DIRECTORATE OF ESTATES & FACILITIES

PROCEDURE AND INFORMATION MANUAL

EPM GM5 - CAD and Modelling Standards

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Revision History

Rev No.	Comments	Date	By	Chk'd	App'd
2.0	Second Issue	Dec 12	CK	-	-
3.0	Document rewritten to include modelling & Building Information Modelling standards. CAD standards updated to bring in line with current industry standards.	Feb 19	GS		
4.0	Restructured to separate 2D from 3D standards	Jan 20	LS		
5.0	Removed details on Fire Drawings and various updates	Jun 23	LS		

Introduction

The purpose of this document is to provide advice and guidance to all who produce drawings and models for the Directorate of Estates and Facilities, including colleagues, consultants and contractors.

Any colleague, consultant or contractor delivering any CAD or 3D models to The University of Manchester (UoM) must ensure these standards are reviewed, understood and followed. To assist with this, templates which align with these standards are available for both AutoCAD and Revit. Details on how to use these templates are available in the relevant authoring sections (Section 3 or Section 4).

This document is split into the following sections, the footer is colour coded according to application.

Section Number	Section	Description
Section 1	File Naming	File Naming Standard for the production of all information types
Section 2	Drawing Presentation Standard	Presentation standards for UoM drawings
Section 3	AutoCAD Authoring Standard	Protocols for authoring drawings in AutoCAD
Section 4	Revit Authoring Standard	Protocols for creating models and authoring drawings in Revit

KEY

Applicable to both CAD and Models	Applicable only to AutoCAD	Applicable only to Revit

Please note that this document is intended to be viewed electronically and can be accessed from the Directorate of Estates and Facilities website.

Policies and Procedures: EPM GM5 CAD & Modelling Standards

The Space Management Team will conduct validation checks upon receipt of any drawings/models and will return any that do not comply with these standards.

Systems and Owners referred to in EPM GM5

Owner/Team using system	System name	Generic Name for System
Space Management Team	Archibus	Space Management System (CAFM)
Projects Team	Concerto	Project Management System
Facilities, Maintenance & Compliance	Concerto	Asset Management System (CAFM)

Documents/Templates linked to this procedure

Procedure Documents	EPM GM10 Building Naming Procedure EPM GM11 Room Numbering Procedure EPM PM25 Employers Information Requirements EPM PM29 UoM Application of BIM
CAD Templates and Checklist	
REVIT Templates and Checklist	

If you have any questions about this document and/or to request templates, please contact the Space Management Team.

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Contents

Section 1: File Naming

1. FILE NAMING

Master General Arrangement - Drawing Numbering / File Naming

UoM master general arrangement drawings have a unique number which assists with identifying the type of drawing, building number, floor type and floor level.

Example Drawing Number*:* **MGA066AA-F000**

MGA	Master General Arrangement	*Type of drawing*
066AA	Building Number	*This is made up of three numeric and two alpha digits. The building number is to be obtained from the Space Management Team.*
F	Floor Type	*The building level (floor) or location code. This must follow EPM GM11 – Room Numbering Procedure.*
000	Floor Level	*A sequential number to identify the floor level. Standard coding should be three numeric digits*
***Note:** Under no circumstances should these drawing numbers be amended.*		

When general arrangement drawings are issued from the Space Management Team to internal or external parties, the drawings will have this file naming format.

File naming during the building project

UoM understand that during the building project there is an industry requirement for all files (drawings, models, documents) to follow the principles aligned with BS EN ISO 19650-1&2 + National Annex for naming and numbering. This is outlined in the Project Management System Protocol Document and an example is outlined on the next page.

At the end of any project, upon receipt of the general arrangement drawings, the Space Management Team will conduct validation checks. Once the checks are complete and the drawing is accepted, the file name will be changed to reflect the UoM file naming format outlined above.

Example

Field	Project	Originator	Volume or System	Level & Location	Type	Role	Classification	Number
Obligation	Required	Required	Required	Required	Required	Required	Optional	Required
Exemplar	086	UoM	AA	G	DR	K	12	000

Project

This is the single common project identifier

Originator

This is a unique identifier for the organisation who was responsible for the creation of the file. (A maximum of three characters)

Volume or System

A unique identifier for the building block located on a site

Level and Location

This unique identifier indicates a single building level (floor) or location. All level or location fields are required to follow EPM GM11 – Room Numbering Procedure.

Type

To assist with recognition, this should consist of a single type of information, as highlighted in BS EN ISO 19650-1&2 + National Annex. Additional Types are listed below:

FO	Fire Operational Plans
FE	Fire Evacuation Plans
FZ	Fire Alarm Zone Plans
SK	Sketch

Role

Each organisation is to be allocated a role within a project as per the standard codes highlighted in BS EN ISO 19650-1&2 + National Annex.

Classification

CI/SfB classification codes to be used, as listed in the Project Management System Protocol Document and Quick Start User Guide.

Number

This is to be a sequential number to identify a drawing that could be part of a series. Standard coding should be a maximum of four numeric digits long.

Classification (CI/SfB)	Numbering	Drawing Type
04	000	Site Plans
07	000	Area plans
10	000	General arrangement plans (site)
11	000	General arrangement plans (building)
20	000	Elevations (site)
21	000	Elevations (building)

22	000	Elevations (enlarge building - internal)
27	000	Roof plans
30	000	Sections (site)
31	000	Sections (building)
34	000	Section (three dimensional)
67	000	Fire plans

Revision (Meta-data)

Each container is required to carry a revision field to indicate the issue sequence.

Section 2: Drawing Presentation Standard

2. DRAWING PRESENTATION STANDARD

This section defines the presentation standard of all drawings produced for UoM. Templates that align with this standard are available for both AutoCAD and Revit; refer to Section 3 (for AutoCAD) and 4 (for Revit).

2.1. Frames, Title block and Revision table

The UoM uses paper sizes ISO 'A' series and the following drawing frame sizes:

- A0 – UoM-A0-Frame (841x1189)
- A1 – UoM-A1-Frame (594x841)
- A2 – UoM-A2-Frame (420x594)
- A3 – UoM-A3-Frame (297x420)
- A4 – UoM-A4L-Frame (Landscape) (210x297)
- A4 – UoM-A4P-Frame (Portrait) (297x210)

All drawing frame sizes shall be created in landscape format, apart from A4 which may be either landscape or portrait.

- Each drawing provided is required to have the UoM drawing frame inserted which comprises of
    - an outline frame,
    - title block,
    - revision table,
    - approved UoM logo
    - and consultants logo.

Note: *All images are to be embedded as OLE objects and must not be referenced outside the .dwg file.*

The drawing frame is to remain as provided and not be amended other than to add company logo and details.

Title block

The following is an example of the UoM drawing title block.

Note: The drawing title block layout is required to remain as shown and other than adding company logo and details, is not to be changed.

