



**US Army Corps
of Engineers®**

Mississippi Valley Division

A/E/C CAD Standard

Supplement

Mississippi Valley Division

6 February 2010

Supplement to A/E/C CAD Standard, release 4.0, developed by the CAD/BIM Technology Center.

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Introduction

This supplement is established to supplement the CAD/BIM Technology Center's A/E/C CAD Standard, and the National CAD Standard. It is intended to be used in conjunction with the A/E/C CAD Standards manuals and National CAD Standard.

Purpose

The purpose of this supplement is to clarify the proper use of the A/E/C CAD Standard and National CAD Standard within the Mississippi Valley Division. Adherence to this supplement will provide a consistent platform for developing Computer Aided Drawings, and is a prerequisite to achieving good drawing management on Mississippi Valley Division projects.

Platforms

The target platform for all CAD work is an Intel-based computer running Windows XP (or later), and using Bentley Systems' MicroStation V8 XM Edition (ver. 8.9) (or later). Unless specifically exempted, all drawings created by or delivered to a district shall be in a format that is fully compatible with the target platform. Compatible files are defined as those able to be opened, viewed, modified, re-saved and plotted successfully from their original delivered format.

Terminology

The terms below are defined as follows:

- Shall** – Mandatory action or item on the part of the Contractor
- Should** – Preferred, but not required, item or action on the part of the Contractor
- May** – Optional action or item on the part of the Contractor
- Will** – Pertains to an action by the Government, this term shall not be used to refer to an action by the Contractor

Note: As standard practice, only the term "shall" is to be used on drawings. If in doubt, confer with the Specifications Engineer.

- Reference Drawing** – A drawing that is part of the contract drawing set that reflects existing conditions.
- Reference File** – A model file that is referenced into a sheet file.
- Section** – A view of an imaginary cut taken through an object to reveal the interior construction.
- Detail** – A view that further defines an object, usually a blow up of a plan or section.

Design Area

File Accuracy (units)

Architectural working units shall be as follows:

Master Units = Feet (')

Sub Units = Inches (")

Architectural resolution shall be 304800 per foot.

Engineering working units shall be as follows:

Master Units = Survey Feet (ft)

Sub Units = Survey Inches (in)

Engineering resolution shall be 304800 per survey foot.

Drawing Sheet Assembly

Use of Design Model and Sheet Model

There shall be one sheet file per drawing. For each sheet file there shall be a maximum of one sheet space (required) and one model space. This model space, if used, shall only be referenced into its own sheet space; if the model space of the sheet file is referenced any where else, then it shall become its own model file. For each model file, there shall be a maximum of one model space, with the only exceptions being for cell or design libraries. There shall be one title block/border model file per project.

Drawing Packages

The work limit tables shall be included in the contract drawing set. The real estate drawings showing all applicable interests may be included as reference drawings.

Electronic Drawing File Naming Convention

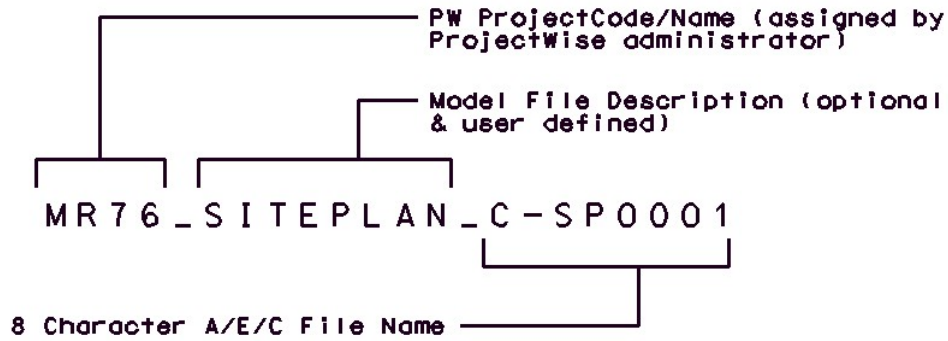
Electronic files shall be named as recommended in Chapter 2 of the A/E/C CAD Standard. This naming convention allows for the use of 28 characters, with the first 20 characters being optional. The first twenty optional characters, defined as the Project Code in the A/E/C CAD Standard, shall be as defined below. The actual number of characters utilized in the Project Code field may vary (20 character maximum). However, use of the last eight characters of the file name, those immediately preceding the file extension, is mandatory.

