THE UNIVERSITY OF SYDNEY

Campus Infrastructure Services

DOCUMENTATION STANDARDS

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INTRODUCTION

7.8.1 Introduction

These **Documentation Standards** describe the standard of documentation required of all consultants providing contract documentation to the University of Sydney for infrastructure projects.

7.8.2 Scope

The standards primarily apply to drawings associated with contract documentation, including measured drawings, sketch designs, development applications, building applications, working drawings, tender documentation, detail and services drawings and as-built or as-installed documentation.

7.8.3 Objectives

This Documentation Standard describes strategies and methods for consultants to prepare their documentation in such a way that the information provided is compatible with the University's requirements. The University has made a distinction between standards that must be followed - "REQUIREMENTS" and standards where some flexibility can be utilised – "GUIDELINES".

7.8.4 University model

The University maintains a model of geometric information of the physical objects of the university buildings and grounds in various CAD drawings and databases. The model is drawn at a real world scale of 1:1 and geometrically coordinated with the University survey network. All documentation provided by the consultant will eventually integrate with the model and should be prepared so as to be compatible.

The model includes information about the following items.

- Architectural components (i.e. walls, doors, windows, columns, etc) which forms the basis for as-built drawings.
- Engineering components (i.e. structural elements, mechanical, and electrical)
- Building services components (i.e. fire, communication etc).
- Assets (i.e. furniture, equipment, computers etc).

The model is currently maintained in the **AutoCAD 2004/LT 2004** drawing format (*.dwg).

7.8.5 Set-out Control Document

For each project, a control document determining the contract documentation set-out based on the University model will be established between the University and the consultant. The contract documentation set-out applies to all drawing files describing plans, sections, elevations and details, drawn at a real world scale of 1:1.

CONTRACTURAL REQUIREMENTS

7.8.6 Contract Clauses

7.8.6.1 Conditions of compliance

The Campus Infrastructure Services expects all consultants to fully understand the requirements and scope of work required to meet the requirements of the **Documentation Standard** prior to the commencement of project documentation.

All consultants will be required to comply with the 'The University of Sydney, Campus Infrastructure Services, Documentation Standards' as part of their conditions of engagement. If documentation provided does not comply, consultants will be required to rectify the documentation before final payment of fees can be approved.

Any documentation provided by The University of Sydney, Campus Infrastructure Services (CIS), is to be used for reference only, with no liability accepted for the accuracy of the documentation for project purposes. All consultants must undertake sufficient investigation as to the fitness of purpose of any documentation provided as determined by their professional obligation and in accordance with their conditions of contract.

7.8.6.2 Submission and Approvals

Consultants will submit a complete documentation set to the CIS Project Manager at the following project stages;

- A tender documentation set upon tender issue.
- An as-built documentation set as soon as practicable after project practical completion.

This documentation will typically include:

- A schedule or register of documents that represent the contract documentation set
- The Set-out Control Document
- Drawings in (*.dwg / *.dxf) format that represent the contract documentation set.
- Drawings in (*.pdf) format that represent the contract documentation set.
- All word processed specifications and spreadsheets required to complete the project, in (*.doc or *.xls) format.
- Any Operation and Maintenance manuals required for building operation and maintenance.

The document files shall be provided on CD-ROM or DVD.

7.8.6.3 Quality Assurance

It is the responsibility of the consultant to implement a quality assurance program that strictly maintains the structure and integrity of information provided in accordance with the Documentation Standards.

Documentation deemed not to comply and will be corrected at cost to the consultant submitting the drawing data. It is the responsibility of the consultant to ensure that all documentation relating to buildings are accurate including the supplied CAD drawing files from the CIS Project Manager.

REQUIREMENTS

7.8.7 Requirements

Consultants may be required to produce any combination of the following CAD drawing types which represent the CAD files for both the University CAD Model and the Contract Documentation Set:

- Measured drawings of existing buildings
- New building works
- Alterations and additions to existing building works
- As-Built drawings
- Services drawings
- Annotated x-referenced files of specific views of the current University CAD Model re-configured as the contract drawing and plotted to an agreed scale.

7.8.8 Measured Drawings

Consultants engaged to provide measured drawings of existing buildings are to comply with the method of measurement standard. In addition to the sample CAD drawing file to be submitted for approval, a copy of the method of measurements and the actual site measurements are to be included with the sample drawing.

7.8.9 Method of Measurement

The University of Sydney requires accurate measured drawings polylined to describe useable room areas for strategic space planning on all new and refurbishment projects. The room is to be measured for useable floor area (UFA) for a horizontal working plane 1m above the finished floor level. All rooms are to show the locations of windows and sill detail in plan, with the UFA excluding any intrusions into the room such as columns, major ducts over 200 x 200mm, stairs etc.

For as built drawings in the older sandstone buildings, a surveyor's CAD file drawing may be required by the project manager. The overall length and width must be measured as a control measurement for the building. Each room must be measured consistently in both the length and width. Where rooms have an external wall, the width of the external wall must be measured at least twice at either end of the building elevation.

7.8.10 Accuracy of Measured Drawings

The recommendations for measured drawings for a specific building or group of buildings are:

- That a survey of the building outline (the external wall) at the nominated main entry floor level and the building foot print at ground level is commissioned. The building is to be located against three existing datum points located on site.
- All overall measured dimensions are to be cross checked against the surveyors plan, with external wall thickness measured.
- Method statement is to be provided to the Campus Infrastructure Services for approval, with a sample room measurements attached.
- Tolerance of up to 20mm in measurements across a building on the real world scale 1:1 CAD Model will be accepted. Drawings not accurately drawn (i.e. lines representing walls, windows, columns etc. not filleted or intersecting at the real world scale of 1:1) will be rejected and will require rectification.

7.8.10.1 New buildings

The drawing structure of all new buildings requires common vertical building elements or co-ordination data to be on separate drawing files and x-referenced into the main building level CAD Model. These co-ordination CAD files will be geometrically coordinated about the University site reference point (known as the origin) and three nominated datum points. The CAD Model drawing files are to be orientated to true north and located on the campus site plan.

7.8.11 Alterations & Additions to existing buildings

All consultants will provide documentation in AutoCAD (*.dwg) or (*.dxf) files as specified. All new works are to be geometrically coordinated about the building co-ordination plan and dimensions set off a nominated fixed reference point, or a nominated building column.

Where additions are minor and approved to be documented manually, they are to show overall dimensions of the new works and must have a co-ordination dimension back to a nominated building column. It is the University's intention that all these new minor works are to be translated to the CAD system in the future so that all data is consistent with the University database.

For major alterations and additions to an existing building a copy of the building CAD Model drawing files shall be provided to the Architectural consultant. The architect is to carry out overall site investigations and update the CAD drawing file to the level of detail required to complete the project. The provided CAD drawing files of the building are to be used only as a reference basis for the works, all consultants are to carry out the normal standard of site investigations as required by their profession and in accordance with their conditions of contract. Computer copies of the final altered plans are to be supplied to the CIS Project Manager.

7.8.12 Campus Site works

The University Campus CAD Model, which is based on the Map Grid of Australia (MGA), is to be configured by X-referencing all the building foot print drawings together about the site reference point. Other site co-ordination plans are to be:

- Roads
- Car parking
- Landscaping (reference set of the building site landscaping plans)
- Services

The site work plans are to be structured based on a zone to be nominated around a building. All plans relating to a nominated building project can be individually upgraded based on each building project. The building plans will be separated into local and site work drawings. Where the building local drawings will describe all the services that are not required to be seen on a campus site working drawing, this represents the detailed planting, landscaping, car parking, and detailed services for each building. The building site plans describe the outline of the building and major feature items required to be shown at the campus plan level. Each building zone for site items will be referenced to a campus CAD Model.

Note: Detailed layers and symbols to be developed in conjunction with consultants on the next project and incorporated into this standard.

7.8.13 Underground Services

Any documentation of underground services must be compliant with the quality levels, attribute information and layering and line colouring types as specified in Australian Standard Classification of Subsurface Utility Information (SUI) AS5488-2013.

7.8.14 Room Space Polylines

Consultants are required to produce polylines (entities on spaces to define floor and room area) on all spaces within each building and to include these polyines in any tender documentation. These polylines are for use in the ArchiBUS system and will be created according to the procedures which can be found in Appendix E.

Generally, the requirements are:

Polyline	Layer Name	Colour
a polyline on the external wall (external outline)	GROS	Magenta
a polyline on the internal face of the external wall (internal outline)	GROS	Magenta
polylines defining Usable Floor area of internal rooms and spaces	RM	Cyan

The internal net polyline is to state the surveyors real levels in relation to the site. A Block for the RL is to be inserted into the drawing with text to describe the following:

RL - ***** (a height)

GUIDELINES

7.8.15 CAD Drawing Guidelines

7.8.15.1 File Management

Drawings will be added to the University CAD Model and database for ongoing building and maintenance programs including space planning. The hierarchical construction of the CAD drawing files is as follow:

C:\ DWG \ CAMPUS \ BUILDING NO \ DRAWING TYPE \ L#.DWG

The University CAD Model is differentiated horizontally over the campus by building number and vertically by building floor level geometrically coordinated about the University Site Reference Point (known as the origin 0,0). It is critical that consultants maintain this hierarchy and separate their data throughout all drawings in accordance with this specification. For example the directory hierarchy of the School of Chemistry building base architectural plans is:

C:\ DWG\CAMP\ F11\a-base\L01.DWG
C:\ DWG\CAMP\ F11\a-base\L02.DWG

7.8.15.2 Co-ordination Plan File Name

The University of Sydney base site co-ordination plan, which is the University site plan including the origin and surveyed datum points (based on the MGA) is to be issued to all consultants by the CIS Project Manager. This plan is to be used for the geometric co-ordination of the consultants' extent of works in relation to the University reference point. If this co-ordination is not complete, the consultant is to confirm the project origin or reference point with the CIS Project Manager.

