**US Army Corps**
**of Engineers**
**Afghanistan Engineer District**

# AED Design Requirements:
## CAD Design Guide

Various Locations,
Afghanistan

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AED DESIGN REQUIREMENTS
FOR
CAD DESIGN
VARIOUS LOCATIONS,
AFGHANISTAN

## 1. General

This design guide presents summarized criteria of Standard CAD Industry accepted practices and procedures. It is intended to assist CAD personnel to perform and execute requirements consistently to meet the A/E/C CAD Standards parameters on all design projects. Emphasis is on drawings meeting sheet layout standards, level/layer naming standards and sheet naming conventions. Use of the comprehensive A/E/C CAD Standards manual Version 3.0 or newer is required for all aspects of CAD drawing.

## 2. Drawing Requirements

Computer Assisted Design and Drafting (CAD) is required for all Afghanistan Engineer District-North contracts **and requirements are stipulated in Section 01335 of these contracts**. Only personnel proficient in the preparation of CAD drawings shall be employed to modify the contract drawings or prepare new drawings. The CAD deliverables shall meet the requirements of the A/E/C CAD Standards (V 3.0 or newer) and as described in Section 3 of this document. The A/E/C CAD Standards may be downloaded at the CAD/BIM Technology Center at the following link: https://cadbim.usace.army.mil/default.aspx?p=s&t=13&i=4. The Contractor shall furnish all softcopy design submittals (and As-Builts) using software applications in either DWG format (AutoDesk, AutoCad Release 2007 or newer) or DGN format (Bentley Systems, MicroStation, version 8.0 or newer). Use of unregistered or student copies of software applications to prepare design drawings **IS NOT PERMITTED**. In addition, the Contractor is required to submit the softcopy design submittals in PDF (Adobe Acrobat) format.

a) Drawings

Drawings shall be prepared in the English language with metric (SI) units of measure. All drawings and details of the working drawings shall be labeled and cross-referenced, thoroughly checked and coordinated with other engineering disciplines.

b) Drawing Size Border Sheets

All drawings shall be prepared in size "A1" border sheets (594mm by 841mm). Hardcopy design submissions may be printed on half size drawing sheets (“A3”, 297 mm by 420 mm) for purposes of saving paper and for ease of review. If drawings are not readable in the half size reduction, the A-E shall submit all drawings in A1 border sheets. All final contract drawing sets (As-Builts) shall be submitted on A1 border sheets. Drawing sheets shall be trimmed to specified size if necessary.

c) Sequence of Design Drawings

In reference to the A/E/C CAD Standards manual, the sequence of drawings in a set shall follow the order as shown below:

Discipline

1. General
2. Hazardous Materials
3. Survey/Mapping
4. Geotechnical
5. Civil
6. Landscape
7. Structural
8. Architectural
9. Interiors
10. Equipment
11. Fire Protection
12. Plumbing
13. Process
14. Mechanical
15. Electrical
16. Telecommunications
17. Resource
18. Other Disciplines
19. Sub-Contractor/Shop Drawings
20. Operations

d) Drawing Sheet Assembly

CAD files will be organized in what is described as "**Option 1a**" (page 9 in the A/E/C CAD Standards Drawing Sheet Assembly manual), normally referred to as "Model Space and Paper Space" in Autodesk Autocad applications and "Design Model and Sheet Model" in Bentley Microstation applications. All files will be drawn consistently in the same manner using this option throughout the entire project.

e) Model Files

Model files represent the building's physical layout and components such as floor plans, elevations and details. Model files shall be drawn to full size (1:1) in metric units in the default model view. Floor Plan Model files represent one floor. Example: do not use one model drawing file to draw several floor plan drawings with several border files. Model files shall have insertion coordinates (x,y,z) of 0,0,0 in model space on layout. The exception for model files with insertion coordinates other than 0,0,0 shall be the civil site plans (using Georeferencing and real-world coordinates.) Dimensioning shall be in millimeters unless noted otherwise, drawn associatively, and not be "forced". Example: if a wall is drawn at 150 mm but the dimensioned number is modified to 200, this is unacceptable.

f) Border Sheet Files

Border sheet files are referenced into model files for plotting and viewing purposes. Every border sheet file has a drawing area, Title Block information and sheet border. The Afghanistan Engineer District – North uses a common Title Block sheet border for each project. Please see Section 4 of this AED CAD Design Requirement document. The project Title Block sheet border with "sheet independent" data is referenced to each drawing. When a drawing file is created, "sheet dependent" Title Block data, such as the Sheet Identification and Title, is added to the specific drawing file and located where the Title Block is referenced and viewed.

g) Sheet Identification Block

The sheet identifier will consist of the discipline designator, the sheet type designator and the sheet sequence number as referenced in the A/E/C CAD Standards.

h) Layer/Level Naming

Layer or level files names shall follow the guidelines of the A/E/C CAD Standards. For AutoCAD, [discipline].dwt (drawing template files) shall be used to import the proper layers that will be inclusive of the correct line type, color, and line thickness of the respective layer. Templates to be used are found on the CAD/BIM Technology Center at the following link: https://cadbim.usace.army.mil/default.aspx?p=s&t=13&i=4. These will also be provided as described in Section 4 of this document.

i) Drawing File Naming Convention

CAD files shall follow the naming convention as described in the A/E/C CAD Standards and must be followed thoroughly.

j) Drawing Scales

The scales indicated on the following list shall be the guide in determining the scale for all drawings. Bar scales on drawings are preferred as printed copies may lose their plotted scale through generational copying. The Contractor may, at its option, make exceptions to the scales indicated, if approved in writing by the Contracting Officer.

