

Working Together as a Team with CAD

Working with a design group composed of many professions, each from a different company, can be a challenge. The architect is from one firm, structural from another, civil, MEP, interior decorator, fire protection, etc. Besides all these company standards and pen tables, each person has their own way of getting their work done and each discipline has unique needs that their CAD system must satisfy. The National CAD standard is an attempt to get the whole world on the same page but there's a long ways to go before we get to the point where everyone will abandon the system they've spent years developing. In the meantime, there are several things a team can do that will make working together much easier. If each team member wants or expects others to reference their drawings with ease, there are certain minimum drafting techniques and processes that must be adhered to. What follows is a list of suggestions that have been found to make working together in a design group easier. Each suggestion is shown in black with the reason why shown in blue after it. Please look these over and consider making these the basis for your CAD work. Please send any feedback, corrections, or suggestions to tstahlnecker@dcengineers.com.

- Everything on a drawing, including blocks and their components, should be set to color by layer.
I consider this to be CAD's Golden Rule. This allows others who xref your drawing to manipulate the colors of your drawing just by modifying the layer color. If you set an object to be a specific color such as color #7, then another drawing which xrefs your drawing will not be able to change its' color from #7. Since the person xrefing your drawing is working with a different pen table, setting an object to a specific color will make your drawing unusable to them.
- Blocks should generally be created from base components that are on the zero layer set to color by layer. This wouldn't apply to blocks that require multiple line weights or to attributes.
Blocks whose basic elements are composed of zero layer set to color by layer will become the color of the layer that they are placed on. This allows other to use your block as-is just by placing it on a layer of the appropriate color. Making these elements linetype by layer is also a good idea but doesn't need to be a strict rule like color by layer.
- Nothing on a drawing should be placed on the zero layer or on the Defpoints layer. If you need something to show but not plot, create a new non-plotting layer.
This is because items on those layers cannot be individually shut off or frozen when xrefed and the person xrefing your drawing may not want those items to display. It may be appropriate to place items on the Defpoints layer for the title block since all disciples would use that.
- A common 0,0,0 point should generally be used on all drawings that is chosen at the project's start and doesn't change during the life of the project. If a drawing shows a floor plan, the 0,0,0 point would best be the center point or corner of a structural column or member chosen by the structural engineer that is not expected to shift during the life of the project. If a drawing only has details, schedules, and so on but not part of the floor plan, the 0,0,0 point should be the lower left corner of the title block extents. Drawings with multiple enlarged views also won't be able to do this.
Having one common 0,0,0 point among all drawings allows anyone to xref someone else's drawing and not have to wonder about where or how to insert it such that it lines up with their drawing.
- When you xref a background onto a drawing, do not move it from the 0,0,0 point or rotate it in any fashion.
Same point as above. If you move the background xref and draw over it, someone xrefing your drawing will not be able to align what you drew to their drawing without extra effort.

- Xrefs should typically be overlays and not attachments.
An xref that is an overlay will not load in with the drawing when it itself gets xrefed by a third drawing. This will prevent the person xrefing your drawing from loading unwanted files such as your title block. This will make loading files faster, uses less system resources such as RAM, and leaves the person xrefing your drawing with fewer layers to manage.
- Text, leaders, call outs, and other tags must not be placed on the same layer as the building elements.
If someone xrefs your drawing, they will likely want to shut off all text, leaders, and tags and only show the building, structure, or equipment. If you have these items on the same layers, they will not be able to shut them off without shutting off what they want to show.
- Try to use fonts that everyone else has. If you use a unique font, please share it with the design team. If you plot PDF's, see if you can embed font subsets so that the PDF will display and plot properly on someone else's computer.
Someone trying to plot or xref your drawing will not be able to do so properly if they don't have the font that you used. When you open someone else's drawing, check the text window to see if your machine is substituting any fonts. If so, you will need to email the person you got the drawing from to get that font. After plotting a PDF, open it, check the Document Properties, and look at the Fonts tab. It will tell you if the fonts are embedded.
- Text styles used in your drawings should have a unique name. Don't use generic style names such as "Standard", "Romand", or "Bold". Make your style names unique by appending your initials or company name such as "DCE-Standard" or "TLS-Bold".
If you have a text style the exact same name as one in the drawing you are xrefing, your settings will take priority over the style in the xref. This will cause text in the xref to display incorrectly.
- When transmitting your drawings, please include any used unique fonts, all xrefs, all photos, and the pen file needed to plot your drawing.
All of these items are needed in order to plot or xref your drawing. The "eTransmit..." function in AutoCAD can assemble all of these items for you. You wouldn't generally have to use this function for every single drawing you send out but it might be useful the first time you send something to make sure that your recipient is getting everything they might need.
- When attaching photos, OLE objects, or xrefs, we recommend setting them to "no path" and place the item in the same folder as the drawing. Give them names that will make them unique.
If you set your xrefs to full path, the directory on the FTP site or another member's local hard drive will not have the same directories. This will make finding the attachment difficult. Relative pathways are better than full pathways but these can also be irritating since it prevents others from organizing their drawing folders the way they want to. You will need to give attachments unique names since your drawing may be placed in a folder with drawings and attachments from a dozen other firms. A photo named PHOTO1.jpg or an xref named BACKGROUND.dwg may be the same name someone else is using. Appending it with your initials, company name, or profession might work. For example "DCE-Photo1.jpg" or "Elec-BKG-1.dwg".
- Avoid archiving old versions of layouts or details by dragging them off to the side of your drawing. Instead, write block them to a separate file that you can keep around on your local drive.
Placing unused items all around your drawing is confusing to others as to what is the current design. If they xref your drawing, these unused elements will also xref in making it necessary for them to xclip your drawing in order to get them out of the way.