The CAD drawing files shall be *geometrically coordinated both in the x and y direction and in the z height of zero*, in such a way that they can be attached to the University coordination plan via x-referencing or insertion without any further manipulation by the University. The reference point or the set-out point shall be maintained and coordinated by consultants throughout all CAD files. This point will be the 0,0 point or the origin of the University site plan, and its location on the building co-ordination plan will be defined by the CIS Project Manager.

The Project Architect is to develop the co-ordination plan (CP) for the building to an approved stage where it can be issued to all other consultants on the project. This co-ordination plan will only contain layers that identify the following:

- the surveyed site boundary
- the University or building reference point
- the building grid (as a single layered drawing referenced in CP drawing)
- an identified and agreed physical point on the building referenced to three nominated datum points and markers located on-site.
- the external wall outline of the building at ground level

The Project Architect is to use this to ensure that all other consultants' extent of new works on the project is geometrically coordinated with the architectural plans. This co-ordination plan will be named in the following convention:

C:\DWG\CAMPUS\BUILDING-NO\BUILDING-NO-CP.DWG

For example:

C:\DWG\CAMP\A11\G12-CP.DWG
C:\DWG\CAMP\A11\A11-CP.DWG

Similarly, a co-ordination plan for each nominated level is to be created. These files provide the basis for the contract set which containing agreed minimum annotation and shall follow the following naming convention:

C:\DWG\CAMPUS\BUILDING-NO\LEVEL-NO\L#-CP.DWG

For example:

C:\DWG\CAMP\QUAD\A11\L1-CP.DWG
C:\DWG\CAMP\QUAD\A11\L2-CP.DWG

7.8.15.3 Block or X-Referenced File Names

All attributes fields and Blocks are to be submitted for approval by the CIS Project Manager prior to the commencement of contract documentation. Where entire drawings are attached via x-referencing or insertion into another drawing, they must be attached at the building or project reference point.

Note: X-reference paths are to be relative to the directory where they exist to allow project's directory to be moved without regenerating the external references.

For individual models of an architectural repetitive building element, they are to be named as follows :

Prefix	*Block Name*	*Type*	*Example*	*Description*
W	**CO**Lumn	**600** dia	**W-COL600**	600 diameter column
W	**D**oo**R**	**900**	**W-DR900**	900 wide door
W	**DD**oo**R**	**2100**	**W-DDR2100**	2100 wide double door
W	**STAIR**	**1**	**W-STAIR1**	stair one

For individual models of a service repetitive building element, they are to be named as follows with the consultants prefix:

Prefix	*Block Name*	*Type*	*Example*	*Description*
E	**FLU**orescent	**E**	**E-FLUE**	electrical fluorescent type E
M	**A**ir**C**on**S**upply	**AIR**	**M-ACSAIR**	mechanical a/c supply air register
H	**FL**oor**W**aste	**F**lushing	**H-FLW**	Hydraulic floor waste flushing

All blocks must only contain approved attributes, and all of these files shall be located in the library sub-directory for a specific Building Number, such as:

C:\DWG\CAMP\QUAD\A11\LIB\W-COL600.DWG

Where any building element is repetitive vertically, such as columns, stairs, grids and symbols they must be external drawings inserted into the layout drawing. These represent architectural and services layout drawing that are x-referenced into the main CAD Model for each building level. These layout drawing are located directly under the building sub-directory and named as:

\building Number-layout type.dwg	*Description*
C:\DWG\CAMP\QUAD\A11\A11-LIFT.DWG	Building lifts
C:\DWG\CAMP\QUAD\A11\A11-GRID.DWG	Building Grid
C:\DWG\CAMP\QUAD\A11\A11-COL.DWG	Column plan
C:\DWG\CAMP\QUAD\A11\A11-STA.DWG	Building Stairs, Ramps
C:\DWG\CAMP\QUAD\A11\A11-SERV.DWG	Building Services and risers

Note: Where consultants create Blocks of symbols they will become the property of the University of Sydney.

7.8.15.4 Contract Document File Name

Contract document drawing files shall be grouped into manageable sections using the following major types:

Consultants Prefix	*Type*
A	Architectural
C	Civil Engineering and Site Work
E	Electrical Engineer
F	Furniture, Fittings & Equipment

H	Hydraulic Engineer
I	Interior Design
L	Landscape Design
M	Mechanical Engineer
O	Acoustic
R	Fire Protection
S	Structural Engineer
T	Lift
U	Security
V	Audio Visual

The contract drawing number is to be agreed by the CIS Project Manager prior to commencement of the project. The contract drawing number is required to be cross referenced to the CAD drawing number for manual retrieval methods.
Note: All contract documents shall be configured for paper space with the University CAD Model x-referenced in to the document. This allows for plotting at 1:1 plotting scale.

7.8.15.5 Detail Drawing File Names

Detail contract document drawing files which are not part of the tender contract set shall be named using an agreed detail numbering system with the CIS Project Manager.

7.8.16 CAD Drawing File Register

All CAD drawing files must be accompanied with a completed CAD drawing file register. The drawing file register will contain information relating to the following:

- contract drawing number
- CAD drawing file name
- drawing title
- all x-referenced files & origin points
- all Blocks
- viewports
- linetype scale
- plotting scale

7.8.17 CAD Drawing File Format

The CAD drawing files required to be submitted by consultants include both the University CAD Model and all contract documents. These are to be submitted *in the latest release of AutoCAD DWG format or AutoCAD DXF*. The CAD drawing files shall be submitted to the University of Sydney at the completion of each nominated stages of the project using electronic media like CD-ROM or DVD in their approved directory path.

CAD drawing files can only be submitted compressed upon approval by the CIS Project Manager and only when the compressed files are formatted with an automatic decompression executable saved within the file. This is conditional only where decompression is achieved through a simple double click with the mouse on the selected file and no additional software is required.

7.8.18 CAD Drawing Scale

All drawings shall only be drawn and submitted in the real world scale of 1:1. The drawing data which represents the building works shall not to be scaled for plotting, the data shall be real world scale of 1:1 where the contract document plotting scale is only to be achieved through paper space view ports with a nominated plotting scale.

Any drawing data scaled shall be deemed not to comply with the conditions of the CAD Drawing Standards and will require rectification.

7.8.19 Room Numbering Protocol

The *Room Numbering & Way Finding Protocol*[1] allows room numbering & way-finding procedures to be applied consistently and uniformly to all University buildings. This in order to facilitate the day-to-day operations as well as for strategic reporting & planning.

Each space requires a unique room number which is in turn used by ARCHIBUS/FM (Used for Space as well as Asset and Facilities management) uses room numbers in association with level codes and building codes, to identify all space against which room function, occupants, condition assessment reporting as well as tracking work requests and identifying areas where work is to be carried out. Any room numbering has to be done according to the University's Room Numbering & Way Finding Protocol. Room numbering can occur when designing a new building or even when refurbishing an existing building.

7.8.20 When to Apply Room Numbering Protocol

The room numbering & way-finding standards should be applied in the following situations:

- New Buildings
- All renovations (no matter how small) where confusion may result from the renovation or where new rooms are created.
- Existing buildings in order to improve clarity of navigation and way-finding.

IMPORTANT: Any new Room Numbering, whether it is for a new building or changes to numbering in an existing building, NEEDS TO BE approved by CIS's Space Information Officer. This needs to happen at a very early stage in the project, preferably that is during the design stages, and NOT after the occupants have moved in!

7.8.21 Data Normalisation

Consultants are only to provide CAD drawing files with their specific scope of works. Any base, set-up or co-ordination drawings required to complete the scope of works defined in the contract shall be referenced into the contract documentation set so that they can be easily removed by the University through the command x-reference detach or simple deletion of a Block. Consultants documenting services or works overlaying the architectural plans are to provide their CAD drawing files at a real world scale of 1:1 geometrically coordinated with the architectural co-ordination plan.

7.8.22 At the Drawing File Level

The CAD Model created will be used as the basis of the contract documentation set. Each drawing file represents a single level (elevation, section or set of details) of the building and no other data (different levels, elevations, sections or details) can be placed on a designated file. The full extent of the building at the nominated level is to be on one file and coordinated back to the origin.
In the contract documentation set, the CAD Model (e.g. L1-CP.DWG) is to be x-referenced into a new file named as a contract drawing (refer to drawing naming convention) and the paper space facility is then used to construct the contract document sheet to a plotting scale with annotation.

7.8.23 At the Layer Level

The consultant is responsible for the consistent use of layer names throughout all the CAD drawing files (the model and contract set). The consultant is to follow the layer naming convention described in the specification, unless otherwise agreed in writing by the Project Manager.

All properties of drawing entities shall be defined by layer. In AutoCAD, colours and linetypes are to be defined 'BYLAYER' and NOT by entity.

[1] For a copy of the Room Numbering & Way Finding Protocol, please contact the CIS Information Manager at the University of Sydney on (02) 9351 6865.

7.8.24 At the Data Level

Layer data is to be consistent where the layer only contains data specifically related to that layer name. For example the layer:

A-WALL-BRK is only to contain internal walls made of bricks

No polylines (complex shapes etc.) with width are to be used for any part of the drawing except for room area polylines. All room intersections are to be filleted, joined or closed and the consultants have to ensure that high standards of CAD drawing quality control are maintained.
Consultants must ensure that all CAD entities such as lines, arc, circles, text etc. conform to the highest level of quality, inaccurate drawing will be deemed not to comply with this specification.

