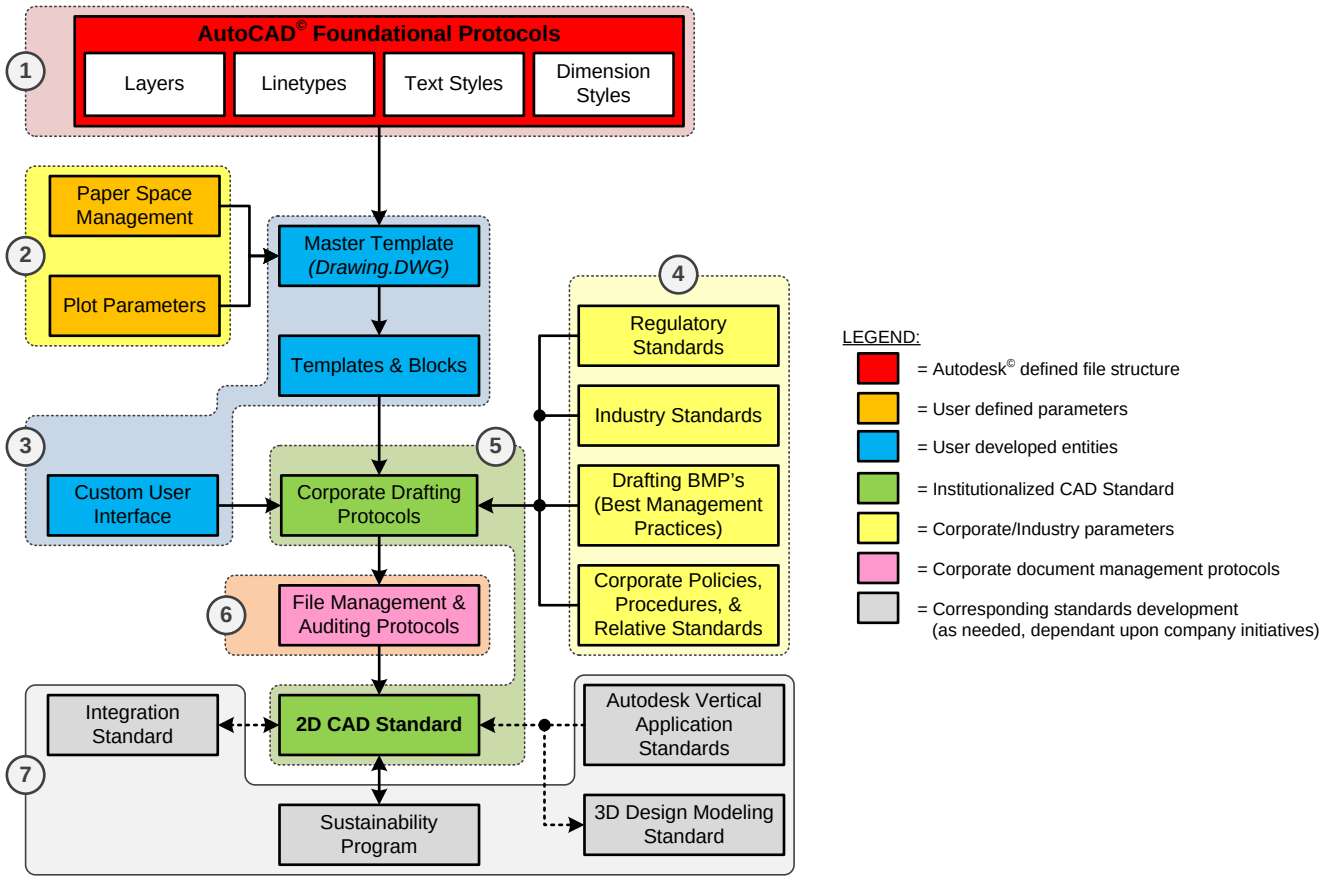
AutoCAD© Elemental (2D) Drawing Standards Model

Autodesk has a well-defined base model for establishing a drafting standard for its 2D AutoCAD© application (as well as its verticals). The DWS file structure, in conjunction with templates (DWT), enables any CAD Manager to develop, audit, and maintain accountability and compliance with a drafting standard regardless if a corporate policy exists or if a departmental best-management practices guideline is defined.

