

**Public Works Division
Indiana Department of Administration
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CAD DRAWING STANDARDS
Effective: July 1st, 2001

Revised 04/08

IDOA / Public Works Division Cad Drawing Standards

INTRODUCTION

All references to the term “Public Works” shall be interpreted to include and mean the Public Works Division of the Indiana Department of Administration, State of Indiana.

These Cad Drawing Standards shall be utilized in full compliance by every entity (whether individual, partnership, corporate or otherwise) that performs drawing work for any Public Works project originating on or after July 1st, 2001.

The latest version of these Cad Drawing Standards is always available online at the following Internet address: www.in.gov/idoa/pwd

This main document describes the information required for the successful completion of formatting procedures and timely submittal of cad drawing files done for all Public Works construction projects.

Some of the information contained with this package is intended towards various AutoCAD® version-specific instruction, and may or may not be directly applicable in any later releases of AutoCAD® softwares.

For all questions or any clarifications regarding the Cad Drawing Standards described herein, please contact:

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IDOA / Public Works Division Cad Drawing Standards

1. OVERVIEW

The standards defined in this manual are to be utilized in the production and archival of all sets of construction documents created for Public Works. These standards are to provide a consistent foundation for the continued development of Public Works' Computer Aided Facilities Management System. It is the prime objective of these standards to provide a convenient method of data acquisition and management of all graphical and non-graphical objects used in the generation of a set of construction drawings. This may be most readily achieved by implementing consistent and uniform qualities in such things as drawing titleblocks, sheet/file naming, and layer naming.

The key points to be presented in these Cad Drawing Standards include:

- **Project directory structure**

Firms may do their project work out of any directory structure they choose. Each drawing sheet shall be submitted as a stand alone electronic file, and therefore all reference files (xrefs) must be "bound" (or binding xreferences) into the stand alone sheet prior to submittal(s).

- **AIA (2nd Edition) layering**

Whether your firm is already using the AIA2 layering system in-house (as many are), the original AIA system, the SMACNA system, another standard, or you have an internal layering system in place, Public Works shall receive all drawing files with their layers named according to the AIA, 2nd Edition, Cad Layer Guidelines. If not currently using the AIA2 system, the suggested remedy is to develop a transposition, or "mapping", routine to rename the layers in the drawing files, prior to submittal to Public Works. You may, of course, wish to keep your original files intact, make copies for this process, and then submit those corrected copies to Public Works.

- **File naming & Sheet naming**

In order to simplify electronic access of desired drawings by Public Works personnel, standardized sheet numbering shall be used on each construction drawing, and the filename for that sheet shall be the same as that sheet number. An example would be that of an Architectural floor plan sheet, named "A101", for which "A101.dwg" would then be the cad filename. Do not add any prefix or suffix to either name.

- **Submittals of files**

Standalone electronic copies of each construction drawing sheet in AutoCAD® (.DWG) format shall be submitted to Public Works upon completion of a project. Project submittals shall be done preferably via email, instead of by CD(s), whenever possible and feasible. Details of the procedures are at the very end of this document.

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2. SOFTWARE TOOLS

In order to provide for the greatest flexibility, and yet retain the standards that are critical to providing consistent design and drafting, the usage of other software applications developed by Autodesk®, such as Architectural Desktop™ and Land Development Desktop®, are encouraged as possible additions to basic AutoCAD®, for assisting the designer/technician in the creation of project drawings. It is recognized that although some vendors currently utilize other leading 3rd-party add-on applications to AutoCAD®, and a few are using different cad softwares, it should be noted that as AutoCAD® continues to evolve and dominate the building industry cad software market, the various applications used within the previous software packages known as Softdesk®, and now used within the Architectural Desktop™ and Land Development Desktop® packages, will be increasingly integrated as part of all AutoCAD® packages, and thereby defaulting towards an inevitable cad software standard for all building design and construction.

Public Works' standard cad software is currently AutoCAD® 2009/2009 LT. Almost every firm doing project work for Public Works has also standardized on some version, or "flavor", of AutoCAD®. While your firm may use a different cad platform, all project cad files shall be submitted in clean and usable AutoCAD® (.DWG) format, and in authentic representation of the original drawing hardcopy. Any conversion problems into AutoCAD® (.DWG) format are the responsibility of the project firm(s), including any cad drawing files generated or modified by any subcontractors or other third-party firms.

Various applications frequently utilize three-dimensional drawing principles, and as such, three-dimensional files may then also be generated, and used for projects. However, these files must be created with care, so that two-dimensional editing may be done later, as needed, without involving any inordinate difficulties by the next user.