7.8.25 Annotation of CAD Drawing Files

7.8.25.1 Text Fonts

All contract document drawings are to use only standard fonts throughout all drawings. Font types are to be compatible with AutoCAD standard fonts which are supplied with AutoCAD.

7.8.25.2 Text Scale

The drawing plotting scale is the assignment of a scale where text, dimensions and the border is scaled to a nominated plotted size. For example the text size for standard notes shall be 2.5mm high for all contract drawings at any plotted scale. The recommended plotted text sizes are:

Small	2.5mm	Small text is generally used for all drawing notes and dimensions.
Medium	3.5mm	Medium text is generally used for all building and room names.
Large	5.0mm	Large text is generally used for main title names.

7.8.25.3 Hatch Scale

Hatch scales for solid black symbols must be as simple as possible and must be tested for plotting with a pen plotter. Suggested hatch scale for a solid 45 degree hatch at 1:100 scale would be 1:200. All symbols are to be external Blocks and they are to have their hatching pattern on a specific hatch layer and not a common hatch layer (refer to Blocks in this specification). This will enable the University to amend the hatch patterns scale globally at a later stage if required.

7.8.25.4 Linetype Scale

Linetype scales must also be checked and are to be common for each plotted scale drawing throughout all documents. Line types are to be compatible with AutoCAD standard linetypes which are supplied with AutoCAD.

7.8.25.5 Border Sheets

The University border sheet and title block is required to be inserted to all contract documents and annotation complete in paper space on border text layers. A section of the title block shall be provided for the Architects and consultants use.
Where details of different scales are placed on contract drawing detail drawing sheets, no detail must be scaled but ‘x-referenced’ in (or referenced as a external drawing) with no text, dimensions or hatching. The text, dimensions and hatch patterns should be created on the main contract drawing.

7.8.26 Layer Guidelines

7.8.26.1 Colours and Pens

Most colours of layers are identified in Appendix B. Pen thickness will depend on the size of the plan printed and should be coordinated with CIS-CAD Services as required

.

Entities colours on a layer must conform to the three standard plotting colours described below:

MAGENTA	shall only be used for	0.18 pen
BLUE	shall only be used for	0.20 pen
RED	shall only be used for	0.35 pen
GREEN	shall only be used for	0.50 pen
CYAN	shall only be used for	0.70 pen

The .25 pen can be represented by any other colour except the four specified above.

7.8.26.2 Layer Names

The naming of the layers is to be a descriptive name and not a number. All layer names are to be representative of the function or element type, they are to have a base prefix allowing grouping of similar layer functions. For example:

Base Prefix Name	Description	Data
A-BORD *	base border	specific border data
A-WALL *	base for all wall types	specific wall data
A-DOOR *	base for all door data	specific door data
A-FURN *	base for all furniture	specific furniture data
A-RC *	base for all reflected ceiling	specific RC data
A-H-*	base hatch	specific hatch data

The asterisk (*) represents the extension to the base name. Each different type of function or element base name is to have a descriptive extension. For example:

Layer Name	Description
A-WALL-EXT	external wall outline
A-WALL-INT	the external wall internal outline
A-WALL-BRK	wall brick
A-H-BRK	hatch brickwork wall

The example above illustrates how different types of walls must be on a specific layer and a specific layer must be created for the wall specific hatching. This convention must be adopted and applied to all the consultants' layer names.

Examples of the layer names to be used by consultants are attached in Appendix B of this consultant's specification. Layer names required but not directly mentioned in Appendix B can be created using the same naming convention. Drawings are only to contain layers appropriate to the drawing requirements, extra layer names may be added if they conform to the layer naming convention stated. Layers with no specific colours can be identified as agreed by the CIS Project Manager.

7.8.27 Space Management using ARCHIBUS/FM

The University of Sydney, Campus Infrastructure Services uses ARCHIBUS/FM for space management where buildings have been documented on CAD. It is critical that all consultants documenting new works comply with the CAD Drawing Standards and the 'Room Numbering & Way Finding Protocol' (see sections 3.6 & 3.6.1 of this document) as part of the data transfer process to the ARCHIBUS/FM database by CIS.

7.8.28 Glossary of Terms

This specification uses the following terms with the definition described below:

AFM	ARCHIBUS/FM™
Annotation	Text, dimensions, arrow symbols, drawing sheet reference symbols, hatching & the border sheet
Block	A named object created from a set of entities with a nominated base point that can be inserted into the current drawing.
CAD	Computer Aided Drafting
CIS	Campus Infrastructure Services
DWF	Drawing Web format (File format for web by AutoCAD)
DWG	AutoCAD native file format
DXF	specific Drawing eXchange File to exchange files between CAD systems
Layer	Electronic drawing sheet within a drawing file that data is drawn and manipulated upon which can be turned on and off as required
X-reference (XREF)	AutoCAD's e**X**ternal **REF**erence function for references/overlaying other drawings. The drawing is referenced or read transparently into current drawing without insertion.

Appendix A: University Campus& Building Abbreviations

Campus abbreviations are:

Burren Street	=	BURR
Camden	=	CAMD
Camperdown	=	CAMP
Conservatorium	=	CONS
Cumberland	=	CUMB
Darlington	=	DARL
Rozelle	=	ROZE
Law	=	JAME
Mallet Street	=	MALL
Molongollo	=	MOLO
Narrabri	=	NARR
Orange	=	ORAN
Others	=	OTHE
Surry Hills	=	SURR

Existing protocol to remain with the building numbers listed as:

Main Building	=	A14
Pharmacy and Bank Building	=	A15
		B#, C#, etc.to Z#

7.8.29 Numbering of Building Levels

Building levels are to follow the existing system as per the 'Room Numbering & Way Finding Protocol'[2]. All buildings shall be numbered by Level, starting from Level 1 being the lowest user occupied level in the building. However, if a floor in a new building connects with a floor in an existing building, the levels shall be determined by the existing building levels. Any underground parking or basements shall be numbered as B1, B2 etc in descending order. If a basement level is occupied by users, it is considered to be part of the building numbering protocol (i.e. Level 1).

However, where an existing building uses the Ground Floor / First Floor numbering protocol, the naming will be retained and can only be changed in the following situations:

- If the building is being totally refurbished and therefore renumbering the levels will have no adverse effects and will bring the building in line with the University level numbering protocol.
- If the room numbering on the Ground Floor will not be affected, that is the rooms do not have a 'G' prefix e.g. G15. However great care needs to be taken when changing the Level naming convention as this might affect systems that rely on that, e.g. AFM, the Essential Services monitoring systems, Alarm systems etc.

IMPORTANT: Any new building needs to have the Level naming or identification approved by the CIS Space Information Officer. This needs to happen at a very early stage in the project. Below is an example of how a new building with 10 habitable floors and 2 basements will be numbered:

Level Code	Level Name	Notes
B2	Basement 2	This relates to the lowest level of the building. There are no occupants in this level and it can be allocated to car parking.

[2] For a copy of the Room Numbering & Way Finding Protocol, please contact the CIS Information Manager at the University of Sydney on (02) 9351 6865

B1	Basement 1	This relates to the second lowest level of the building. There are no occupants in this level and it can be allocated to car parking.
01	Level 1	This relates to the lowest habitable level. This may not always be the equivalent to the 'ground floor' of a building. Note regardless of the Level Name, the Level Code (in AFM) remains 01
02	Level 2	This relates to the next habitable level above Level 1
03	Level 3	This relates to the next habitable level above Level 2
03M	Level 3M Level Three Mezzanine	Mezzanine levels have a suffix of 'M' applied to the Level Code from which the mezzanine is accessed.
04,05,06 07,08,09	Level 4 etc…	This relates to the next habitable level above Level 3 and so on etc…
10	Level 10	This relates to the next habitable level above Level 9
10M	Level 10M Level Eleven Mezzanine	Similar to Level Three Mezzanine.

Appendix B: CAD Drawing Layer Names

ARCHITECTURAL LAYER NAMES

Layer	Description	Colour	Line Type	Pen
A-BORDER	border in paper space	white	continuous	0.5
A-CHECK	unclear information to be checked	green	continuous	0.25
A-CLNG	reflected ceiling plan	white	continuous	0.25
A-CLNG-ELE	reflected ceiling electrical	white	continuous	0.25
A-CLNG-GRID	reflected ceiling grid	8	continuous	0.18
A-CLNG-LIT	reflected ceiling lights, mainly fluorescent boxes	8	continuous	0.18
A-CLNG-MEC	reflected ceiling mechanical	white	continuous	0.25
A-CLNG-TILE	ceiling tile	8	continuous	0.18
A-CLNG-O	ceiling other	yellow	continuous	0.2
A-COL-BASE	column base	white		
A-COL-CON	concrete columns	green	continuous	0.5
A-COL-STL	steel columns	green	continuous	0.5
A-COL-TBR	timber columns	white	continuous	0.5
A-COL-ALM	Aluminium columns	Blue	continuous	0.3
A-DEMO	demolition works	Magenta	continuous	0.25
A-DIM	dimensions			
A-DOOR	door	white	continuous	0.25
A-DOOR-MAT	door mats	8	continuous	0.18
A-DOOR-NO	door number	yellow	continuous	0.25
A-ELEV-FIN	Elevation - fine line	cyan	continuous	0.1
A-ELEV-HEV	Elevation - heavy line	white	continuous	0.5
A-ELEV-LIT	Elevation - light line	8	continuous	0.2
A-ELEV-MED	Elevation - medium line	blue	continuous	0.35
A-FLOOR-CARP	floor carpet	8	continuous	0.18
A-FLOOR-PAV	floor paving	8	continuous	0.18
A-FLOOR-TILE	floor tiles	8	continuous	0.18
A-FLOOR-O	other floor finishes	8	continuous	0.18
A-FLOOR-LEV	Floor level survey points			
A-FURN	built-in furniture	yellow	continuous	0.25
A-FURN-LOO	loose furniture	blue	continuous	0.25
A-FURN-OUT	outside furniture	blue	continuous	0.25
A-FURN-O	other furniture	yellow	continuous	0.25
A-GRID	building grid	magenta	dash dot	0.18
A-HANDRAIL	handrail	21	continuous	0.25
A-HAT-BRK	hatch brick walls	magenta	continuous	0.18
A-HAT-BLK	hatch block work walls	magenta	continuous	0.18
A-HAT-CLNG	hatch ceiling	magenta	continuous	0.18
A-HAT-CON	hatch concrete walls	magenta	continuous	0.18
A-HAT-COL	hatch concrete column	magenta	continuous	0.18
A-HAT-STN	hatch stone walls	magenta	continuous	0.18
A-HAT-PB	hatch plasterboard walls	magenta	continuous	0.18

