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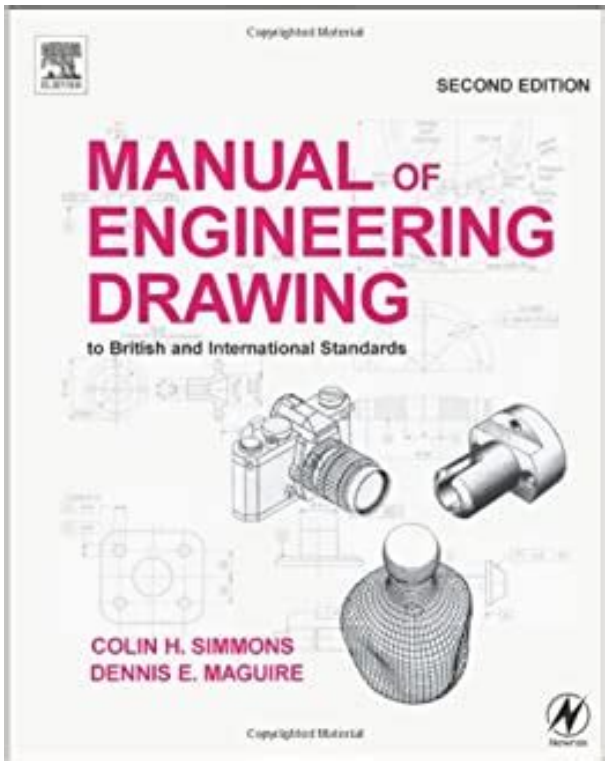

The goal of Whole Building Design is to create a successful highperformance building by applying an integrated design and team approach to the project during the planning and programming phases. Disclaimer. It is through the collection and documentation of these practices that consistent models and drawings shall be achieved throughout the U.S. Army Corps of Engineers USACE, as well as other federal agencies. In the collection of these practices, various historical USACE District drafting manuals were consulted and compared against practices contained in various industry and national standards. The documentation of these practices will help to achieve both clear and aesthetically pleasing construction documents. It is through the collection and documentation of these practices that consistent models and drawings shall be achieved throughout the U.S. Army Corps of Engineers USACE, as well as other federal agencies. The documentation of these practices will help to achieve both clear and aesthetically pleasing construction documents. ERDC develops innovative solutions in civil and military engineering, geospatial sciences, water resources, and environmental sciences for the Army, the Department of Defense, civilian agencies, and our nation's public good. The manual is part of an initiative to develop a nonproprietary CAD standard that incorporates existing industry, national, and international standards and to develop data standards that address the entire life cycle of facilities within the DoD. The Centers primary goal is to develop a CAD standard that is generic enough to operate under various CAD software packages such as Bentleys MicroStation and Autodesks AutoCAD and incorporate existing industry standards when possible. DISCLAIMER The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products.http://atol-res.pl/uploads/eqs-500db-manual.xml

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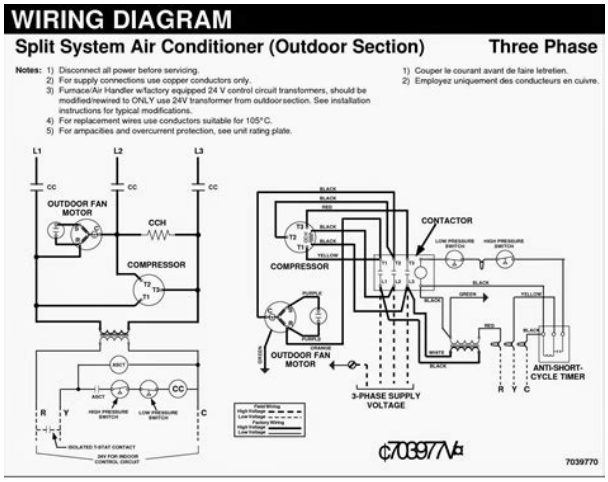
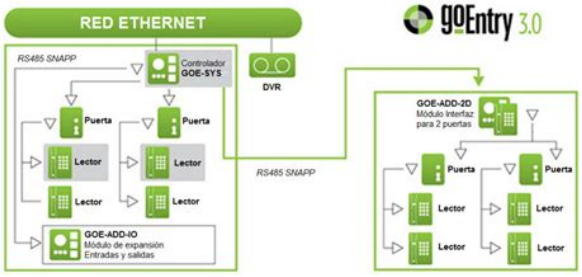


