



**US Army Corps  
of Engineers** ®

Tulsa District



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# **Tulsa District CAD Standard (TDCS)**

**Information included;**

**National/AEC/Tulsa District CAD Standard, AEC Graphics Standard, File Naming and Composition, Georeferenced Design Files, Amendment/Modification/As-Built Guidance, Deliverables and Data Exchange, Example Military/Civil Title Blocks and AEC Non-Compliance Documentation**

**(For use with;**

**AEC CAD Standard R6.0, ERDC/ITL TR-12-6 and AEC Graphics Standard R2.0, ERDC/ITL TR-12-1)**

**(CESWT - TDCS)**

October 2015

# Tulsa District CAD Standard (TDcs)

## Electronic Data Management

### Table of Contents

- Unit:** 1. General Information  
2. Distribution Policy  
3. National CAD Standard, A/E/C CAD Standard, A/E/C Graphic Standard & Tulsa District CAD Standard  
4. CAD File Naming  
5. Drawing Composition  
6. Amendments, Modifications and As-Built CAD Files  
7. GeoReferenced Design Files (Plan Views)  
8. Deliverables and Data Exchange Formats  
Appendix A – Tulsa District Standard CAD Documents, Design & Support Files, Sample Title Blocks & Non-Compliance Documentation

### **Unit: 1 – General Information**

Tulsa District currently produces a wide variety of drawings for both military and civil works projects. Primary CAD software used in the creation of the digital design files is ©Bentley Systems, Inc. MicroStation® and ©AutoDesk's AutoCad®. The TDcs provides guidance and clarity for CAD file development. The TDcs also addresses customer requirements and provides further uniformity in design file compositions, naming and delivery. The AECcs initiative is part of an Enterprise Geospatial Data and Systems (eGD&S) effort underway within the DOD/Federal network, designed to provide uniform data collection, creation and transfer. **This is not a design instruction manual. For design standards, refer to the SWD-AEIM and other appropriate design guides.**

### **Unit: 2 – Distribution Policy**

The distribution of this document is unlimited. It may be copied and distributed as needed to provide users with the guidelines necessary for production of CAD designs for the Tulsa District Corps of Engineers (TDCOE). For additional copies, contact the Tulsa District Office, Design Branch, Military Design Section at (918) 669-7320 or download from Tulsa District web site at: <http://www.swt.usace.army.mil/BusinessWithUs/Engineering.aspx>.

### **Unit: 3 – National CAD Standard r6.0 (Ncs), A/E/C CAD Standard r6.0 (AECcs), A/E/C Graphics Standard r2.0 (AECgs) & Tulsa District CAD Standard October 2015 (TDcs)**

The Ncs, AECcs, AECgs and the TDcs each build on the previous. The AECcs adds DOD/Federal specific requirements to the Ncs guidelines. The AECcs is a *superset* of the Ncs and includes additional items such as expanded; File Names, Layer/Level Names, Graphic Symbolologies and Standardized *Editable* Details. The AECgs provide guidance on standard Border/Cover Sheets and Font Specifications, all of which are required for consistent DOD/Federal Military and Civil Works designs.

Where conflicts exist between Ncs and AECcs, the AECcs will take precedence. Likewise, where conflicts exist between the AECcs and TDcs, the TDcs will take precedence. The Ncs, AECcs, AECgs and TDcs remain the primary standards for paper-centric drawings.

Recently the U. S. Army Corps of Engineers published A/E/C Graphics Standard Release 2.0 ERDC/ITL TR-12-1 to provide guidance for creation of construction documents. Most typical industry standard symbols remain however there are adoptions of specific graphical representations for some symbols and drawing layouts to support uniformity across USACE construction documentation.

## Unit: 4 - CAD File Naming

File naming is an important part of the overall manageability of digital design files due to design file referencing and transport to different systems. Filenames must be unique to ensure they are not overwritten or misplaced within other projects.

The procedure described below provides a file naming convention that guard against duplicate design file names. All project design files shall be stored under their own project folder to simplify project archival procedures and reduce folder structure complications. The AECcs allows 20 characters for Project Code definition.

