

# CAD Standards


## Guidance & Support v 1.5



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## Introduction



**External contractors and consultants should only follow sections that have this red icon, in the left margin as some sections are intended for internal use only.**

If this icon appears next to the heading of a section e.g. “**Layers**” this applies to the whole section.



### **Support**

- In the first instance all enquiries should be directed to the **Project Manager/Officer**
- Technical enquiries can be sent to the CAD Manager [paul.eyden@bristol.ac.uk](mailto:paul.eyden@bristol.ac.uk)

**Please ensure you are working the current version of the CAD standard. The latest version can be downloaded from <http://www.bristol.ac.uk/estates/gpr/project-info/cad-standards/>**

The CAD Standards are in place to create a unified effort and result through the adoption of a single conformed standard.

These CAD Standards are to be applied to the creation or editing of any CAD data/ files (.dwg), whether they are created by **UoB internal staff** or **external contractors and consultants**.

**Project Managers/Officers** are responsible for ensuring that external contractors and consultants are aware and apply these standards.

To explain the CAD Standard, this document is broken down into two sections:-

- 1. Administration**
- 2. Production**

## Definitions

### **CAD Data & Drawings**

- CAD Data refers to the embodied (visual and non-visual) data and information in CAD files. This information can be external integrated or linked to a drawing. A Drawing is one element of CAD data and will usually be in the uncontrolled format of PDF or printed paper hard copy.

### **CAD System**

- The CAD System manages and develops anything to do with CAD and generally encompasses
  - Standards
  - Data
  - Drawings
  - Software
  - Procedures

### **Project Drawings**

- CAD Drawings produced to illustrate proposed and intended work by internal or external sources throughout the design stages of a project.

### **As Built/Constructed /Fitted/Installed Drawings**

- Drawings that represent exactly what has been physically built/constructed/fitted/installed on a project.

### **Master Drawings**

- Building record drawings produced in-house and containing compliance information for the operational management of existing facilities. These are assumed to be the most up to date version of a building and use As Built information from project drawings via the Operation and Maintenance Manual process. Master drawings are loaned as a basis for external or internal sources to produce CAD Drawings updates or gain space information.

### **External**

- Any consultants, architects, contractors or sub-contractors employed by, or working in conjunction with, or supplying CAD drawings and data to the University.

### **Internal**

- University of Bristol Estates staff.

### **Drawing Updates**

- Any CAD drawing or data produced as a result of an update to existing, or creation of a new building, or part of a building. This data can come from internal or external sources.

### **CAD Standards**

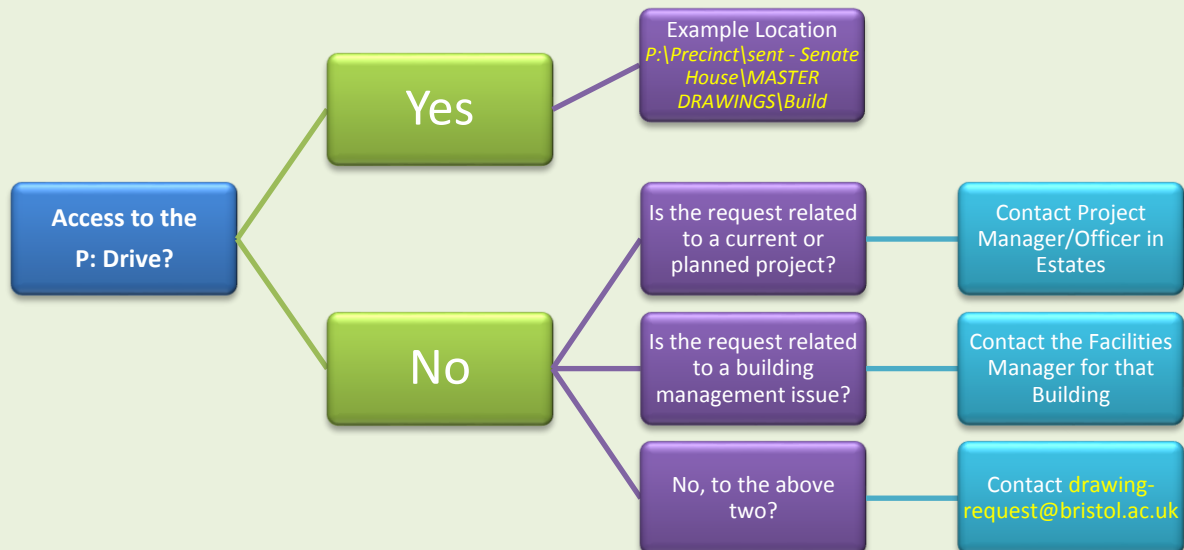
- This refers to the production and editing the elements that make up the CAD drawing and data to ensure consistency and a unified approach.

