

6 CAD DOCUMENTATION PROTOCOL

6.1 CAD

6.1.1 Introduction

6.1.1.1 General

The purpose of this protocol is to set out conditions and requirements in relation to CAD procedures and standards for “AS CONSTRUCTED” documentation produced for Edith Cowan University by its consultants.

Edith Cowan University's Facilities and Services use AutoCAD as the base CAD system, and several specialised software applications for Space Planning and Facilities Management.

These include –

- FMMS for Facilities Maintenance
- ARCHIBUS FM for Space Planning
- CADCORP SIS (GIS) for Space Planning and reporting
- SISFM for distributing graphical and non graphical data to the users

Edith Cowan University's CAD and spatial database is based on the GDA94 map grid coordinate system. All site information is correctly related to this coordinate system with the units set to 1 unit = 1 metre.

The University's Asset Delivery Office now commissions out all of its Capital Works and Maintenance works programs, design and documentation to external consultants. These consultants provide their services using a variety of CAD systems and standards. To achieve data uniformity that is absolutely necessary for the successful management of the University's graphical and spatial database, which includes accurate and up-to-date composite CAD drawings for each building based on consultant's “AS CONSTRUCTED” CAD information, required for effective management of the University's facilities, which includes space planning, GIS system, efficient operation of campus maintenance crews and provision of comprehensive information to various clients, it has been necessary to implement a set of procedures in relation to the production of CAD drawings.

The following standards are set out using AutoCAD as the base CAD system. For users of other CAD systems the following standards will need to be interpreted for that particular CAD system with an additional proviso that all drawings, before being delivered to the University, are converted to AutoCAD DWG format and then thoroughly tested on a PC equipped with AutoCAD. This and other requirements stipulated by this document will be evaluated for compliance by a CAD drawing contents checking application.

PLEASE NOTE From 1 October 2011, all consultants should also in addition to the above requirement, provide all documentation in REVIT 2011 format.

6.1.1.2 Schedule of Documentation to be Provided

6.1.1.2.1 At Tender

The Consultant shall supply a full set of contract documents as tendered to the Principal's Representative, including the following:

- 1 set of drawings in hard copy form (A1 size prints) and
- 1 set of electronic drawings in PDF format (A1 size prints)
- 1 set of openable and legible electronic drawings, compliant with ECU CAD protocols, in AutoCAD DWG format and
- Supply a CAD Drawing Information Sheet – Appendix X1

6.1.1.2.2 At “As Constructed”

The Consultant shall supply the following “AS CONSTRUCTED” documents to the Principal's Representative:

- 1 set of “AS CONSTRUCTED” drawings in hard copy form (A1 size prints) and
- 1 set of electronic drawings in PDF format (A1 size prints) and
- 1 set of openable and legible electronic drawings, compliant with ECU CAD protocols, in AutoCAD DWG format and
- 1 set of other "AS CONSTRUCTED" documents such as Operation Manuals and Building Manuals in hard copy form (printed) and
- 1 set of other "AS CONSTRUCTED" documents such as Operation Manuals and Building Manuals in electronic form on CD-ROM.
- Supply a CAD Drawing Information Sheet – Appendix X1

6.1.1.2.3 Format of Documentation to be Provided

All drawings provided to the University shall comply with the standards referred to in this manual.

All drawings provided are to be in AutoCAD 2004 DWG format only.

All “AS CONSTRUCTED” drawings shall include an “As-constructed” stamp with company name in it.

All drawings shall be clearly labelled with current issue type, revision and date. For example: Tender Issue, As-constructed, etc.

All site and floor plans are to be provided as a single complete model saved in model space.

All title blocks to be inserted in paper space. Multiple paper space layouts of the complete model or parts thereof are allowed.

All site plans are to be provided at standard scales, eg 1:1000, where (1 unit = 1 metre) and match the spatial coordinates of the GDA94 geographical coordinate system contained in the site plan as supplied by the University.

All floor plans are to be provided at standard drawing scales, eg 1:100, where (1 unit = 1 mm).

Each floor plans shall be in a separate CAD file.

Each set of drawings shall include a cover sheet providing an index of all the drawings in the contract set. The index will list the drawing number and the title of each drawing.

Consultants shall provide the CAD Drawing Information Sheet, duly completed, as attached to the back of this manual.