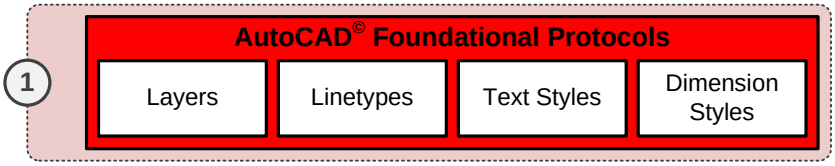
By defining the DWS parameters, you are well on your way to developing a comprehensive 2D-based file structure standard. The structure and design of a DWS file is based upon the four major components of drawing standardization commonly used within the AutoCAD environment (e.g., Layers, Linetypes, Text Style, and Dimension Styles). These components make up the foundation of all templates, blocks, and other customized entities created for use within the application. The following diagram depicts an elemental standardization model and forms the cornerstone for a drafting standard that can be adopted as the corporate needs expand.



The following sections will highlight the components that comprise a basic drafting standard and define how the pieces can fit together to form the overall structure of a fundamental standards model. A working knowledge of these components is presumed. For additional instruction for one or more of these components please consult the Autodesk website and/or the application's Help feature.

Note: For the purpose of this document the use of the terms *CAD standard*, *Drafting Standard*, and *Drawing Standard* are interchangeable with each being used to help clarify the subject of discussion.

1 Autodesk Defined File Structure



At the core of every AutoCAD drawing are four primary components that must have, as a minimum, one of each identified. The degree of complexity is of course user definable, however a conservative approach should always be considered when developing these components. This will be self-evident when attempting to audit a drawing file created by these foundational elements.

1.1 Layers

The minimum amount of layers is dependent upon the AutoCAD (and/or vertical) application being used; the corporate mandates needed for data segregation; and for entity creation, display, and editing purposes.

Each layer (and its status) represents one the more diverse property values used within most CAD applications and thus are oftentimes widely abused and misinterpreted. Any layering scheme (regardless of its complexity) should be well defined and illustrated to avoid misuse whenever possible.

1.2 Linetypes

Linetypes are defined within the ACAD.LIN (or other company specific *.LIN) file and must be loaded into each drawing prior to its use. Default linetypes that are consistent across all disciplines of drawings should be preloaded in the templates or other user defined entities when created.

All linetypes (including those defined by the base CAD application) should be represented in a data dictionary and properly illustrated to avoid misuse. This becomes paramount when extended ASCII codes or non-standard text fonts are used to display symbols within the linetype.

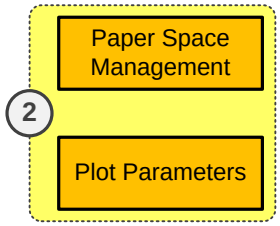
1.3 Text Styles

Text styles may be easier to standardize and maintain as each defined style is dependent upon an installed text font. However, care must be taken when establishing standard text styles as specific fonts can become non-supportive or obsolete over time and eliminating a predefined text style/font can become a challenging task especially if it is embedded within blocks or templates used throughout the organizational structure.

1.4 Dimension Styles

Dimension styles are as diverse as Layers and usually vary across drawing disciplines and the intended use of all or part of a drawing. Each dimension style is controlled by numerous system variables and settings within the Dimension Style Manager, thus each dimension style used should be well defined and illustrated to ensure proper use. This is fundamental to any corporate standard given that at any time during drawing creation or editing a dimension style may be overridden.

2 User Defined Parameters

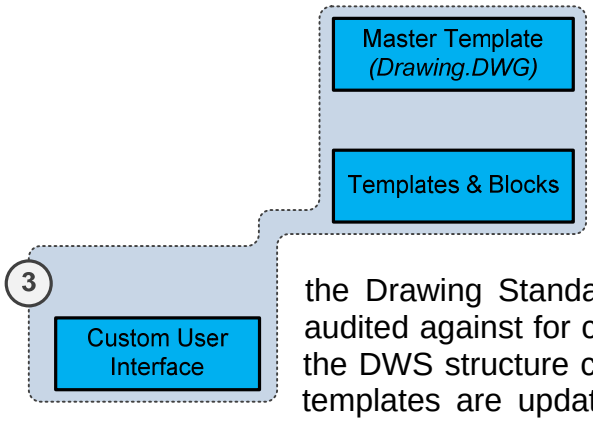


Beginning with board drafting, the drafter was forced to scale or fit specific details within a given physical space, oftentimes this was a pre-printed sheet unique to each company. While the use of Model Space affords the CAD user the ability to work in an unlimited amount of space, at some point the work may need to be printed. Thus, the parameters established in the Page Setup Manager allows for multiple sheets sizes to be used within Paper Space layouts. This method of Paper Space management is critical to established drafting standards and protocols.

