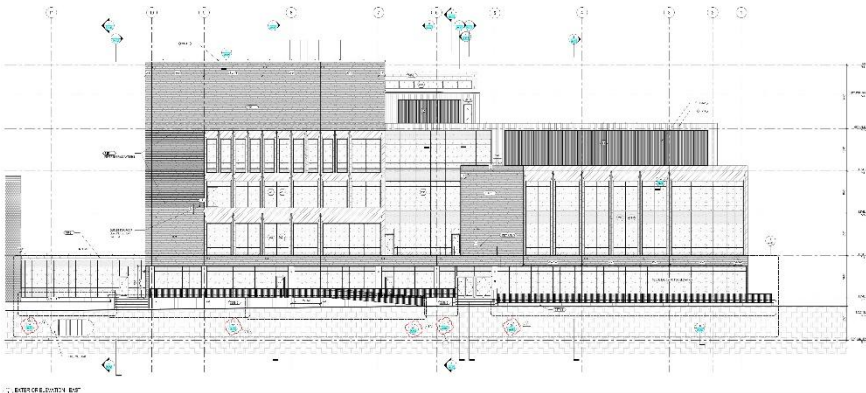


CWRU

AutoCAD™ and REVIT™ Documentation Standards and Procedures



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1.1. Overview

These standards are issued to aid in the development of AutoCAD™ drawings suitable for use at Case Western Reserve University (CWRU). By maintaining consistency and compatibility with existing documents, electronic drawings produced and submitted in accordance with these standards have a significantly greater value to the University, as well as other architects, engineers, consultants and contractors working with CWRU. CAD layering standards are essential for the seamless sharing of visual data throughout the CAD industry.

1.2. Drawing Format

AutoCAD™ and REVIT™ versions through 2024 are the only acceptable file formats for drawing submission to CWRU. REVIT™ file submissions shall conform to LOD (Level of Development) 350. Other formats are not acceptable without prior consent from the Planning, and Design department at Case Western Reserve University. Data Interchange Files (.DXF files) will not be accepted as an alternative. If project drawings are created using a computer aided drafting and design program other than AutoCAD™, the consultant shall be responsible for any conversion procedures necessary to generate acceptable AutoCAD™ files for submission to CWRU. The consultant shall also be responsible for maintaining accuracy and inclusion of all items within the drawings during the translation process. (See Section 1.3 – Drawing Composition for specific details.)

*Note: Renaming the file extension from the original format (i.e. .DXF, .PDF etc.) to an AutoCAD™ format (.DWG) will not convert the drawing.

1.3. Drawing Composition

AutoCAD™ files should not contain more than one drawing sheet per file (.dwg); either by multiple drawings in model space or spread out across several layouts. While this may facilitate the production of construction documents, it can impede the archival process, and create content discrepancies.

- ❖ AutoCAD™ files containing multiple drawing sheets shall be broken down into single sheets prior to delivery to CWRU.
- ❖ AutoCAD™ files delivered to CWRU shall contain only one drawing and one title block per file. However, multiple Paperspace tabs are acceptable per drawing file.
- ❖ Individual electronic drawings shall be named with the sheet number followed by the sheet title (i.e., A1.1 – Architectural – First Floor Plan).

All AutoCAD™ and REVIT™ files shall be purged of empty, unused, or non-essential drawing data prior to submittal to CWRU. This includes the removal of all unused layers, linetypes, blocks, nested blocks, fonts, dimension styles, and other entities. Unused objects and entities contained in the drawing must directly apply to the specific purpose of the drawing with the exception of the title block.

- ❖ AutoCAD™ or exported REVIT™ to AutoCAD™ files submitted to CWRU shall not contain any frozen layers. Unused entities on frozen layers should be erased, the empty layers purged, and all layers thawed.
- ❖ AutoCAD™ or exported REVIT™ to AutoCAD™ files shall not contain multiple overlaid lines or lines with multiple segments unless the overlaid lines or adjacent line segments are assigned to different layers. Multiple overlaid lines or blocks can be removed from the drawing by using the "OVERKILL" command.
- ❖ Survey data shall be included in the AutoCAD™ files and placed on the appropriate layers. (See Section 1.5)
- ❖ Survey data collected and used for project design shall be submitted as text files (e.g. ASCII files).