- The first six (6) characters of all project design file names (Model and Sheet File) shall incorporate Tulsa District's Project Code and be terminated by a single Underscore (\_) symbol.
  - The first two (2) characters shall be the beginning letter(s) of the installation name or project location (i.e. **TI**-Tinker AFB, **MC**-McAlester, **GC**-Garvin County).
  - The third and fourth characters shall be the last two numbers in the fiscal year of the project contract award (i.e. **15**-FY15).
  - The fifth and sixth characters shall be two (2) beginning letters from any word(s) in the official project title (i.e. **CL**-Consolidated Logistics Support Facility, **SB**-Stream Bank Protection, **SR**-Starship Barracks Rehab).
  - If desired the remaining 14 Project Code characters may be used to further identify different features within a project (i.e. areas, buildings, etc.). This addition within the 20 character Project Code shall follow the six (6) character Tulsa District Project Code and a Hyphen (-), and be terminated by a single Underscore (\_) symbol, immediately prior to the Discipline Designator.
  - Remaining **Model File** naming shall be as shown in the AECcs, beginning on page 11
  - Remaining **Sheet File** naming shall be as shown in the AECcs, beginning on page 18
- Note: Only ONE Model File Type per "Model File" and only ONE printed drawing per "Sheet File" as outlined in the AECcs.**
- The three (3) character file extension shall reflect CAD file format (\*.**dgn** for MicroStation and \*.**dwg** for AutoCad files). The "XXX" used in examples are user definable and optional.

Examples: MicroStation, Architectural, Floor Plan, Model File

**TI14CL\_A-FPXXXX.DGN**

MicroStation, Architectural, Floor Plan, Model File

**TI14CL-bldg2\_A-FPXXXX.DGN (w/additional project definition)**

\*\*MicroStation, Architectural, Floor Plan, Sheet File

**TI14CL\_A-101XXX.DGN (No add'l. project definition or Level 2 Designator)**

\*\*MicroStation, Architectural, Floor Plan, Sheet File

**TI14CL\_AD101XXX.DGN (w/Level 2 Designator)**

MicroStation, Architectural, Floor Plan, Sheet File

**TI14CL-bldg2\_A-101XXX.DGN (w/additional project definition)**

\*\* On all except the most complex projects, provide Sheet File names using Discipline Designator and a dash (-) instead of Level 2 Designators. (C-101, A-101, M-101, etc.)

In Sheet Files containing title blocks, the Sheet Identification Block shall be as shown in AECgs, page 11-12. In the example above the resulting Sheet Identification Number would be **A-101**. **Note: Sheet Reference Numbers are also used in detail/section bubble symbols.**

## Unit: 5 – Drawing Composition

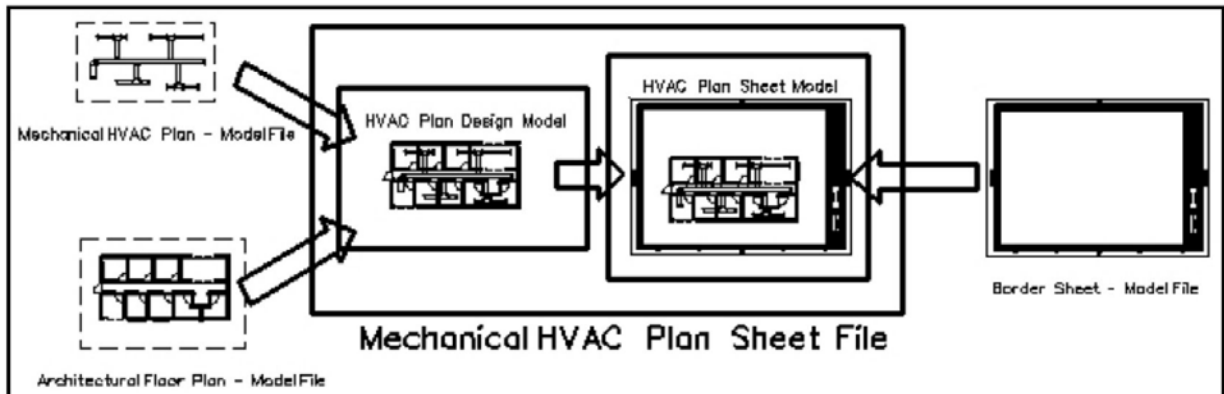
1. Previous releases of the AEC CAD Standards provided two (2) options for Design Model/Sheet Model use. The latest release depicts only Option 1 Drawing Composition. Tulsa District employs an additional Drawing Composition as follows to provide CAD deliverables formatted to support CAD Standards in use at the installation/facility.