6.1.3 Provision of Data to the Consultant by ECU

The Asset Delivery Office shall provide the following files for the use of the Consultant :

File	Description
A1sheet 2007.DWG	A1 size (841 x 594) floor plan base drawing sheet with title block
A1sheet 2007 – site plan.DWG	A1 size (841 x 594) site plan base drawing sheet with site information specific title block and services line types & legend
A1cover 2007.DWG	A1 size cover drawing with title block with standard text
ECU CAD Documentation Protocol 2007.DOC	A copy of the University CAD Documentation Procedures Manual in Microsoft Word format.

6.1.3.1 Template Drawings

The Consultant's own logos are to be inserted in the area provided at the base of the drawing sheet title block. The area may be adjusted to suit by moving up or down the University logo block.

These template drawings contain attributable title blocks. These title blocks are NOT to be exploded and are to be filled in or edited as blocks.

6.1.3.2 Compliance of Existing Drawings with the Standard

Not all drawings supplied by ECU will fully comply with the current standards of this protocol. It shall be the responsibility of the Consultant to convert these drawings, as necessary, for their own use, so as to comply with Clause 1.3. Provision of Data to the University.

6.2 Drafting Standards

6.2.1 Drawing Sheet Numbering

Drawing sheets shall be numbered as follows:

1. **Character 1** identifies type of **Discipline or Consultant**:
 - A** Architectural
 - C** Civil
 - E** Electrical
 - F** Fire detection and protection and/or Security
 - G** General
 - H** Hazardous materials
 - I** Interiors
 - L** Landscaping and Irrigation
 - M** Mechanical
 - P** Plumbing
 - S** Structural

2. **Characters 2 and 3 identify Drawing Sheet Number:**
Numbers from **01** through to **99**, identify drawing sheet number in each series.
3. **Character 4 identifies Revision stage:**
Characters from "**A**" through to "**Z**", identify revision stage of drawing sheet.

Examples of valid drawing sheet numbers:

A01	Architectural; drawing sheet number 01; no revision
E17 C	Electrical; drawing sheet number 17; revision C
M09 B	Mechanical; drawing sheet number 09; revision B

6.2.2 CAD Drawing File Naming Conventions

1. **Characters 1 to 4** as described in 6.1.2.1 Drawing Sheet Numbering
2. **Separator** (a dash separating Drawing Number from Drawing Description):
“_“
3. **General Drawing Contents Description:**

SITE	Site Plan and/or Site Details
FLOOR	Floor Plans
ROOF	Roof Plans
CEILING	Reflected Ceiling Plans
ELEV	Elevations
SECT	Cross sections
DETAIL	Details
LAYOUT	Room Layouts
WINDOW	Window Schedules
DOOR	Door Schedules
FINISH	Schedules of Finishes
FURNIT	Furniture Schedules and Details
MISC	Miscellaneous
	...etc. ...

Examples of valid CAD drawing file names:

A15-FLOOR.dwg	Architectural; drawing sheet 15; Floor plan
A09B-ELEV.dwg	Architectural; drawing sheet 9; Revision B; Elevations
E17-FLOOR.dwg	Electrical; drawing sheet 17; Floor plan
M06C-SECT.dwg	Mechanical; drawing sheet 6; Revision C; Sections

6.2.3 Australian Standards

Drawings shall meet the requirements of the relevant parts of the Australian Standard drafting codes for each relevant discipline.

6.2.4 Graphic Symbols

Graphic symbols shall be in accordance with the relevant Australian Standards Association publications.

6.2.5 Linework

All linework shall be as follows:

COLOUR No	COLOUR	PEN SIZE No (mm) & Colour
1	RED	0.18 Black
2	YELLOW	0.25 Black
3	GREEN	0.35 Black
4	CYAN	0.50 Black
5	BLUE (Construction lines)	0.25 Black
6	MAGENTA	0.70 Black
7	WHITE/BLACK	1.00 Black
8	GREY (Background / Hatching)	0.20 Grey

N.B. - Consultants shall supply the CTB plot style/s used for plotting the drawings.

6.2.6 Linetypes

Consultants shall use linetypes from the ACADISO.LIN file. Special linetypes are permitted. The drawing variable "measurement=1" shall be set to ensure ISO compliance.

6.2.7 Text

The preferred text shall be ISO font type - ISOCP2.shx

N.B. - All special fonts used in the production of detail feature survey drawings, special fonts used in the consultant's logo and any other fonts that are not normally supplied with AutoCAD are to be supplied with the drawings by the consultant.

6.2.8 Drawing Sheet Size

All drawings shall be produced on A1 size sheets.

No documents shall be produced on other sheet sizes without the prior written approval of the University Architect.

6.2.9 Paper Space

Paper space viewports are to be locked.

6.2.10 Entities Outside Drawing Borders

All unnecessary content & entities outside of drawing borders are to be erased.