1.4. Title Block Requirements

Title Blocks created in AutoCAD™ are to be drawn in paper space with the lower left hand corner point inserted at a Cartesian coordinate location of (0,0,0). All title blocks within AutoCAD™ files submitted to CWRU should contain the following information:

- ❖ Original Issue Date – this date should not change once the drawing has been issued and should remain the same on every drawing throughout the drawing set.
- ❖ Sheet Number – a unique identifier which refers to the discipline and number of the drawing in the set. Do not assign numbers longer than 5 letters/digits.
- ❖ Title – description of drawing and location information. Location information should include building, floor and room numbers as applicable.
- ❖ Revision history – as applicable.
- ❖ Drawing Phase – drawings submitted as as-builts should be clearly marked as such.
- ❖ CWRU CIP# – if no CIP# is identified by the CWRU project manager, the architect may assign their own job/project number.
- ❖ Architect, Engineer or Consultant – the individual responsible for producing the drawings should be clearly identified.
- ❖ Drawing Scale(s) – representing the intended plot scale of the drawing with the title block. Sheets containing more than one scale should state "as noted" in the space on the title block where the scale is usually located, and each scale should be included as it applies to each drawing, section or detail.
- ❖ North Arrow – as applicable.
- ❖ Contractor – as-builts should clearly indicate the General Contractor/Construction Manager.

1.5. Layering Standards

The implementation of layering standards is to promote consistency between CAD drawings, and to maximize the reusability of the drawing data. The effective use of CAD layering standards also facilitates the grouping of shared graphical information for display, editing and plotting purposes. Case Western Reserve University's layering standards are based upon the United States National CAD Standard® - Version 4.0 that includes the American Institute of Architects (AIA) AIA CAD Layer Guidelines, 3rd Edition. For more detailed layering information and helpful background material visit their web site at <http://www.nationalcadstandard.org/ncs5/>.

AIA Layering Format

As recommended by the AIA CAD Layer Guidelines, layer names may be as short as six characters (discipline code + major group) or as long as sixteen characters (discipline code + major group + minor group + status). The following are the four examples of acceptable formula variations, with explanations of the formula variables.

- # 1 A-WALL = discipline code + major group
- # 2 A-WALL-FULL = discipline code + major group + minor group
- # 3 A-WALL-DEMO = discipline code + major group + status code
- # 4 A-WALL-FULL-DEMO = discipline code + major group + minor group + status

These layering standards should always be followed:

- ❖ Use only AIA recommended layer names. Use the CWRU_ACAD_TEMPLATE.dwg as a recommended format for all submitted drawing files. This file contains all of the standard layers currently used by CWRU
- ❖ Use the minimum number of layers necessary to adequately separate entities in each drawing. The number of layers contained in each drawing will vary depending on the scope and complexity; however drawings should not contain extraneous, redundant or overly detailed layer names.
- ❖ Purge each drawing of unused and/or unnecessary layers prior to submittal to CWRU. The drawing file should contain only those layers necessary for displaying and plotting the information and drawing entities contained within each drawing.

The effective use of CAD layering standards will:

- ❖ Allow users to isolate systems and drawing elements by controlling the visibility of objects – improving system performance and eliminating visual clutter.
- ❖ Facilitate the sharing of information between drawings and disciplines.
- ❖ Allow users to control display and printing characteristics such as color, line type, line weight, etc.

*Note: A single layer shall be created in each drawing and shall be named "A-AREA. This layer will contain only polylines that outline each room in the drawing. The polylines for each room will overlay the interior edge of the wall of the room and will be a closed polyline. This layer is only required for Record or Conformed AutoCAD™ drawing submittals.

1.6. Lines, Objects and Entity Properties

To ensure the integrity of the original drawing when viewing or printing, it is essential that AutoCAD™ entities are created using these standards.

- ❖ Entity colors shall be defined by layer, not entity.
- ❖ Blocks shall be defined/created on layer 0 (zero).
- ❖ All attributes shall be defined on layer 0 (zero).
- ❖ All lines, objects, blocks and entities must be drawn where the Z-axis is 0 (zero), meaning there is no elevation to the elements in the drawing and the drawing is truly 2-dimensional.

1.7. Model and Paper Space Usage

The following guidelines are suggested for the effective use of model and paper space.

- ❖ Place title blocks, schedules and general notes at full-scale (1:1) in paper space.
- ❖ Do not place or draw model-related blocks, tags and objects in paper space.
- ❖ Draw all model space objects at full-scale.
- ❖ Scale objects using paper space viewports – zoom viewports to the appropriate scale.

1.8. External References – XREF's

External references (XREF's) are described as a reference to another, external file — one outside the current drawing — that is inserted into your drawing as a block and may be manipulated according to the type of referenced file. Objects brought into the drawing as an outside source may include but are not limited to: AutoCAD™ drawings (.dwg), images (.jpeg, .gif, .png, .bmp, etc.) or other files (.pdf, .dwf, .dgn, etc.). XREF's contained within AutoCAD™ drawings may be helpful, but when the drawing and/or XREF locations are moved around discrepancies are likely to occur within the drawing set. The following guidelines will ensure the integrity of the drawing set and minimize potential problems.