**Option 1**-AutoCad; Compose Design and Sheet Model as shown in AEC 6.0, Figure 2-1, pg. 9. *Typically Air Force customers.*

**Option 2**-MicroStation; Compose Design Model Only as shown in Figure 2-3 below. *Typically Army, BIA and DOT customers.*

### Option 1 – Use of Design Model and Sheet Models

This option uses the Design Model and Sheet Model (or Paper Space). The Sheet Model would have all *Design Models scaled down* (ie. 96:1 @ 1/8” per Foot, 48:1 @ 1/4” per Foot) to fit inside a 1:1 border model.



### Option 2 – Use of Design/Sheet Model only

This option uses the Design Model only. The Design (Sheet) Model would have all model files referenced to it, including the border. The *Border Sheet shall be scaled up* (ie. 96:1 @ 1/8” per Foot, 48:1 @ 1/4” per Foot) to fit around the *Non-Scaled (1:1) Design Model*.

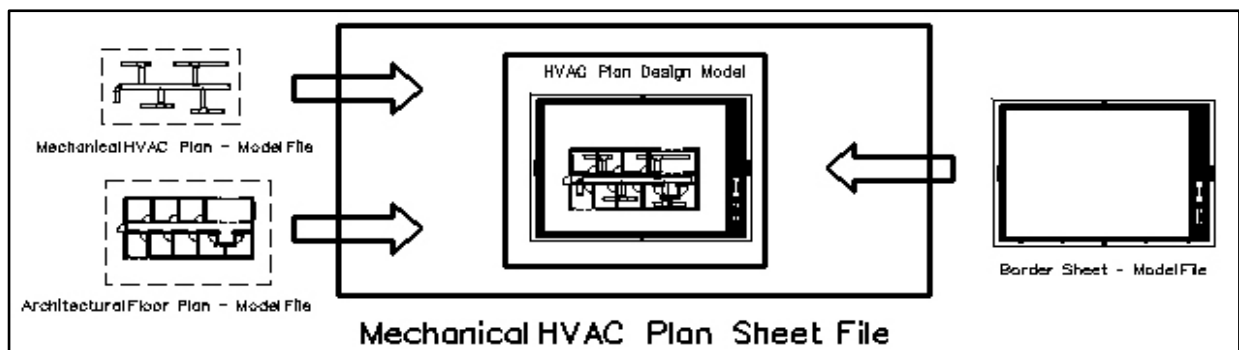


Figure 2-3. Sheet file composition using only the Design Model.

2. Tulsa District provides modified versions of the AEC CAD Standard Border Sheets for use on Tulsa District projects. Additional fields such as Invitation, Contract Number and Plot Date have been added to satisfy contractual requirements. Refer to Appendix “A”, Tulsa District Standard Engineering Files for links to the AEC CAD Standard Border and Cover Sheets in B, C, D and F sizes.

## Unit: 6 – Amendments, Modifications and As-Built CAD Files

1. During the evolution of all projects, amendments play an important role, in finalizing the project design. **Amendments** occur after Bid Documents (100% submittal) have been plotted and before construction contract award. **Note: All Amendments shall be posted in the most current project CAD files. Amendments shall be posted sequentially to design files as they are issued. This insures later Amendments consider previous Amendments made to the same design files.**

2. Final Amended drawings shall be plotted for the construction contractor after contract award. Contract **Modifications** occurring during project construction shall be posted in the Contract design files. **Note: All Modifications shall be posted in the most current project CAD files. Modifications shall be posted sequentially to design files as they are issued. This insures later Modifications consider previous Modifications made to the same design files.**

3. As-Built information collected during construction activities that reflect final conditions on-site shall be posted to the CAD files by the construction contractor. For Design-Build contracts the designer and construction agent are one in the same. These As-Built CAD files shall be forwarded to Tulsa District as required by contract.