All product names and trademarks cited are the property of their respective owners. The findings of this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.Additional thanks go out to Roger Fujan; Carl Broyles; Gerald Piotrowski; Jonathan Broadie, U.S. Army Engineer District, Savannah; Danny Griffin, U.S. Army Engineer District, Mobile; and Brian Dinnon, U.S. Army Engineer District, Rock Island, for assisting in the revision of the USACE Border Sheet and the development of a USACE Cover Sheet. Working together, these organizations agreed to develop an integrated set of documents that collectively would represent the United States National CAD Standard NCS. Recognizing such potential benefits, each of the DoD agencies independently initiated efforts to establish CAD standards in the late 1980s. In 1989, the Air Force Logistics Command released the Architectural and Engineering Services for CADD Implementation within Air Force Logistics Command. However, to ensure successful translations among CAD applications, certain systemspecific characteristics were considered and the standard adjusted accordingly. AutoCAD and MicroStation were chosen based on their prevalence in the DoD. These applications can be used by designers to generate graphics inside CAD files. Most notable are design software packages for CIM and BIM. Document management systems that contain attributes or metadata for individual files and have such features as title block integration are becoming standard tools for management of electronic files. Use of these systems to store searchable metadata for files is encouraged. 1.7 Coordination with design agent With all the complexity and options currently available in the world of CAD, it becomes important to coordinate fundamental aspects of design work.http://www.recykla-glas.cz/media/images/upload/equal-i-zer-hitch-manual.xml

The previously mentioned issues of basic platform, design applications, and document management are only three of the issues that can affect the success of a project and the future usefulness of the final documents. As such, each project should have at its initiation discussions and agreements on such issues as these. Suggestions for improvements are strongly encouraged so that subsequent updates will reflect the input and needs of CAD users. The most common units are feetinches, survey feethundredths or thousandths of feet, and metersmillimeters. In AutoCAD, the basic drawing unit for any file is the distance between two fixed Cartesian coordinates. For example, the distance between coordinates 1,1,1 and 1,1,2 is one drawing unit. A drawing unit can correspond to any measurement e.g., foot, inch, meter, mile, fathom. AutoCAD users may enter the Units display option to set the desired drawing units. The Units command of AutoCAD does not have a direct metric system setup. For metric designs, the recommended procedure is to choose the Decimal option in the Drawing Units dialog box. This will allow each drawing unit to represent decimal meters, millimeters, and so forth, at the discretion of the user. 2.1.3 International Feet versus Survey Feet Many sites have to deal with the initial question as to whether a particular project is designed using International Feet or Survey Feet. In MicroStation, the units.def file does contain a definition for Survey Feet usually stored in c\Program Files\Bentley\Workspace\ System\data, but it is disabled by default in some earlier versions. Note If a drawing has already been created using International Feet, changing the Master Units to Survey Feet will not automatically scale all elements in the drawing to Survey Feet. 2.1.4 Origin global origin Positioned within every electronic drawing file is an origin “global origin” in MicroStation and “origin” in AutoCAD.