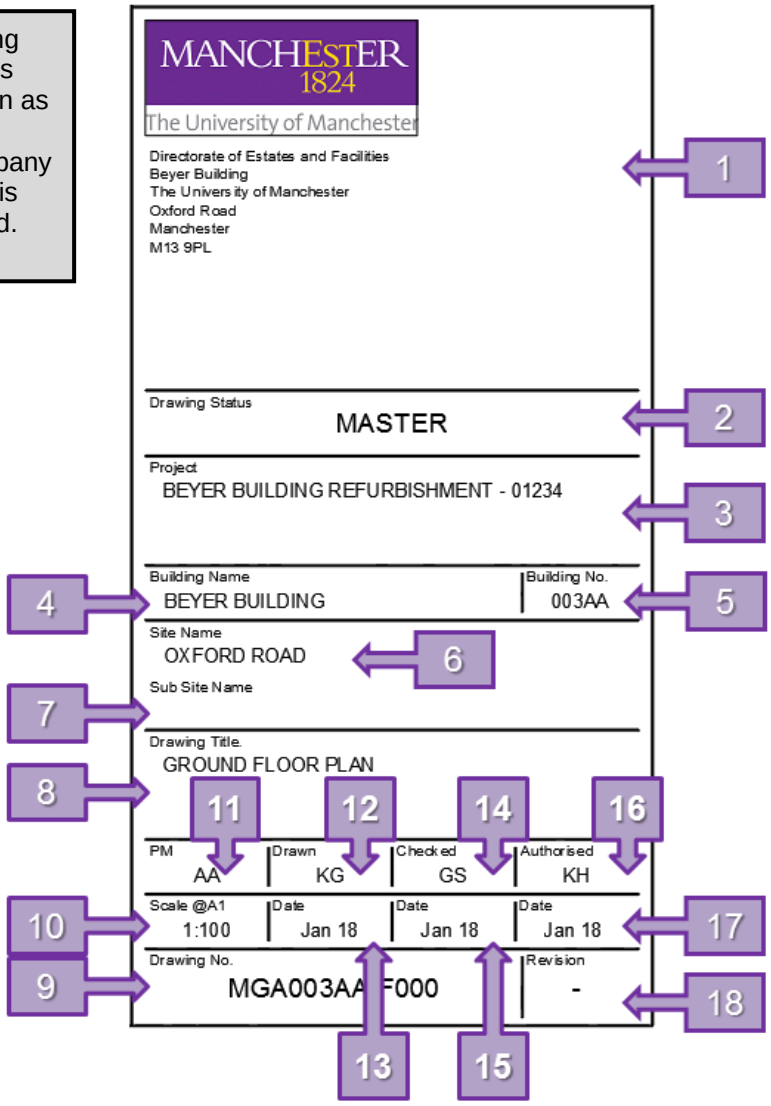

Figure 1 – Example UoM Drawing Title Block

Table 1 – Title Block Attributes

Reference	Field Name	Description
1	Company Details	This is where to add company logo and details.
2	Drawing Status	Status of the drawing (not BS1192)
3	Project	Name of project and project number being undertaken.
4	Building Name	Building name.
5	Building No.	Building unique number. Supplied by UoM
6	Site Name	The site where the building is located.
7	Sub Site Name	Due to the size of the site some locations have a sub site where the building is located.
8	Drawing Title	The title of the drawing i.e. ‘Ground Floor Plan’.

Reference	Field Name	Description
9	Drawing No.	The unique drawing number specific to the drawing.
10	Scale @ A1	The scale of the information shown as per the drawing size.
11	PM	Only applicable if a project manager is appointed.
12	Drawn	Initials of the person who has created the drawing.
13	Date	Date drawing created in dd/mm/yyyy
14	Checked	Initials of the person who has checked the drawing.
15	Date	Date the drawing was checked.
16	Authorised	Initials of the person who has approved the drawing for issue.
17	Date	Date the drawing was approved for issue.
18	Revision	The current drawing revision.

If drawing information has to continue across onto another sheet, please clearly highlight that in the drawing title, stating which sheet it is; Example, Sheet 1 of 2.

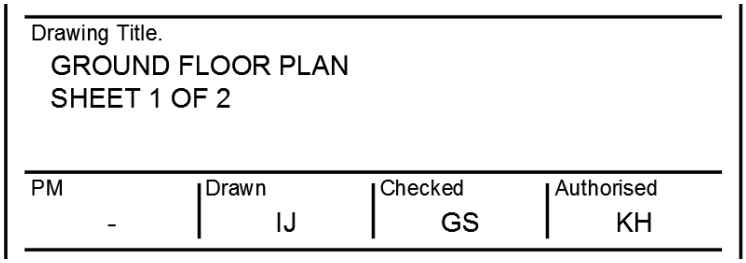

Figure 2 - Drawing Title Continuation

Revision Table

The following example is a typical drawing frame revision table and will be provided as part of the UoM template in the format of a block.

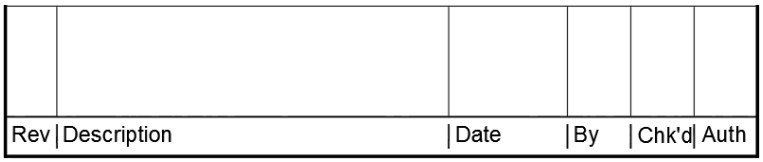

Figure 3 - Drawing Revision Table

Table 2 - Drawing Revision Table Attributes

Field Name	Description
Rev	Revision code letter
Description	Description of revisions
Date	Date revised
By	Revised by
Chk'd	Checked by
Auth	Authorised by

Hazard Table

The drawing frame does not automatically include the hazard table. If required this can be inserted as a block. The following is a typical example of the drawing frame hazard table

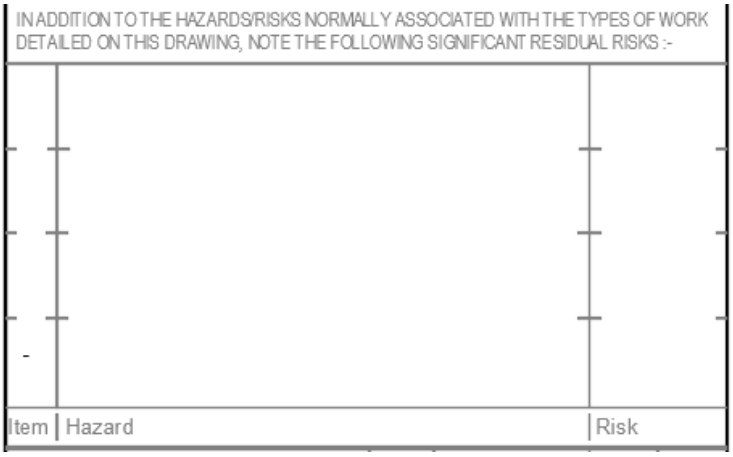

Figure 4 - Hazard Table

Table 3 - Hazard Table Attributes

Field Name	Description
Item	Identification of hazard. i.e. letter/number or symbol
Hazard	Detail notes of hazard(s)
Risk	Detail of potential risk(s)

2.2. Key Plans

A key plan is to be used to assist with identifying a specific location of part of a building in relation to its layout or a whole building on a site plan.

To highlight the area in question please use a thick line around the building or part of the building on the key plan.

All plans are to be to a recognised scale e.g. 1:2500 or 1:5000 and not inserted “Not to Scale”.

2.3. Sections, Elevations and Details

Any sections, elevations or details created, but only used for reference and not added to a drawing sheet, are to be removed from the drawing.

2.4. Drawing Revision Control (Space Management Team Only)

All revisions to a drawing must be highlighted by placing a cloud around the revised area, using layer **Z301-Rev Clouds.**

The revision table must be completed indicating the changes made and the revision version added, and/or updated, to the title block.

2.5. Scales

Table 4 - Drawing Scales

Drawing Scales			
Details	Sections/Elevations	GA Plans	Site Plans
1:1	1:50	1:100	1:250
1:2	1:100	1:200	1:500
1:5			1:1000
1:10			1:1250
1:20			1:2000
1:25			1:2500

2.6. Font/Text Styles

Only **Arial** should be used on and within drawings.

- The template includes the standard text colours/sizes.
- Minimum text height is 2.0mm. 1.8mm can be used on A3/A4 plans only if necessary
- All text is required to be placed on the correct layers.

2.7. Line Types, Dimension Styles and Leaders

These are set up in the relevant templates and should not be changed.

2.8. Layers

UoM's existing layer standards are based on British Standards.

General Layers

UoM approved layers are within the templates and standards files provided. They contain all layer names and settings for standard layers. An example list can be found at Appendix B, section 5.2.

- Every element within a drawing is required to have its own layer and nothing should be placed on Layer **'0'**.
- Any additional layers should align with the naming convention
- Layers are not to be changed, unless approved by the Space Management Team.

Room & Space Layers

These layers are to be used for the room, GIA, and NIA area polylines and text drawn within a drawing.

Name	Colour	Linetype	Lineweight	Plot Style	Description
GROS	green	Continuous	Default	Color_3	Default gross area polyline
GROS$	red	Continuous	Default	Color_1	Gross area polyline linked to Archibus database
GROS$TXT	red	Continuous	Default	Color_1	Gross area data values linked to specific floor area
RM	magenta	Continuous	0.25	Color_6	Default room area polyline
RM$	blue	Continuous	Default	Color_5	Room area polyline linked to Archibus database
RM$TXT	blue	Continuous	Default	Color_5	Room area data values linked to specific room

Discipline Layers

The layers for the below listed disciplines have all been included in their own standards template files, which can be provided on request from the Space Management Team.