Note: The project drawing files may be submitted in any version of AutoCAD® drawing (.DWG) format, since AutoCAD® drawing (.DWG) files are generally upward-compatible in all respects. The AutoCAD® 2000i and 2002 (.DWG) formats are directly compatible with the version 2000 format, since internally they are all the same version (2000) format. Only the softwares have been enhanced within 2000i and 2002.

3. FILE DESCRIPTIONS

Construction projects

A "base" drawing file (entire floor of a building) contains the exterior building shell walls, windows and the building core, such as elevators, stairs, rest rooms and common corridors, as well as interior walls and doors. It is a pure model file, often referred to as a "background" in construction drawing sheets.

It is strongly recommended that the "sheet" drawing files for building Mechanical, Plumbing, Electrical, Structural, and etc., have the "base" drawing file referenced in during the course of the project, in case of ongoing changes.

Once a project is completed, all "sheet" files are to have ALL references bound in, for archival of the Construction Document drawing files. All references and "sheet" files are to be submitted to Public Works, commensurate with the closeout of a particular construction project.

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Note: A small “key plan” of the entire building floor, and with the project limits hatched, shall be included on each “plan” type drawing, when working in a project area that is less than an entire floor.

If a project is smaller (typically one individual is working on the cad files for that project), the “base” drawing file *may* be used to contain the various construction drawing sheets in paper space or layouts within that same file, rather than referencing into separate “sheet” files, *during* the ongoing project revisions. However, once the project is completed, the submittal to Public Works must be broken apart (i.e., “Copy” or “Saveas”) into the separately-named “sheet” files (ex: A201.dwg and E201.dwg), and all other sheet arrangements. Again, you may wish to leave your original files intact, and process copies for submittal to Public Works.

Reminder: All “sheet” files are to have all references bound in, prior to submittal.

4. CONSTRUCTION SHEET NUMBERING AND FILE NAMING CONVENTIONS

Each construction sheet number shall be the same as the (.DWG) file name. Discipline sets of drawings shall be numbered sequentially within a series type. For example, an Architectural floorplan sheet “A101” (the first in a series of submitted *plan* sheets from the Architect) would be contained in a drawing file named “A101.dwg”. The following two lists (based upon the National Cad Standard – <http://www.nationalcadstandard.org>) shall be combined and used for the sequential naming of all construction sheets/filenames:

- A Architectural / Interiors (optional, see “I”)
 - C Civil / Site – environmental, grading, roads, topo, survey, utilities, etc.
 - D_ Demolition – all disciplines: *combine the letter “D” with the discipline code*
Examples: DA### for an Architectural demolition sheet/file
DFP### for a Fire Protection demolition sheet/file
 - E Electrical – pwr, light, comm, grnd, alarms/paging, security, a/v, etc.
 - F Foundation (optional, see “S”)
 - FP Fire Protection
 - H Hazardous Materials, Safety Zoning, Evacuation Plans, Life Safety, etc.
 - I Interiors (optional, see “A”)
 - L Landscaping
 - M Mechanical – HVAC, piping, temperature controls (optional, see “T”)
 - P Plumbing
 - Q Equipment drawings
 - R Resource drawings
 - S Structural / Foundation (optional, see “F”)
 - T Temperature controls (optional, see “M”)
 - Z Shop drawings
-
- 000 Series General – cover, index, symbols, legends, general notes, vicinity
 - 100 Series Plans (horizontal views)
 - 200 Series Elevations (vertical views)
 - 300 Series Sections (sectional views)
 - 400 Series Large Scale Views (plans, elevations, sections)
 - 500 Series Details
 - 600 Series Schedules and Diagrams
 - 700 Series user defined
 - 800 Series user defined
 - 900 Series 3D Representations (isometrics, perspectives, photographs)

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Combining sheets - small projects may incorporate more than one image per sheet, in order to minimize the number of total sheets and printing costs. For example, sheet "A101" may incorporate the Construction and Demolition plans for a small project area. The above listed sheet number series are designed for larger projects, but shall also be maintained on small projects. Use the dominant image presented on a sheet for the naming of the particular drawing sheet/file.

Note: All firms involved on a particular project shall coordinate naming of the sheets/files as necessary, so as to avoid any possible duplication of these names.