- ❖ AutoCAD™ drawings should not contain any XREF's prior to submittal.
- ❖ External references (excluding drawings, .DWG) should be inserted into the drawing as a block prior to submittal.
- ❖ Externally referenced blocks should be exploded and the resulting objects placed on the appropriate layer.
- ❖ All drawings containing other drawings as an XREF should bind the external referenced drawing into the main drawing. This should be done using the "Insert" bind type.
- ❖ All layers contained in XREF's inserted as blocks shall conform to the standards outlined in this document.
- ❖ File translation from non-AutoCAD™ systems resulting in wall blocks within AutoCAD™ are unacceptable.

1.9. AutoCAD™ Drawing Support Files

Drawings created using non-standard AutoCAD™ fonts, linetypes and hatch patterns can result in content discrepancies in the delivered drawing set. The following guidelines will ensure the integrity of the drawing set, and minimize potential problems:

- ❖ Only native AutoCAD™ fonts, linetypes and hatch patterns or the approved CAD symbolism provided by the AIA CAD Standards is acceptable.
- ❖ Custom fonts, linetypes and hatch patterns including those provided by 3rd party software, are not acceptable.
- ❖ Postscript fonts should not be used.

1.10. File Transmittal

The content of electronic drawings provided by the architect/engineer should match the delivered original hard copy set as closely as possible, if not exactly.

- ❖ To ensure drawings adhere to the guidelines presented in this document, the CAD Quality Assurance Checklist (see section 1.13) should be completed and submitted with all AutoCAD™ and REVIT™ drawings submitted to Case Western Reserve University.
- ❖ All physical objects shown in plan, elevation, or detail sections shall be drawn in actual size and then scaled appropriately for plotting. To avoid scaling problems or drawing distortions nominal sizes should not be used.
- ❖ Forms can be found on our web site:
case.edu/administration/cpfm/pdc/forms/CWRU%20Drawing%20Request%20Form.pdf or by request.
- ❖ A full-scale, hard copy set of drawings should be included with all file transmittals.
- ❖ Include all AutoCAD™ .PC2, .PCP or .CTB plot configurations used to make the final prints to ensure CWRU's ability to make exact printed re-creations of drawings from the project.

Include all field survey data as indicated in Section 1.3

1.11. Record Drawing Requirements

Architects/engineers shall submit final, approved Record or Conformed documents to CWRU electronically in addition to hardcopy format in accordance with the contract. The electronic files should contain the Record or Conformed information and .PDF, .DWG, and .RVT formats of the CAD drawings in accordance with the CAD standards outlined herein. All record drawings, including civil and site drawings, are required to have a signed and dated professional seal.

Third-party drafting companies used to create consultant's drawings are not required to submit an electronic format; however hardcopy documents must be submitted with the final as-built set.

Refer to Section 1.10 for specific transmittal requirements

1.12. Error-Free AutoCAD™ Drawing Deliveries

Case Western Reserve University recognizes that many of its vendors do not use the same CAD systems as the University. However, the University expects the vendors who work with non-AutoCAD™ file formats to submit .DWG formatted CAD files upon project closeout that are fully compliant with all of the standards outlined herein, and which have no significant loss of drawing entities or project data that can result from standard CAD file translation procedures.

All .DWG files and CAD drawing entities submitted at the end of a project should be capable of manipulation through standard AutoCAD™ drafting procedures. Non-compliance with this policy may result in CWRU's non-acceptance of CAD files in addition to delayed final project payment, with no additional cost to CWRU for non-compliance. .DXF files will not be accepted at project closeout as substitution for .DWG CAD files.

1.13. CAD Quality Assurance Checklist

AutoCAD™ drawings delivered to CWRU upon project closeout must be accompanied by submission of the CAD Quality Assurance Checklist. A signed checklist indicates to CWRU that the standards and guidelines were read, understood and complied with.

FILE FORMAT AND SETUP

- ☐ Electronic File Format
- ☐ Scale, Units, & Tolerances
- ☐ Fonts and Text Styles
- ☐ Blocks
- ☐ Title Blocks
- ☐ Policy on Model Space and Paper Space
- ☐ Policy on External Reference Files (XREFs)

LAYERING

- ☐ Standard Layer List
- ☐ Layer Name Formatting
- ☐ General Rules about Naming and Uses
- ☐ Layer Attributes (Colors, Pens, Linetypes)

CAD, PDF & RVT FILE NAME CONVENTIONS

- ☐ Building and Floor Identification Codes
- ☐ Discipline Identification Codes
- ☐ Drawing Type Codes
- ☐ Drawing Numbers

POLICY ON CAD FILE TRANSLATION

- ☐ Full AutoCAD™ Compliance
- ☐ Translation Testing Procedures (if applicable)

POLICY ON PDF FILE TRANSLATION

- ☐ Scan at 600 dpi
- ☐ Files must be uncompressed

FINAL SUBMISSION

- ☐ Completed CWRU Blueprint Submittal Form is attached to drawings

Signature, Vendor Representative _____

Phone Number _____ Date _____

Signature, CWRU Representative _____