CAD Standards
University of Bristol- Estates Office

Guidance and support in the production and administration of CAD data. V 1.0

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1/23/2012
## Contents

- **Introduction** ........................................................................................................................................ 4
- **General Rules** ...................................................................................................................................... 4
- **Definitions** ........................................................................................................................................... 5
- **Administration** .................................................................................................................................... 6
- **Storage** ................................................................................................................................................ 6
- **Production** ........................................................................................................................................... 8
- **New drawings** ..................................................................................................................................... 8
- **General drawing & editing** .................................................................................................................. 9
- **Drawing Naming Convention** ............................................................................................................ 10
- **Text** ................................................................................................................................................... 13
- **Dimensions** ........................................................................................................................................ 14
- **Hatch** ................................................................................................................................................. 15
- **Symbols Library** ................................................................................................................................. 15
- **Lineweights** ....................................................................................................................................... 15
- **Linetypes** ........................................................................................................................................... 16
- **Layers** ................................................................................................................................................ 16
- **Layering Convention** ......................................................................................................................... 16
- **Plotting Protocol** ................................................................................................................................ 17
- **Final check Protocol** .......................................................................................................................... 17
Introduction

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 drawings/files (.dwg), whether they are created by UoB internal staff or external contractors and consultants.

Project Managers are responsible for ensuring that external contractors and consultants are aware and apply these standards if it is not already captured in GPR or framework agreements.

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

1. Administration
2. Production

External contractors and consultants should only follow sections that have this red icon, as not all sections are relevant and 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.

General Rules

1. **CAD drawings are not to be emailed around the University to internal staff.** Where possible, please direct people to the storage location of the drawing. This ensures staff will always be working from the same and most current version of a file. Drawings stored on email can go out of date very quickly. People outside of Estates (with no access to the P: Drive) can access drawings through the Drawing Request Procedure- **002- Accessing CAD Drawings-Non Estates Staff**

2. **Always request electronic (.dwg) versions of CAD drawings when sending out Requests for Information.** This makes developing CAD drawings infinitely quicker because the base information is already in CAD format.

3. **Please don’t guess, ask.** If you are not sure how to do something, contact me. I am happy to spend the time improving CAD users’ knowledge to ensure things are done correctly. This approach will reinforce the standard, accuracy and quality of CAD data we produce for current and future use.  [ollie.mouland@bristol.co.uk  18016]
Definitions

CAD System

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

CAD Drawings/data

- Electronic drawings produced with AutoCAD software creating a file identified by the file extension “.dwg”.

Project Drawings

- CAD Drawings produced to illustrate proposed work by internal or external sources throughout the design stages of a project. This may be for projects undertaken by Operations or Capital Projects.

Master Drawings

- CAD Drawings produced in-house as building record drawings. These are assumed to be the most up to date version of a building and use As built information from project drawings from internal and external sources. Master drawings are loaned as a basis for external or internal sources to produce CAD Drawings updates.

External

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

Internal

- Any CAD Drawing produced ‘in-house’ by University of Bristol Estates staff.

Drawing Updates

- Any CAD drawing 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

- University of Bristol CAD Standard to which all CAD Drawings are to be produced be they from internal or external sources. This document is the written standard.

UoB

- University of Bristol
**Administration**

The principle for the administration element of these CAD Standards is to ensure anyone working with CAD data, should be able to find the correct information quickly and easily across different projects and disciplines.

Before drawings are produced, a bare minimum of drawing file administration and storage is needed to allow them to be located efficiently. Basically, this is to assure you are working with the most current data.

**Storage**

Adequate drawing storage is required to allow the efficient location of drawings.

1. The first level of storage is that **All CAD Drawings** are to be stored on the departmental server, under the mapped drive called ‘Property’ drive or P: Drive.
   - A. Not on the I: Drive
   - B. Not on individuals C: 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 drawing.