Design Model Files

The first 20 characters (Project Code) of a design model file name shall consist of a ProjectWise (PW) Project code/name and design model file description (optional). The PW Project code/name shall be the same for each project drawing file (could be the P2 number, if unique). The PW Project Code/Name is assigned by the ProjectWise Administrator. Use of the underscore symbol “_” to separate the fields is optional.

EXAMPLE: A model file containing the site plan for Mississippi River would have the model file name MR76_SitePlan_C-SP0001.dgn.

MODEL FILE PROJECT CODE
(20-character maximum)

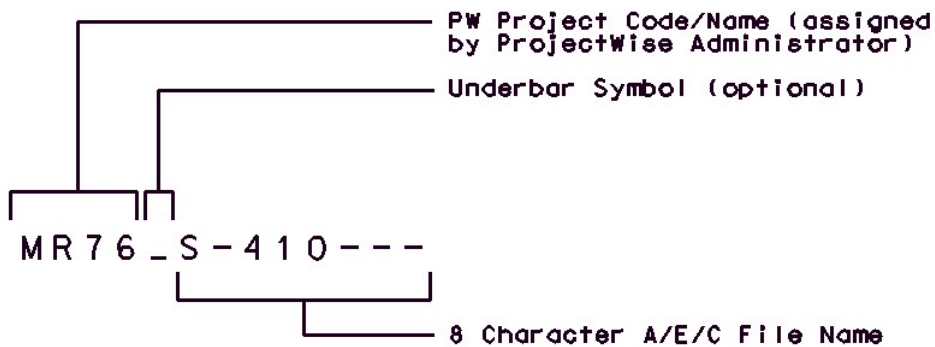


Sheet Files

The first 20 characters (Project Code) of a sheet file name shall consist of the ProjectWise (PW) Project Code/Name. Use of the underscore symbol “_” to separate the fields is optional. With the exception of hydrographic data, reference drawings shall follow the sheet file naming convention.

EXAMPLE: A structural sheet file containing concrete outlet plan and sections for a Mississippi River plans and specifications drawing set would have the file name MR76_S-4010---.dgn.

SHEET FILE PROJECT CODE
(20 character maximum)



Drawing Packages

Contract Drawing Set

The drawings within the contract set shall be arranged in the following sequence:

1. General Drawings
 - a. Cover sheet
 - b. Vicinity and Location maps
 - c. Drawing index sheet (s)
 - d. Legend sheet(s) (may be combined with drawing index)
 - e. Site plan, general plan, or general arrangements
2. Scope of work (scope of work may only be included in the drawing set when specifications will not be furnished.)
3. Geotechnical Drawings
 - a. Boring Log location plan
 - b. Boring Logs
4. Civil Site Drawings
 - a. Plan or plan and profile drawings
 - b. Profile drawings
 - c. Section drawing
 - d. Detail drawings
5. Landscape and Recreation Drawings
6. Structural Drawings
7. Architectural Drawings
8. Mechanical Drawings
9. Electrical Drawings
10. Reference drawings (No changes to be made to these drawings)
 - a. Hydrographic Data
 - b. Existing Condition Drawings

Drawings within each discipline shall be arranged in sequence of overall perspective or fewest details to those drawings containing the most detail, followed by those drawings containing supporting information.

Presentation Graphics

Unless otherwise specified, presentation graphics shall be as recommended in the A/E/C CAD Standard. Line width and color requirements for specific features are listed in the A/E/C CAD Standard.

Line Widths

Final plotted line widths are determined by the line weights assigned to an element.

Line Types/Styles

Only the default, “out-of-the-box“ MicroStation or AutoCAD line styles, or the A/E/C CAD Standard supported/furnished line styles shall be used. Custom line styles developed by the user shall not be allowed.

Line Color

The actual display color associated with a specific MicroStation element color (CO=) is defined by the color table attached to the design file. The default MicroStation color table is used to standardize the appearance of elements on the computer display. If the user has a hard time distinguishing between the assigned colors, the screen color table can be modified. However, the line widths used shall be as recommended in the A/E/C CAD Standard.