| **TYPICAL DRAWING SCALES** | |
|---|---|
| **DRAWING TYPE** | **METRIC** |
| SITE PLAN | 1:200 |
| | 1:400 |
| | 1:500 |
| | 1:600 |
| | 1:700 |
| | 1:1000 |
| | 1:2000 |
| | 1:5000 |

| | |
|---|---|
| | 1:6000 |
| | 1:10000 |
| | 1:20000 |
| FLOOR PLAN | 1:50 |
| | 1:100 |
| ROOF PLAN | 1:200 |
| EXTERIOR ELEVATIONS | 1:100 |
| | 1:200 |
| INTERIOR ELEVATIONS | 1:50 |
| | 1:100 |
| CROSS SECTIONS | 1:50 |
| | 1:100 |
| | 1:200 |
| WALL SECTIONS | 1:20 |
| STAIR DETAILS | 1:10 |
| DETAILS | 1:5 |

k) Symbols, Line Styles and Patterns

Approved symbols, line styles, and patterns shall be in accordance with A/E/C CAD Standards The approved symbols, line styles, and patterns associated with AutoCAD software maybe downloaded in the following link:
https://tsc.wes.army.mil/products/standards/aec/aecstdsym.asp

l) Legends

For each submittal, legends of symbols and lists of abbreviations shall be placed on the drawings. They shall include all of the symbols and abbreviations used in the drawing set, but shall exclude any symbols and abbreviations not used. Since many symbols are limited to certain design disciplines, there is a definite advantage to the use of separate legends on the initial sheet of each design discipline or in the Standard Details package for each discipline. If legends have not been shown by discipline, a legend shall be placed on the first drawing of the set.

m) Location/Column Grid

To facilitate the location of project elements and the coordination of the various disciplines' drawings, all plans shall indicate a column line or planning grid, and all floor plans (except structural plans) shall show room numbers.

n) Composite and Key Plans

If the plan of a large building or structure must be placed on two or more sheets in order to maintain proper scale, the overall plan (key plan) shall be placed on one sheet at a smaller scale to accommodate entire building/site. Key plans shall be used not only to relate large scale plans to total floor plans but also to relate individual buildings to large complexes of buildings. This key plan with match lines shall be referenced on all segmented drawings and shall be placed in a

convenient location to indicate the relative location of the represented plan area by crosshatching.

o) Specifications Placed on the Drawings

Details of standard products or items which are adequately covered by specifications shall not be included on the drawings.

p) Revisions

Drawing revisions shall be prepared only on the original CAD files. A revision history (located in Title Block) is required on all sheets.

q) Plotter Prepared Original Drawings and PDF files

Design files shall be developed in anticipation of plotting on a monochrome, vector plotter. Line density shall be equivalent to that produced by black India ink: half tone plots are only acceptable where the half-tone color setting of RGB (red, green blue) settings equal a value of 153 . (Please refer to the A/E/C CAD Standards). Drawings plotted/printed in color are not acceptable. Manual changes to plotted originals are not acceptable. A separate Adobe PDF file shall be made of each drawing file oriented in "Landscape". Each PDF drawing file shall then be compiled into one "binder" PDF file for each set of drawings.

**3. 100% DESIGN DRAWING DELIVERABLE PROCEDURES**

At every design submittal phase, all drawings will have an A/E/C CAD Standards (V3.0 or newer) audit conducted by the Afghanistan Engineering District-North. Prior to submitting the 100% Final drawings to the Government, the following procedures will be performed by the A-E on each drawing:

AutoCad drawings:

a) All external referenced (XREF) files shall be BOUND to drawing.
b) All unused layers, dimension styles, blocks, line types, materials, mline styles, plot styles, shapes, table styles and text styles shall be PURGED from drawing.
c) Drawings will be saved as AutoCad 2007 or newer.

Microstation drawings:

Compress (using full Options)

## 4. GOVERNMENT PROVIDED FILES

All CAD files provided by the Government as described below can be downloaded through the following Afghanistan Engineering District-North website link:

http://www.aed.usace.army.mil/AEN-Index.asp

If you are unable to gain access to this site, a CD will be provided upon request to the Project Manager.

a) AutoCad Release 2009 Afghanistan Engineering District-North Title Block and Cover/Index sheet files (AED_TITLEBLOCK.dwg, AED_COVER/INDEX.dwg)

b) Microstation Afghanistan Engineering District-North Title Block and Cover/Index sheet files (AED_TITLEBLOCK.dgn, AED_COVER/INDEX.dgn)

c) Autocad 2009 drawing template files per A/E/C CAD Standards V4.0 for layer conventions. Included in these template files are the compiled shape file (.shx), multi-line style file (.mln) and line definition (.lin) files. (Please note that these files may be directly downloaded from the CAD-BIM Technology Center website https://cadbim.usace.army.mil/default.aspx?p=s&t=13&i=4
:

1) Architectural.dwt(s)
2) Civil.dwt(s)
3) Electrical.dwt(s)
4) Fire_Protection.dwt(s)
5) General.dwt(s)
6) Geotechnical.dwt(s)
7) Hazardous_materials.dwt(s)
8) Interiors.dwt(s)
9) Landscape.dwt(s)
10) Mechanical.dwt(s)
11) Plumbing.dwt(s)
12) Structural.dwt(s)
13) Structural_TF-analysis.dwt(s)
14) Survey_Mapping.dwt(s)
15) Telecommunications(s)

c) PDF of the A/E/C CAD Standards V4.0