### **UoB**

- University of Bristol

## How to request UoB CAD data & drawings

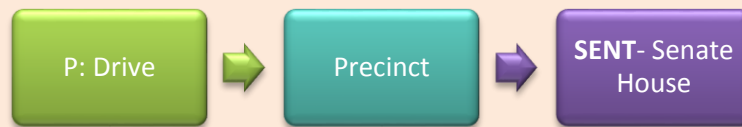
In the interest of security, all University building plans, electronic data (CAD/PDF) or paper hard copies must be accessed through appropriate Estate channels (as set out below). This following guidance applies to University staff and external companies requesting access to this information.



## Administration

### 1. Storage

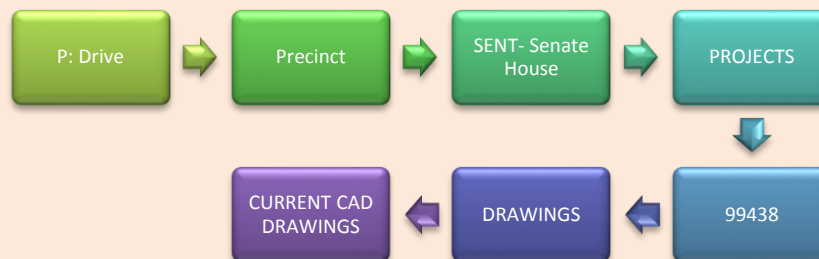
1. The first level of storage is that All CAD Data must be stored on the departmental server, under the mapped drive called **The Property drive** or **P: Drive**.
  - Not on the I: Drive
  - Not on individual's C: Drive
  - Not on individual's personal O: Drive
2. The second level of storage is the area e.g. **Precinct**.
3. The third level of storage is the building folder e.g. **SENT- Senate House**. All University Buildings are assigned a unique building short code, which consists of up to five alphanumeric characters.



4. The fourth level of storage (within the building folder) depends on the type of data.

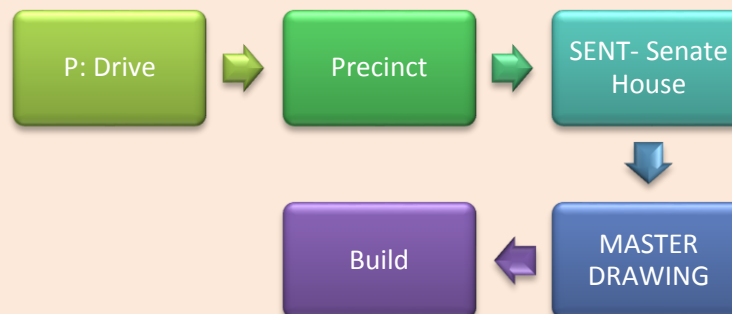
- A. **Project data** relating to a current project is stored within the project folder which is identified by the project number.

**Example** *P:\Precinct\sent - Senate House\PROJECTS\99438\DRAWINGS\CURRENT CAD DRAWINGS*



- B. **Master data** is stored within the building folder.

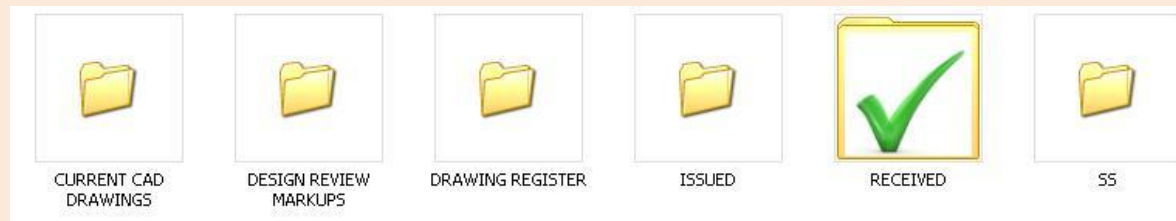
**Example** *P:\Precinct\sent - Senate House\MASTER DRAWINGS\Build*



## 2. Incoming CAD data & drawings

**Responsibility:** Project Manager/Officer

1. All received CAD data must be saved within the project folder > **DRAWINGS> RECEIVED**
2. All received incoming CAD data must include a drawing issue register that will be saved within the **RECEIVED** folder.