The origin of a drawing file is important because it serves as the point of reference from which all other elements are located. Origins are typically defined in a drawing file by the Cartesian coordinate system of x, y, and z. The benefit of standardizing the location of the origin of a drawing is most notable in the use of reference files see section Reference Files XREFs in Chapter 4. A standardized origin is also helpful when translating files between CAD applications. A model file contains the physical components of a building e.g., columns, walls, windows, ductwork, piping. Model files are drawn at full scale and typically represent plans, elevations, sections, etc. Model files are used as components in creating plotted sheet files. The information contained within a model file for a discipline may be referenced by other disciplines to create the particular model files or sheet

files for that discipline. A model file can be considered a work in progress. For instance, a mechanical engineer may reference the architect's floor plan model file to begin development of the HVAC ductwork layout model file. Meanwhile, the architect can continue developing the floor plan to meet new requirements. Any changes to the floor plan would be immediately accessible to the mechanical engineer. The viewing of realtime updates eliminates a great deal of frustration for other disciplines because it allows for onthespot rather than afterthefact modifications. Design Models are where models are developed or possibly assembled prior to creation of the Sheet Model see the following section, Drawing Sheet Assembly. Design Models contain graphic information in a model file format. For example, it may contain the entire Architectural Floor Plan model file for a building. It is this model file that is used as a reference for creating individual sheet files. Drawing Models include items such as plans, sections, elevations, and details referenced to the Sheet Model. 2.2.1.



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2 Sheet files A sheet file is synonymous with a plotted CAD drawing file. A sheet file is a selected view or portion of referenced model files within a 11 border sheet. The addition of sheetspecific information e.g., text, dimensions, symbols completes the construction of the document. In other words, a sheet file is a readytoplot CAD file. A design model inside the sheet file contains the model information assembled as it would be displayed on a sheet. This model would have realworld spatial alignment and would be used as the primary model for graphical information to be displayed and presented in the sheet model. A useful generalization for differentiating between model files and sheet files is stated in Module 1 "Drawing Set Organization" of the Uniform Drawing System UDS NIBS 2014 "Model files are always referenced by other files, while sheet files are never referenced by other files." A Sheet Model shows the presentation of model file graphics as they would appear on an individual sheet. This assembly area would contain referenced files, one of which would be the border sheet. 2.2.2 Border model files Borders are model files referenced by all disciplines to create sheet files. This model file contains border linework, the title block, and projectspecific symbols and text. This realtime access to the work of others ensures accuracy and consistency within a set of drawings and helps promote concurrent design efforts. No longer does one discipline have to wait until another discipline is nearly finished before they begin their drawings. Note Never bind references. JPG best for nonaerial photographic imagery used for depicting existing conditions referenced to sheets. PDF best for drafted drawings used as background images. Note MrSID files are NOT to be directly referenced. It is recommended that the MrSID image be clipped, resampled, and saved as a GeoReferenced TIF file. The border shall be an individual, unnested reference file in the Sheet Model.

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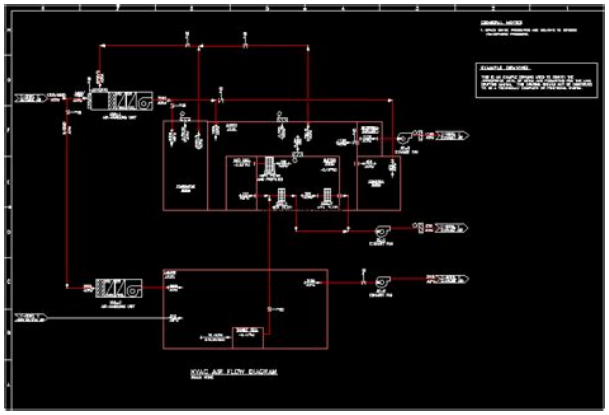
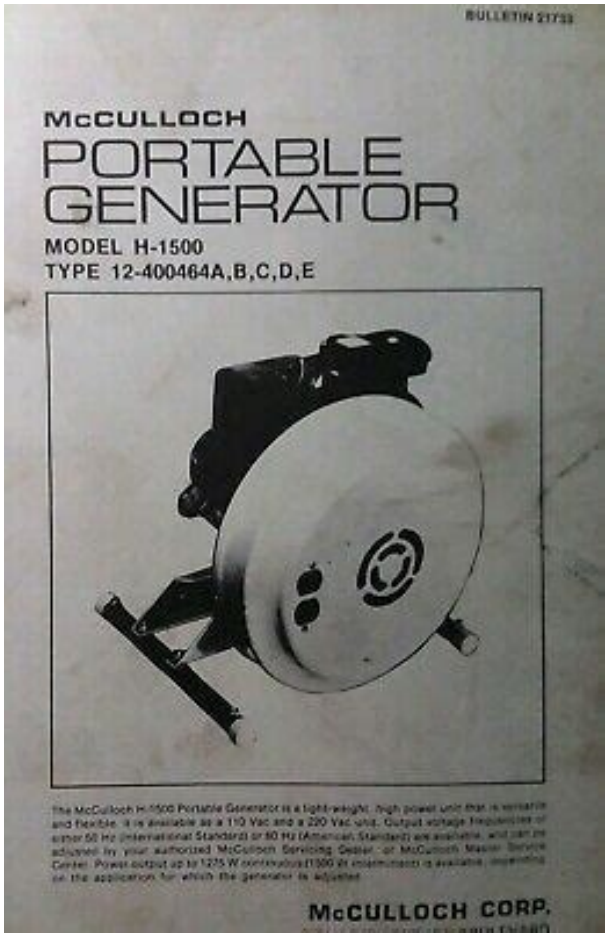