Architectural	Mechanical (Ventilation)
Electrical	Structural
Fire Protection	Survey
Landscape	

Section 3: AutoCAD Authoring Rules

3. AutoCAD AUTHORING RULES

3.1. Standard Drawing Format

All drawings must be submitted in the following format

- DWG, readable in AutoCAD 2019 or above but NO LATER than 2023.

3.2. Drawing Template

The UoM AutoCAD drawing template is a drawing file with pre-established settings to be used for all new drawings.

To request a copy of the UoM AutoCAD Template file **XXXX-UoM-XX-XX-DR-X-XXXX_CAD Temp.dwt** contact the Space Management Team.

3.3. Drawing Layout

- Only one drawing layout tab to be included in each AutoCAD drawing.
- Drawing layout tab to be named as per the drawing number.

3.4. Drawing Frame

The drawing frame will consist of the project title, revision table, hazard table and general notes.

- The AutoCAD drawing frame is to be inserted in the lower left corner at **0,0** into all the drawings in paperspace only.
- The AutoCAD drawing frames are drawn at a scale 1:1 in model space and are not to be scaled once placed into a drawing.
- The AutoCAD drawing frame should be set to layer **Z010-Drawing Frame**.
- Only one drawing frame should be attached to each AutoCAD drawing.

Drawing Title

A type has been set up for each AutoCAD drawing frame size.

UoM-A0-Frame	UoM-A3-Frame
UoM-A0-Frame-Horizontal	UoM-A3-Frame-Horizontal
UoM-A1-Frame	UoM-A4-Frame_Land
UoM-A1-Frame-Horizontal	UoM-A4-Frame_Land-Horizontal
UoM-A2-Frame	UoM-A4-Frame_Port
UoM-A2-Frame-Horizontal	UoM-A4-Frame_Port-Horizontal

The drawing title is to be inserted in the lower right corner of the drawing title frame in paperspace only.

Drawing titles are drawn at a scale of 1:1 in model space and are not to be scaled once placed into a drawing.

The drawing frame should be set to layer **Z011-Drawing Title**.

Once placed the drawing title should not be changed by editing the block.

3.5. Layers

The default UoM standard layers are contained within the standard **XXXX-UoM-XX-XX-DR-X-XXXX_CAD Temp.dwt** and noted in Section 2. Additional layers which are specific to a discipline will be found in the sub-template for that discipline.

The UoM uses layer states to configure the layer properties and visibility state of objects while working in AutoCAD drawings. If any layer states are found within a drawing, under no circumstances are they to be removed or changed.

Layer states can be added to a drawing but the Space Management Team must be notified of its use.

3.6. Linetype

Standard AutoCAD line types are to be used. Where special line types are required they must be provided with the drawing files.

Line type must be set to *'ByLayer'*.

Lineweights control the graphical display of objects either on screen or when plotted.

- Default lineweights are set to 0.25.
- Layer lineweights must be maintained to enable the drawing information to be plotted correctly within the software.
- AutoCAD colours 1 to 9 have been assigned a lineweight as identified in the table below.
- Colours 10 to 255 should be plotted as their respective colour if required; otherwise these too should be plotted in black.

Table 5 - Plot Pen Sizes/Colours

Pen	Colour	Weight/Pen Thickness	Plot Colour
1	Red	0.25mm	Black
2	Yellow	1.0mm	Black
3	Green	0.25mm	Black
4	Cyan	0.18mm	Black
5	Blue	0.7mm	Black
6	Magenta	0.5mm	Black
7	White	0.35mm	Black
8	Colour 8	0.09mm	Grey
9	Colour 9	0.05mm	Grey

The pen size colour determines the plotted lineweight of objects that use the selected drawing colour. Lineweights set in a plot style table override object lineweights set in a drawing. The lineweights listed in a plot style table can be displayed in either millimeters or inches. Additionally, custom lineweight values can be added. These settings are controlled using the Edit Lineweights button.

3.7. Drawing Viewports

- All viewports are required to be set to **Z000-Viewport** layer, so it does not plot.
- All viewport scales are required to be set as per UoM standards, refer to section 2.
- Once a drawing is complete, all viewports are to be locked to retain their viewport scales.
- Viewports are to remain visible and should not be frozen or switched off.

3.8. Drawing Units

The units to be used are either metres or millimetres, with millimetres being the preference.

3.9. Blocks

When inserting blocks into a drawing the following should be adhered to:

- All blocks are to be named as such; e.g *Door, **Door 910x2010mm** and not named **block 1***
- No duplicate blocks of the same type but named differently
- No ellipses to be used. Arc's need to be used for door swings
- All inserted blocks must be assigned to an appropriate layer, not layer **'0'**
- Under **NO** circumstances are blocks to be exploded within drawings. **NB:** there are exceptions where UoM have exploded some blocks to assist with publishing drawings to the Space Management database, this is to be decided by the Space Management Team
- Dynamic blocks can be used

3.10. Referencing Files (xrefs)

Xref is a graphical file which is referenced into another file such as a drawing.

- Please ensure the referenced file is inserted at 0,0 position in the host drawing to coordinate the data in the correct location.
- Xrefs are not to be repositioned within the hosted drawing. If the xref is not in the correct location then it should be corrected in the master file.
- Xref files are to be overlaid and not attached to a drawing or model.
- Xref should be assigned to **Z920-Xref** layer (AutoCAD).
- Xref file naming is to follow the same rules as the naming of drawings, see Section 1.

3.11. Room Naming/Numbering Standard

When adding room numbers to any building within a drawing or model EPM GM11 – Room Numbering Procedure must be followed.

Note: When placing text, the room number block provided should be used to allow toggling between circulation / static spaces. Corridors, ducts, plant, stairs and lifts should be on the circulation layer and all other room names on room name layer.

3.12. Scales

All AutoCAD drawings are required to be drawn in model space at a scale of 1:1 (full scale) and scaled in the viewports in paperspace.

Drawing scales have been saved as part of the drawing or model templates.

Note: If multiple scales are used in an AutoCAD drawing please indicate all scales used in title blocks scale. Drawings which are not to scale will be rejected

The *LTscale* factor in an AutoCAD drawing will always be set to **1**.

The *PTLTScale* should be set to **1**.

Annotation Scales

UoM does not use annotation scales, however they can be used on creation of new drawings. Annotation scales is an option which automatically scales objects such as dimension, text, multileaders, hatch patterns, tables and blocks within a drawing.

3.13. Fonts

In AutoCAD drawings only multiline text (MTEXT) is to be used (including notes). Single line text (DTEXT) is not to be used and will be rejected. Font style is not to be changed within MTEXT.

3.14. Dimension Styles

All the approved dimension style scales for drawing in both millimetres and metres are found in the standard AutoCAD template file.1 unit = 1m and 1 unit = 1mm, these must not be altered.

A dimension style has been set up to match the standard UoM scales. The image below highlights the three types which have been included at each scale.

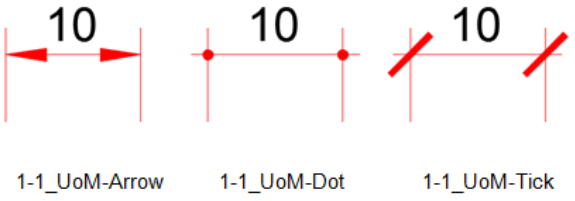

Figure 5 - Example Dimension Styles

- The dimensions style should not be overridden or manually changed.
- All dimensions are required to be placed on the correct layer.

3.15. AutoCAD Leaders

All the approved multileader style scales for drawing in both millimetres and metres are found in the standard template file.1 unit = 1m and 1 unit = 1mm. These must not be altered.

All text has been set up so if a leader is added the leader arrowhead will be *'Arrow Filled 20 Degree'*. A text style *'UoM-025-Dot Leader'* has been created to include a Filled Dot 2mm. Please see examples below.