## 3. Outgoing CAD data & drawings

**Responsibility:** Anyone wishing to send a CAD drawing outside the University

There are two stages for sending drawings outside the University

### Stage 1

- **All CAD data/drawings to be issued outside the University are subject to the Drawing Loan Undertaking (DLU) document being signed and returned by the intended recipient(s) before any CAD data/drawings are sent out.**

<http://www.bristol.ac.uk/estates/gpr/project-info/cad-standards/>

- Copies of data/drawings will only be issued once the CAD Manager [paul.eyden@bristol.ac.uk](mailto:paul.eyden@bristol.ac.uk) has received a copy of the completed and signed DLU.
- It is the responsibility of the individual(s) wishing to issue the CAD data/drawings outside the University, to issue the DLU document to the intended drawing recipient(s) and ensure they are aware of the process.

### Stage 2

- [Drawing Issue Register](#)- see below Section 4. (page 8)





## 4. Drawing register/Issue register

**Responsibility:** Project Manager/Officer

The drawing register/issue register works in two ways.

- 1. **Register**- Keeps an accurate record of what drawings currently exist on a project, whilst also quickly providing an overview of project and drawing status.
- 2. **Issue Register**- Becomes the issue register when drawings are sent outside the University. This keeps a record of what has been issued, who issued it, to whom and when.



## 5. CAD Data/Drawing Requirements

**Responsibility:** Project Manager/Officer

**All CAD data/drawings submitted as part of an O&M manual from external or internal UoB staff, must meet the following requirements at a minimum:**

1. Be drawn or edited to the University of Bristol CAD Standards (see [Production](#) section) i.e. layering, text, dimensions and line types.
2. Include a current and complete drawing issue register, see above (Section 4).
3. Include a title block as part of the CAD drawing showing the following: version, revision numbers which should match the version and revision numbers of the drawing issue register.
4. Marked as "As Built", "As Fitted", "As Constructed" or "As Installed" within the title block of each drawing.
5. eTransmitted (where possible) to include all support files and xrefs related to that drawing.
6. .DWG or .DXF file format
7. Two dimensional
8. Include all general arrangement drawings for building structure, including all Services, Electrical and M&E drawings. Specific fabrication details etc. are not required.



## 6. Minor jobs & amendments plus non O&M projects

**Responsibility:** Project Manager/Officer/anyone wishing to submit an amendment

1. All changes to building/room layouts that may not require an O&M manual (no matter how minor) must be submitted to the **Drawing Repository** P:\\_general\DRAWING REPOSITORY
2. The CAD manager [paul.eyden@bristol.ac.uk](mailto:paul.eyden@bristol.ac.uk) should then be informed so the master drawing can be updated.
3. If the information is part of a project update, but does not go through the O&M system it is the project manager/officer's responsibility to ensure the information is saved in the drawing repository and the CAD manager is informed.

## 7. Surveys

**Responsibility:** Project Manager/Officer




1. Survey proposals must be discussed with [Space & Asset Management](#) before any work is undertaken or instructed.
2. Once the agreed survey has been undertaken, it is the responsibility of the project manager/officer to check the issued survey drawings and ensure the survey has been carried out accurately and to the full extent of the requested work.
3. If the proposed survey has agreed to capture room numbers, the room numbering convention must be obtained from Space & Asset Management prior to any surveys taking place. Contact [buzmjf@bristol.ac.uk](mailto:buzmjf@bristol.ac.uk)

### **All surveys must meet the following standard at a minimum**




1. Undertaken and produced to the current RICS Code of measuring Practice.
2. Must be produced in the form of a 2D AutoCAD drawing file (.dwg or dxf).
3. Adhere to the University of Bristol CAD standards where possible and practical.