## Unit: 7 – Georeferenced Design Files (Plan Views)

The data format(s) should be clearly stipulated and agreed upon with contractors and cooperators prior to data collection and processing start. It is the preference of SWT to have all work georeferenced to conform to existing mapping, which can be identified at commencement of work. This applies to plan view data as it relates to global positioning.

## Unit 8 - Deliverables and Data Exchange Formats

1. Upon completion of all design work within CAD files, contractor shall;
  - a. Purge all Unused Layers/Levels, Reference File Links, Text Styles and Dimension Styles from each CAD file.
  - b. Delete all unnecessary graphics within each CAD file.
  - c. Compress all CAD files to provide the smallest electronic file size.
  - d. Save the CAD file with intended plotted area, fit into the opening View.
  - e. Remove ALL Unnecessary Files from delivery media.
  - f. Provide Electronic Documentation for all Non-AEC CAD Std. Compliant File Name and Layer Names. Refer to Appendix A.

2. All files and media shall be in a ©Microsoft Windows compatible format. All media shall be clearly labeled with project name, contract number and contents description. Do not include any “AutoRun” or startup files on CD’s or DVD’s. **Note: All data shall be written to digital media in an uncompressed, native format, except as noted otherwise.**

**Format Combinations for Digital Data** (listed in order of preference)

1. Recordable Compact Disc CD-R 650MB or 700MB w/Printed Label
2. ReWritable Compact Disc CD-RW 650MB or 700MB w/Printed Label
3. Recordable Digital Versatile Disc DVD+/-R Disc 4.7GB w/Printed Label
4. ReWritable Digital Versatile Disc DVD+/-RW Disc 4.7GB w/Printed Label

3. Due to variances of digital data read/write capabilities, TDCOE reserves the right to require delivery of digital data, utilizing any combination of media listed in the above sections. These requirements will be determined on a case by case basis. Electronic transfer of digital data may be requested by TDCOE for small amounts of data and/or to facilitate scheduling requirements. The A/E shall be responsible for obtaining assistance from third party contractors, if necessary, to provide digital data in the required format as directed by TDCOE.

**Improvements & Suggestions-**

Recommendations, suggestions, clarifications and additions to this document should be sent to:

Attn.: Blake English, Military Design Section  
CAD Systems and ProjectWise Administrator  
Tulsa District, Army Corps of Engineers  
1645 S. 101st E. Avenue, Tulsa, Oklahoma 74128  
Or <mailto:Blake.English@usace.army.mil>

# Appendix A

## **Tulsa District CAD Resource Library and Sample Title Blocks**

Find CAD related documents under the following directories available by connecting to –  
<http://www.swt.usace.army.mil/BusinessWithUs/Engineering.aspx>

### **Tulsa District CAD Standard Files**

- Tulsa District CAD Standards Review Checklist
- Sample Non-AEC Compliant List
- Tulsa District CAD Standards for AEC R4.0
- Tulsa District CAD Standards for AEC R5.0
- Tulsa District CAD Standards for AEC R6.0

#### DESIGN FILES-

- Tulsa District Standard MicroStation Covers and Borders.zip
- Tulsa District Standard AutoCad Covers and Borders.zip