In association with each paper space layout are specific printer/plotter requirements that are managed within a plotter parameter (.PMP) file utilizing the Calibrate Plotter wizard and a plotter configuration (e.g., .PC2 and .PC3) file. Depending upon the plotter settings and corporate standards there may also exist a Plot Style Table (.STB) file and/or a Color-Dependent Plot Style Table (.CTB) file. Such files should be well documented and copies of each stored in a secured location if needed for dissemination to others or to restore an altered or missing file.

If a Drawing Management System is utilized for publishing non-native drawing formats (i.e., .PDF, .DWF, etc.) for consumption by others outside of the CAD environment, or if all managed drawings are configured for a specific type of printer/plotter, then the plot parameters must be established and documented in case they are altered for use by an alternate output device.

3 User Developed Entities

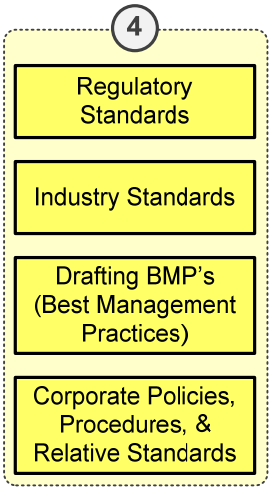


After the foundational drawing elements and user defined parameters (Sections 1 & 2) have been established they should support the development of a master template file (e.g., Drawing.DWG) that all other templates (.DWT) and blocks (.DWG) are based upon.

In conjunction with this should be the creation of the Drawing Standards (.DWS) file, or files, that all drawings will be audited against for compliance assurance. When altering any portion of the DWS structure care must be taken to ensure that all corresponding templates are updated accordingly to avoid loss of data or problems arising during a *"CheckStandards"* (audit) process.

All AutoCAD verticals and many 3rd party applications provide a robust menu, ribbon panel, and toolbar set. However, none of these will be inclusive to every industry and corporation, thus the need to create additional interfaces may exist. The Custom User Interface (CUI) may expand beyond to need of simple commandline syntax and block insertions to include custom programming code (i.e., VB, LISP, VLISP, DIESEL, etc.); and/or external files defined within the Program Parameters File (PGP).

4 Corporate/Industry parameters



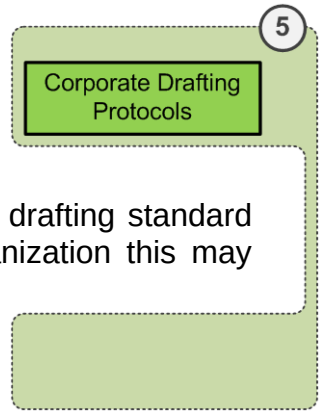
Regardless of the industry, there are most likely Federal, State and/or Local government regulations that impact specific document retention and recordkeeping protocols, some of which may be directly or indirectly related to the drawing files created or edited within an organization. As such, a company's legal counsel should be engaged to ensure compliance with all respective regulatory requirements.

Oftentimes an industry group will exist to develop comprehensive processes to promote a consistent and standardized approach to general work practices. If pertinent, these standards should be adopted and applied to the company's CAD standards.

The CAD standard should be specific about the procedures, protocols, and drafting practices that must be adhered to on a continual basis. However, there may exist a suitable alternative to achieving an end result. Such alternatives should be defined in a Best Management Practice (BMP) document to provide a general guideline for preferential methods for drawing creation and editing. The end result should be to provide guidance when undefined conditions arise or when an alternate end-user preference is acceptable.

5 Institutionalized CAD Standard (Corp. Drafting Protocols)

(DWS)
(Paper Space Mgmt.)
(CUI)
\+ (Corp./Ind. Stds.)
Corporate Drafting Protocols



The results of the previous sections make up various aspects of a drafting standard however; at this point they are still fragmented. For a small organization this may suffice as communication and work processes may not be hampered by the restrictions of larger corporate settings.

