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Beginners Guide to AutoCAD – Lesson 3, Drawing Correctly

For the past couple of weeks we've been talking about beginning drawing in AutoCAD. This week we are going to step back for a few minutes and talk theory rather than deal with command structure.

For the few (and I do mean few) Project Managers, Architects, Designers and Principals that actually do know how to draw on CAD and actually do it correctly of whom I have met only a handful, skip to the bottom of the article for interesting links. Otherwise consider the following article carefully as it plays an important role in how much you bill a client, your drawings "correctness" and creating a happy drafting force.

When people start to draft in AutoCAD there is a definite split between the people who are starting out learning CAD as a drafter and those that are coming back into the classroom to learn CAD. One of the biggest problems faced by the drafter is controlling your boss to get them to draw correctly in ACAD. One of the biggest problems for the project managers is that they want to directly manipulate the drawings, but either don't know how, or if they do they are more concerned with the overall drawing they are working on, then the details of actually drawing a correct drawing. Most designers want to simply sit down and sketch on a drawing. They don't take into account that what they are drawing will be used "as is" to start a project. They are of the mindset that they can simply sketch as if they were doing a drawing on flimsy and that the person who comes along next needs to clean it up. Unfortunately it doesn't work this way. As a drafter, you get drawings that you believe are correct. As a project manager, you don't want to think about colors, layers, line types, line type scales, etc. Unfortunately either the drafter will need extra time to maintain the drawings or the project manager has to leave the CAD drawings alone.

As a principal in a firm you have to figure out how you want your firm to be based. Shall the project managers have access to the files knowing that in most cases that they will mess up the drawings? How many hours did you put into your contract for drafting work? Did you double the numbers in order for the drafting staff to keep the drawings maintained if your managers aren't well versed in CAD? In simple terms of efficiency the best solution is to have the management keep out of the drawings. Mark up the drawings either in a stand-alone program that doesn't effect the actual drawing (see below for a new Autodesk program that does this), or on paper. Most prefer the paper method because it's easier to markup, note, see and read, and mark that it has been completed. This will keep the people you hired to draft busy, happy, and working on furthering the drawings rather than simply trying to keep them correct. Your project

managers should be good at detailing, managing, redlining, and creating a project. Your drafters are good at drawing in CAD. You wouldn't put a drafter in charge of a million-dollar home project and expect the house not to leak. By the same token you shouldn't put a project manager into the position of CAD drafter. Hopefully over the next 20 years this will start to change as today's drafters learn more and become tomorrow's managers, but until that happens I find it's best to keep the two separated. I know one firm that has been starting to implement this idea. They did it not only for the cost saving efficiency mentioned above, but also consider how much a computer costs to upkeep with today's hardware and software on a yearly basis. Then multiply that by 10 project managers, architects, principals, etc. You will quickly see a number growing in front of you that isn't pretty. Just placing AutoCAD on 10 manager's computers will cost you at best in the range of $25,000. That's half a year's salary for most people. Instead you can place something like the Whip viewer running in either Netscape or IE or Autodesks' new Volo program which will probably cost you in the range of $1,000 for all 10 employees. That's a $24,000 price tag that is hard to find a good reason to swallow, not to mention the training, down time, corrections, mistakes, errors, etc.

So, why is it important to keep a drawing correct? Well, most of you in school learned how to do an orthographic projection. Taking from the plan and creating a section, elevation, etc. Well in CAD we take that a step further. The plans are used to create an architectural site plan, roof plan, reflected ceiling, electrical, mechanical, landscape, enlarged plans, details, and fixture plans. Then plans are used to project up details, sections, elevations, etc. Everything is dependent upon each other whether you use Xref's, blocks, take-off's or not. If you draw something as 10'-6 1/8" long at an angle of .00001 degrees, and then simply call it 10'-6" angle 0 degrees by manually adjusting the dimensions it will be wrong. Unfortunately this is exactly what most project architects do, and what I stumbled upon the other day. The project was a multi family housing project where the hip roofs have gables here and there. Do to varying slopes the distances from the top of the gable to the top of the hip is very small. Since we only had a few inches to work with, it was very important that we have the exact elevation and roof plan to be sure that it would work without the gable going higher than the hip ridge. What ended up was that in both the elevation and the roof plan the gable did end up higher, which we specifically did not want. Someone had been using the drawing like a sketch and moving things about in it without regard for the correct dimensions. It took several days to fix. Part of the problem was that the person had exploded the dimensions and edited the numbers manually. This is wrong. Please don't do this. Some of the walls were drawn too long; windows and doors slightly out of place and some walls were too short, elevations had plate heights that were slightly off, etc. We had to go through every drawing on an 18 page set of drawings and double check every window, every door, every wall and every dimension. It was not an easy job. Had the project been further along or the contract for a slightly less amount we would have been over budget very quickly all because someone hadn't paid attention to proper drawing habits. People assume the drawing is correct when in fact it isn't. Anything that is then taken off from this drawing will be wrong. The string of dimensions is wrong. You have to manually add up all the various parts on a drawing to figure out what the overall dimensions are. If