This method consists of using a sheet file that contains a Design Model and a Sheet Model. This may include references to individual views of Design Models in other files, or even coincident references. The Design Model should also contain realworld graphics such as northing and easting coordinate values of points. The Sheet Model contains a reference to the project border sheet model file at 11, plus a reference to the Drawing Model in the active sheet file, scaled to fit into the Sheet Model Figure 21. Figure 21. Sheet file composition using Design Model and Sheet Model. Note With Bentley software, when using Drawing Models, never reference Drawing Models to Design Models, since resymbolization problems occur. 2.4 Electronic drawing file naming conventions Naming conventions for electronic drawing files both model files and sheet files allow CAD users to determine the contents of a drawing without actually displaying the file. They also provide a convenient and clear structure for organizing drawing files within project directories. 2.4.1 Project code The Model File naming convention and the Sheet File naming convention both require a Project Code 1 to 20 characters at the beginning of the file name. The use of Project Codes in file names prevents the same file name from existing in different directories. When a project includes multiple sites or buildings, it is important to identify each file with the appropriate feature. This should be done as a part of the Project Code. All fields must be used and in the correct sequence. Following the Project Code field, the first twocharacter field represents the Discipline Designator. The allowable characters for the first character in the Discipline Designator are listed in Table 21. The second character of the Discipline Designator field is always a hyphen . The next twocharacter field represents the Model File Type Table 22. The final field is User Definable, and all four characters shall be used.



Note The NCS states that a Discipline Designator “denotes the category of subject matter contained on the specified layer.” However, this denotation leaves this type of Designator too open ended, resulting in Discipline Designators that are usually subsets of other disciplines. For example, Distributed Energy which has the Discipline Designator “W” in the NCS is typically shown in disciplines such as Mechanical or Electrical. There are instances when a facility is being renovated and the asbuilt designs need to be revised to show demolition and new items. These revisions would not be made on existing asbuilt model files but on copies to ensure the original asbuilts are not modified. This model file type is used to aid users in separating existingtoremain items from items that will be demolished. Example. An architect has an existing asbuilt floor plan model file for Building 1000, second floor. For the current project, walls will be demolished and new walls constructed on the second floor. The first field is used for a 1 to 20character Project Code see section 2.4.1, “Project code”. The next two characters are the Discipline Designator with either a hyphen or an alphabetical Designator Table 23. Sheet Type Designator General symbols legend, notes, etc. 0 Plans horizontal views and combination plan and profile 1 Elevations and profiles vertical views 2 Sections sectional views, cross sections, etc. 3 Large scale views Scaled up reproductions of plans, elevations, or sections that are not details 4 Details 5 Schedules and diagrams 6 User defined 7 User defined 8 3D Representations isometrics, perspectives, photographs 9 Note If the sheet sequence number goes above 99 sheets for a particular discipline, the user might want to consider using alphabetical Designators in the Discipline Designator to further subdivide the discipline Table 23. If this is the case, the dominant Sheet Type determines the Sheet Type Designator. 2.4.