A-HIDD-UND	Hidden under			
A-LIFT-CAR	lift car and detail	magenta	continuous	0.25
A-OVERHEAD	objects above plan line	yellow	hidden	0.2
A-RAMP	all ramps	white	continuous	0.25
A-REVISIONS	clouds to all revisions	cyan	continuous	0.35
A-ROOF	roof lines	cyan	continuous	0.25
A-ROOF-PROJ	roof line projection	white	continuous	0.25
A-ROOF-SECTION				
A-RM	space polylines	cyan	continuous	0.25
A-ROOM-CH	room ceiling height	white	continuous	0.25
A-ROOM-NA	Room name			
A-ROOM-NO	room number	blue	continuous	0.25
A-ROOM-AREA	room area	yellow	continuous	0.25
A-SERV-AV	audio visual services	white	continuous	0.25
A-SERV-ELE	electrical services	white	continuous	0.25
A-SERV-FIRE	fire services	green	continuous	0.25
A-SERV-MEC	mechanical services	white	continuous	0.25
A-SERV-POW	power services	white	continuous	0.25
A-SERV-SAN	sanitary services	green	continuous	0.25
A-SERV-HYD	hydraulic services	green	continuous	0.25
A-SERV-DATA	data services	blue	continuous	0.25
A-SERV-COM	communication services	blue	continuous	0.25
A-SERV-STR	Storm water/dp/gutters	green		
A-SERV-VENT	Air vents			
A-SIGN-NORTH	north signage	white	continuous	0.25
A-SIGN-EXIT	exit signage	green	continuous	0.25
A-SLAB-CON	concrete slabs	green	continuous	0.25
A-SLAB-FLR	floor slab	8	continuous	0.18
A-SLAB-O	slab other	yellow	continuous	0.2
A-STAIRS	all stairs	white	continuous	0.25
A-TEXT				
A-TEXT-S	text small	white	continuous	0.25
A-TEXT-M	text medium	red	continuous	0.35
A-TEXT-L	text large	green	continuous	0.5
A-TEXT-CLNG	reflected ceiling specific text	white	continuous	0.25
A-TEXT-COL	column specific text	white	continuous	0.25
A-TEXT-DEMO	demolition specific text	white	continuous	0.25
A-TEXT-GRID	building grid specific text	green	continuous	0.25
A-TEXT-PS	paper space text	white	continuous	0.25
A-TEXT-TITL	title block information & text	white	continuous	0.25
A-TEXT-WALL	wall specific text	white	continuous	0.25
A-TEXT-WIND	window specific text	white	continuous	0.25
A-WALL-BLW	wall below as in projection in voids or similar	8	continuous	0.18
A-WALL-BLK	wall block work	green	continuous	0.5
A-WALL-BLKP	wall block work projection	green	continuous	0.5
A-WALL-BRK	wall brickwork	red	continuous	0.35
A-WALL-BRKP	wall brickwork projection	white	continuous	0.2
A-WALL-COOL	cool room walls	blue	continuous	0.25
A-WALL-CON	wall concrete	green	continuous	0.35
A-WALL-CONP	wall concrete projection	white	continuous	0.2

A-WALL-EXT	external wall outline	white	continuous	0.25
A-WALL-FINM	wall finish, metal	yellow	continuous	0.25
A-WALL-FINT	wall finish, timber, mazonite	yellow	continuous	0.25
A-WALL-FINO	other wall finish,	yellow	continuous	0.25
A-WALL-FIRE	Fire rated cladding	white		
A-WALL-GLZ	wall glass - glazed partitions & curtain walls	blue	continuous	0.25
A-WALL-GRA	wall granite	yellow	continuous	0.25
A-WALL-INT	external wall internal outline	white	continuous	0.25
A-WALL-O	Other int walls (fences, etc.)			
A-WALL-OP	operable walls and movable partitions			
A-WALL-PRC	precast concrete wall	blue	continuous	0.25
A-WALL-TP	toilet partitions, including precast toilet partitions	white	continuous	0.25
A-WALL-STL	steel & metal walls	red	continuous	0.25
A-WALL-STN	wall stone	red	continuous	0.35
A-WALL-STNP	wall stone projection	white	continuous	0.2
A-WALL-STDP	stud wall, plasterboard	cyan	continuous	0.25
A-WALL-STDT	stud wall, timber	white	continuous	0.25
A-WALL-STDFC	stud wall, fibre cement sheet	white	continuous	0.25
A-WALL-TILE	wall tiles	yellow	continuous	0.25
A-WIND	window	blue	continuous	0.25
A-WIND-NO	window numbers			
A-WIND-SIL	window sill	8	continuous	0.18
A-WIND-O	High windows			
A-VPORT	view ports in paper space	white	continuous	0.2

All major services layer names are to named using the group type prefix (i.e. S or E), followed by the functional characteristic and material or type. Further development for the following layer names is to be made in conjunction with the current projects.

LANDSCAPE DESIGN LAYER NAMES

Layer	***Description***
L-BAT	bank batter
L-BLDG	buildings foot print
L-CAD	cadastral
L-CONT-MA	major contours
L-CONT-MI	minor contours
L-ELECT	electricity
L-FENCES	fences
L-GAS	gas
L-VEGE	vegetation
L-GRID	grid
L-LIGHT	lighting
L-LOT-SLOPE	lot slope arrows
L-RIVER	rivers and creeks
L-ROADS	roads/tracks/kerbs
L-SEWER	sewer
L-SPOT-CODE	spot code
L-SPOT-HEIGHT	spot height/level
L-SPOT-LOC	spot cross
L-SPOT-NUM	spot number
L-STORM-WATER	stormwater
L-STREET-FURN	street furniture
L-SURVEY-DATA	survey data
L-TELECOM	telecom
L-TREE	tree
L-TREE-TXT	tree text
L-WATER	water

L-PATH	foot path
L-GRASS	grass
L-STEPS	steps
L-WALL	retaining walls

STRUCTURAL ENGINEERS LAYER NAMES

Layer	***Description***
S-SLAB	slab on ground
S-SLABPR	slab pre-stressed
S-SLABCJ	slab control joint

ELECTRICAL ENGINEERS LAYER NAMES

Layer	***Description***
E-POW	power to mains
E-POWBD	power distribution board
E-DIFF1	diffuser type 1
E-CAB	cable power general
E-CABCPU	cable power computers

MECHANICAL ENGINEERS LAYER NAMES

Layer	***Description***
M-ACIN	air conditioning duct fresh air intake
M-VNTIN	air conditioning vent fresh air intake
M-ACEXH	air conditioning duct exhaust
M-VNTEXH	air conditioning vent exhaust

HYDRAULIC ENGINEERS LAYER NAMES

Layer	***Description***
H-SPRKP1	sprinkler pipe
H-SPRKH1	sprinkler head
H-WATH	hot water
H-WATC	cold water
H-SEW	sewer

FIRE SERVICES LAYER NAMES

Layer	***Description***
F-HYD	fire hydrant
F-HYDHRL	fire hose reel
F-HYDEXT	fire extinguisher
F-CONTBD	fire control board
F-EXIT	fire exits and signs

AUDIO VISUAL LAYER NAMES

Layer	***Description***
V-LECT	audio visual lecture theatre
V-SEM	audio visual seminar room
V-VCONF	audio visual video conferencing facility
V-VCR	audio visual vcr recorder facility

3D CAD DRAWINGS LAYER NAMES

Layer	***Description and Colour***
A-3D-AC	Air Condition (8)
A-3D-BOX-GUTTER	Box Gutter (Green)
A-3D-CAPPING	Capping (Magenta)

A-3D-DP	Down pipes (Green)
A-3D-GUTTER	Gutter (Green)
A-3D-ROOF-T	Roof Tiles (Red)
A-3D-ROOF-S	Roof Slates (8)
A-3D-ROOF-C	Roof Colourbond (8)
A-3D-ROOF-P	Roof Colourbond transparent (White)
A-3D-ROOF-G	Roof Glaze (Blue)
A-3D-ROOF-RB	Roof Rubber Membrane (Black)
A-3D-ROOF-CT	Roof Concrete (8)
A-3D-WALLS	Walls (Red)

Appendix C: External Drawings and Symbols (Asset Models)

Any physical building element that is repeated on a floor plan shall be a Block or external drawing inserted into the plan with attribute data attached to the drawing file. The University of Sydney, Campus Infrastructure Services is currently developing its asset models for insertion into the University CAD Model as a tool for updating the asset register and maintenance programs. These asset models will be developed in-conjunction with current building projects.