6.2.11 Purging

All drawings are to be purged of all unused content, i.e.: layers, linetypes, blocks, text styles, etc.

6.2.12 Orientation

All plans and part plans are to be orientated such that North is towards the top of the sheet where possible.

6.2.13 External Referencing

All drawings must not include XREF's.

If XREFs are used, they are to be bound to the drawing using the INSERT option, such that they become standard blocks.

6.2.14 Master List of Suggested Layer Names

ARCHITECTURAL LAYERS

Layer name	Layer definition
A-GRID	Building planning grid or column grid
A-WAL	Walls
A-DOOR	Doors
A-GLAZ	Windows, glazed partitions
A-COLS	Columns
A-FLOOR	Floor information
A-CEIL	Ceiling information
A- LIGHT	Light fixtures
A-HVAC	HVAC diffusers
A-ELEV	Exterior building elevations
A-DETAIL	Details
A-EQUIP	Equipment
A-FURN	Furniture
A-ROOF	Roof
A-SECT	Sections

CIVIL LAYERS

Layer name	Layer definition
C-PROP	Property lines, survey benchmarks, text
C-TOPO	Proposed contour lines and elevations
C-BLDG	Building footprints
C-ROAD	Roadways
C-CARP	Car parking lots

ELECTRICAL LAYERS

Layer name	Layer definition
E-AUDIO	Audio (sound, PA, etc) system
E-AUDIO-VISUAL	Audio-visual system
E-COMM	Telephone & communications systems
E-LIGHT	Lighting
E-POWER	Power
E-CONTROL	Electric control systems
E-GROUND	Ground system
E-AUXL	Auxiliary systems
E-LTNG	Lightning protection system
E-FIRE	Fire alarm, fire extinguishers
E-DATA	Data outlets
E-TVAN	TV antenna system
E-CCTV	Closed-circuit TV
E-NURSE	Nurse call system
E-SECU	Security system
E-PAGE	Paging system
E-DICT	Central dictation system
E-BELL	Bell system
E-CLOCK	Clock system
E-ALARM	Miscellaneous alarm system
E-INTERCOM	Intercom system
E-LEGEND	Legend of symbols
E-1LINE	One-line diagrams
E-RISER	Riser diagram
E-SITE	Site electrical substations, poles

FIRE DETECTION AND PROTECTION AND/OR SECURITY LAYERS

Layer name	Layer definition
F-FIRE	Fire system
F-CO2S	CO2 system
F-HALON	Halon
F-IGAS	Inert gas
F-SPRINCL	Fire protection sprinkler system
F-STDP	Fire protection standpipe system
F-DETECT	Fire detection system
F-PROT	Fire protection system
F-SECU	Security system

GENERAL LAYERS

Layer name	Layer definition
G-PLAN	Floor plan - key plan
G-SITE	Site plan - key map
G-ACCESS	Access plan
G-EVAC	Evacuation plan
G-CODE	Code compliance plan

HAZARDOUS LAYERS

Layer name	Layer definition
H-PLAN	Floor plan
H-SITE	Site plan

INTERIOR LAYERS

Layer name	Layer definition
I-ELEV	Interior wall elevations
I-FURN	Furniture layout
I-DETAIL	Details

LANDSCAPING AND IRRIGATION LAYERS

Layer name	Layer definition
L-SITE	Site improvements
L- ACCESS	Access
L-PAVE	Paved areas
L-IRRIG	Irrigation system
L-PLANTS	Plant and landscape materials

MECHANICAL LAYERS

Layer name	Layer definition
M-BRINE	Brine systems
M-CHIMNEY	Prefabricated chimneys
M-AIR	Compressed air systems
M-CONTROL	Controls and instrumentation
M-DUST	Dust and fume collection system
M-ELHEAT-EQUIP	Electric heat equipment
M-ENERGY	Energy management system
M-EXHS	Exhaust systems
M-FUEL	Fuel systems
M-CHILLWATER	Chilled water systems
M-HOTW	Hot water heating system
M-HVAC	HVAC systems
M-MACH	Machine shop equipment
M-GAS	Gas systems

M-GAS-LAB	Laboratory gas systems
M-GAS-MED	Medical gas systems
M-GAS-NAT	Natural gas piping
M-PROC	Process systems
M-REFG	Refrigeration systems
M-SPECIAL	Special systems
M-STEAM	Steam systems