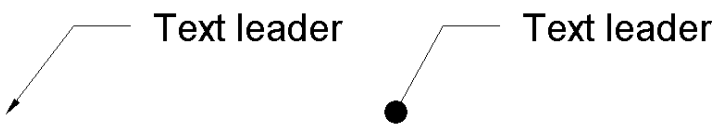

Figure 6 - Example Text Leaders

3.16. Tables

A standard UoM table has been created which is to be used when required. If any further tables are required, the standard font and layers must be adhered to.

3.17. Fill and Hatch Patterns

- Only standard AutoCAD hatch patterns should be used and these should be Associative.
- Hatch patterns are not to be exploded.
- All hatching to be allocated to a different layer associated to the element being hatched. Any special hatch pattern types created to be used within models are required to be provided.

3.18. Gross Internal Area (GIA) and Polylining of Room Areas

The capture of room area and GIA data is required across all building floor plans and drawings created.

In addition to the architectural drawing lines, polylines must be drawn around all internal areas on the dwg *'as-built'* general arrangement floor plans as directed below.

GIA for Each Room

i. The polyline must be on the ***'RM'*** layer and its designated colour must be **magenta**.
ii. Polylined rooms must be drawn to the internal face of walls using a closed polyline.
iii. The polylines must clearly define each room, corridor and stair as a separate entity.

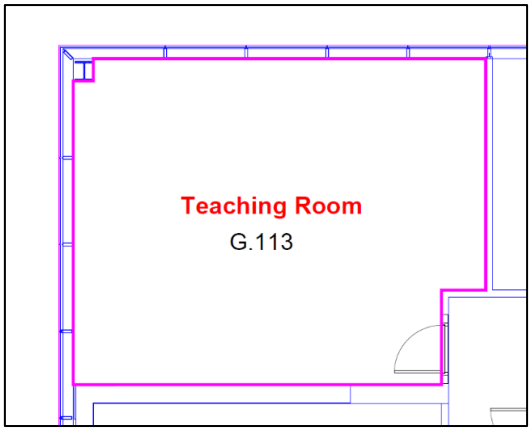

Figure 7 - Example Room Polyline

If a polylined area has an entity within it, such as a column, internal room or structure, this must be subtracted from the polylined shape using regions, see in below image.

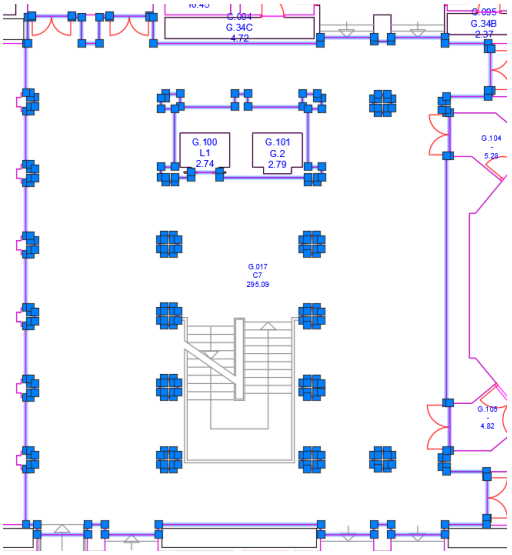

Figure 8 - Example Polyline Regions

GIA for Each Floor

The Gross Internal Area is to be measured to the internal face of the perimeter walls at each floor level as stated in RICS Code of Measuring Practice as amended.

i. The polyline must be on the ***'GROS'*** layer and its designated colour must be **green**.
ii. Polylined internal floor area must be drawn to the internal face of walls using a closed line.
iii. The polylines must clearly define each floor.

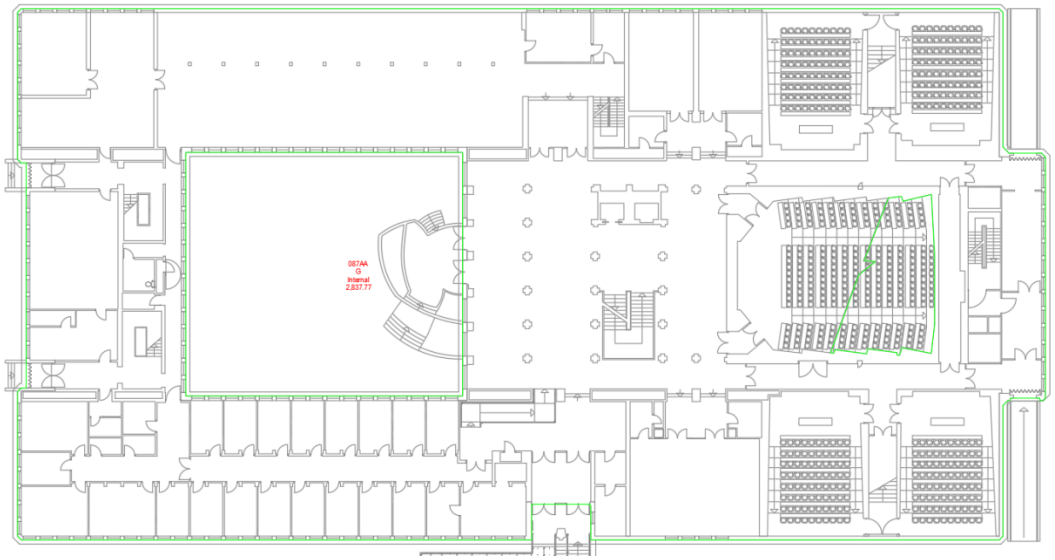

Figure 9 - Example GIA Polyline

3.19. Printing and Plotting

UoM uses colour dependent plot style table (*ctb*) files when printing. These are provided with the AutoCAD template.

- ***UoM-Full Size Mono.ctb*** – To be used when plotting actual size drawings in monochrome. The AutoCAD colours 1 to 9 will plot with UoM standard lineweights. All other colours will plot 0.25mm thickness in monochrome.
- ***UoM-Full Size Colour.ctb*** – To be used when plotting actual size drawings in colour. The AutoCAD colours 1 to 9 will plot with UoM standard lineweights. All other colours will plot 0.25mm thickness in colour.
- ***UoM-A1 Reduced A3 Mono.ctb*** – To be used when plotting drawings reduced from A1 to A3 size in monochrome. The AutoCAD colours 1 to 9 will plot with UoM standard lineweights. All other colours will plot 0.125mm thickness in monochrome.
- ***UoM-A1 Reduced A3 Colour.ctb*** – To be used when plotting drawings reduced from A1 to A3 size in monochrome. The AutoCAD colours 1 to 9 will plot with UoM standard lineweights. All other colours will plot 0.125mm thickness in colour.

Each plan should have the appropriate plot style settings imported (if not already attached) from the Template file and assigned to the sheet layout.

3.20. External Drawing Validation Checks

This checklist can be used to ensure that all drawings, new and updated comply with EPM GM5.

Drawings are to be issued in AutoCAD and a drawing register is to be included.