4 Adding a drawing sheet If a sheet needs to be added between two sequential sheets, a Supplemental Drawing Designator may be appended to the end of a sheet file name Figure 24. For example, if two sheets need to be added between sheets ERDC8000A104 and ERDC8000A105, then the sheet file names for the inserted sheets would be ERDC8000A104A and ERDC8000A104B.

Figure 24. Supplemental drawing designator. 2.5 Coordination between sheet file name and sheet identifier In assigning a sheet identifier for use in the sheet identification block, reference bubbles, etc., the user should coordinate with the name assigned to the electronic sheet file. The sheet identifier shall consist of the discipline designator, sheet type designator, and the sheet sequence number Figure 25. Presentation graphics typically consist of drawing elements such as lines, arcs, shapes, text, and their attributes line color, line width, line style. This chapter presents brief overviews of the characteristics of presentation graphics and the philosophy used to standardize them. Most commercial CAD systems provide an extensive variety of line widths. Table 31 lists information about the various allowed line widths. Table 31. Comparison of line widths. Line Thickness mm in. Note For consistency and interoperability, use of the IGDS default Bentley line styles 17 should be avoided. 3.1.3 Line color The primary reason to use color in CAD drawings is to improve the clarity of the drawing on a computer monitor. The variety of colors available in a CAD application depends on the capabilities of the computer monitor and its video card. Table 32 lists the basic colors used predominantly throughout the model files. This manual standardizes presentation graphics as they relate to electronic drawing files screen display and not the final printed or plotted paper drawing.

By employing pen tables, each agency can ensure that consistent drawings are produced from an electronic file regardless of the type of printer or plotter used. Varying the intensity of gray scales allows users to distinguish different aspects of a drawing when it is plotted. For example, on a demolition plan the existing items not designated for demolition can be assigned a color that has been assigned a screening percentage. When plotted, those items will be shown at a lighter shade compared with other items slated for demolition in the drawing. This will allow the contractor to immediately identify the demolition items on the drawing. Table 33 lists colors recommended to be used for screening along with a recommended screening percentage. Optionally, when variations in screening are not important, a single screening can be applied to all screened graphics. Note The AutoCAD vs. MicroStation color numbers have been combined to avoid confusion when creating a screened effect in either software. Table 33. Screened colors. Gray Scale Ratios RGB as plotted Color No. MicroStation has various fonts stored in font resource files, with each resource file capable of containing multiple fonts. AutoCAD has individual fonts as shape files. In addition, each platform has the ability to support TrueType fonts that are installed on the individual computer. Each application also has the ability to create additional fonts for its use. This includes fonts for symbology, logos, business titles, etc. There is not a direct relationship between MicroStation resource files and AutoCAD shape files. Therefore, it is important that font use be reviewed at the start of a project and decisions made on fonts that are then used consistently throughout the project by all disciplines. This information is often shared between CAD files drawing model and sheet file through the use of reference files. Examples include walls, doors, light fixtures, and room numbers.

Model filespecific information may be either literal e.g., walls or symbolic e.g., electrical outlets. Sheet filespecific information may include notes, annotative symbols, and titles. Drawing models inside a sheet file contain graphic information that would relate to realworld information e.g., point coordinates or information that would be sectioned off into multiple sheets e.g., a floor plan that may take three sheets to present because of its size. Sheet modelspecific information would include items specific for the presentation of that sheet. This is one reason that sheet models shall never be used as a reference file to other files. The reuse of graphic information reduces drawing time and improves project coordination. For further differentiation, another fourcharacter Minor Group may be used e.g., AWALLFULLEXTR for exterior fullheight walls versus AWALLFULLINTR for interior fullheight walls. This includes the line style, line width, and color. Note The recommended