   A. **Project drawings** relating to a current project are stored within the project folder which is identified by the project number. **Example P:\Precinct\sent - Senate House\PROJECTS\99438\DRAWINGS**
B. **Master drawings** are stored within the building folder. **Example** *P:\Precinct\sen - Senate House\MASTER DRAWINGS\Build*

All files shall be accessed through Windows Explorer to access the drawing register. Master Drawings can be located using the **Master Drawing Directory**. Master Drawings will underpin the Universities CAFM system.

Project drawings start as part of a project. These can either be drawings of a new building and services, or revisions to existing buildings and services.
**Production**

**New drawings**

1. All drawings must be produced in AutoCAD (.DWG) and be in 2D format. All drawings will be produced on the version (or as updated in the future) of AutoCAD 2012 that is in use at Estates Services. AutoCAD has been set to save all CAD drawings in 2004 format by default.

2. Floor plans must be individual drawings.

3. When a new CAD drawing is produced or revised it must be added to the project Drawing Register as per the CAD procedure [012- Drawing Register](#).

4. All drawings produced through either internal or external means are to be produced to the UoB CAD Standards by utilising the UOD template file. These can be found in the Property drive: [Property on ‘buar-srv002.wbd.bris.ac.uk’][1]  
P:\ALL_TEMPLATES\AutoCAD\UOB standards drawing.dwg

5. If Master Drawings exist, then these shall be used as the basis or background to create project drawings. Should no Master Drawings exist, then the project drawings will eventually become the Master Drawings.

6. 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. 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.

7. To bring all our CAD drawings and system into one standard and format all CAD drawings that require editing will have to undergo the following additional changes and edits.  
   - All existing AEC (3D) CAD entities will be converted to 2D. Any extra reworking or redrawing will have to undertaken as part of this process
General drawing & editing

1. All drawings will be drawn full size (1:1 scale) in millimetres (model space); however highways, mappings and surveys often need to be full size (1:1 scale) in metres.

2. Where details are required on a drawing at various scales it must not be achieved by scaling in model 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
Drawing Naming Convention

A drawing naming convention is in place to identify drawings. Drawing files will be named according to the drawing number.

Master Drawings

The drawing numbering system for Master Drawings will adopt the following convention:-

There are three fields, as follows:-

Field No. 1

This field comprises five characters identifying the site location and building. The first character represents the site:-

i.e.    C   Clifton    A   Long Ashton    S   Stoke Bishop
       L   Langford    O   Others
       W   Leigh Woods    P   Precinct

The next four characters in this field represent the commonly used building short code as used within the Space Management Systems.

i.e.   SENT   Senate House
i.e.   CHEM   Chemistry School
i.e.   MANH   Manor Hall

Field No. 2

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
Field No. 3

This field comprises three characters that identify the type of drawing

i.e. MAS Master Drawing

Example

Typical drawing numbers for Master Drawings would be:-

PSENT_ØØ1_MAS (Precinct_Senate House_First Floor_Master Drawing)

or

CMANH_ESE_MAS (Clifton Manor Hall_Elevation South East_Master Drawing)

or

LLHLD_ALL FLOORS_MAS (Langford_Langford House_All Floors_Master Drawing)
**Project Drawings**

The drawing numbering system for project drawings generally follows the same philosophy as for Master Drawings, but with four distinct fields.

**Field No. 1**

This field is identical to the Master Drawing field; that is, 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:

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting</td>
<td>LTG</td>
</tr>
<tr>
<td>Outdoor Lighting</td>
<td>EXT LTG</td>
</tr>
<tr>
<td>Emergency Lights</td>
<td>EL</td>
</tr>
<tr>
<td>Small Power</td>
<td>PWR</td>
</tr>
<tr>
<td>Communications</td>
<td>COM</td>
</tr>
<tr>
<td>Fire</td>
<td>FA</td>
</tr>
<tr>
<td>Heating</td>
<td>HTG</td>
</tr>
<tr>
<td>Air Conditioning</td>
<td>AC</td>
</tr>
<tr>
<td>Ventilation</td>
<td>VEN</td>
</tr>
<tr>
<td>Water / Domestic</td>
<td>HCW</td>
</tr>
<tr>
<td>Drainage</td>
<td>DRN</td>
</tr>
<tr>
<td>Gas / Medical</td>
<td>GAS</td>
</tr>
<tr>
<td>Service Ducts</td>
<td>DUC</td>
</tr>
<tr>
<td>Schematics</td>
<td>SCH</td>
</tr>
</tbody>
</table>

**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:

- 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

Text
Guidelines have been set up to determine the standard style and size of text used on University of Bristol drawings to ensure uniformity 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 and with 0.8 Width Factor. All title block text shall be in UPPERCASE.