- Set the line type scale factor system variable (LTSCALE) to the same value as your drawing scale. For example, an 1/4" scale drawing would have the LTSCALE set to 48, an 1/8" scale drawing would be set to 96, a 1"=30'-0" drawing would be set to 360. It would also make sense to set the DIMSCALE system variable to the same value as the LTSCALE and the PSLTSCALE variable to 0.

This serves two purposes. One is that it makes it clear to all what your drawing scale actually is. Secondly, it makes it more likely that your DASHEDX2 line will display the way you intended when someone xrefs your drawing. Setting the PSLTSCALE to 0 will assure that your linetypes look the same in model space as they do in paper space. If you follow these rules, objects should display the correct linetype no matter how they are viewed and you can set all objects to a linetype scale factor of 1.

- CAD Scaling Chart

Appended to this document is a CAD scaling chart from Design & Construction Engineers. This chart is a handy reference to determine how large standard sheet sizes are at different scales. You can also use it to determine what to set your TEXTSIZE system variable to after you determine what scale your drawing will be done in. My company likes to use 3/32" tall text as a standard. This chart assists in getting all of the variables set correctly for any given scale. For example: If I want a 24x36 drawing at 1/4" scale, the extents of my title block would measure 96' x 144'. I would set my LTSCALE variable to 48, my DIMSCALE to 48, my PSLTSCALE to 0, and my TEXTSIZE to 4-1/2".

DCE CAD Sheet Sizing Chart

	Full 1:1 1	1" = 1' 1:12 0.083333	3/4" = 1' 1:16 0.062500	1/2" = 1' 1:24 0.041667	3/8" = 1' 1:32 0.031250	1/4" = 1' 1:48 0.020833	3/16" = 1' 1:64 0.015625	1/8" = 1' 1:96 0.010417	3/32" = 1' 1:128 0.007813	1/16" = 1' 1:192 0.005208
30 x 42 Full	30" x 42"	30' x 42'	40' x 56'	60' x 84'	80' x 112'	120' x 168'	160' x 224'	240' x 336'	320' x 448'	480' x 672'
30 x 42 Half	15" x 21"	15' x 21'	20' x 28'	30' x 42'	40' x 56'	60' x 84'	80' x 112'	120' x 168'	160' x 224'	240' x 336'
24 x 36 Full	24" x 36"	24' x 36'	32' x 48'	48' x 72'	64' x 96'	96' x 144'	128' x 192'	192' x 288'	256' x 384'	384' x 576'
24 x 36 Half	12" x 18"	12' x 18'	16' x 24'	24' x 36'	32' x 48'	48' x 72'	64' x 96'	96' x 144'	128' x 192'	192' x 288'
22 x 34 Full	22" x 34"	22' x 34'	29'4" x 45'4"	44' x 68'	58'8" x 90'8"	88' x 136'	117'4" x 181'4"	176' x 272'	234'8" x 362'8"	352' x 544'
8.5 x 11	8-1/2" x 11"	8' 6" x 11'	11'4" x 14'8"	17' x 22'	22'8" x 29'4"	34' x 44'	45'4" x 58'8"	68' x 88'	90'8" x 117'4"	136' x 176'
11 x 17	11" x 17"	11' x 17'	14'8" x 22'8"	22' x 34'	29'4" x 45'4"	44' x 68'	58'8" x 90'8"	88' x 136'	117'4" x 181'4"	176' x 272'
1/4" Text	1/4"	3"	4"	6"	8"	12"	16"	24"	32"	48"
3/16" Text	3/16"	2-1/4"	3"	4-1/2"	6"	9"	12"	18"	24"	36"
1/8" Text	1/8"	1-1/2"	2"	3"	4"	6"	8"	12"	16"	24"
3/32" Text	3/32"	1-1/8"	1.5"	2-1/4"	3"	4-1/2"	6"	9"	12"	18"
1/16" Text	1/16"	3/4"	1"	1-1/2"	2"	3"	4"	6"	8"	12"