Screening

Screened colors (half-tone lines) may be used to depict existing/unchanged features on plan, profiles and sections. Grids on profiles & sections may be screened.

Plotting

All aerials shall be plotted in grayscale. All sheet files shall be plotted grayscale only.

Text Styles and Fonts

The TrueType (TT) font Arial shall be used for text callouts and dimensions. If symbols such as “+” or “=” are a part of the text, TT Symbols shall be used. TT Lucida Console shall be used for general notes and table/schedule text. TT Arial italicized shall be used for labels denoting water, such as river names and the direction of flow. All text shall be in upper case unless lower case lettering is needed to define a formula. TT font Black bold shall be used for a filled font.

Text Size

Dimension, callout, and table/schedule text shall be plotted equivalent to 0.125” (or 3 mm) lettering size for all full size A/E/C CAD Standard compliant drawings. Contour line elevations, azimuths callouts, boring log text and hydrograph text may be plotted equivalent to 0.09375” (or 2.4 mm) lettering size. Sub-titles and Titles shall be plotted equivalent to 0.1875” (or 5 mm) and 0.25” (or 6 mm) lettering sizes, respectively. The text

height and text width shall be assigned equal number values. Line spacing shall be equal to one half of the text height.

Drawing Callouts

The “Place Note” command shall be used for all drawing callouts in MicroStation. “Generate Leader” shall be toggled on and “Association” is recommended to be toggled on when using this command. Callouts shall be left justified, and whenever possible, they shall be aligned. Callout text shall be placed so that it appears horizontal on the sheet file. Callout leaders shall never cross text, dimension lines, or each other. Placing callout leaders through dimension extension lines shall be avoided whenever possible; however, if this type of placement is necessary, the extension line shall be broken where the leader line passes through it. This shall be accomplished without dropping the dimension. When placing callouts, long lines shall be avoided so each callout remains within the modular area of the detail. If the leader to the multi-line callout is on the right side, the lines of text subsequent to the first line of text should be no longer than the first line of text whenever possible.

General Drawing Notes

Notes shall be placed in the upper right corner of the drawing whenever possible. Notes shall be contained within a single text node with upper left justification. Standard notes designating the units of measure shall appear on each metric drawing.

Plotting

Plotting is keyed from the line weight of the line work within the drawing. To achieve the proper line width and grayscale color (screening) on the plotted copy, the appropriate line weight and pen tables shall be used.

Border Sheets

Sheet Sizes

ANSI D size borders shall be used for all drawings. Drawings shall be plotted half-size when included in reports. ANSI A size borders may also be used for sketches/drawings to be included in reports.

Title Block

Sheet identification block. The sheet identification block (Figure 3-6) shall only contain the sheet identification as defined in the A/E/C CAD Standard.



Figure 3-6. Sheet identification block

Bar Scales

Sheet files containing scaled views shall contain the appropriate graph bar scale(s). When imperial units are used, a graph bar scale shall be placed for each scale used on the drawing. For metric drawings, only one graph bar scale representing the scale of the primary view on the drawing shall be used. Graph bar scales from the general cell library shall be used.



Figure 3-7. Sample graph bar scale

View Titles

View titles shall be placed using the symbols available on in the general cell library. View titles shall be centered under the view.

Dimensioning

General

The automatic dimensioning features of MicroStation shall be used for all dimensioning. Association shall be toggled on. If the extension line is broken to accommodate the placement of a callout leader, the association shall be dropped.

Filled arrowheads shall be used as dimension terminators.

Levels/Layers**Level/Layer Naming Convention**

All level or layer naming for projects within the Mississippi Valley Division shall conform to the AIA Format described in the A/E/C CAD Standard.

Level/Layer Assignment Tables

For all new project starts, the level/layer assignment tables found in the A/E/C CAD Standard shall be used.

