

SECTION 4 EF: ELECTRONIC FILES

CAD DIVISION

Latest Update 7-14-11, See underlined text

PART II: PROJECT FILE MANAGEMENT AND ORGANIZATION

1. SCOPE:

- 1.1. This part outlines the requirements for the management and organization of the CAD Files for all UM projects

2. DIRECTORY STRUCTURE:

- 2.1. The electronic drawing files submitted to UM shall be organized so the files can be transferred to a "UM Folder" without any alterations, adjustments, re-organization, etc. The typical UM File path is defined as "Drive/Folder/Sub Folder/File" where the path "Drive/Folder/" are created by UM, and the path "/ Sub Folder/File" is created by the contractor who is responsible for the electronic file submissions to UM.

- a. **Example:** Contractor Created Path-"/Sub Folder (Contractor - Discipline) /File (Project File Name)" where "Discipline is the Contractor Type such as "Civil", Architect", etc. and the Project File Name is "Building #_C_100" as defined in this document.

3. DRAWING ASSEMBLY:

- 3.1. The base model file is externally referenced into the discipline specific model File at full size in Model Space. The discipline specific model file is externally referenced into the sheet file at full size in model space. Viewport(s) are drawn in paper space. The drawing content is scaled through the viewport(s) and plotted at 1:1.

4. FILE TYPES:

- 4.1. **CAD Deliverable Files:** UM requires two types of CAD deliverable files model and sheet files. UM will provide UM template files for the development of these files.
- 4.2. **Model Files:** Model files represent the building's physical layout and components such as floor plans and elevations. Model files are drawn full size in model space. Floor Plan Model Files represent one floor. Insert the UM template file on layer G-ANNO-TTLB at insertion point 0, 0, 0 in paper space on layout.
- 4.3. **Sheet Files:** Sheet files are used to assemble model files for plotting and viewing purposes. Every sheet file has a drawing area, title block, and border and represents one plotted drawing. Sheet files shall be assembled in paper

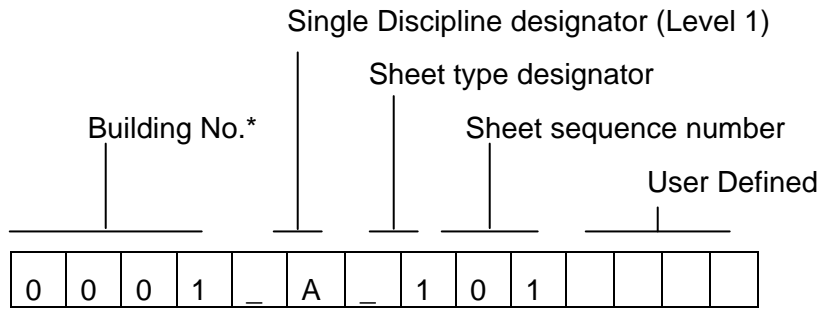
Discipline Designator (two character field with Second character as an underscore)		Model File Type (Apply to all disciplines) * Discipline Designator			
A	Architectural	*_FP	Floor Plan	*_EL	Elevation
B	Geotechnical	*_DP	Demolition Plan	*_SC	Section
C	Civil	*_SP	Site Plan	*_DT	Detail
D	Not Used	*_QP	Equipment Plan	*_SH	Schedules
E	Electrical	*_XP	Existing Plan	*_3D	Isolmperal / 3D
F	Fire Protection	Model File Type (Discipline Specific)			
G	Not Used	Civil		Fire Protection	
H	Fire Protection	C_EP	Environmental Plan	F_KP	Sprinkler System
I	Interiors	C_UP	Utility Plan	*_VP	Evacuation Plan
L	Landscape	C_GP	Grading Plan		
M	Mechanical	*C_RP	Road Plan		
O	Not Used	C_SV	Survey Plan		
P	Plumbing	Structural		Plumbing	
Q	Owner Furnished Equipment	S_FP	Framing Plan	P_PP	Plumbing Plan
R	Not Used	S_FP	Foundation Plan	P_RD	Riser Diagram
S	Structural	Architectural		Mechanical	
T	Telecommunications	A_EP	Enlarge Plan	M_CP	Control Plan