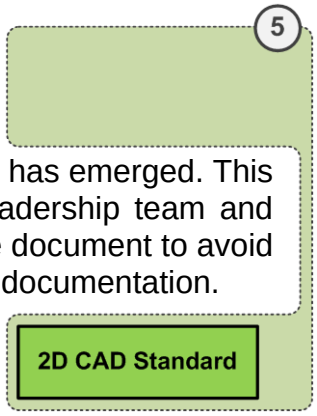
Regardless of the corporate structure, the tools, processes and procedures developed thus far must be vetting by all end-users to ensure that these foundational elements are working in concert with each other as well as the expectations of all concerned parties.

6 Corporate document management protocols

Whether an enterprise document/drawing management system is deployed companywide, or a basic file structured is defined using minimal resources locally, file maintenance procedures must still be documented and communicated as the official protocol for all CAD related files. A fundamental file management system should transcend mere file maintenance (i.e., drawing dissemination, printing, etc.) and provide guidance for file naming and specific tasks required to create, edit, and house drawings along each phase of development.

In conjunction with file maintenance and management a formal auditing process must be developed and documented to ensure that drafting standards are adhered too and accountability is placed at the correct level of drawing development and editing.

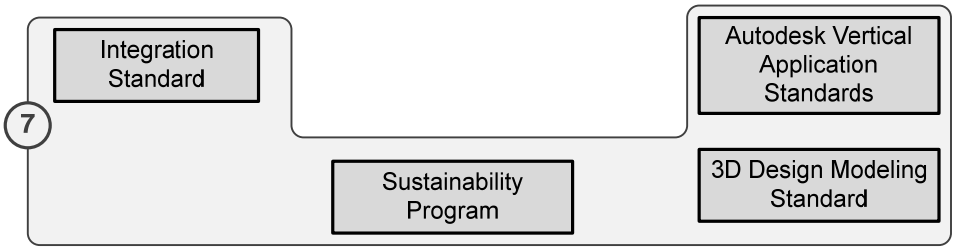
7 Institutionalized CAD Standard (2D CAD Standards)



The results of the previous sections culminate in a comprehensive drafting standard however, it must be compiled into one document that can be easily navigated and used for training and reference. Upon completing these steps and incorporating them into a document/drawing management system (if used) a 2D CAD Standard has emerged. This standard must have the approval and support of the company's leadership team and such acceptance should be well communicated to all end-users of the document to avoid misuse and the misappropriation of drawing files and their supporting documentation.

8 Corresponding Standards Development

Developing a CAD standard does not end once the document has been printed and placed on a shelf. The document must be reviewed on an annual basis or whenever the software is updated or amended; or company policies and procedures alter any function of the content.



The following sections identify other areas of concern that may affect the functionality and intent of the 2D CAD Standard and should be considered if appropriate.

8.1 Integration Standard

Other systems may exist that are dependent upon the information housed in a CAD drawing and/or the drawing management system used to maintain it. These may include G.I.S., EAM, CMMS, Procurement, Financial, etc. and all applications should be researched to determine how data can be shared without duplicating a dataset or restricting the use of the native system.

8.2 Autodesk Vertical Application Standards

If additional vertical applications are utilized (i.e., Mechanical, Electrical, etc.) then modifications to the drafting standard can be expected. These changes may be amended to the existing standard or a separate document may be created specific to the vertical application used.

8.3 3D Design Modeling Standard

3D applications will add another level of complexity to the 2D CAD Standard beyond that of the verticals mentioned above. In some cases, the processes used in a 3D application can nullify or render some portions of the 2D standard obsolete. If this is the case then care must be taken to properly document these variances from both the 2D and 3D perspectives.

8.4 Sustainability Program

As mentioned earlier, a scheduled review of all items mentioned herein must be prepared and offered to all end-users of the document. Moreover, anyone affecting the integrity of a drawing must be trained on the use and intent of this subject matter and understand the ramifications of failing to comply with this standard.

9 Conclusion

In this model the basic constructs of the AutoCAD product, along with regulatory and corporate procedures, define the corporate drafting protocols that must be adhered to when creating or editing a company sponsored drawing.

All drawings and supporting file structures should be maintained within a formal document management system. This system should compliment the drafting standard for file naming and data distribution to all concerned parties.