### **United States National CAD Standard V6**

<https://www.nationalcadstandard.org/ncs6/>

### **A/E/C CAD Standard Release 6.0**

<https://cadbim.usace.army.mil/default.aspx?p=a&t=1&i=7>

### **A/E/C Graphics Standard Release 2.0**

<https://cadbim.usace.army.mil/default.aspx?p=a&t=1&i=9>

### **CAD Details Library**

<https://cadbim.usace.army.mil/default.aspx?p=a&t=1&i=8>

**Tulsa District Homepage** - <http://www.swt.usace.army.mil/>

**©Bentley Systems, Inc. Homepage** - <http://www.bentley.com/>

**©AutoDesk, Inc. Homepage** - <http://www.autodesk.com/>





## Sample AEC CAD Standard Non-Compliancy Documentation

<b>NON AEC COMPLIANT DOCUMENTATION</b>		
<b>Date:</b>	Nov-08	
<b>Project:</b>	SAFB - 08 Pipeline Dormitory	
<b>Project No.:</b>	ABCD-1234	
<b>NON-COMPLIANT FILE NAMES</b>		
<b>File Name</b>	<b>Layer</b>	<b>Documentation</b>
SH08PD_V-GP01.dwg		file contains existing topography in a free-standing file which is only referenced into a small number of files.
<b>NON-COMPLIANT LAYER NAMES</b>		
<b>File Name</b>	<b>Layer</b>	<b>Documentation</b>
<b>General Xref files</b>		
SH08PD_G-KP.dwg	G-ANNO-PATT-AWING	Sheet-specific patterning and hatching (keyplan area patterning)
SH08PD_G-KP.dwg	G-ANNO-PATT-BWING	Sheet-specific patterning and hatching (keyplan area patterning)
SH08PD_G-KP.dwg	G-ANNO-PATT-DWING	Sheet-specific patterning and hatching (keyplan area patterning)
<b>Civil Xref files</b>		
SH08PD_V-SP01.dwg	V-SITE-FENC-DEMO	Existing fence to be demolished
SH08PD_V-SP01.dwg	V-SITE-IDEN-DEMO	Existing site annotation of item to be demolished
SH08PD_V-SP01.dwg	V-SITE-OTLN-DEMO	Existing site features to be demolished
<b>Architectural Xref files</b>		
SH08PD_A-FPF101.dwg	S-COLS-PRIM	Primary columns
SH08PD_A-FPF201.dwg	A-FLOR-STRS-4TH	Stair risers/treads, escalators, ladders (floor specific)
SH08PD_A-FPF201.dwg	A-FLOR-STRS-5	Stair risers/treads, escalators, ladders (floor specific)
<b>Structural Xref files</b>		
SH08PD_S-FPF100.dwg	S-BEAM-SCND	Secondary beams, girders
SH08PD_S-FPF100.dwg	S-BEAM-SCND1	Secondary beams, girders
SH08PD_S-FPF100.dwg	S-BEAM-SCND2	Secondary beams, girders
<b>Mechanical Xref Files</b>		
SH08PD_M-HPF101.dwg	E-POWR-XFMR	Electrical Transformer
SH08PD_M-HPF101.dwg	M-CWTR-RETN	Piping (includes fittings, valves) - return
SH08PD_M-HPF201.dwg	M-CWTR-RETN	Piping (includes fittings, valves) - return
<b>Electrical Sheets</b>		
180007E-101.dwg	F-ALRM-DTCT	Smoke/heat/other detectors - model space
180007E-104.dwg	F-ALRM-DTCT	Smoke/heat/other detectors - model space
180007E-101.dwg	F-ALRM-INDC	Indicating appliances - model space
<b>Electrical Xref Files</b>		
SH08PD_E-PL.dwg	C-PKNG-CURB	Curbs and gutters - Electrical Site
SH08PD_E-PL.dwg	C-PKNG-STRP	Parking space striping
SH08PD_E-PL.dwg	C-SITE-FENCE	Fences and handrails
<b>Plumbing Sheets</b>		
180007P-504.dwg	P-DETL-GRPH-LITE	Graphics, gridlines, non-text items (lite pen weight)
180007P-504.dwg	P-DETL-GRPH-SCRN	Graphics, gridlines, non-text items (screen pen weight)
<b>Plumbing Xref files</b>		
SH08PD_P-PPF101.dwg	P-DOMW-EQPM-HTR	Hot and cold water equipment
SH08PD_P-PPF101.dwg	P-DOMW-EQPM-PUMP	Hot and cold water equipment
SH08PD_P-PPF101.dwg	P-DOMW-EQPM-CLER	Hot and cold water equipment