PLUMBING (HYDRAULIC) LAYERS

Layer name	Layer definition
P-EQUIP	Plumbing miscellaneous equipment
P-FIXT	Plumbing fixtures
P-STORM	Storm drainage system
P-SEWER	Sewer system
P-WASTE	Waste water system
P-WATER	Water system
P-GAS-NAT	Natural gas systems
P-GAS-LAB	Laboratory gas systems
P-GAS-MED	Medical gas systems
P-FIRE	Fire protection-systems

STRUCTURAL LAYERS

Layer name	Layer definition
S-GRID	Column grid
S-FOUND	Foundation
S-FOOT	Footings
S-SLAB	Reinforced concrete slabs
S-ANCHORBOLT	Anchor bolts
S-COLS	Columns
S-WALL	Structural bearing or shear walls
S-METAL	Miscellaneous metal
S-BEAM	Beams
S-JOISTS	Joists
S-DECK	Structural floor decks

GENERAL LAYERS

Layer name	Layer definition
*-ANNO	Annotations
*-ANNO-SYMB	Symbols
*-ANNO-TITLEBL	Border and title block
*-DIMS	Dimensions
*-ELEV	Elevations (external or internal) or 3D views
*-SECT	Cross sections
*-DETAIL	Details

The use of an asterisk (*) indicates a place holder for the discipline code and/or feature group.

COMMON FEATURE / SUB CATEGORY DESCRIPTIONS

Layer name	Layer definition
*-****-ELEV	Elevation
*-****-IDENT	Identification numbers, names or tags
*-****-PATT	Hatching
*-****-ANNO	Annotation

6.3 Layering Standards

6.3.1 General

All drawings must utilise a feature based layering system, which ensures that layer names are meaningful and logical and can be easily used and interpreted.

The use of feature based layer names ensures:

- That all drawing content is placed on the appropriate layer for the building systems, engineering service, etc... that is being drawn.
- Each drawing object is fully contained in one layer,

6.3.2 Layer Format

The CAD layer names are organised as a hierarchy based on 2 or 3 key elements:

Discipline , Feature & Sub Category

1. Discipline: Single character identifier ie Architectural, Electrical, etc...
(as detailed above in section 2.1)
2. Feature: Primary Feature, ie Building, service or drafting element
3. Sub Category: Provides a breakdown of the primary feature into logical groups

For example:

[A][-][W][A][L][L]

| |
Discipline, Feature

[A][-][W][A][L][L][-][M][A][S][O]

| | |
Discipline, Feature, Sub Category

The feature and sub category designations are abbreviated to four or more character. This arrangement accommodates expansion of layers and their further differentiation by the use of additional feature based names to the layer list.

6.3.3 Master List of Suggested Layer Names

The master list of layer names above is supplied as a guide and is recommended for use should the consultant not have an equivalent, compliant layering system. Additional layer names can be added as long as the naming remains clear.

CAD DRAWING CHECKLIST

PROJECT NAME: _____ DISCIPLINE _____

The ECU PROJECT No _____ The ECU JOB FILE No _____

Tick the box to indicate compliance with ECU requirements.

- Drawings produced on the ECU standard drawing sheets where relevant.
- Each “As constructed” drawing is clearly labelled as such in its title block.
- The ECU Project No and other relevant information is entered into the Title Block.
- All file names comply with the ECU drawing file naming convention.
- All disks have been scanned for virus infections.
- All drawings have been saved as AutoCAD 2004 and REVIT 2011.
- All drawings have been test plotted directly from the disks using AutoCAD 2004.
- The current layer in all drawings is set to 0.
- The current menu to all drawings is set to “Acad” or “None” .
- The drawings are saved in model space.
- The drawing units in model space set to 1 unit = 1 metre.
- The drawing limits set to the correct sheet size where relevant.
- All site plans and floor plans at 1:100 scale or smaller (1:200, 1:500, etc.) have their spatial coordinates set to match the GDA94 geographical grid system contained in the base site plan(s) supplied by ECU or, in case of all other drawings, the bottom left hand corner of each drawing is set to 0,0.
- Text styles, linetypes & hatchings and entity colours conform to the ECU CAD Documentation Procedures Manual.
- Any special fonts and standard fonts that are not normally available in typical AutoCAD installations are provided with the drawings.
- All entities are placed on their correct layer, using the ECU layering standard.
- All X-ref drawing files used in the production of drawings have been removed or inserted into the model drawings.
- All drawings have been purged of all unused layers, linetypes, blocks, text styles, etc, and all other extraneous and unnecessary information and entities have been erased.
- The Project Information sheet has been completed in collaboration with ECU.

CONSULTANT NAME: _____

CONSULTANT SIGNATURE: _____
(Authorised Person)

DATE: _____