Discipline Designator (two character field with Second character as an underscore)		Model File Type (Apply to all disciplines) * Discipline Designator			
V	Survey /Mapping	A_CP	Ceiling Plan	M_HP	HVAC Ductwork
W	Not Used	A_RP	Furniture Plan	M_PP	Piping Plan
X	Other Disciplines	A_NP	Finish Plan		
Z	Contractor /Shop Drawing				

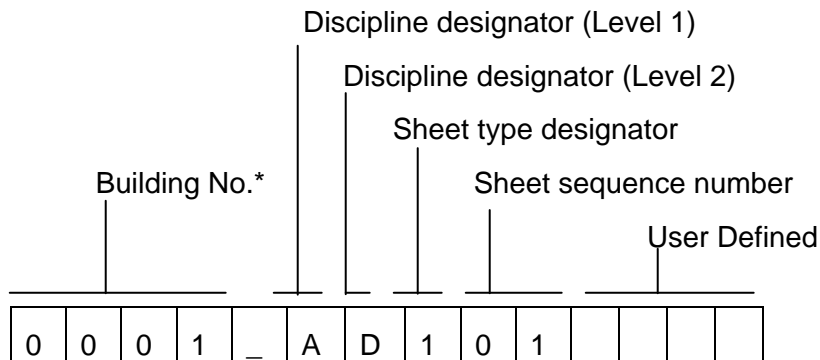
Discipline Designator (two character field with Second character as an underscore)		Model File Type (Apply to all disciplines)			
Floor Number		Interiors		Electrical	
01-99	First to 99 th Floor	I_EP	Enlarged Plans	E_LP	Lighting
B1	Basement	I_CP	Ceiling Plans	E_PP	Power
G1	Ground Floor	I_RP	Furniture Plans	E_GP	Grounding
K1	Parking	I_NP	Finish Plans	E_CP	Communication
M1	Mezzanine	CAFM (Assignment Plan Only)		Telecommunications	
P1	Penthouse			T_TP	Telecomm.
RX	Roof				
SB	Sub Basement				

5.3. Sheet Files: Sheet file names for new building projects consist of the building number followed by a discipline designator, either a single character with underscore (Level 1) or two character (Level 2); followed by the sheet type designator, followed by the sheet sequence number; usually a two-character field starting at 01 and continuing through 99. Use of a three-character user definable field is optional.

- a. **Single Discipline Designator:** 8 Minimum to 14 Maximum characters



- b. Multiple Discipline Designators:** 9 Minimum to 14 Maximum characters within the two-character discipline designator, the first character is the discipline character and the second is the modifier. The modifier is used to subdivide the information for a specific use or purpose, such as project complexity, or need for specialization in intricate fields. For example: 0001_AD101 would be the first architectural demolition plan in the set.



* For campus renovation projects substitute the project number here.

- c. Sheet File Designator's:** Sheet file designator's include a Level 1 designator and level 2 designator, description and content as indicated in the following chart:

Level 1	Level 2	Description of Suggested Name	Content
A		Architectural	Any or all portions of subjects in Level 2
A	S	Architectural Site	Building Footprint, Orientation, etc.
A	D	Architectural Demolition	Protection and Removal
A	E	Architectural Elements	General Architectural
A	I	Architectural Interiors	
A	F	Architectural Finishes	
A	G	Architectural Graphics	
A	*	Architectural – User Defined	
A	*	Architectural – User Defined	User Defined
A	*	Architectural – User Defined	User Defined
B		Geotechnical	Any or all portions of subjects in Level 2
B	*	Geotechnical	User Defined
B	*	Geotechnical	User Defined
C		Civil	Any or all portions of subjects in Level 2
C	D	Civil Demolition	Structural Removal and Site Cleaning
C	S	Civil Site	Plats, Dimension Control
C	G	Civil Grading	Excavation, Grading etc.
C	P	Civil Paving	Roads, Driveways, Parking Lots etc
C	I	Civil Improvements	Pavers, Retaining Walls, etc.
C	U	Civil Utilities	Water, Electrical, Sanitary, Storm etc
C	*	Civil	User Defined
C	*	Civil	User Defined