## Production

### 8. New drawings

- 
1. All drawings must be produced in AutoCAD (where possible) and be in 2D format. All drawings will be produced on the version (or as updated in the future) of AutoCAD that is currently in use within the Estates Office. This is currently 2007 format.
  2. When a new CAD drawing is produced or revised it must be added to the project [Drawing Register](#).
- 
3. All drawings produced, either via internal or external means, are to be produced to the UoB CAD Standards. [The UoB CAD Template File](#) can be used to aid this process.
  4. If available, Master Drawings should be used as the basis or background to create project drawings. If not available, the final As Built project drawings will become the basis for the new Master Drawing.
- 
5. Data should not be relocated away from the original survey grid, as sometimes it is a requirement that all drawing files are to be positioned in the correct location over the OS Map. The setting out position should remain constant throughout the project. This can be achieved by creating a new UCS and then setting up named views. *Please ask if you need help.* If the external contractor or consultant moves their details from its original insertion/origin point, then these details should be corrected during production of revised Xrefs. UoB layouts should not be amended to suit these changes in location. Instead the external contractor or consultant's plan is moved back into its previous location, as initial issue.
  6. All existing AEC or 3D CAD entities will be converted to 2D. Any extra reworking or redrawing will have to be undertaken as part of this process.

## 9. General drawing & editing

-  1. All drawings will be drawn full size (1:1 scale (1 drawing unit =1mm)) in millimetres (model space); however it is acceptable for highways, mappings and surveys to be produced in meters (1:1 scale (1drawing unit =1m)).
-  2. Where details are required on a drawing at various scales this must not be achieved by scaling in model space. Please use viewports within the layout/paper space. The drawing in model space should always be at 1:1.
-  3. To avoid problems with overlaying information the drawing rotation in model space must never be altered. Do not move, re-scale or rotate drawings.
4. If a drawing needs to show duplicated areas or more than one building level, therefore contain more than one background Xref, then these files should not be moved from their original insertion/origin point. The final result (plot) is to be accomplished by the correct use of layers, layer manager and view ports.
5. Drawings should be purged and audited regularly, note that only objects that are not being used on the drawing will be removed. **Do not purge UOB dimension or text styles.**
6. Delete all unused layout tabs when not required.
7. When exiting a drawing ensure that all required layers are turned on and ready for plotting with the full paperspace view displayed on the screen. This not only enables the viewer to see the drawing on the preview but also assists with batch plotting. It is also good practice to make full use of layer manager whenever possible.
8. When drawing files are to be closed, they must be saved to the default status, as follows:-
  - a. All completed drawings are to be purged
  - b. All unused layouts to be deleted
  - c. All required layers are turned on and layer '0' made current.
  - d. Zoomed to extent
  - e. Paper space view

## 10. Drawing naming

The drawing naming convention for project drawings has four distinct fields.

### Field No. 1:

This field is identical to the Master Drawing field; it will identify the site location and building.

### Field No. 2:

This field contains the project number and comprises six characters.

### Field No. 3:

The third field comprises two or three characters and identifies the drawing discipline.

Abbreviations for common project disciplines:-

Lighting	LTG	Air Conditioning	AC
Outdoor Lighting	EXT LTG	Ventilation	VEN
Emergency Lights	EL	Water / Domestic	HCW
Small Power	PWR	Drainage	DRN
Communications	COM	Gas / Medical	GAS
Fire	FA	Service Ducts	DUC
Heating	HTG	Schematics	SCH

### Field No. 4

This field comprises three characters that identify the floor (level) of the building or whether the drawing is an elevation or section:-

i.e.	RP	Roof Plan
	MZ1	First Floor Mezzanine
	ØØ1	First Floor
	MZG	Ground Floor Mezzanine
	ØØØ	Ground Floor
	UGF	Upper Ground Floor
	LGF	Lower Ground Floor
	-ØØ1	Basement 1
	-ØØ2	Basement 2
	LVD	Level D (Medical School)
	ENW	Elevation (North West)
	ESE	Elevation (South East), etc
	SAA	Section AA

### Example

A typical drawing number for a Project drawing would be:-

.e.g.      PCHEM\_902522\_LTG\_01B

PCHEM	Precinct – Chemistry School
902522	Project Number
LTG	Lighting
01	First Floor
B	Revision



## 11. Text

Guidelines have been set up to determine the standard style and size of text used on University of Bristol drawings to ensure consistency throughout all drawings.