Drawing Checklist

Drawing register	*Has a drawing register been provided?*
DWG Files	*Have DWG's been provided in correct / agreed version of AutoCAD?*
PDF Files	*Have the pdf files been provided to the correct scale and named to match the corresponding drawing file with the revision number as per section 1.*
Drawing status	*Have the drawings been provided in "AS-BUILT" status - If not, refer to Client Representative / Project Manager*
Drawing file numbering	*Have the drawings been named in accordance with section 1.*
Drawing template and standards	*Have the drawing(s) been produced using the UoM template and standards files*
Title information	*Is the title correct? Does it include the correct information?*
Drawing sheet	*Has the default UoM drawing sheet been used?*
Paper size	*A0 or A1 for plans*
Key Plan	*Is there a key plan locating the area of the building? (Only if required)*
Revision history	*Has the drawing's revision history been included?*
Text size / scale	*Has the correct text size been used for corresponding styles?*
Dimension styles	*Have the correct UoM dimension styles been used to correspond with the drawing scale? i.e. 1-100_UoM-Arrow (250 text size for 1:100 scale view with Arial font)*
Multileader styles	*Have the correct UoM multileader styles been used to correspond with the drawing scale? i.e. 1-100_UoM-Dot (250 text size for 1:100 scale view with Arial font)*
Tables styles	*Has the correct UoM table style been used? i.e. UoM Table (250 text size for 1:100 scale view with Arial font)*
Fill and Hatch Patterns	*Have the correct fill and hatch patterns been used? Are they exploded?*
Line Types	*Have the correct line types been used?*
Arcs	*Have Arc's been used for door swings? NOT ellipses.*

AutoCAD Authoring Checklist

Drawing tab / sheets	*Has only 1 drawing sheet been used? (an additional A3 sheet can be provided for scaled roof plans)*
Drawing scale	*Is the drawing to scale? "NTS" drawings will not be accepted.*
Sheet boundary	*Is there anything drawn outside the sheet boundary?*
Paper space use	*Has the Title Sheet been placed in paperspace?*
Viewport scale	*Does the viewport scale match the scale noted within the title.*
Polylining of Room Areas	*Have rooms been correctly polylined?*
Blocks	*Are all blocks within the drawing named correctly, assigned to a layer and not exploded?*
External references	*Does the drawing have any external references attached to the file, and are they relevant?*
Purged	*Has the drawing been purged of all unused items?*
Audited	*Has an audit been run to ensure there are no errors within the drawing?*
Layer names	*Do all the layer names comply with UoM template and standards?*
Layer styles	*Do all the layer styles comply with UoM template and standards? (i.e.: linetype colours, widths and styles)*
Room Naming/Numbering	*Are rooms named and numbered according to EPM GM11?*

Note: Upon receipt of any drawing file, UoM will complete an audit and if found to be non-compliant all drawing files will be returned to the provider via the Client Representative / Project Manager.

Section 4: Revit Authoring Rules

4. REVIT AUTHORING RULES

4.1. Standard Model Format

All models are required are required to be submitted in the following format;

- RVT, readable within Autodesk Revit release **2023** with all views to be kept.
- DWGs, readable within AutoCAD release 2020 or above but NO LATER than 2023

> **Note:** Please contact the Space Management Team to confirm the release prior to production of the model.

4.2. Model Templates

UoM has set up Autodesk Revit model templates (2021 format only) to be used for each discipline which may produce a model file, with pre-established settings for standards for all new models and drawings. Any consultant or contractor is required to use the correct template and version for all models to be provided UoM.

Model Template Types

Below is a list of each of the UoM templates (.rte) and a brief description of its use.

- **XXXX-UoM-XX-XX-M3-X-XXXX-UoM Revit Arch** – Architectural template to be used by Architects for building and internal.
- **XXXX-UoM-XX-XX-M3-X-XXXX-UoM Revit Struct** – Structural template to be used by Structural Engineers.
- **XXXX-UoM-XX-XX-M3-X-XXXX-UoM Revit MEP** – Building Services template to be used for all Mechanical, Electrical, Plumbing information.

Note: If the model you are creating does not fit within any of the above, please contact the Space Management Team.

Model Templates Splash Screen

All UoM Revit templates will open with the starting view switching to a splash screen. This allows users to add default information about the model and project related details.

Note: This may be adjusted within a project but is required to remain as the starting view on opening the model file.

4.3. Project Settings

Browser Levels Naming/Numbering (Views)

Default level naming has already been created within the UoM Revit templates however if levels need creating EPM GM11 – Room Numbering Procedure is to be followed.

When organising the project browser please sort all views by ascending associated level (i.e. floor level) starting with lower level first.

Project Browser Views Rules of Use

- When working on a UoM Revit file do not change the browser view set in the file/template. Please create a new property set to control the views with your properties.
- Consultants may set up their own browser organisation within the project browser while working on the file. Once completed for handover these need to be changed to suit the University's requirements.

Units

The basic unit length within models is to be millimetres for buildings and metres for infrastructure projects.

Note: Avoid switching between imperial and metric units to avoid any discrepancies in measurements.

Project/Site Location (Coordinates)

Real world coordinate systems must be used.

All models are required to use a common project origin and orientation point. This is to allow all models to be referenced without requiring any further adjustment.

The specific geographic location can be changed and the building or site can be rotated accordingly. Please ensure that when rotating a building or site it is only done when the view is set to True North. This will ensure the correct sun path. All views must not be rotated when set to Project North.

4.4. Model Content

Model content can be derived from a number of different sources which UoM will accept but please consider the following:

- Manufacturers' content should be modelled to an appropriate level of detail. Please refer to EPM PM25 or the project EIR for more details.
- Content is to include all the relevant fields of information required by UoM to transfer into CAFM systems to operate buildings.

3D Model objects naming and properties should be based on BS8541 and should be consistent across the entire project. The UoM does not accept any duplicate objects in models with different names. And they should be named as such *e.g door* ***Door 910x2010mm*** *and not just named* ***door type 1***

Any shared parameters added to the families are required to be in the same shared parameter file. Please refer to section 1 of this document for file naming.

All attributes required by UoM will be identified in the project template and EPM PM25 or the project EIR. Please ensure that all parameters are setup with the correct field name.

System and Loadable Families

When working with families please only use system and loadable families, and do not create any in-place families within a model.

Content can be created in other CAD formats and imported into loadable families. Do not import files as dwg and/or adsk. As imported geometry does not offer capabilities as a family built in Revit format; it could affect the performance of the file and increase the file size.

4.5. Drawings and Annotations

All Revit drawings are to be drawn to the approved scales

The drawing frames will consist of the project title and revision table. The hazard table will be a family which can be inserted on the drawing as required. The general notes will be set up as a schedule which will be editable, allowing users to add to each drawing individually.

Element Tagging

- All tag family files to be provided with the delivered model
- When placing tags into the Revit model please make sure the font is **Arial.**
- The standard text height is to be 2.5mm. 1.8mm/2.0mm can be used if necessary (eg Room names and numbers in risers and small areas such as cleaners cupboards)

Revit Dimension Styles

Dimension styles have been created within the Revit templates to match the styles created in AutoCAD template. Three styles have been set up so users can place *Continuous, Baseline* or *Ordinate* style dimensions. Each style has a tick mark symbol for arrows, dots and ticks. The images below highlight examples of each type/style.

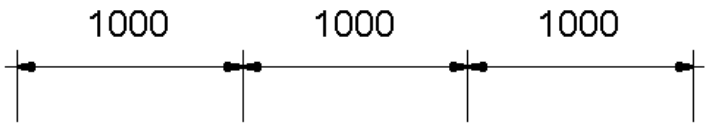

Figure 10 - Continuous Arrow

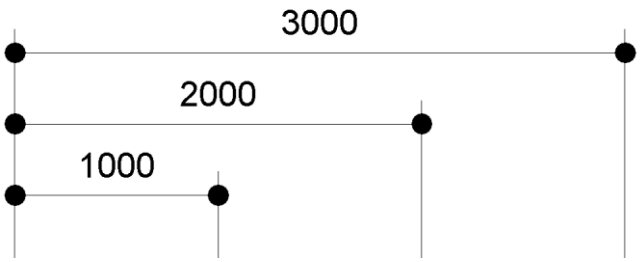

Figure 11 - Baseline Dot

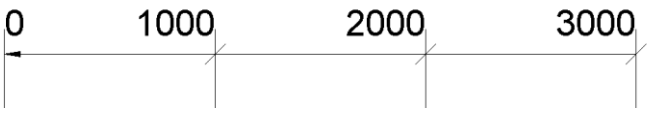

Figure 12 - Ordinate Tick

- The dimensions style should not be overridden or manually changed.
- If dimensions are shown in a continuous run they are required to be joined continuously and not placed individually.

Line Weights

Similar to the plot styles for AutoCAD printing and plotting, the standard UoM line weights have been applied to each Revit template. However, where required the user may amend these to suit the requirements of their model. Please make sure details of any changes are provided when the model is sent through on completion.

4.6. Worksets

Worksets can be used to divide models into parts which can be assigned to users to work on.

Please use a suitable approach when naming any worksets to remain in the model. For example; based on location ***Zone A Wing_Foundations***, or based on element ***MEP HVAC System***.