Symbols are to conform to the Universities CAD drawing standards, if the required symbol is not described then consultants are required to conform to the current Australian Standards. Each symbol is to be a separate drawing and inserted as a Block. Symbol attributes and the insertion point is to be scheduled for University on completion of the project. The following sections present some of the examples of the Asset Model symbols.

ARCHITECTURAL

- THE COLUMNS	**- THE WINDOWS**	**-THE DOORS**	**- CHAIRS**	**- THE STAIRS**	**- LIFTS**	**- WORKSTATIONS**
- OFFICE STANDARD LAYOUT LECTURER		**- OFFICE STANDARD LAYOUT DEAN**			**- OFFICE STANDARD LAYOUT SEMINAR ROOM**	

ELECTRICAL (LIGHTING)

CAD Drawing	*Type*	*Description*
E-FLUA.DWG	Type A	2 x 18w Fluorescent plaster flanged troffer
E-FLUB.DWG	Type B as for Type A	1 x 36w Fluorescent plaster flanged troffer
E-FLUC.DWG	Type C	2 x 18w recessed Fluorescent luminaire
E-FLUD.DWG	Type D as for type C	
E-FLUE.DWG	Type E	1 x 18w surface mounted Fluorescent luminaire
E-FLUF.DWG	Type F as for type E	2 x 18w surface mounted Fluorescent luminaire
E-FLUG.DWG	Type G as for type E	1 x 36w surface mounted Fluorescent luminaire
E-FLUH.DWG	Type H as for type E	2 x 36w surface mounted Fluorescent luminaire
E-FLUI.DWG	Type I	2 x 36w surface mounted weather proof Fluorescent luminaire
E-FLUJ.DWG	Type J as for type I	luminaire
E-FLUK.DWG	Type K	2 x 18w recessed compact Fluorescent downlight
E-FLUL.DWG	Type L	2 x 36w recessed compact Fluorescent downlight class 1 zone 1
E-FLUM.DWG	Type M	2 x 13w recessed compact Fluorescent downlight
E-FLUB18.DWG		2 x 18w Fluorescent baretube batten
E-FLUB36.DWG		2 x 36w Fluorescent baretube batten
E-FSMS18.DWG		2 x 18w Fluorescent surface mounted single
E-FSMS36.DWG		2 x 36w Fluorescent surface mounted single
E-F2SM36.DWG		2 x 36w Fluorescent surface mounted single
E-TUNHRS.DWG		1 x 10w tungsten halogen recessed single
E-SW1W.DWG		10a one way switch
E-SW2W.DWG		two way switch
E-SWINT.DWG		intermediate switch
E-SWSPI.DWG		switch panel
E-FEX.DWG		2 x 10w fluorescent exit

E-BD1.DWG	distribution board 1

ELECTRICAL (POWER)

CAD Drawing	*Description*
E-MSB.DWG	main switch board
E-DB.DWG	distribution board
E-EMP.DWG	electricity metering panel
E-CP.DWG	control panel
E-UPS.DWG	uninterruptible power supply
E-GPO.DWG	general purpose outlet
E-GPO2.DWG	double general purpose outlet
E-GPO15A.DWG	single general purpose outlet
E-3SSO.DWG	three phase switch socket
E-DPO.DWG	dedicated power outlet
E-SPPC.DWG	single phase permanent connection
E-3PPC.DWG	three phase permanent connection
E-OISO.DWG	onload isolator]
E-MCCB.DWG	moulded case circuit breaker
E-FUSE.DWG	fuse
E-CONTOR.DWG	contactor
E-COIL.DWG	contactor coil
E-RLINK.DWG	removable link
E-CTRANS.DWG	current transformer
E-MTRKHR.DWG	kilowatt hour meter
E-MTRAM.DWG	ammeter
E-MTRVOL.DWG	voltmeter
E-SSWIT.DWG	selector switch
E-TRNDUC.DWG	transducer

FIRE PROTECTION

CAD Drawing	*Description*
F-DATA.DWG	data outlet
F-DPP.DWG	patchpanel for data/voice telephone systems
F-EDOD.DWG	electromagnetic door hold opening device
F-FAB.DWG	fire alarm bell
F-FIP.DWG	fire indicator panel
F-FRP.DWG	fire alarm repeater panel
F-MANT.DWG	matv antenna
F-MCP.DWG	manual call point
F-MDF.DWG	main distribution frame
F-PABX.DWG	private automatic branch exchange
F-RVD.DWG	remote visual indicator
F-SD.DWG	smoke detector
F-SDAD.DWG	smoke detector within air duct
F-SDCS.DWG	smoke detector in concealed spaces
F-TD.DWG	thermal detector
F-TDCS.DWG	thermal detector in concealed spaces
F-TEL.DWG	telephone outlet
F-TV.DWG	tv outlet

EWIS SYSTEMS

CAD Drawing	*Description*
EWIS-CP.DWG	master emergency control panel
EWIS-RS.DWG	warning system recessed ceiling speaker
EWIS-SMS.DWG	warning system surface mounted speaker
EWIS-HS.DWG	horn speaker

EWIS-IP.DWG	warden intercommunication point
EWIS-AID.DWG	emergency alarm initiating device
EWIS-VAD.DWG	visual alarm device

HYDRAULIC

CAD Drawing	*Description*
H-DP.DWG	down pipe
H-RO.DWG	rainwater outlet
H-PD.DWG	planter drain
H-SWP.DWG	stormwater pit
H-GD.DWG	grated drain
H-EDP.DWG	existing down pipe
H-WC.DWG	water closet
H-B.DWG	basin
H-FW.DWG	floor waste
H-TD.DWG	tundish
H-S.DWG	shower
H-T.DWG	tub
H-WM.DWG	washing machine
H-KS.DWG	kitchen sink
H-BTH.DWG	bath
H-HT.DWG	hose tap
H-ST.DWG	stop tap
H-BT.DWG	boundary tap
H-OG.DWG	overflow gully
H-IPMF.DWG	induct pipe mica flap
H-CO.DWG	clear out
H-RV.DWG	relfux valve
H-SIP.DWG	sewr inspection pit
H-WST.DWG	waste stack
H-SST.DWG	soil stack
H-VP.DWG	vent pipe
H-HWF.DWG	hot water flow
H-HWR.DWG	hot water return
H-CW.DWG	cold water
H-FHR.DWG	fire hose reel
H-GWM.DWG	glass washing machine
H-H&HR.DWG	hydrant & hose reel
H-RTA.DWG	rise to above
H-BTB.DWG	drop to below
H-RFB.DWG	rise from below
H-DFA.DWG	drop from above
H-AT.DWG	autopsy table
H-FC.DWG	fume cup/d
H-BWU.DWG	boiling water unit
H-FH.DWG	fire hydrant
H-LB.DWG	lab sink
H-FLFW.DWG	flushing floor waste
H-EYEW.DWG	eye wash
H-SSHOW.DWG	safety shower
H-ICEM.DWG	ice machine
H-BOOSTB.DWG	brigade booster
H-HYDPLL.DWG	pillar hydrant
H-TSTER.DWG	sterilizer / type
H-PITGIN.DWG	grated inlet pit
H-PITCON.DWG	concrete covered pit
H-SYM.DWG	hydraulic symbol

MECHANICAL

CAD Drawing	*Description*
M-BOILER.DWG	boiler
M-CTOWER.DWG	cooling tower
M-ACSAIR.DWG	air con ceiling supply fitting
M-ACRAIR.DWG	air con ceiling return fitting
M-SBDAMP.DWG	single blade damper
M-OBDAMP.DWG	opposed blade damper
M-FRDAMP.DWG	fire damper
M-ACCON.DWG	console air conditioning unit
M-ACUC.DWG	ceiling air conditioning unit
M-FANAX.DWG	axial fan
M-FILTRP.DWG	panel filter
M-LOUVRE.DWG	louvre
M-VAL.DWG	general valve symbol
M-VALB.DWG	butterfly valve
M-VALS.DWG	globe valve
M-VALI.DWG	isolating valve
M-VALCH.DWG	check valve
M-STRAN.DWG	strainer
M-VENTA.DWG	air vent
M-DCOCK.DWG	drain cock
M-ENDBLK.DWG	blanked end
M-CAPFL.DWG	cap flange
M-PUMP.DWG	pump
M-PGUAGE.DWG	pressure / temperature gauge

Appendix D: Ground Survey CAD Drawing Layer Names

Layer Names

The naming of the layers is to be a descriptive name and not a number. All layer names are to be representative of the function or element type, they are to have a base prefix allowing grouping of similar layer functions. For example:

Base Prefix Name	Description
L-TREE	trees
L-TREE-TXT	trees text

Examples of the layer names are listed below. Extra layer names required can be created using the same naming convention. Drawings are only to contain layers required for the drawing requirements.