	1" = 10' 1:120 0.008333	1" = 20' 1:240 0.004167	1" = 30' 1:360 0.002778	1" = 40' 1:480 0.002083	1" = 50' 1:600 0.001667	1" = 60' 1:720 0.001389	1" = 70' 1:840 0.001190	1" = 80' 1:960 0.001042	1" = 90' 1:1080 0.000926	1" = 100' 1:1200 0.000833
30 x 42 Full	300' x 420'	600' x 840'	900' x 1260'	1200' x 1680'	1500' x 2100'	1800' x 2520'	2100' x 2940'	2400' x 3360'	2700' x 3780'	3000' x 4200'
30 x 42 Half	150' x 210'	300' x 420'	450' x 630'	600' x 840'	750' x 1050'	900' x 1260'	1050' x 1470'	1200' x 1680'	1350' x 1890'	1500' x 2100'
24 x 36 Full	240' x 360'	480' x 720'	720' x 1080'	960' x 1440'	1200' x 1800'	1440' x 2160'	1680' x 2520'	1920' x 2880'	2160' x 3240'	2400' x 3600'
24 x 36 Half	120' x 180'	240' x 360'	360' x 540'	480' x 720'	600' x 900'	720' x 1080'	840' x 1260'	960' x 1440'	1080' x 1620'	1200' x 1800'
22 x 34 Full	220' x 340'	440' x 680'	660' x 1020'	880' x 1360'	1100' x 1700'	1320' x 2040'	1540' x 2380'	1760' x 2720'	1980' x 3060'	2200' x 3400'
8.5 x 11	85' x 110'	170' x 220'	255' x 330'	340' x 440'	425' x 550'	510' x 660'	595' x 770'	680' x 880'	765' x 990'	850' x 1100'
11 x 17	110' x 170'	220' x 340'	330' x 510'	440' x 680'	550' x 850'	660' x 1020'	770' x 1190'	880' x 1360'	990' x 1530'	1100' x 1700'
1/4" Text	2' 6"	5'	7' 6"	10'	12' 6"	15'	17' 6"	20'	22' 6"	25'
3/16" Text	1' 10-1/2"	3' 9"	5' 7-1/2"	7' 6"	9' 4-1/2"	11' 3"	13' 1-1/2"	15'	16' 10-1/2"	18' 9"
1/8" Text	1' 3"	2' 6"	3' 9"	5'	6' 3"	7' 6"	9' 9"	10'	11' 3"	12' 6"
3/32" Text	11-1/4"	1' 10-1/2"	2' 9-3/4"	3' 9"	4' 8-1/4"	5' 7-1/2"	6' 6-3/4"	7' 6"	8' 5-1/4"	9' 4-1/2"
1/16" Text	7-1/2"	1' 3"	1' 10-1/2"	2' 6"	3' 1-1/2"	3' 9"	4' 4-1/2"	5'	5' 7-1/2"	6' 3"

This chart is made available to the public by Design & Construction Engineers, LLC for the benefit of anyone who works with computer aided drafting. The chart allows you to determine the area being shown by standard size blueprint sheets at various scales. Please note that the actual usable area of a sheet will be less than that shown due to margins and space used by the title block. Nevertheless, it helps you to determine what scale factor to choose when you begin a drawing as well as to determine the paper dimensions of a sheet you received electronically. The text figures indicate the actual height text needs to be in order to display at the indicated size. There are no restrictions on redistribution of this document. Contact tstahlnecker@dceengineers.com if you wish to suggest any improvements or point out errors. (Updated 4/15/2004)