4.7. Visibility Graphics and Object Styles

The visibility graphics overrides the visibility and graphic display within the view when it is applied.

An object style specifies the line weight, line colours, line patterns and materials for all categories and subcategories for model elements, such as object and annotation. These have been set within the standard Revit templates to suit the standard UoM requirements.

However, if necessary, the user may amend these to suit the requirements of their model but must discuss with the Space Management Team beforehand and make sure details of any changes are provided when the model is sent through on completion.

4.8. View Templates

View templates specifically control how the view properties, such as visibility, level of detail, and scale are displayed within a model. All default UoM templates are provided with the standard view

templates used by the university. Please ensure that the view templates provided remain unchanged as they are for internal use only.

When any user is to create any new view template these must be provided with the final model at handover.

4.9. View Filters

Filters provide a way to override the graphic display and visibility of elements in a view. If filters are to be used within a model please name them to clarify their use.

For example, a filter for a wall fire rating, ***'Wall_60Minutes_Fire,'*** or to highlight a concrete or steel column, ***'Concrete_Column'***.

4.10. Materials

Materials control how model elements are displayed in views and when rendered. When setting up any new materials as part of model creation, these are required to be provided with the model.

4.11. Parameters

Parameters and Object Tags

Any imported families / templates and parameter files added must be provided with the model.

The UoM has parameter files set up which include the following;

Project Parameters

Project Information						
No.	Title	Parameter Name	Parameter Type	Parameter Category	Parameter Data	Parameter Group Under
1	Building Name	Building Name	Shared	Project Information	Instance	Identity Data
2	Building Number	Building Number	Shared	Project Information	Instance	Identity Data
3	Site Name	Site Name	Shared	Project Information	Instance	Identity Data
4	Sub Site Name	Sub Site Name	Shared	Project Information	Instance	Identity Data
5	Drawing Status	Drawing Status	Shared	Project Information	Instance	Identity Data
6	Project Name	Project Name	Embedded	Project Information	Default Instance	Identity Data
7	Project Number	Project Number	Embedded	Project Information	Default Instance	Identity Data

Shared Parameters

Drawing Title Text						
No.	Title	Parameter Name	Parameter Type	Parameter Category	Parameter Data	Parameter Group Under
1	Drawing Title	Drawing Title	Shared	Sheet	Instance	Identity Data
2	Drawing Number	Drawing Number	Shared	Sheet	Instance	Identity Data
3	Project Manager	PM	Shared	Sheet	Instance	Identity Data

4	Project Manager date	PM date	Shared	Sheet	Instance	Identity Data
5	Drawn by	Drawn by	Embedded	Sheet	Instance	Identity Data
6	Drawn by date	Drawn by date	Shared	Sheet	Instance	Identity Data
7	Checked by	Checked by	Shared	Sheet	Instance	Identity Data
8	Checked by date	Checked by date	Shared	Sheet	Instance	Identity Data
9	Authorised by	Authorised by	Shared	Sheet	Instance	Identity Data
10	Authorised by date	Authorised by date	Shared	Sheet	Instance	Identity Data
11	Drawing Revision	Drawing Revision	Shared	Sheet	Instance	Identity Data
12	Project Number	Project Number	Shared	Sheet	Instance	Text
13	Originator	Originator	Shared	Sheet	Instance	Text
14	Volume or System	Volume or System	Shared	Sheet	Instance	Text
15	Type	Type	Shared	Sheet	Instance	Text
16	Role	Role	Shared	Sheet	Instance	Text
17	Sheet Number	Sheet Number	Embedded	Sheet	Instance	Identity Data

Note: All fields must be completed correctly. Please ensure that only the associated values are inputted with the parameter fields. When audited any model received with these parameters missing or not assigned to the correct location will be rejected.

4.12. Archibus Parameters (Architectural Models Only)

The Architectural room space data will be linked directly into Archibus (CAFM system). The following table lists all the required parameters as part of the model creation.

A shared parameter text file will be supplied with the standard University Revit template. These parameters have already been included as part of each template and assigned to the category. If for any reason these parameters have not been included or they are being added to, they will be required as per the below table.

		Revit Parameter				
No.	Title	Parameter Name	Parameter Type	Parameter Category	Parameter Data	Parameter Group Under
1	Building Id Number	Building ID No.	Shared	Rooms	Instance	Other
2	Floor Level	Default floor name	Embedded	-	-	-
3	Floor Code	Floor Code	Shared	Rooms	Instance	
4	Archibus Room Number	Archibus Room Number	Shared	Rooms	Instance	Other
5	Room Number	Number	Embedded	-	Default Instance	Identity Data
6	Room Name	Name	Embedded	-	Default Instance	Identity Data
7	Room Area	Area	Embedded	-	Dimensions	Identity Data
8	Room Capacity (no. of people)	Capacity	Shared	Rooms	Instance	Other
9	Room Design Capacity (no. of people)	Design Capacity	Shared	Rooms	Instance	Other
10	Syllabus Plus	Syllabus Plus	Shared	Rooms	Instance	Other

11	Room Category	Room Category	Shared	Rooms	Instance	Other
12	Room Type	Room Type	Shared	Rooms	Instance	Other
13	School Name	School	Shared	Rooms	Instance	Other
14	Discipline	Discipline	Shared	Rooms	Instance	Other
15	TRAC fEC	TRAC fEC	Shared	Rooms	Instance	Other
16	Room Height	Unbounded Height	Embedded	-	Dimensions	Identity Data
17	Room Length	Room Length	Shared	Rooms	Dimensions	Identity Data
18	Room Width	Room Width	Shared	Rooms	Dimensions	Identity Data
Area Parameters						
19	Gross Internal Area (GIA)					
20	Net Internal Area (NIA)					

Note: All fields must be completed correctly. Please ensure that only the associated values are inputted with the parameter fields. When audited any model received with these parameters missing or not assigned to the correct location will be rejected.

1. Building Code

The Space Management Team provide the building code. It consists of 3 numerical and 2 alpha characters e.g. 001AA and there must be no spaces between characters and letters must be in UPPERCASE.

2. Floor Level

This is the default floor name embedded within Revit.

3. Floor Code

The floor code must follow EPM GM11 – Room Numbering Procedure

4. Archibus Room Number

These are created by the Space Management Team once as built drawings have been provided either prior to or at handover stage. It is a sequential reference for each space (example G.001) therefore it should not contain suffixes or specific referencing. It is allocated using a clockwise sequence starting from the main entrance and follows a room hierarchy (set out below).

Hierarchy:

- Useable space
- Plant rooms
- Toilets
- Corridors
- Staircases
- Lifts
- Voids/Ducts

Example Archibus Room ID G.001

The **'G**' identifies the floor level and the 3 digits are the room label, which are separated by a '.'.

The room label (three digits) allows numbering between 001 and 999 on each floor. Where blocks exist within a building then the first number of the three digits should be used to identify the number of the block, i.e. Block 1 allows numbering between 101 and 199. Block 2 between 201 and 299, etc. The block system can only be adopted if the total number of rooms per floor within a block does not exceed 89, as a contingency is retained to allow for future changes.

5. Room Number

The room number must follow EPM GM11 Room Numbering Procedure. This should be the number which is displayed on the room door.

6. Room Name

This should be a functional description of each room which succinctly summarises the activity taking place, e.g. Knitting Lab, Alumni Office, X-Ray room, Music Practise room etc. If a room has an official name this is what should be entered. The maximum field length is 60 characters and must be entered in UPPERCASE.

7. Room Area

This is derived from the room area object (m2).

8. Room Capacity

This should be the actual capacity of each room e.g. number of desks in offices, number of seats in teaching spaces etc. Capacity is not however applicable to all spaces e.g. circulation space, store rooms etc. This should be identified as a numerical figure only. If no value is applicable then the field is to be left blank.

9. Room Design Capacity

This should be the maximum design capacity for the function taking place in the room. This should be identified as a numerical figure only. If no value is applicable then the field is to be left blank.

10. Syllabus Plus

This identifies whether the room is a timetabled space or not and should be identified as a number 0 = No and 1 = Yes.