Landscape Design and Surveying Layer Names

Layer	***Description***
L-BAT	bank batter
L-BAT-TEXT	bank batter text
L-BLDG	building foot print (at ground level)
L-BLDG-TEXT	building foot print text
L-CAD	cadastral
L-CONT-MA	major contours
L-CONT-MA-TEXT	major contours text
L-CONT-MI	minor contours
L-CONT-MI-TEXT	minor contours text
L-ELECT	electricity
L-ELECT	electricity text
L-FENCES	fences
L-FENCES	fences text
L-GAS	gas
L-GAS	gas text
L-WATER	water
L-WATER	water text
L-TEL	telstra
L-TEL	telstra text
L-VEGE	vegetation
L-VEGE	vegetation text
L-GRID	grid
L-GRID	grid text
L-LIGHT	lighting
L-LIGHT	lighting text
L-LOT-SLOPE	lot slope arrows
L-PLAY	playing/sports fields
L-PLAY-TEXT	playing/sports fields text
L-RIVER	rivers and creeks
L-RIVER-TEXT	rivers and creeks text
L-ROADS-MAJ	roads (kerbs/centre lines/median strips)
L-ROADS-MAJ-TEXT	roads text (kerbs/centre lines/median strips)
L-ROADS-MIN	Tracks (vehicle crossing points/drive ways)
L-ROADS-MIN-TEXT	tracks text (vehicle crossing points/drive ways)
L-GUTTER	invert of gutter
L-GUTTER-TEXT	invert of gutter text
L-SEWER	sewer
L-SEWER-TEXT	sewer text
L-SPOT-CODE	spot code
L-SPOT-HEIGHT	spot height/level
L-SPOT-LOC	spot cross
L-SPOT-NUM	spot number

L-STORM-WATER	stormwater
L-STORM-WATER-TEXT	stormwater text
L-STREET-FURN	street furniture
L-STREET-FURN-TEXT	street furniture text
L-SURVEY-DATA	survey data (tertiary control)
L-CONTROL	survey control (primary .secondary)
L-TREE	tree
L-TREE-TEXT	tree text
L-PATH	foot path
L-PATH-TEXT	foot path text
L-GRASS	grass
L-GRASS-TEXT	grass text
L-STEPS	steps
L-STEPS-TEXT	steps text
L-WALL	retaining wall
L-WALL-TEXT	retaining wall text
L-NON PLOT	field data not plotted
L-HATCH	hatching

Note: Where being prepared in a CAD software other then AutoCAD, like Microstation or similar where the layering is carried out numerically, then a conversion table should be supplied along with CAD files.

Appendix E: PolyLine Procedure

Poly Lines for Area Management

Since Archibus FM is a Facilities Management software application that allows an organization to track most aspects of its Infrastructure, Campus Infrastructure & Services has employed the software for the facilities management of the buildings and grounds in the University of Sydney.

After receiving the CAD floor plan drawings, the Facilities Management office must convert the architectural drawing into a CAFM and add polylines to these drawings to represent the various areas on a floor. Each polyline is linked to a record in the database. The polylines must be updated whenever a drawing is modified.

Creating Polylines

All areas must be depicted such as rooms, suites, vertical penetration areas, and gross areas in their floor plan drawings (x-ref file).

Create a layer called **RM** (**Cyan colour** and a continuous line type) for room polylines, and a layer called **GROS Magenta Colour** and a continuous line type) for gross external and internal polylines.

It is very important to spell the layer's name correctly so it is compatible with Archibus.

Change the current layer to RM.
Use the BPOLY command to draw polylines around the different types of areas.
Polylines should be drawn around all different types of areas (useable and non-useable) in the building.

Polylining Procedure

Click on the "Layer Properties" menu and create new layers
Layer "GROS" and assign it the colour Magenta – this layer will be used to draw **the floor exterior and interior gross area**.

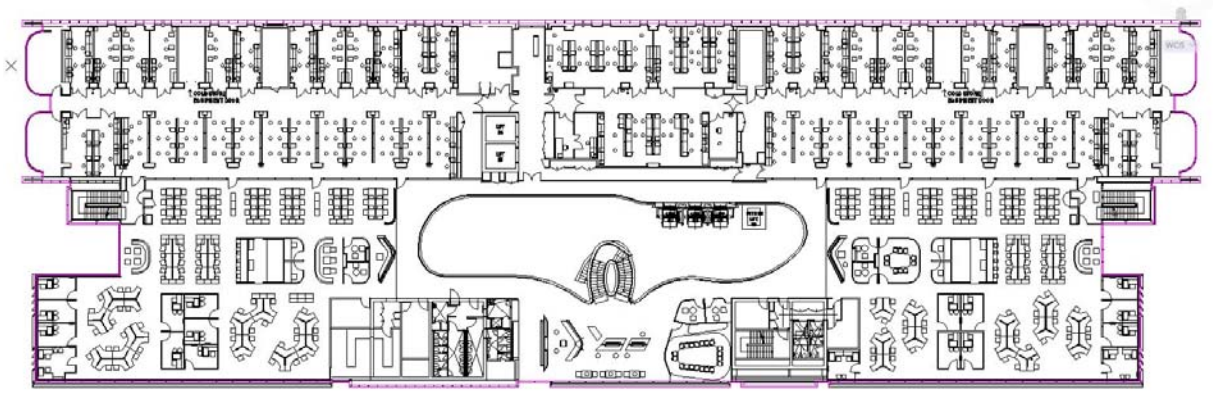

Figure 1 – Example exterior and interior gross area

Layer “RM” and assign the colour Cyan - this layer will be used to draw **room areas**.

Figure 2 – Example Room Layer

All facilities spaces ought to be drawn with a polyline that captures the area and the perimeter of an object.

Make the “RM” layer current, and draw polylines around all **vertical penetrations**. Vertical penetrations include enclosing walls, but do not include external walls. Walls between vertical penetrations are split at the centerline.

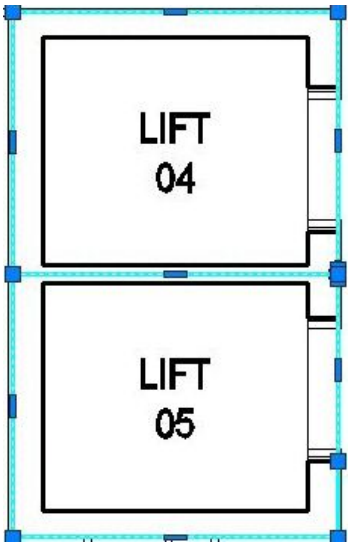

Figure 3 – Vertical Penetrations

Draw polylines around all **service areas**. Service areas include enclosing walls, but do not include walls enclosing vertical penetrations or external walls. Walls between service areas are split at the centerline. Do not draw polylines for each cabinet in the toilets. Simply draw polylines around the entire area.

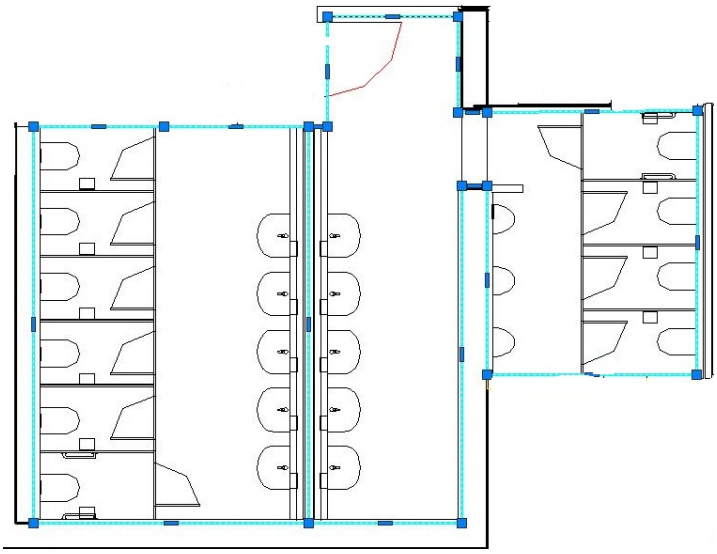

Figure 4 – Example Service Areas e.g. amenities

Draw polylines around usable areas as needed. **Offices** - Draw polylines at the wall surface to capture area for space charging and perimeter for all other FM services and maintenance.

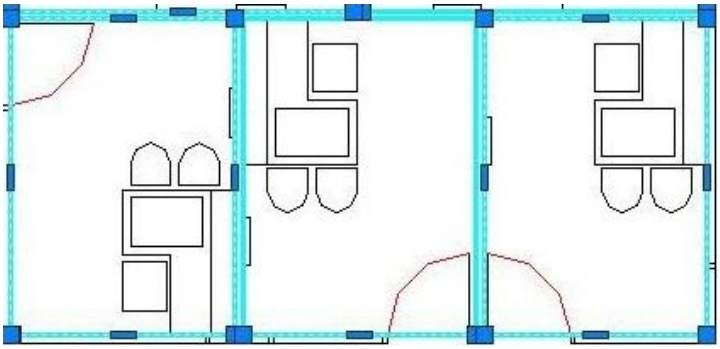

Figure 5 – Example Office

Horizontal Circulation – Foyers,/Lobbies & Corridors should be broken into segments to better differentiate egress requirements from hallways and more efficiently perform building assessments and repairs on items like extinguishers, lights, exit signs, etc,…

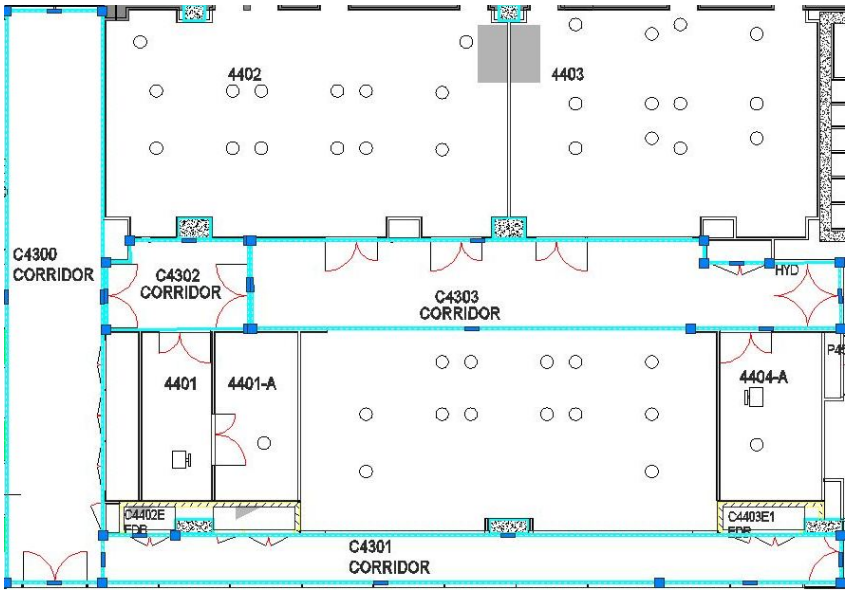

Figure 6 – Horizontal Circulation e.g. Corridors

The polylined areas are to be broken at the intersection of the corridors to indicate a change in direction.
The breaking line should be drawn as close as possible to the first door opening in the corridor as shown in Figure 7.

