s) |
| d) Location | j) Suitability |
| e) Originator | k) TfL Security Classification |
| f) Project | l) Title |
- 3.5.9 Drawing definitions shall be presented to allow drawing renditions and printed drawings to be derived as an exact copy.

Note: i. If drawing renditions / printed drawings are intended to be displayed as monochrome, the drawing definition shall be presented in monochrome, not colour.

3.6 Lifecycle stages

- 3.6.1 CAD files shall carry the meta-data of 'Lifecycle Stage', to indicate the stage within the project that the contained information has been approved for use.
- 3.6.2 One of the following Lifecycle Stages shall be used:

Lifecycle Stages	
Outcome Definition	Detailed Design
Feasibility	Delivery
Concept Design	Operational

3.7 Status

3.7.1 CAD files shall be assigned a status, consisting of:

- a) Suitability (see 3.7.2); and
- b) Revision (see 0).

3.7.2 Suitability

3.7.2.1 CAD files shall carry the meta-data of 'suitability', to indicate the approved use of the contained information.

3.7.2.2 Suitability codes shall be one or two alpha-numeric and shall be reserved for use with a specific phase of the collaboration process, as defined in the table below:

	Code	Description	Model Files	Drawing Renditions
Work in Progress (non-contractual)				
a)	S0	Non-verified design The file is Work in Progress, not to be shared with others.	YES	YES
Shared (non-contractual)				
b)	S1	Coordination (for use) The file is shared and can be used by others for the purpose of design coordination and / or LU acceptance.	YES	YES
c)	S3	For Comment The file is shared and is to only be used, by others, to identify and communicate potential impacts of the change to the design.	YES	YES
d)	AM	As Maintained (LU use only) The file content has been maintained throughout the lifecycle of the asset.	YES	NO
Published (contractual)				
e)	AD	As Designed The file content has been accepted, by LU (see 3.2.5), as meeting the requirements for the stage deliverable.	YES	YES
f)	AS	As Surveyed The file content has been accepted, by LU (see 3.2.5), as meeting the survey scope requirements and those defined in LU's Survey standard (S1026).	YES	YES
g)	AB	As Built The file content has been accepted, by LU (see 3.2.5), as being verified as to what has been built / installed.	YES	YES