11. Room Category

This relates to the use of each room, valid categories are listed below. The code rather than the name should be used and must be entered in UPPERCASE with no spaces between words.

Code:	**Room Category Name:**
BALANCE	Balance
COMMUNAL	Communal Space
LEASED	Leased from or to 3rd Party
MEETING	Meeting Space
OFFICE	Office
PS LAB	Technical space for Professional Services
RESIDENTIAL	Residential
RLAB	Research Lab
STORAGE	Storage
STUDY	Study
TEACHING	General Teaching
TLAB	Teaching Lab
WORKSHOP	Workshop

12. Room Type

This is a sub section of the room category i.e. if the room category is 'Office' it will also have a room type such as academic, admin, professor etc. Valid entries are subject to change each year therefore an up-to-date list must be obtained for each project from the Space Management Team. This entry must be made in UPPERCASE with no spaces left between words.

13. School Name

Example School Name **HUM-ALC**

The School represents the occupant of the space and is made up of 2 sections. The first part represents the Faculty the School belongs to and the second part is an acronym for the name of the School. Valid entries are subject to change each year therefore an up-to-date list must be obtained for each project from the Space Management Team. This entry must be made in UPPERCASE with only a dash between words.

14. Discipline

Example Discipline **ALC-DRA**

The Discipline is a sub division of the School and is also made up of 2 sections. The first part refers to the School the Discipline belongs to, and the second part is an acronym for the name of the Discipline. Valid entries are subject to change each year therefore an up-to-date list must be obtained for each project from the Space Management Team. This entry must be made in UPPERCASE with only a dash between words.

15.TRAC / fEC (Transparent Approach to Costing the **F**ull **E**conomic **C**ost)

This represents the operational cost of carrying out teaching, research and associated activities i.e. a store room would cost less to run than a highly serviced lab. Each space must be given a code from 0-5 as per the table below.

TRAC / fEC Categories

Cost Category	Description	Typical examples
0	This is space that is unsuitable for occupation and is only periodically accessed (less than once a day). Typically, this category of space is: • not heated; • not cleaned; • has low power consumption (only lighting); and may have water and drainage Rooms that could, with minimal expenditure, be classed as category 1 are not to be included in this category. It is anticipated that only very few rooms would fall into this cost category. This cost category would not have any comfort cooling or forced air extraction. Therefore it would only have natural or no ventilation.	Basement stores; Garages; Stables; Sheds; Greenhouses without environmental controls.
1	This is space that is not a permanent base for members of staff and it is anticipated that these types of areas will not be heavily used. Office space would not be found within this cost category. This is space that will have a minimal use of the type of facilities that might normally be expected, such as:	All other stores; Seminar room; Teaching room; Meeting room; Interview/advice room;

Cost Category	Description	Typical examples
	• heat; • light; • cleaning and • telephone and data services. This cost category would not have any comfort cooling or forced air extraction. It would only have natural or no ventilation.	Waiting area.
2	This is space that will be permanently occupied and/or accessed frequently. Space within this cost category would have normal use of the type of facilities that might normally be expected, such as: • heat; • light; • cleaning; and • telephone and data services. This cost category would not have any comfort cooling or forced air extraction. It would only have natural or no ventilation.	Office; Computer room; Kitchen; Mathematics, languages (or similar) teaching laboratory; audio visual aid room.
3	This is space that will have more facilities than type 2 and would be considered to have a higher usage of services, with one or more significant additional element of cost. These additional cost elements include: • natural gas (to laboratory benches); • regular use of multiple pieces of laboratory type equipment; • heavy water usage; • comfort cooling, ventilation system, air conditioning, where there are: o any number of cooling units within a room larger than 30 m^2; or o only 1 cooling unit within a room of 30m^2 or less; • mechanical ventilation, with between 0.5 and 15 air changes per hour; • forced air extraction (ie fume hood, fume cupboard, safety cabinet, laminar flow cabinet and ventilated bench).	Science, engineering (or similar) laboratory; Computer cluster; Freezer room; Workshop; Office with comfort cooling; Teaching room with comfort cooling.
4	This is space which would be considered to be even more expensive to run than type 3 and therefore have a much higher usage of services. It will typically include one or more of the following cost elements; • 24-hour use; • comfort cooling, ventilated system, air conditioning, where there are: o 2 or more cooling units within a room of 30 m^2 or less; • constant temperature system; • mechanical ventilation, with over 15 air changes per hour approximately; • use of equipment with a heavy power load, for example centrifuges, autoclaves, incubators, compressors, etc • environmental controls; • humidification and/or de-humidification (may be part of an air conditioning system). • any room that has a requirement for external plant (air handling, full air conditioning, etc) which occupies a significant amount of space, ie low net to gross space ratio.	Clean room; Constant temperature room; Cold room running 24 hours; Greenhouse with environmental control; Specialised laboratory; Autoclave room; Centrifuge room.
5	Home Office licenced/designated	BSF

16. Room Height (mm)

This relates to the height (mm) of the room i.e. from the finish of the floor to the underside level of the ceiling.

17. Room Length (mm)

The room length (mm) based on the room shown horizontally in plan i.e. to the internal face of the perimeter wall. As shown in the below image

18. Room Width (mm)

The room width (mm) based on the room shown vertically in plan i.e. to the internal face of the perimeter wall. As shown in the below image.

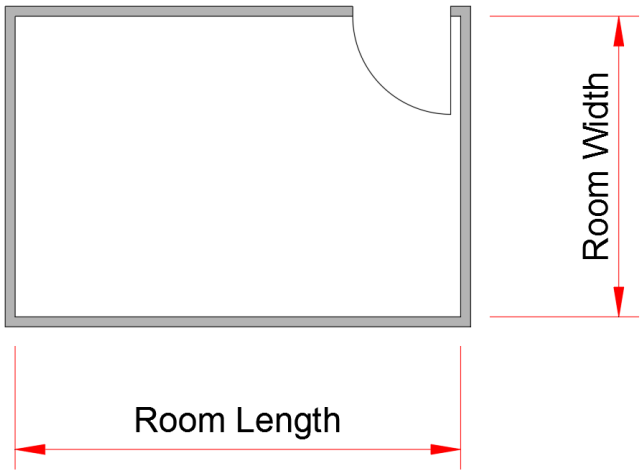

Figure 13 - Room dimensions

19. Gross Internal Area (GIA)

The gross internal floor area as defined in the RICS Code of Measuring Practice as amended.

20. Net Internal Area (NIA)

The net internal floor area as defined in the RICS Code of Measuring Practice as amended.

4.13. Export Styles

An EXAMPLE model export file mapping styles for layers has been set up by UoM. Please request this from the Space Management Team before creating CAD exports.

The project consultant should submit their version of this file for approval prior to exporting any drawing files.

For more details on Export Styles: Please refer to the process for extracting AutoCAD .dwg files from a Revit model for The UoM.

4.14. Room Naming/Numbering Standard

When adding room numbers to any building within a drawing or model EPM GM11 – Room Numbering Procedure must be followed. Upon receipt of the drawings, the Space Management Team will check the room numbering.

4.15. Printing in Revit Plot Styles

Line styles, patterns, weights and object styles have been set up within the Revit template files, so printing directly from Revit should result in the correct styles. These have all been applied as per the AutoCAD standards. If any changes or additions are required to these please amend accordingly.

4.16. External Model File Validation Checks

The following checklist can be used to ensure that all models and drawings, new and updated comply with EPM GM5.

Note: All drawings and models should be accompanied by a document issue register.

External Model File Validation Checks

It is expected that all organisations who produced or update models for UoM will check that all models comply with the current University EPM GM5 CAD and Modelling Standards. Please use the below checklist as a guide.