1. All text will be in model space and not added to the layout.
2. All text shall be UPPERCASE (except units of measurement) in **Mtext**. All title block text shall be in UPPERCASE.
3. All general notes, annotations, etc will be in **Romans** style 2mm high (printed) and justified according to usage.
4. All room numbers and room names shall be in **Romans** style 2mm high (printed) and Middle Center justified.
5. All text for titles, headings, etc shall be in **Titles** style and be 2.8mm high (printed), and justified according to usage.
6. With the exception of contours and chainage, all text should be readable from the bottom right hand side of the drawing.

Text styles used on drawings are inserted with UOB Title Blocks.dwt template files and are set up using the following parameters:

#### Text styles

Style Name	Romans	Titles
Font Name	romans.shx	Arial Regular
Height	2mm	2.8mm
Width Factor	0.80	0.90



## 12. Dimensions

1. The automatic dimensioning facility must be used for all dimensions.
2. Do not explode dimensions into their constituent parts.
3. Dimensions can be annotated, but should always be to scale.
4. Various Dimensioning Styles with different terminator styles will be brought in with the UOB template files. Below are a few examples:

<b>UOB 1-100 Arrow</b>	The terminator will be a 'Closed Arrow' for a scale of 1:100
<b>UOB 1-100 Dot</b>	The terminator will be a 'Dot' for a scale of 1:100
<b>UOB 1-100 Tick</b>	The terminator will be an 'Architectural Tick' for a scale of 1:100

Typically either Arrows or Ticks should be used depending on the type of drawing being produced.

## 13. Hatch

1. Hatch should not be used for internal or external walls.
2. Do not explode hatches.
3. Only Standard AutoCAD hatch patterns should be used.
4. Do not associate hatch patterns to entities that are part of an Xref.
5. The hatch pattern 'dots' is memory hungry and should be avoided.
6. To enable objects to keep their by layer properties, place hatch patterns on a separate layer.
7. Where possible all hatch should be associative to aid the editing process.

## 14. Symbols library

Standard UOB Symbols and Blocks are accessible through the use of tool palettes.

All symbols are inserted onto an appropriate BS 1192 Descriptive layer. Most symbols are drawn at 1:1 and will be placed at the Dimscale set for the drawing. Others are drawn full scale, eg luminaires, radiators.

## 15. Line weights (general guidance)

Line weight	Application
0.10	Fine hatching and hidden items
0.13	Architectural background / building outlines (xref)
0.25	Text and general notes – leaders and dimensions
0.25	General editing
0.35	Symbols and services





## 16. Line types

1. All users must keep to the line styles provided with AutoCAD and template file.
2. All objects in the drawings must keep their by layer properties. Therefore if more than one line type is required for a particular category, multiple layers for each can be created to suit.
3. Standard AutoCAD line types (acadiso.lin) must be used. Site survey drawings showing main service supply routes may use special line types such as:-
  - GAS\_\_\_GAS\_\_\_GAS
  - CCTV\_\_\_CCTV\_\_\_CCTV

These special line types must be supplied with the drawing files.

## 17. Layers

The University of Bristol, Estates Office follow the **AEC (UK) CAD Standard** which is based on **BS1192**, with minor modifications and additions to suit the usages of the University.



## 18. Layering

**The layering convention will be used when creating all drawing files.**

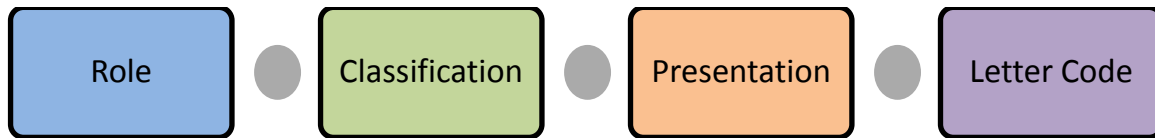
- All objects should be colour by layer
- Line type set to by layer
- Line weight set to by layer
- Plot Style set to full saturation

All corresponding text and leaders should be on the correct services layer name.

Layer **Z-Note-T** should be used for general notes, titles, charts, legends, etc.

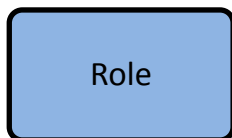
## 19. Layer naming

The layering standard naming convention uses the following fields.