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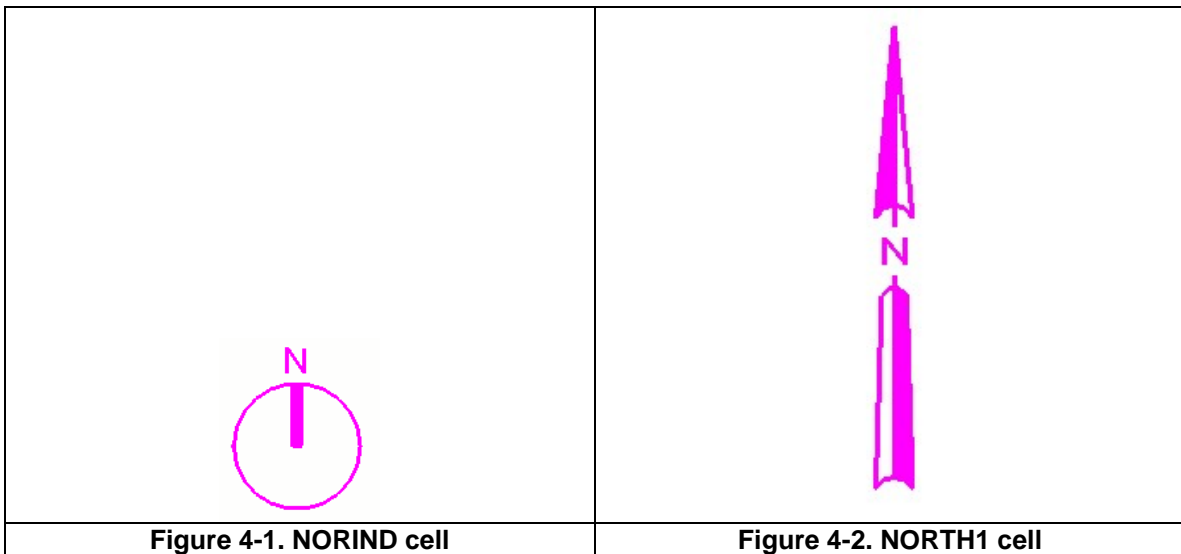
STANDARD SYMBOLOGY

Cell Libraries

General use cell libraries shall be used for all non-specific discipline symbology (e.g. north arrows, scale bars, section cuts, etc.). Project specific cell libraries shall be placed in the appropriate discipline folder of the project directory.

North Arrows

The north arrow used shall be either the cell NORIND or NORTH1. The location of the north arrow shall be consistent (or as consistent as possible) within the drawing set.



CAD Symbol

There shall not be any CAD symbols shown on any sheets.

Safety Symbol

There shall not be any safety symbols shown on any sheets.

Value Engineering Symbol

There shall not be any Value Engineering symbols shown on any sheets.

General

In general, all features shall be drawn to scale. Prefabricated items for which exact dimensions may vary depending on the manufacturer shall be drawn proportional. Connecting feature/component lines shall connect (i.e., do not “eye-ball” feature lines; use the snap and precision placement features which are a part of the CAD software). When break or match lines are used, feature lines shall be terminated at the break or match line. Match lines connecting two sheets shall match exactly.

For 3D files, 2D elements (such as text, real estate line, etc) shall be placed at elevation zero.

Drawing Layout

Modular Drawing

Modular drawing is an organizational technique that uses a grid to divide each drawing sheet into a system of drawing spaces called modules. All drawing areas shall be placed in a module or group of modules. Parts of one drawing area shall not enter into a module occupied by an adjacent drawing area. Leaving space between modules helps to clearly information pertaining to each module and enhances the overall appearance of the drawing.

View Orientation

Views shall be orientated on the sheet so that elevation and features are aligned when ever possible. When detailing, details shall appear on the sheet based on their orientation on the feature. For instance, a detail of the top of a wall shall be orientated above a detail of the bottom of the wall. If a detail is taken from a large-scale plan or elevation, the orientation shall remain the same as the view from which the cut was taken. If this not possible, a note stating the orientation was changed will be added (e.g., VIEW ROTATED 90 DEGREES). When two or more plans of the same structure or the plans of two or more different structures are put on the same drawing, the orientation of all must conform to one another and to their relative positions on the ground.

Civil maps (e.g., site plans, general plans, etc.) will be oriented so north is toward the top of sheet, or toward the right of the sheet if top orientation is impractical.