3. All general notes, annotations, etc will be in Romans, 2mm high and justified according to usage.

4. All room numbers and room names shall be 2.0mm high, Romans and Middle Center justified.

5. All text for titles, headings, etc shall use the text style Titles and be 2.8mm high, Arial with 0.9 Width Factor 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**

<table>
<thead>
<tr>
<th>Style Name</th>
<th>Romans</th>
<th>Titles</th>
<th>Title Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Font Name</td>
<td>romans.shx</td>
<td>Arial Regular</td>
<td>Arial Regular</td>
</tr>
<tr>
<td>Height</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Width Factor</td>
<td>0.80</td>
<td>0.80</td>
<td>0.90</td>
</tr>
</tbody>
</table>

**Application of Text**

<table>
<thead>
<tr>
<th>Paper Size</th>
<th>Font Name</th>
<th>Height (Paperspace)</th>
<th>Pen Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0, A1, A2, A3 &amp; A4</td>
<td>Romans</td>
<td>2.0mm</td>
<td>White</td>
</tr>
<tr>
<td>A0, A1, A2, A3 &amp; A4</td>
<td>Titles</td>
<td>2.8mm</td>
<td>White</td>
</tr>
</tbody>
</table>

**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:

<table>
<thead>
<tr>
<th>UOB 1-100 Arrow</th>
<th>The terminator will be a ‘Closed Arrow’ for a scale of 1:100</th>
</tr>
</thead>
<tbody>
<tr>
<td>UOB 1-100 Dot</td>
<td>The terminator will be a 'Dot' for a scale of 1:100</td>
</tr>
<tr>
<td>UOB 1-100 Tick</td>
<td>The terminator will be an ‘Architectural Tick’ for a scale of 1:100</td>
</tr>
</tbody>
</table>

Typically either Arrows or Ticks should be used depending on the type of drawing being produced.
Hatch
1. Hatch should not be used to 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.

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

External users can access these symbols (blocks) through the UoB template file.

All symbols are inserted onto an appropriate BS 1192 Descriptive layer. If the layer is not present it will be created. 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.

Lineweights

<table>
<thead>
<tr>
<th>Lineweight</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10</td>
<td>Fine hatching and hidden items</td>
</tr>
<tr>
<td>0.13</td>
<td>Architectural background / building outlines (xref)</td>
</tr>
<tr>
<td>0.25</td>
<td>Text and general notes – leaders and dimensions</td>
</tr>
<tr>
<td>0.25</td>
<td>General draughting</td>
</tr>
<tr>
<td>0.35</td>
<td>Symbols and services</td>
</tr>
</tbody>
</table>
Linetypes

1. All users must keep to the line styles provided with AutoCAD and template file.

2. All objects in the drawings must keep their bylayer properties. Therefore if more than one linetype 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.

Layers

A standard CAD layering system is necessary to enable consistent drawing production from a wide variety of sources and services. The University of Bristol, Estates Services follow the BS1192 Descriptive Stb Layering Standard, (with minor modifications to suit the usages of the University.)

Layering Convention

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

- All objects should be colour by layer
- Linetype set to by layer
- Lineweight 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_Notes Gen should be used for general notes, titles, charts, legends, etc.

Generally, Estates Services CAD drawings uses three lineweights:-

0.13mm for all building elements.

0.25mm for all text.

0.35mm for all M&E services.
Plotting Protocol

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.

Check the drawing content carefully to ensure that all of the changes have been carried out carefully.

Final check Protocol

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, linetype, lineweight 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. Have all of the necessary notes been added to the notes column?
5. If required, is the legend correct?
6. Has the location plan been hatched in the correct area?