presentation graphics may be changed to aid in drawing clarity e.g., to show hidden objects. Most items can be shown through referenced model files or changing the line style of items. For instance, in a “New Work” model file, “Existing to Remain” items can be shown through a screened reference file. “Not in Contract” items and “Future Items” could be shown with a dashed line style. The use of such symbology enhances CAD productivity and provides an excellent opportunity for CAD standardization. Those naming limitations no longer exist. However, an additional problem with the symbols was that duplicate symbols existed over multiple discipline symbol libraries. Updating symbols became a chore because if changes were made to a symbol that existed in multiple libraries, it was vital that the changes were implemented in all duplicate symbols as well. The block library only contains the definitions and not the graphics. Blocks are best inserted by selecting them from Design Center. 5.2.

2 Line styles Lines are defined as a graphical representation of linear drawing features e.g., utility lines, fence lines, contours. Patterns are defined as repeated drawing elements e.g., lines, dots, circles within a defined area. Line style definitions determine the particular dashdot sequence and relative length of dashes, blank spaces, and the characteristics of any included text or shapes. Working with line styles provides a means of distinguishing the purpose of one line from another. AutoCAD and MicroStation both provide a set of standard line styles, as well as allowing the user to define custom line styles. Ohio WrightPatterson Air Force Base. American Institute of Architects. 2000. Architectural graphic standards. 10th ed. New York John Wiley and Sons. American National Standards Institute. 1972. Graphic symbols for electrical wiring and layout diagrams used in architect and building construction. ANSI Y32.91972. New York Institute of Electrical and Electronics Engineers. Headquarters, U.S. Army Corps of Engineers. 1990. Standards manual for U.S. Army Corps of Engineers computeraided design and drafting CADD systems. Engineer Manual 111011807. ISO 135672. Switzerland. National Fire Protection Association. 2012. Standard for fire safety and emergency symbols. NFPA 170. Quincy, MA. National Institute of Building Sciences NIBS. 2014. United States National CAD Standard. A3 Hazardous Materials. A51 Plumbing. A53 Mechanical. A55 Electrical. A62 Telecommunications. Deauthorized channel limits, anchorages, etc. annotation Docks, decks, floats, piers, and mooring facilities Channel limits, anchorages, turning basins, disposal areas, etc. Normal Stress BSSNSDATA Shear strength vs.Deauthorized channel limits, anchorages, etc. annotation Docks, decks, floats, piers, and mooring facilities Channel limits, anchorages, turning basins, disposal areas, etc.

Small Civil Works Structures Decks Substructure Column Plan Framing Plan Hydraulic Structures Dams 0 0 0 0 0 0 0 0 0 0 Bridges Locks Adits in galleries and passages Chambers Elevators Galleries, cross overs, trenches, etc.MHCSFSPLYPIPE Hydraulic system supply piping MHCSFVALV Hydraulic valves MHCSFVALVCONT Hydraulic directional control valves MHCSFVALVFLOW Flow control valves, check valves, etc. MHCSFVALVPRES Pressure control valves relief valves, counterbalance valves, etc. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports 07040188, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 222024302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS. 1. REPORT DATE DDMMYYYY August 2015 2. REPORT TYPE 3. DATES COVERED From To Final 4. TITLE AND SUBTITLE 5a. SECURITY CLASSIFICATION OF a. REPORT UNCLASSIFIED b. ABSTRACT UNCLASSIFIED 17. LIMITATION OF ABSTRACT c. THIS PAGE UNCLASSIFIED SAR 18. NUMBER OF PAGES 112 19a. NAME OF RESPONSIBLE PERSON Stephen Spangler 19b. TELEPHONE NUMBER include area code 6016343104 Standard Form 298 Rev. 898 Prescribed by ANSI Std. 239.18 So please help us by uploading 1 new document or like us to download We are a