Model formats	*What models formats have been provided? E.g Revit rvt, IFC, other, etc*
Revit (rvt) version	*What version is the native Revit (rvt) format? i.e. 2017, 2018, 2019, etc.*
File name	*Does the file name conform to UoM file naming standards within EPM GM5*
Model status	*Has the model been provided in "AS-BUILT" status? If not, refer to the Internal PM.*
Central file	*Has the model been provided detached from central?*
Attached files	*Have all attached drawings and models been removed?*
Shared Parameters	*Have all the shared parameter fields been provided?*
Tag Families	*Have tag family files been provided with the model?*
Splash screen	*Has a splash screen been included with all project,model and model originator information?*
Project Browser	*All relevant drawing sheets, views, schedules, legends, etc. are left within the model? Note: All those which are not used to be removed.*
Project Levels	*All levels named in accordance with GM11 and are they consistent with the other models?*
Project Coordinates	*Do the project coordinates match the EIR?*
Model Content	*Do the project coordinates match the EIR?*
General Model Parameters	*Do the project coordinates match the EIR?*
Model Duplicates	*Does the model contain duplicates?*
Room Naming/Numbering	*Are rooms named and numbered according to EPM GM11?*
Families	*Do all families conform to standards (UoM / BS8541 series) and are they modelled to an agreed Level of Detail (LOD).*
Purged	*Have the models been purged of all unused objects?*
Warnings	*Has the model been reviewed and all warnings been addressed?*
Space parameters	*Have the Archibus parameters been included?*
Oracle parameters	*Have the oracle parameters been included?*

Note: Upon receipt of any model file, the University will undertake an audit on those files. If they are found to be non-compliant; they will be returned to the provider via the Client Representative / Project Manager.

5. APPENDICES

5.1. Appendix A - Exemplar Drawings

Below are exemplar drawings created in accordance with Section 2 of this document:

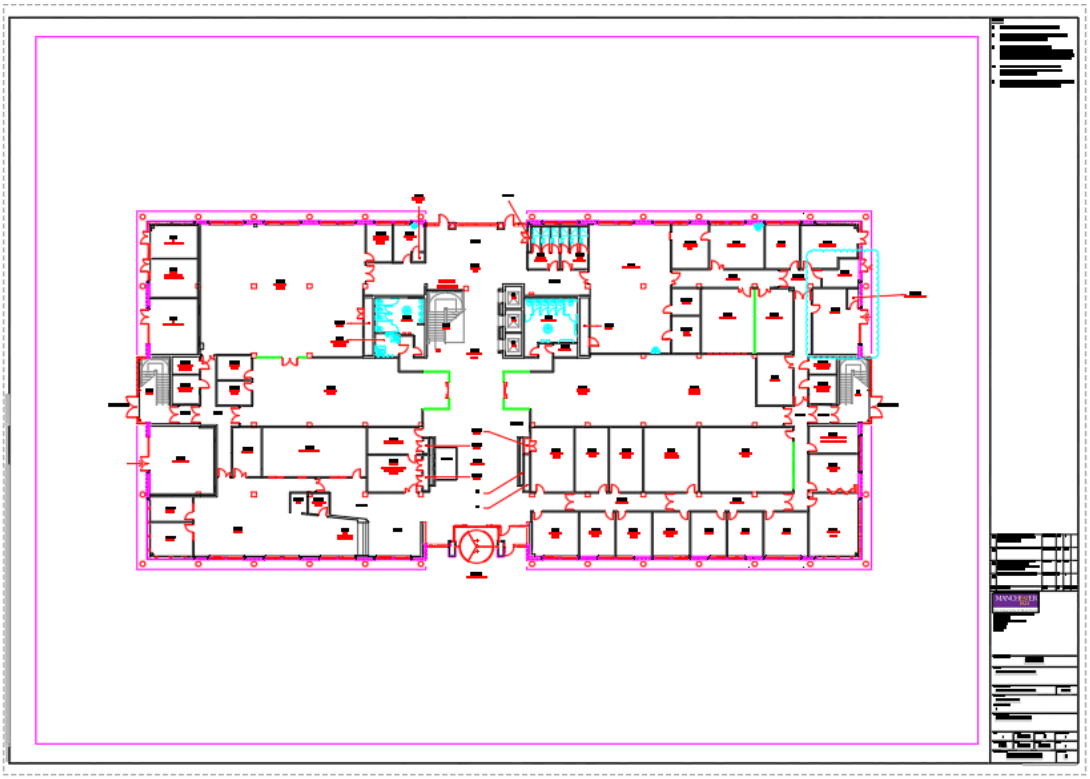

Figure 14 – GA Floor Plan

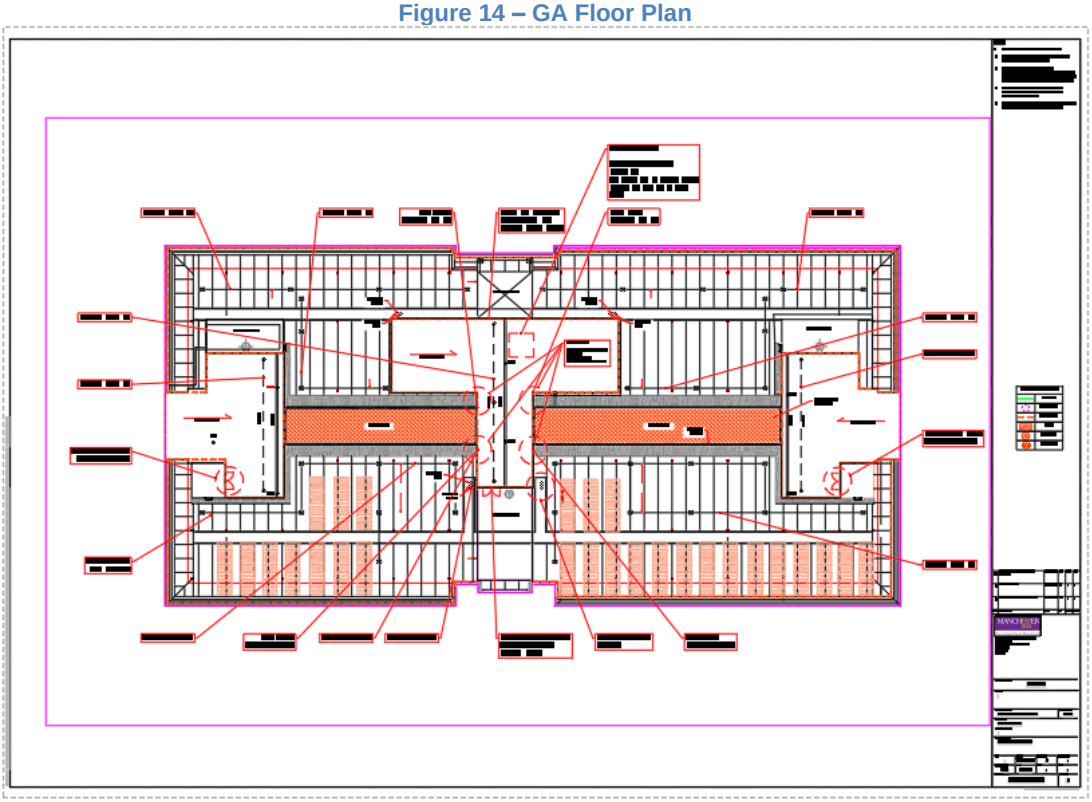

Figure 15 – Roof Plan

5.2. Appendix B - Example of Layers

Below is an example of the list of layers and their naming convention. This is not an exhaustive list. The complete list is readily available within the CAD templates, to be obtained from the Space Management Team.

List of Layers

0
A022-Floors
A023-Balustrades
A023-Ladders
A023-Ramps
A023-StairBstr
A023-Stairs
A026-Columns
A026-ColumnsSteel
A044-SanitaryFittings
A251-CurtainWalls
A251-ExternalWalls
A251-InternalWalls
A251-InternalWalls-X
A251-StudPartitionGlaz
A251-StudPartitionWalls
A251-Walls
A321-ExternalWindows
A321-InternalWindows
A321-Windows
A322-Doors
A322-ExternalDoors
A322-InternalDoors
A561-Lifts
A561-Voids
A740-ToiletCubicles
Defpoints
RM$TXT
Z000-Viewport
Z010-Drawing Frame
Z010-Drawing Frame-T
Z011-Drawing Titles
Z015-MatchLine
Z015-MatchLine-T
Z016-UoM Logo
Z302-Rev Table
Z920-Xref