Level 1	Level 2	Description of Suggested Name	Content
E		Electrical	Any or all portions of subjects in Level 2
E	S	Electrical Site Plan	Utilities, Site Lighting etc.
E	D	Electrical Demolition	Structural Removal and Site Cleaning
E	P	Electrical Power	Receptacles, MCC, Panels etc
E	L	Electrical Lighting	Light Fixtures, Circuits, Panels etc.
E	T	Electrical Instrumentation	Telephone, Voice & Data etc.
E	Y	Electrical Auxiliary Systems	Alarms, CCTV, PA etc.
E	*	Electrical	User Defined
E	*	Electrical	User Defined
F		Fire Protection	Any or all portions of subjects in Level 2
F	A	Fire Detection and Alarm	Smoke and Fire Alarms
F	X	Fire Suppression	Sprinkler System and Equipment
F	*	Fire Protection	User Defined
F	*	Fire Protection	User Defined
H		Hazardous Materials	Any or all portions of subjects in Level 2
H	A	Asbestos	Abatement, Identification, Containment
H	C	Chemicals	Handling, Removal, Storage
H	L	Lead	Pipe or Paint Removal
H	P	PCB	Containment or Removal
H	R	Refrigerants	Ozone Depleting Refrigerants
H	*	Hazardous Materials	User Defined
H	*	Hazardous Materials	User Defined
Level	Level	Description of	Content

1	2	Suggested Name	
I		Interiors	Any or all portions of subjects in Level 2
I		Interior Demolition	Any or all portions of subjects in Level 2
I	S	Interior Design	Utilities, Site Lighting etc.
I	D	Interior Furnishings	Structural Removal and Site Cleaning
I	P	Interior Graphics, Murals, etc.	Receptacles, MCC, Panels etc
I	*	Interiors	User Defined
I	*	Interiors	User Defined
L		Landscape	Any or all portions of subjects in Level 2
L	D	Landscape Demolition	Removal / Protection, existing LC
L	I	Landscape Irrigation	Automatic Watering Systems
L	P	Landscape Planting	Trees, Flowers, etc.
L	*	Landscape	User Defined
L	*	Landscape	User Defined
M		Mechanical	Any or all portions of subjects in Level 2
M	S	Mechanical Site	HVAC Equipment, Piping etc.
M	D	Mechanical Demolition	Protection, Termination, Removal, etc.
M	H	Mechanical HVAC	Ductwork Air Devices, Equipment, etc.
M	P	Mechanical Piping	HVAC Piping Systems
M	C	Mechanical ATC Controls	Diagrams, Sequences of Operation, etc.
M	*	Mechanical	User Defined
M	*	Mechanical	User Defined

Level	Level	Description of	Content
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1	2	Suggested Name	
P		Plumbing	Any or all portions of subjects in Level 2
P		Plumbing Site	Extent of Piping Beyond Building
P		Plumbing Demolition	Protection, Termination, Removal, etc.
P		Plumbing Piping	Piping Plans, etc.
P		Plumbing Equipment Plans	Mechanical Equipment Rooms
P		Plumbing Diagrams	
P	*	Plumbing	User Defined
P	*	Plumbing	User Defined
Q		Owner Furnished Equipment	Any or all portions of subjects in Level 2
Q	E	Educational Equipment	Tack Boards, etc.
Q	L	Laboratory Equipment	Refrigerators, Freezers, etc
Q	P	Parking Equipment	Gates, Ticket and Card Readers, etc.
Q	S	Site Equipment	Bicycle Racks, Benches, etc.
Q	*	Q	User Defined
Q	*	Q	User Defined
S		Structural	Any or all portions of subjects in Level 2
S	S	Structural Demolition	Protection, Removal, etc.
S	D	Structural Site	
S	P	Structural Substructure	Foundations, Retaining Walls, etc.
S	L	Structural Framing	Floors, Roof, etc.
S	*	Structural	User Defined
S	*	Structural	User Defined