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Use of the NCS can reduce costs and produce greater efficiency in the design and construction process. Read more If you already have a license code, proceed to Step 3. This is your license code. We are aware of this. Yet so few of us have taken the time to develop, document, and deploy the CAD standards we desperately need. We have the best intentions—we say we will “get to it when things slow down.” But it just doesn’t happen. The reason is simple—developing CAD standards is hard work. It outlines the process of installing CAD standards in your company, including knowing when it’s right for you to create standards and identifying which standards are needed. CAD managers, coordinators, and office leaders learn triedandtrue steps that everyone can put to use, regardless of how busy you are. Looking for an overview of the process.Some firms feel that CAD standards rest entirely on the integrity of the DWG and therefore “the beginning” is a point in the drawing. Other believe that a valid standard revolves around the proper application of company processes and therefore work should start with a collection of Best Practice documents. I believe that the beginning is a point that can only be identified by communicating with a firm’s CAD leaders. However, while it may be instinctive to meet and discuss the new standard, I recommend these initial meetings revolve around current efforts. Specifically, I think that only by having open communications with CAD leaders can you properly identify the pain points of the current CAD production process. You must meet with the people doing the work to find out what does not work. These are the high points that require immediate, or added, attention in the creation process. This is an ideal point to refer to as “the beginning.” But, just a bit more reflection is required before you can begin work.

You may have decided that the starting point for your CAD standard is the following In researching DWG files, you may learn that the actual cause has nothing to do with plot styles, but rather with the colors associated with entities. This could lead to the secondary assumption that “layering standards” are an ideal starting point. However, further examination of several representative projects could determine that while layer configurations are consistent with an existing drawing template, your CAD staff has been modifying individual entities to change the color “by object” rather than “by layer.” This revelation points to an entirely different starting point for your standard, that being a “best practice” issue. Without this initial hashing and analysis, it is incredibly easy to become derailed and focus effort, and costs, on areas of a CAD standard that will yield reduced, or ineffective, results. It is also a major step in building confidence in your stakeholders that the efforts to develop a new standard are not aimless or misguided. Once apprised of your progress, your stakeholders may have input to add. Once everyone aware of the direction the work is going, it is time to move on. The possibilities are almost infinite. In addition, I feel that any person selected as the coordinator of an organization’s standard should have extensive CAD experience from which they can draw on to know the minutia making changes such as layer color in order to set up an ideal drawing. The following is a list of the most common items included in general CAD standards and therefore will probably show up on your roadmap to a new standard A standard file structure for CAD drawings that categorizes existing, proposed, survey, and record drawing files is essential. This reduces the time it takes to find needed files. This is especially true after long periods of time pass between project phases.

Mistakenly opened drawings files require rendering time to initially “open,” and that time does add up. Remember, time is money! Establishing conventions for nomenclature, color, and visibility are just a few ways to create a standard that can be relied on throughout your organization. And do not forget the layer descriptions! Plan sheets with varied font styles, orientations, colors, dimension

styles, and leader callouts rob your organization of the professional impression it deserves! The most common issue being “circular references” in which external references have multiple, nested, entries in a single drawing file. Establishing a best practice of inserting external references as “overlay” objects is a quick and reliable fix. Since most plan sets are still shared in print, it is very important that any organization have a single or standardized set of plot files that can be relied on to accurately produce reliable and prints with accurate lineweights and colors. Nor is it a detailed direction of “how to change layer colors” or other minutia. The wealth and depth of information on the Internet and in resources available for purchase more than covers those deep, detail needs. These can take several forms that include When beginning a new DWG file, a template can be selected as a “seed” that AutoCAD and other CAD products will use to create a new file with all of the DWTs predefined aspects. These can include layer standards, plot configurations, annotation styles, and many other details. Therefore, DWT files are essential for inclusion in any CAD standard. The process is as simple as taking a drawing based on the existing DWT in use, making the desired changes, and saving the file as a “Drawing Template” for future use. This highlights the importance of document file locations and file structures so all involved parties can be confident that they can find the needed template. A template that can’t be found won’t be used!