5. PRESENTATION OF DRAWINGS

A. TEXT FONTS/STYLES

Public domain and custom AutoCAD® .SHX fonts Postscript fonts (.PFA, .PFB, etc.), and any other types of fonts (GhostScript, .ABF, .CPI, .TEX, etc.), are **not** allowed. Apple/MAC versions of TrueType fonts must be converted to PC format for submittal(s).

Customizing a standard .SHX font included within any AutoCAD® package is **not** allowed. You are free to *copy* one of the standard fonts to a *new* filename, and modify it (usually the addition of special characters, such as a centerline, phaseline, and other symbols, common fractions, etc.). The reason for this is really quite simple: not everybody's *fontname.shx* is the same, which would then cause textual errors on display, plotting, etc. on drawing files from a different firm. The latest versions of all customized fonts, and all shape and other support files, used in the creation or modification of a project's drawing files, shall be submitted once to Public Works for inclusion. See the submittal procedures for miscellaneous files at the very end of this document.

B. TITLEBLOCKS

IDOA-Public Works Division Standard Titleblock Information. This information needs d appear on each sheet.

- Project Title
- Project Building
- Project Institution
- Project Address Line #1
- Project Address Line #2
- Public Works Project #
- Public Works Requisition #
- Public Works Account #
- Designed By Initials
- Drafted By Initials
- Drawing Date
- Drawing Number
- Drawing Scale
- Sheet Number
- Total Number of Sheets
- Revisions (multiple, as needed)

Note: Use of (Sheet Number/Total Number of Sheets) in addition to the "Drawing Number", is discretionary to the particular project.

Feel free to add additional information, such as your own A/E project#, billing#, and etc., in reasonable sizes and locations within the titleblock, or upon the individual sheets, by adding any combination of text, mtext, or attributes. Please note that these entities shall only be contained within the layer "A-TBLK-ANNO".

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The titleblocks can each be either left alone as single inserted blocks, or split into 'insert' and 'xref' "halves", with all of the attributes divided with best respect given to controlling information on the individual sheets, or across the entire project.

C. DAYSTAMP

All construction drawings shall have a daystamp (date/time) placed upon them, vertically just inside of the sheet information, so as not to get lost in a stapled set of plans, and easier viewing from a rolled set.

All other CAD software users shall also provide this daystamp, vertically oriented.

6. BLOCKS, COLORS, AND LAYERS

A. BLOCKS

Public Works does not have a standard symbology scheme at this time, but attention is being paid to ongoing efforts to standardize on symbology, with the likely future standard being a modified form of the current ANSI set. Public Works would like to see all firms continue standardizing on all blocks used in the creation or modification of any drawing files. For those firms that utilize the older Softdesk® softwares, or the more recent "Desktop" softwares, the blocks inserted in the drawings should be the standard blocks supplied with these softwares, and utilized to the fullest in the creation of all construction documents. The users of other third-party add-on applications should be using the blocks included in those packages as well. The simple reason for this standardization is to maintain consistencies for future implementation of data acquisition based upon block names, block attributes, or other block features.

Note: The block definitions (and the sizes, orientations, tagnames, and etc. of the associated attributes) provided with the packages should not be modified in any way from their original definitions, except to ensure an entity's color is set to BYLAYER. It is equally important that the block's entities exist on the transparent layer "0", and/or the correct AIA2 layer(s). If a needed block is not included with the software, a block may be created and used for incorporation into a drawing. All entities of this block shall exist either on the transparent layer "0", and/or the appropriate AIA2 layer(s). Please review Section 7-B for more details.

B. LINE WIDTHS, COLORS, AND LINETYPES

The "A-TBLK" layers within the standard titleblocks are to remain with linetype "Continuous". Other than that, your firm is free to use any colors, line widths, and linetypes that are desired in the creation of any drawing work. Public Works is not attempting at determining a color standard for project work at this time, but will remap drawing colors using predefined AIA2 layernaming (see below).

Therefore, the color of all entities within a drawing, including those entities that comprise "blocks", shall always be BYLAYER.

C. AIA2 LAYERING SCHEME

The layering scheme utilized is based upon the 2nd Edition of the "CAD Layer Guidelines", as sponsored by the American Institute of Architects. All firms shall ensure that the layers in all submitted project drawing (.DWG) files conform to the AIA2 layernaming system

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Almost all layers used in a drawing should follow the AIA Cad Layer Guidelines, 2nd Edition. The exceptions to these are the few specialized layers used in the correctly configured AutoCAD®, Softdesk®, Architectural Desktop™, Land Development Desktop® and other Autodesk® and compatible softwares, such as the "DAYSTAMP" layer, the "DEFPOINTS" layer, the "NOPLOT" layer, along with a few others. These layers are also correctly considered as valid layers, within the intended context of the Public Works Cad Drawing Standards.