*Example-*

**A-Door-G** (Role = Architect, Presentation= Door & Letter Code= Graphical information)



The layer names starts with a code to signify producer/owner & discipline

<b>A</b>	<b>Architect</b>
<b>AL</b>	<b>Landscape Architects</b>
<b>B</b>	<b>Building Surveyors</b>
<b>C</b>	<b>Civil Engineers</b>
<b>CB</b>	<b>Bridge Engineers</b>
<b>CD</b>	<b>Drainage, Sewage &amp; Road Engineers</b>
<b>CW</b>	<b>Water/Dam Engineers</b>
<b>D</b>	<b>Spare</b>
<b>E</b>	<b>Electrical Engineers</b>
<b>F</b>	<b>Facilities Managers</b>
<b>G</b>	<b>GIS Engineers &amp; Land Surveyors</b>
<b>GA</b>	<b>Aerial Surveyors</b>
<b>H</b>	<b>Heating and Ventilation Engineers</b>
<b>I</b>	<b>Interior Designers</b>

<b>J</b>	<b>Telecommunications</b>
<b>K</b>	<b>Client</b>
<b>L</b>	<b>Lift Engineers</b>
<b>M</b>	<b>Mechanical Engineers</b>
<b>ME</b>	<b>Combined Services</b>
<b>N</b>	<b>Spare</b>
<b>P</b>	<b>Public Health Engineers</b>
<b>Q</b>	<b>Quantity Surveyors</b>
<b>R</b>	<b>Railways</b>
<b>RS</b>	<b>Railways Signalling</b>
<b>RT</b>	<b>Railways Track</b>
<b>S</b>	<b>Structural Engineers</b>
<b>SF</b>	<b>Façade Engineers</b>
<b>SR</b>	<b>Reinforcement Detailers</b>
<b>T</b>	<b>Town &amp; Country Planners</b>
<b>U</b>	<b>Spare</b>
<b>V</b>	<b>Spare</b>
<b>W</b>	<b>Contractors</b>
<b>X</b>	<b>Sub-Contractors</b>
<b>Y</b>	<b>Specialist Designers</b>
<b>YA</b>	<b>Acoustic Engineers</b>
<b>YE</b>	<b>Environmental Engineers</b>
<b>YF</b>	<b>Fire Engineers</b>
<b>YL</b>	<b>Lighting Engineers (Non-Building Services)</b>
<b>Z</b>	<b>General (Non-Disciplinary)</b>

Classification

In the case of non-physical CAD bases items, the layer name may start with this code as a replacement for the role code

*Examples-*

**X** External References

**Z** General CAD specific layers

Presentation

Indicates the type of data associated with the layer

*Examples-*

**Medical Gas**

**Column**

Letter Code

This may be appended to the end of a layer name to signify the particular CAD specific purpose for the layer information

*Examples-*

**T** Text

**G** Graphical information

**D** Dimension

**H** Hatch

## 20. Plotting

To ensure that all paper information produced from the Bristol University CAD system is of a consistent standard, all of the following procedures should be followed. The Designer / CAD Technician is responsible for carrying out all necessary checks before committing the CAD file to the plotter/printer.

## 21. Final check

**All CAD data must be checked to ensure that all information corresponds to the CAD standards detailed in this document.**

1. All data has been produced using the appropriate layers.
2. Check that the correct colour, line type, line weight and plot style have been used to represent each object.
3. Make sure that the latest layouts are being used from other disciplines. If incoming procedures are correctly followed then this should always be the case.
4. Check that viewport(s) are zoomed to the correct scale.

**Check all notes and dimensions.**

1. Make sure that correct English Grammar has been used.
2. Run a spell check.
3. Check the font and size of text.
4. Check that viewport boundary has not trimmed off any of the text/building; adjust the boundary to suit.
5. Check that the continuation notes (if any) are accurate and cross-referenced.

**Check the title block in paper space.**

1. Check that the title block has been filled in correctly.
2. The correct revision letter and date has been added.
3. The correct reason for issue has been added.
4. The correct scale/scales have been added.
5. Add the Project Manager, Designer and CAD drafter initials.
6. Have all of the necessary notes been added to the notes column?
7. If required, is the legend correct?
8. Has the location plan been hatched in the correct area?