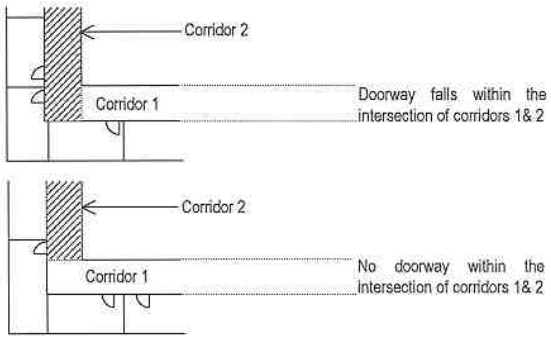

Figure 7 – Corridors – Breaking Line

Additional notes about Polylines

Split levels:
There are many occasions that polylines are drawn for the split levels such as lecture theatres, mezzanines, stairs and stores. The polylines for tiered lecture theatres are drawn at the lowest point of the lecture theatre (Plant rooms and other services room under the theatre should be separated from the main drawing). Data entry and synchronizing should occur on the plant room drawing.

Mezzanines:
Polylines for mezzanines are similar to theatres. These drawings are treated as separate entities to the main drawing.

Store rooms under Staircase:
If areas such as storerooms exist under the stairs these must be shown where they occur under the upper part of the stairs as shown in the Figure 8. If no other spaces exist in the staircase, polylines for each level of stairs are drawn in full.

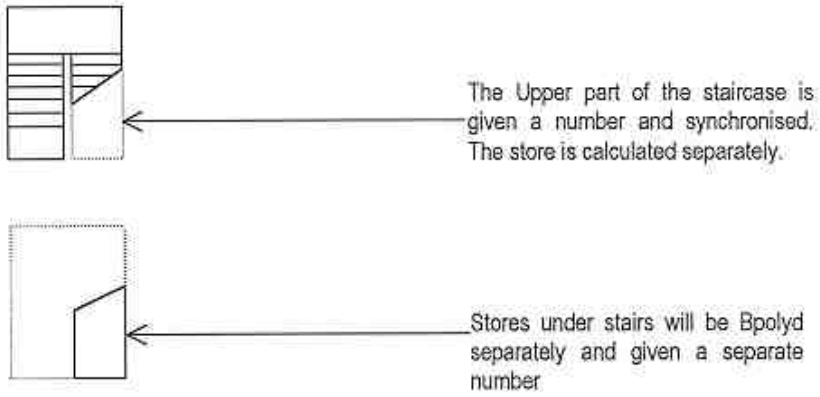

Figure 8 – Store rooms

Footprints:
Where mezzanine levels occur and the building line changes considerably e.g. on roof levels, it is necessary to provide a building footprint. This is drawn on the RM layer. Where two buildings have two or more distinct parts, that are linked physically but use different building codes, a footprint should be drawn around the part of the building that is not active to show relative position. In these situations text should be added to the footprint in order to assist users in finding accurate information.

Examples of this type of building are Fisher Library and Fisher stack (F03/F04), Aeronautical and Mechanical Engineering (J11/J09). Appropriate text would be “Refer to Building Code, Level Code for drawings of this area”. An example is shown in Figure 9:

Figure 9 – Building Footprint

Double counting of a space within another space

Double counting of room areas often occurs when a room exists in another room. To prevent this, the polyline of the larger room needs to be modified to exclude the smaller room. Consider the case shown in the Figure 10 A below where there is a smaller storage room (323a) inside the room 323. To draw the polylines correctly, the area of room 323a and the area of room 323 should add up to the area bounded by the boundaries of the room 323 (outlined by the dotted line in the Figure 10).

Figure 10

Definition of Building Areas

The Definitions and procedures provided in this document are intended to clarify and provide guidelines for the most used types of data to be collected and compiled on buildings and how to interpret and apply measurement procedures for CAFM.

These guidelines and definitions have been widely adopted and used by colleges and Universities.

They are also intended to establish a common standard for the minimum amount of data to be included in a building inventory in order to provide a database that is usable for both inter-institutional and intra - institutional purposes.

1. Gross External Area:

Gross External Area = Net Usable Area + Structural Space.

A. Definiton: It is the sum of all areas on all floors of a building included within the outside faces of its exterior walls, including floor penetration areas, however insignificant, for circulation and shaft areas that connect one floor to another. This includes the area within the outside faces of exterior walls and floor penetration areas, however insignificant. Gross External Area also includes all building structural,

mechanical and other infrastructure systems, all building circulation space, and all support space such as public toilets, lobbies, etc. Gross External Area also includes space located above and below grade (basements.)

B. *Basis for Measurement:* Gross External Area is computed by physically measuring or scaling measurements from the outside faces of exterior walls, disregarding cornices, pilasters, uncovered floor areas, etc., which extend beyond the wall faces. Exclude areas having less than a six-foot, six-inch clear ceiling height unless the criteria of a separate structure are met.

C. *Description:* Gross External Area should include the following:

Excavated basement areas; mezzanines, penthouses, and attics; garages; enclosed porches, inner or outer balconies whether walled or not, if they are utilised for operational functions; and corridors whether walled or not, provided they are within the outside face lines of the building, to the extent of the roof drip line. The footprints of stairways, elevator shafts, and ducts (examples of building infrastructure) are to be counted as gross area on each floor through which they pass.

D. *Limitations**:*** Exclude open areas such as parking lots, playing fields, courts, and light wells, or portions of upper floors eliminated by rooms or lobbies that rise above single floor ceiling height.

E. *Exception**:*** Include top, unroofed floor of parking structures where parking is available.

2. Gross Internal Floor Area:

Gross Internal Area = Useable Floor Area + Non-Useable Floor Area.

A. *Definition**:*** The sum of all areas on all floors of a building either assigned to, or available for assignment to, an occupant or specific use, or necessary for the general operation of a building.

B. *Basis for Measurement**:*** Gross Internal Floor Area is calculated by summing the assignable area and the non-useable area.

C. *Description:* The Gross Internal Floor Area of a building is measured to the internal face of the perimeter wall for each floor level. It includes areas occupied by internal walls and partitions, columns, piers and other internal projections, internal balconies, stairwells, toilets, lift lobbies, fire corridors, atria measured at base level only, and covered plant rooms. It excludes the perimeter wall thickness and external projections, external balconies and external fire escapes. Furthermore, unused areas such as unheated cellars or lofts are not included in the gross internal floor area.

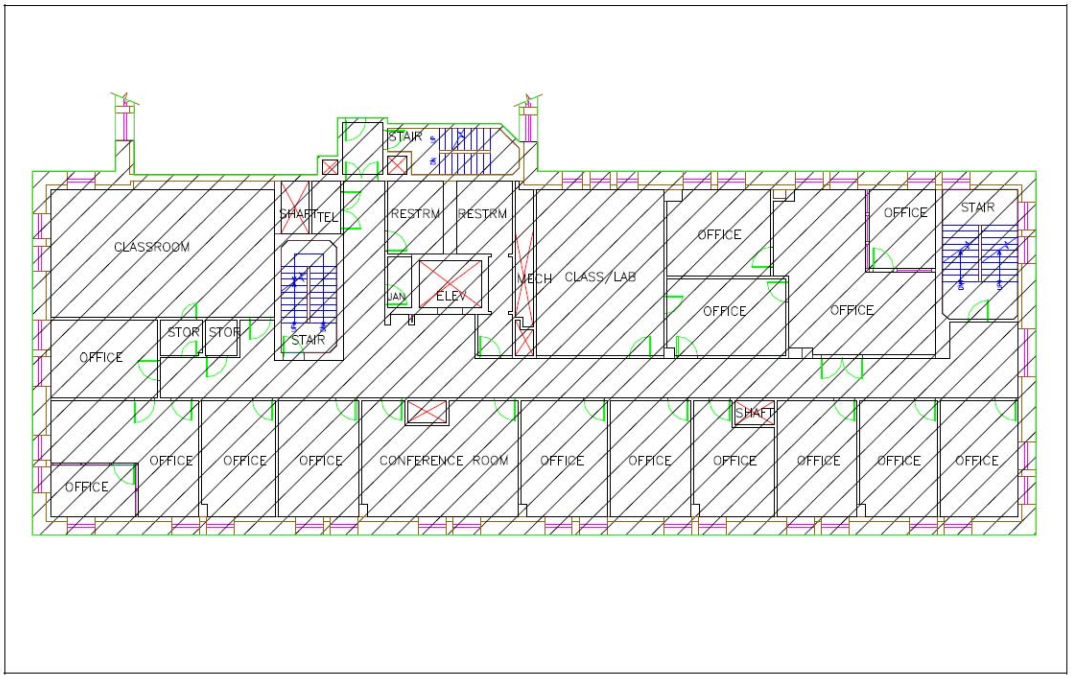

Figure 11 – Gross External Area (represented by green line) and Gross Internal Floor Area (represented by black line)

3. Useable Floor Area:

A. *Definition:* The sum of all areas on all floors of a building assigned to, or available for assignment to, an occupant or specific use.