Additional standards and data integration schemes may be deployed to compliment and support the drafting protocols in use. The length at which an organization may go to deploy 3D modeling, BIM, GIS, or additional Autodesk vertical applications varies greatly and must be evaluated as the corporate business model and internal needs dictate. Thus, such standards are depicted outside of the scope of the foundational CAD Standard model depicted here.

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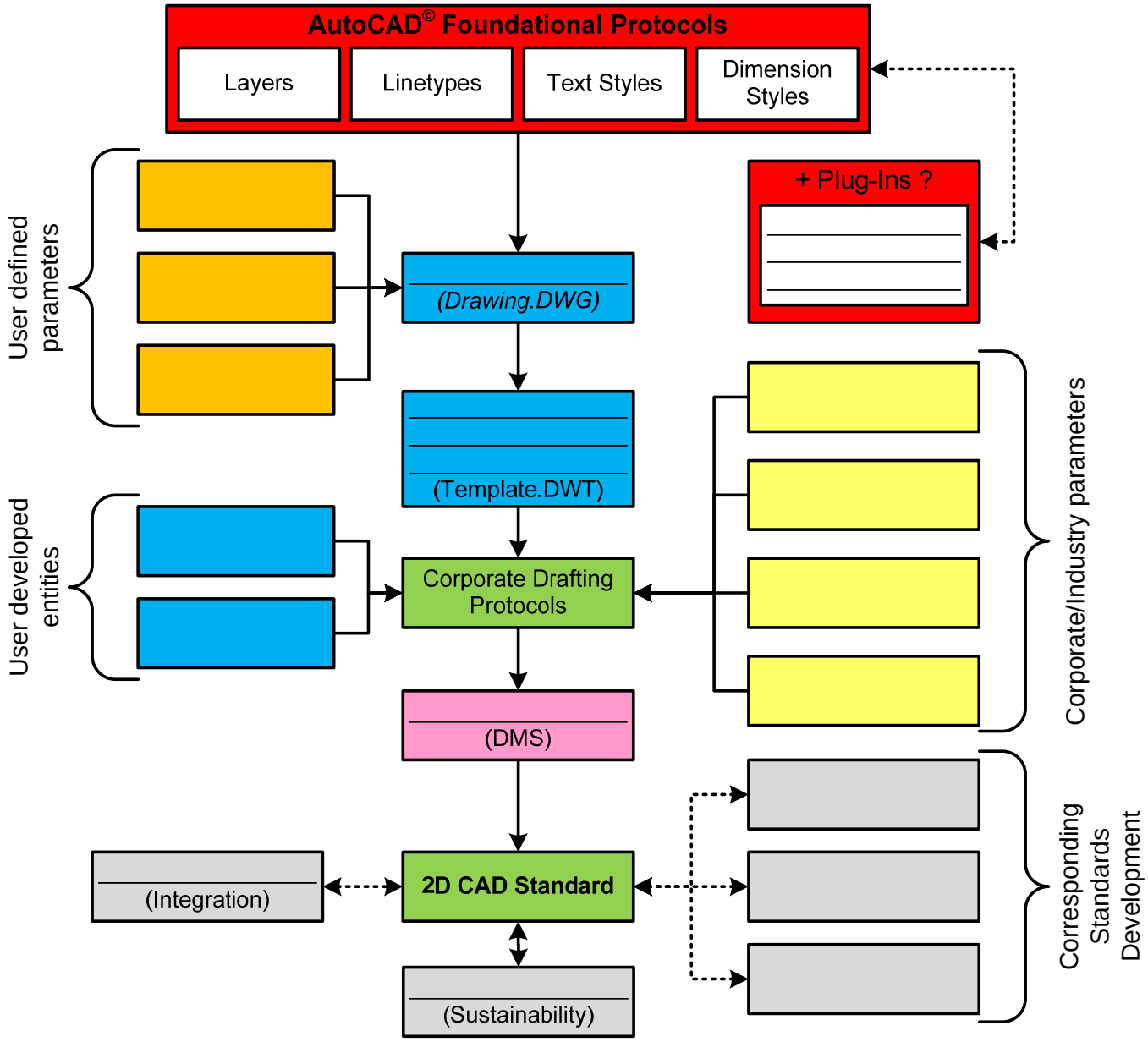
AutoCAD© Elemental (2D) Drawing Standards Model

The following bank model is supplied as a template to begin the process of mapping a CAD standards model for a given organization.



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