Level 1	Level 2	Description of Suggested Name	Content
T		Telecommunications	Any or all portions of subjects in Level 2
T	A	Audio Visual	Smoke and Fire Alarms
T	C	Clock and Program	Sprinkler System and Equipment
T	I	Intercom	User Defined
T	M	Monitoring	User Defined
T	N	Data Networks	Any or all portions of subjects in Level 2
T	T	Telephone	Drawing Index, Code Summary etc.
T	S	Security	Project Phasing, Erosion Control etc.
T	*	Telecommunications	User Defined
T	*	Telecommunications	User Defined
X		Other Disciplines	Any or all portions of subjects in Level 2
X	*		User Defined
X	*		User Defined
Z		Contractor Shop Drawings	Any or all portions of subjects in Level 2
Z	*		User Defined
Z	*		User Defined

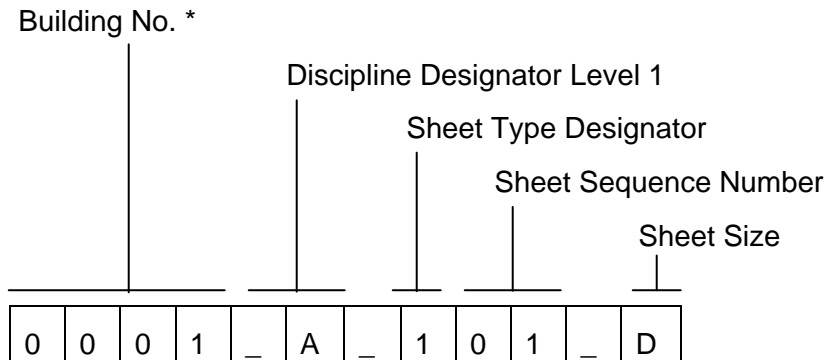
- d. **Field Sheet Designators:** Sheet Field Designators are a one number as defined in the following chart:

Field – Sheet Designator	Description
0	General (Symbols, Legends, Notes, etc.)
1	Plans (Horizontal Views)
2	Elevations (Vertical Views)
3	Sections (Cross Sectional Views)
4	Large Scale (Plans, Elevations, Sections that are not details, etc.)
5	Details
6	Schedules and Diagrams
7	User Defined
8	User Defined
9	3D Views (Isometric, Perspectives, Photographs, etc.)

5.4. Layout Tab Names: In Autodesk Architectural Desktop CAD Files include a model tab and a layout tab. These tabs shall be organized for new projects and renovation projects as follows:

- a. **Model File Tab:** The model files tab shall contain all drawing elements without view ports. Additional layout tabs shall be used for viewing and working on the building model and named appropriate for the view.
- b. **Layout Tab and Name:** With in each electronic file it is UM's objective to have one sheet file name for each project. When a new project is initiated rename the layout tab as the sheet file name for the new project. When an existing electronic file is used for a renovation project; create a new tab and name that tab as the sheet file name for the renovation project. Layout tabs may be used in sheet files for plotting different sizes of the same drawing within the same sheet file.

(1) Each layout tab will be named with the sheet name as described in section 2.2.3 with the user definable field being the sheet size.



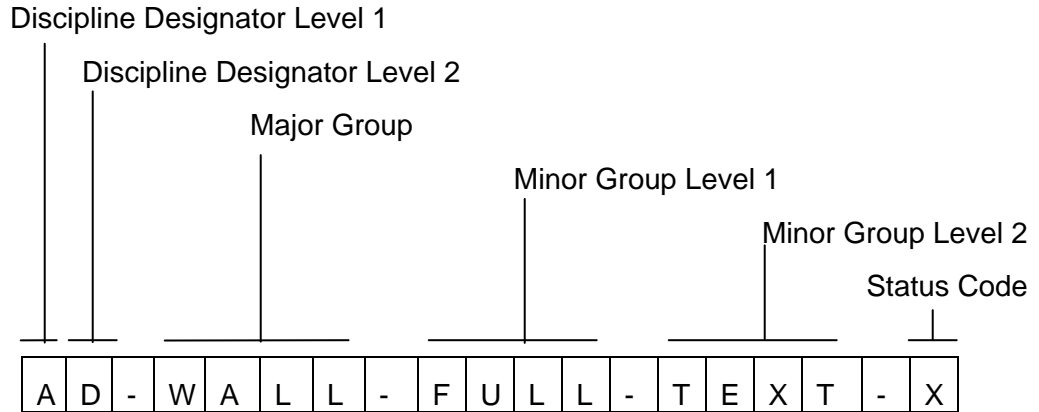
* For campus renovation projects substitute the project number here.