B. *Basis for Measurement**:*** Useable Floor Area is calculated by physically measuring or scaling measurements from the inside faces of surfaces that form the boundaries of the designated areas. Exclude areas having less than a six-foot, six-inch clear ceiling height unless the criteria of a separate structure are met.

C. *Description**:*** Included should be space subdivisions of the ten major room use categories for useable space — classrooms, labs, offices, study facilities, special use, general use, support, health care, residential and unclassified—that are used to accomplish the institution's mission.

D. *Limitations**:*** Deductions should not be made for necessary building columns and projections. Areas defined as building service, circulation, mechanical, and structural should not be included.

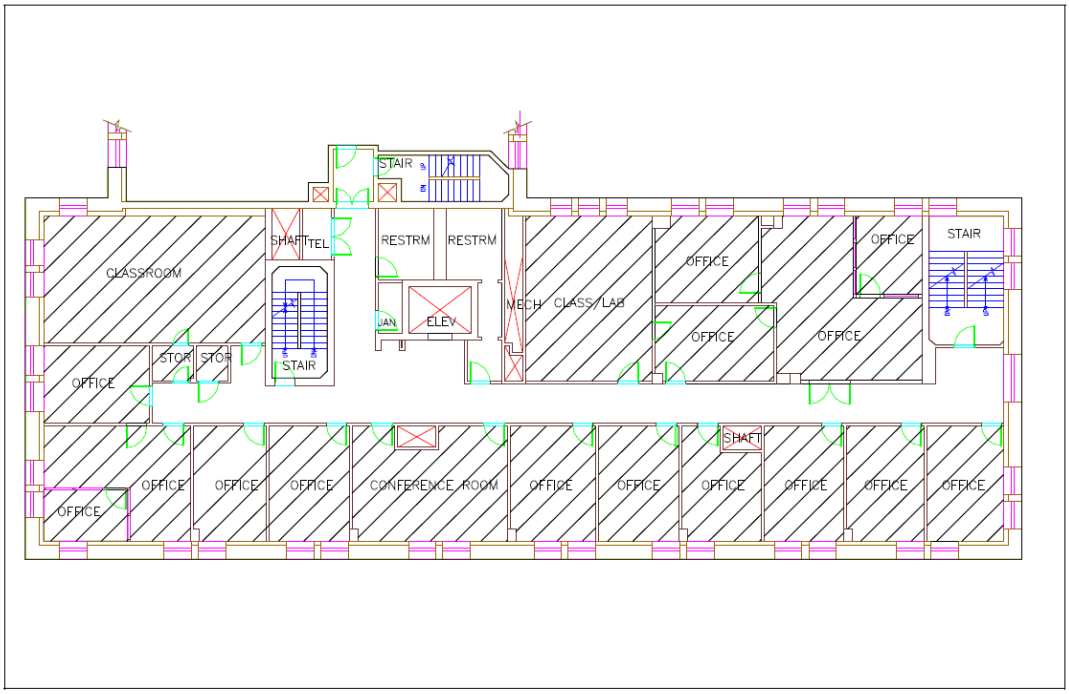

Figure 12 - Useable Area

4. Non-Useable Floor Area

A. *Definition*: The sum of all areas on all floors of a building not available for assignment to an occupant or for specific use, but necessary for the general operation of a building.

B. *Basis for Measurement*: Non-useable Floor area is calculated by physically measuring or scaling measurements from the inside faces of surfaces that form the boundaries of the designated areas. Excludes areas having less than six-foot, six-inch clear ceiling height unless the criteria of a separate structure are met.

C. *Description*: Included should be space subdivisions—building service, circulation and mechanical—that are used to support the building's general operation.

D. *Limitations*: Deductions should not be made for necessary building columns and projections. Areas defined as useable should not be included.

5. Circulation Area

A. Definition: The sum of all areas on all floors of a building required for physical access to some subdivision of space, whether physically bounded by partitions or not.

B. *Basis for Measurement*: Circulation area is calculated by physically measuring or scaling measurements from the inside faces of surfaces that form the boundaries of the designated areas.

C. *Description*: Included should be, but is not limited to, public corridors, fire towers, elevator lobbies, tunnels, bridges, and each floor's footprint of elevator shafts, escalators and stairways. Receiving areas, such as loading docks, should be treated as circulation space. Any part of a loading dock that is not covered is to be excluded from both **circulation area** and the **gross external area**. Also included are corridors, whether walled or not, provided they are within the outside face lines of the buildings to the extent of the roof drop line.

D. *Limitations*: Deductions should not be made for necessary building columns and minor projections. When determining corridor areas, only spaces required for public access should be included.

Restricted access private circulation aisles used only for circulation within an organizational unit's suite of rooms, auditoria, or other working areas should not be included.

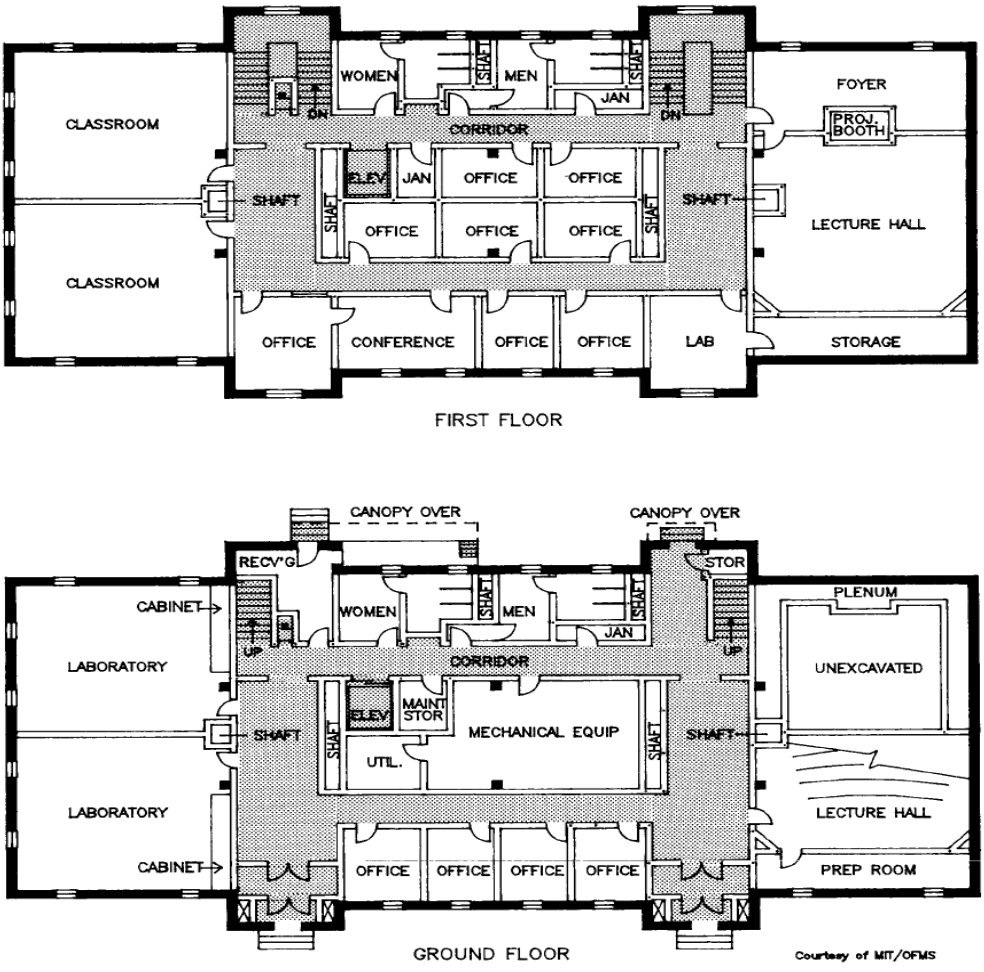

Figure 13 – Circulation Area

6. Mechanical Area

A. *Definition*: The sum of all areas on all floors of a building designed to house mechanical equipment, utility services, and shaft areas.

B. *Basis for Measurement*: Mechanical area is calculated by physically measuring or scaling measurements from the inside faces of surfaces that form the boundaries of the designated areas. Exclude areas having less than six-foot, six-inch clear ceiling height unless the criteria of a separate structure are met.

C. *Description*: Included should be mechanical areas such as central utility plants, boiler rooms, mechanical and electrical equipment rooms, fuel rooms, meter and communications closets, and each floor's footprint of air ducts, pipe shafts, mechanical service shafts, service chutes, and stacks.

D. *Limitations:* Deductions should not be made for necessary building columns and projections.

7. Structural Area:

Structural Area = Gross Area - Net Usable Area.

A. *Definition**:* The sum of all areas on all floors of a building that cannot be occupied or put to use because of structural building features.

B. *Basis for Measurement**:* Precise calculation by direct measurement is not possible under these definitions. It is determined by calculating the difference between the measured gross area and the measured net usable area.

C. *Description**:* Examples of building features normally classified as structural areas include exterior walls, fire walls, permanent partitions, unusable areas in attics or basements, or comparable portions of a building with ceiling height restrictions, as well as unexcavated basement areas.