Flood control and navigation drawings (plans, elevations, and longitudinal sections of channels, levees, locks, dams, and similar structures). Cross-sections will be shown as if the observer were looking downstream. Stationing shall read up station and be from left to right, and shall take precedence over a north orientation.

Roadways and other structures. General plans, elevations, and longitudinal sections of roadways and other structures will be so oriented that north will be toward the top of sheet, or toward the right of the sheet if top orientation is impracticable. Stationing will be from west to east or south to north. Cross-sections will be shown as if the observer were looking up station. Stationing shall read up station (perpendicular to control line).

Required Notation

Coordinate Systems

The specified coordinate system/datum (usually State Plane) shall be denoted on maps (civil plans) whenever possible. The grid system used shall be described in the general notes.

Directional Indicators

The direction of water flow of all waterways will be indicated by the standard district flow symbol, at the upper and lower limits of sheet, pointing in the direction toward which the water moves. The true meridian will be shown on all maps or charts of land or water areas and, when useful, the magnetic declination (dated) should also be given.

Survey Source Data

All maps shall list the source of data used to generate the map to include scale, and type of source (e.g., USGS QUADRANGLE 1:24,000, AERIAL MAPPING at 1 in = 50 ft, 3rd LEVEL FIELD SURVEYS, SURVEY BOOK NUMBER, OR DATE OF SURVEY). This information shall also be included in the General Notes of a drawings set.

Cross Referencing Between Drawings

All Drawings shall be cross-referenced using the Sheet Reference Number located in the sheet identification block of the border.

Section and Detail References

Sections shall be denoted alpha characters. Details should use numbers for identification. A combination of alpha and numeric characters may be used, provided that the first character of a section is an alpha character and the first character of a detail is numeric. All alpha characters shall be capitalized. When referencing sections/details from another sheet, use characters unique to the drawing set (don't reuse letters/numbers).

Drawing Contents

The drawings are the instructions to the builder. They must be accurate, easily interpreted, and leave nothing to guess work. Drawings shall be prepared so that they convey the complete meaning intended with a minimum number of details. Drawings shall be prepared so that each drawing contains only one major category type per drawing (e.g., plan & profile, sections, details, miscellaneous metals).

Cover Sheet

The cover sheet, or first drawing in the set, shall include the approval signature block. The approval signature block is not required on the cover sheet for report and real estate drawings. If required by the owning district, the AE signature block/stamp shall be placed on the cover sheet where there is space. The date on the cover sheet shall be the month and year of drawing completion; for the solicitation drawing package, this would be the

month and year advertisement. The solicitation number is only required on the cover sheet for the plans and specifications drawing set. The plans and specification drawing set cover sheet shall be plotted on Mylar for signature, and then scanned to create a PDF file.

Location Sheet

The location sheet is the second drawing in the set and shall include the location map and vicinity map. The purpose of the vicinity map is to show major access routes to the project site. The location sheet shall be in engineering working units.

Index Sheet

The index sheet is the third drawing in the set. This sheet shall contain the index of all drawings in the set and list the reference drawings. If space permits, the sheet may contain the general legend and symbols. If there is not adequate space, additional drawings may be added for the indexing and/or the general legend and symbols.

Key Plans

If Key Plans are used, the following describes the specifics. Key Plans shall be shown on each plan view sheet. The Key Plan shall consist of a shape representing each plan view sheet. The footprint of the proposed project shall be shown. Additional project information (either existing or proposed) shall not be shown. There shall be a north arrow. The Key Plan shall be shown with north to the top of the sheet. The shape representing the plan view sheet that the Key Plan is on shall be hatched. The location on the sheet shall be consistent within the drawing set. It is recommended to be located in the upper right or the lower right of the border.

Legends

Legends shall be shown on the legend sheet. They shall not be repeated on each plan/profile sheet.

Survey & Mapping

Contours shall not cross contour text or buildings/structures.

Geotechnical

There shall be a plan view showing the locations of the boring logs. This may be a separate Geotechnical plan view or in combination with the Civil plan view.

Reference Drawings

Reference drawings are drawings that are included at the end of the drawing set that portray existing or historic conditions. These drawings are used for reference only, and shall not be changed.