6. DRAWING FILES:

6.1. Layer Names: UM has adopted AIA layer naming conventions. The AIA CAD Layer Guidelines, U.S. National CAD Standard Version 3.1, or latest edition, contains the AIA master layer list that contractors must follow. UM has developed electronic templates with the most common layers for each discipline. The templates are available at, [http:](http://) or [ftp:](ftp://) Architectural and Engineering Standards.

- a. Layer names consist of four defined field groups: discipline designator, major group, two minor groups, and status. The discipline designator and major group are mandatory. The minor groups and status fields are optional. Each field is separated from adjacent fields by a dash (“-”) for clarity.
- b. A one or two character discipline designator followed by a four-character major group designator indicating the building system. Two four-character minor group designators may be added to further define the major group. Lastly an optional one-character status designator can be used. For example, AD-WALL-FULL-TEXT-X would be the layer for full – height, architectural, demo wall text, not in contract. Refer to sheet file designators for level one and level 2 discipline designators.

(1) Layer Name: 19 Characters Maximum



(2) The AIA master layer list allows different layer names for the same information such as A-COLS, I-COLS, and S-COLS. UM does not allow the use of duplicate names preferring that the information be placed on the layer of the discipline responsible for the information. For example, columns should always be placed on the structural layer (S-COLS), lighting should always be placed on the electrical layer (E-LITE), and plumbing fixtures should always be placed on the plumbing layer (P-FIXT). Additional layers may be may be required for specified projects

6.2. **Layer Status Field Code:** Layer status field code, included in the layer name, is a single "Letter" entry as indicated in the chart below:

Layer Status Field Code	
Code	Description
D	Demolition
E	Existing to Remain
F	Future Work
M	Items to be Moved
N	New Work
T	Temporary Work
X	Not In Contract
1 - 9	Phases of Work

6.3. **Layer Key Styles:**

- a. Autodesk Architectural Desktop provides additional layer tools which add layer standards, layer keying, and a layer management interface, the layer manager, to help you standardize, automate, and manage the use of layers in your office, in your projects, and in your drawings.
- b. Each layer key style contains a set of layer keys. You can create different sets of layer keys that you can use to place objects on defined layers in your drawings. The UM-AIA (256 color) layer key styles contain layer keys and layer properties, including layer name, description, color, linetype, line weight, plot style, and plot settings for all of the AEC objects. You can copy an existing layer key style and purge unused layer key styles. You can purge only those layer key styles not currently in use. Layer key styles can be imported to and exported from existing drawings and new drawings. You can import the UM-AIA (256 color) layer key styles from file UM_KeyLayer.dwg that is available for download at UM_KeyLayer.dwg. For more information about Layer Key Styles refer to Architectural Desktop Help file.

6.4. Additional Drawing Requirements: The following additional drawing requirements are to be included in each project file:

- a. **Attributes:** Attributes may be used to store data in the drawing. Do not use attributes to store large amounts of data (greater than 10% of drawing size) or types of data that are better stored in external databases. UM requires the use of an attributed title block and a model file attributed block to store descriptive data about the drawings; see title blocks.
- b. **Blocks:** Any graphic entity that occurs repeatedly in drawings should be made into a block. Attributes contained within a block should pertain to the current project. Insertion points for each block shall be consistent with its placement in the drawing. Use logical insertion points such as the center of a circle, bottom left corner of an object, etc. Keep names simple and descriptive. Purge all unused blocks from the drawing. Nested blocks are permitted but should be avoided whenever possible. If nested blocks are used, they must be documented on the project and drawing documentation form (see Section 3 Deliverable Requirements). Draw objects used to create blocks on layer **zero (0)** so the block inherits the properties of the layer on which it is inserted. Do not insert blocks on layer **zero (0)**. When drawing files are submitted no objects shall be placed on layer 0 unless otherwise specified.
- c. **Dimensioning:** All dimensions shall update automatically when the distance they are measuring changes (associative dimensioning).
- d. **Drawing Limits:** Do not set the limits any larger than necessary to accommodate the drawing. No entities shall be located outside the drawing limits.
- e. **Drawing Origin:** Organize drawings in model space so that the lower left intersection of the outermost column lines that remain constant on most floors is placed at 0,0,0. In order to ensure proper insertion of xrefs and

the stacking of floor plans, the origin point for an entire building must be consistent between model files. Once the origin is established, it cannot be changed. For sheet files, place the lower left corner of the sheet at 0,0,0.