Construction projects are greatly facilitated, and Public Works' project managers will be able to work better with the correspondingly submitted project drawing files, when the same layernaming convention is utilized throughout projects.

7. GENERAL CAD GUIDELINES

A. Generally set your layer to the transparent layer "0" before attaching reference ("xref") files.

B. Prior to making a custom block, all entities to form that block shall have the following properties: *color* – set to "bylayer", *linetype* – also set to "bylayer", and *layer* – set to "0", when another layer or linetype is not specifically needed. If there are defined AIA2 layers proper for the block entities, it may be appropriate to set the entities to these layers prior to the creation of the block.

C. All forms of filenames and pathnames, including, but not limited to, directories, AutoCAD® font, shape, xref, and image files, and all other drawing support files, shall be completely free from punctuation (and especially "space") characters, *except* for the following, which have been allowed since DOS: the dash " – ", the underscore " _ " (recommended replacement for the "space"), the dollar " \$ ", the exclamation " ! ", the tilde " ~ ", the 'at' symbol " @ ", the pound " # ", and the percent sign " % ". Usage of other punctuation characters is not acceptable.

D. All finished project drawing (.DWG) files shall be submitted in an "as-plotted" condition. This means they shall be zoomed to a proper "Limits" or "Extents" view. There are to be no stray pieces or parts leftover outside of the drawing's titleblock. This includes visible and invisible entities, such as dimensionless textual entities that have no display string value, or have only "space" characters, or other formatting-only (%%, for example) characters as their string value. Other types of dimensionless entities include invisible-attribute-only blocks, which are primarily meant for databasing and other concerns. Examples of these kinds of blocks are the AME_NIL, AME_FRZ, and AME_SOL blocks, created with various packages from Autodesk™, and others. This is not to say the drawing (.DWG) file cannot contain these kinds of blocks, but just that when they exist in paper space or layouts, that they shall exist inside the titleblock area only because of "Extents" concerns. Contact Public Works if you need help on controlling these kinds of issues.

E. NEVER click on, or leave on, the checkbox for "Save path" when attaching xrefs or images to any drawing file, but always ensure that the source and target files are located within the same directory. Using the "Save path" checkbox in AutoCAD® embeds the complete, hard-coded full pathname (including the user's associated drive letter), and the resulting drawing file then causes pathname "file not found" errors upon opening by the next user.

8. PROJECT DRAWING FILES SUBMITTAL REQUIREMENTS

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PREFERRED METHOD:

Email submittal containing all required project information AutoCAD® drawing (.DWG), MS-word (DOC) Specifications files (and any necessary raster <scanned background> images – typically .TIF files), and submit by attaching files into an email, and send it to the Public Works project manager.

Reminder: All construction sheet drawing (.DWG) files must have all reference (“xref”) files ‘bound’ in first. Any project drawing files missing any reference drawing or image files will be rejected for immediate correction and replacement.

Submit the project drawing files to an **email**, give the email a subject of “**Cad submittal: <project familiar name>**”, include within the email text body any usual and customary sender/contact information, any necessary distinguishing factors (such as the particular discipline(s) of the drawings being sent, and/or a simple drawing list), and then send the email directly to the Public Works project manager.

You may use multiple emails if necessary to avoid submittal by CD-ROM(s). Please keep total of email submittals to five (5) or less. The Public Works email system will allow a file size of up to 10MB per email. If more than five required please submit by Alternative method CD-ROM(s) or DVD(s).

ALTERNATIVE METHOD:

Copy project submittal information to CD-ROM(s) DVD(s), and CLEARLY LABEL the media, *and any packaging of this media*, with the FAMILIAR PROJECT NAME, any customary sender/contact information, any necessary distinguishing factors (such as the particular discipline(s) of the drawings being sent, and/or a simple drawing list), and then deliver this package directly to the Public Works project manager. Do not forget to label media.

Reminder: All construction sheet drawing (.DWG) files must have all reference (“xref”) files ‘bound’ in first. Any project drawing files missing any reference drawing or image files will be rejected for immediate correction and replacement.

REGARDLESS OF THE METHOD CHOSEN ABOVE:

Submittal is **not** complete until the Public Works project manager has verified the receipt of all relevant project files in authentic representation of the hardcopies. And/or missing CAD file information.