- f. **Graphic Standards:** Drawing standards and symbols shall be in accordance with the AIA Architectural Graphic Standards. The U.S. National CAD Standard is also a good reference for drawing symbols, details, and guidelines.
- g. **Hatching:** Do not use polylines with increased width for poché or hatching. All hatching shall be associative.
- h. **Key Plan:** G-SITE is the layer on which the key site plan should be drawn.
- i. **Layers:** UM has adopted most of the layer name and use rules recommended by the CAD layer guidelines published in 1997 by the American Institute of Architects (AIA). AIA recommendations which have been adopted by UM are included in this section. Where noted, UM has supplemented the AIA guidelines with its own rules and standards, as necessary. A copy of the AIA guideline may be obtained by calling the AIA/Rizzoli bookstore toll-free at 1-888-272-4115 and asking for item #R809-97 (CAD Layer Guidelines, **Latest** Edition).
 - (1) Use the UM Autodesk architectural desktop layer.
- j. **Layer Colors:** All entities shall be assigned color by layer.
- k. **Line Types:** Contour lines, dashed lines, and other fonted lines shall be made of one continuous line segment, not a series of separate line segments. If line types other than standard Autodesk® Architectural Desktop line types are used the *.LIN file must be provided with the **submission. Use** of toned or poché lines are acceptable for distinguishing between various types of work, such as new from existing, phase 1 from phase 2, or background floor plans. Curved entities such as circles, arcs, and ellipses shall be created of one continuous line segment, the exception being entities that have to be physically constructed in a segmented fashion. These may be segmented to represent the joints in the actual construction.
- l. **Scale:** Create drawing entities at full size. For example, a 30' wall will be drawn to 30' and a 1' column will be drawn to 1'. Drawings considered schematic in nature can be drawn to any scale. Some examples of schematic drawings are schedules, riser diagrams, schematic diagrams, and single line diagrams.
- m. **Plan Drawings:** Create a separate sheet file for each drawing. Use sheet files to combine floor plans with non-plan information or multiple elevations. Do not combine several drawings such as elevations, sections, and details in one model file. When a floor plan is too large to fit on a single sheet at the desired scale; use viewports in separate sheet

files to show portions of the floor. Do not create individual model files for portions of a floor.

- n. **Title Blocks:** UM requires the use of a standardized, attributed title block for each sheet file. UM also requires a standardized, attributed block in all model files.
- o. **Text and Fonts:** Use only standard Autodesk Architectural Desktop or approved True Type fonts.
 - (1) Text used for drawing notation shall be a minimum of 1/8 inch high.
 - (2) Text used as “Titles” shall be a minimum of 1/4 inch high.
 - (3) For clarity and presentation purposes it may be necessary to use other text sizes.
- p. **Units:** Imperial units shall be the standard system of measurement for new facilities unless otherwise specified.
- q. **Xrefs:** Autodesk Architectural Desktop term for external reference. Xrefs help to organize drawing information, enhance coordination, and minimize redundant data. The xref path shall not include drives or directory designations and the xref is placed on layer G-ANNO-REFR and locked. Document the relationship between drawing file and xref on the project documentation report and deliverables matrix.
- r. **Project Area Information:** As part of the project electronic files, the A/E shall outline the project areas as follows:
 - (1) **Gross Square Footage:** On layer A-Area-Space-GSF outline the perimeter of the project area with a continuous poly line to identify the project gross square footage.
 - (2) **Individual Square Footage:** On layer A-Area outline each space in the project area with a continuous poly line to identify the square footage of each space. The individual spaces shall include all occupied spaces, storage areas, toilet rooms, stairwells, elevator shafts, janitor closets, mechanical and electrical rooms and shafts, corridors, and lobby's.

END OF SECTION 4 CAD - PART II