you change a part of the drawing you have to manually change everything yourself recalculating things. While this was the case when you worked on paper, this is not the proper way to draft on a computer. You use the computer because it is supposed to increase your speed, make you more productive, and in general make life easier. One way that ACAD does this is by automatically figuring out dimension sizes and placing that number in the dimension. Should you have something wrong, then the automatic dimensioning is lost and everything must be switched to manual. When I work on a complex drawing I can dimension it in about 30 minutes to 2 hours depending on the complexity. If it has to be done manually that can easily jump up to 6 to 8 hours, and the chance that the numbers are wrong quickly multiply. When I hand that drawing over to the structural engineer and he starts to do his work, the chances of him taking to drawn distance rather then the quoted distance also grows. Whose fault is it then when the building is built poorly because you drew it wrong? Or what if the wrong parts are ordered or if it turns out you're an inch off on that handicap ramp? If you draw with an ink pen you know to start in the upper corner of the drawing and work your way across the sheet. You know that to erase something you need an erasing shield. If you are working with a very soft lead pencil you know you are better off using eraser powder to keep the drawing clean. These seem obvious to experienced hand drafters. When these sorts of people step up in front of a computer they bring with them the drafting methods of paper including the idea that they can't move things around or that they need a defined area for drawing in. They also bring with them the idea that what they are drawing is only an approximation and that the dimensions are what are correct because it is what they write into the dimension. Unfortunately these are false on a computer. On the computer the drafter must remember that the drawing is the absolute and that unlike on paper the drawing defines what the dimension is. Many people also think that it is easier to simply change one number, because what will it matter – it's only a little change, it's nothing major. Unfortunately it is major and small little errors that you allow to creep in can quickly grow in proportion and add up to a real large mess at the end of the project.

Personally I wish everyone would draw drawings correctly, placing items on the correct layers, never changing an objects color or line type from bylayer, or switch a lines' line type scale, but people do. And almost every project that I have worked on has had problems crop up because someone went into it and changed stuff manually without considering the consequences. It really isn't something that you can even think about. It should be automatic for you to draw correctly without ever having a second thought cross your mind of drawing it any other way.

So, what do you need to do to make it a correct drawing? First, use your running Osnaps. Almost any decent drafter will tell you that in order to have a correct drawing you must use your Osnaps, and the only way to be productively quick is to have them running. I personally turn on End, Intersection, Midpoint, Quadrant (0, 90, 180, and 270 degrees on a circle or arc), Center, Node (created with the point command or the defining points of a dimension) and Insertion (for text, blocks and Xref's). I find that Perpendicular gets in the way too often and causes many errors to occur and the same goes for Tangent and

Nearest. Apparent Intersection is ok, but to an inexperienced user it can be confusing to get the correct point. Second, turn on your Ortho. If you are drawing a straight line, it won't be correct unless the Ortho is on. If you list a line, it should have an angle of 0, 90, 180 or 270 unless you are specifically trying to draw the line at an angle. There is some debate in the drafting community as to the linetype scale value for the entire drawing. Most people consider the correct number to be a byproduct of the scale factor. Basically it amounts to a 1/8" drawing having a scale factor of 96 and a 1/4" drawing being 48. The way to generate this is by figuring out how many units are in a foot – example – there are 96 1/8's in 12 inches (12 / .125 = 96). The reason people don't like this is because it is the number that changes the length of dashes in a dashed line. Many people think that they should change to number to get a different length dash. The better way to do it is to instead use a different linetype. If you need to create a new linetype to better suit your needs open the file called ACAD.LIN in the support directory in the Notepad program. Finally, never change an objects' color or line type. They should always be set to bylayer. If you need a line to be a different color, or a different line type, simply create a new layer with the correct settings and change it's layer. If you use the command DDCHPROP and type ALL at the select prompt, what you should see in a correct drawing are 5 fields: Color, Layer, Linetype, Linetype Scale and Thickness. Color should show a black box with the word BYLAYER after it. Layer should be the ONLY box that reads Varies. Linetype should say bylayer. Linetype Scale should read 1" and unless you are drafting in 3D the old fashioned way the thickness should read 0". Anything else here and it's considered wrong by better drafters everywhere.

Other Stuff:

Here's a couple of interesting links for you. The first, http://www.homeportfolio.com/ is a nice link to give to your clients so that they can feel more a part of the project by looking up pictures of various items to be included in the project. The site is geared toward the client by using lots of pictures that download quickly showing how and where the products are used. They include everything from spas to mirrors and then some. The site is nicely laid out, telling the client the manufacture, style, and product name. One nice thing about this site is that there is little if any advertising to be found other than the products that are listed in the search.

For you there's always the commercial oriented site at http:/www.sweets.com that is geared to the professional person. This site includes Descriptions, CAD drawings, specs, pictures, Excel Tables and lots and lots of advertising. Depending on the company there are DWG, DXF or DWF formats available.

If you wish to view DWF files before you download them, you will need the Autodesk Whip plug-in. Even if you already have it, you should go to http://www.autodesk.com/products/whip/index.htm and download the new version that

includes support for A2k's DWF files. Soon there will be a program to replace Whip called Volo View. There will be 3 versions of this program, the first being a freebie that anyone can download to view and print a DWF, DWG or DXF drawing called Volo View Express. Then they have one that you pay for that will also let you markup the drawings which sounds allot like the old Autodesk View. Finally there is the Volo Explorer which is supposed to somewhat replace your Windows Explorer or My Computer and allow you to view and manage your drawings from the explorer interface. All three products are based on products that they tried once before with little or no success, and now they are better integrating those older products with a few other items and some new ideas in hopes of creating a set of programs that you will buy. While it's a nice idea to become a paperless office that doesn't need to use plots for checking and saving money by keeping those who shouldn't be drafting out of AutoCAD but in reality I have yet to see it work effectively. While I'm all for keeping a project architect out of a drawing set, the ability to mark up a drawing on the computer is still theory. Until we can look at the entire drawing as a 24x36 sheet on the screen and see the whole thing without zooming in and out we won't be able to effectively redline our drawings. I work on a 21" monitor with the resolution at 1900x1600 and I still can't properly reproduce the entire drawing clearly on the screen.

Finally there is a site that some of you in smaller or specialized firms might want to use for advertising. https://www.improvenet.com/ gives clients the ability to search for firms that specialize in certain areas such as bathrooms, stairs, kitchens, etc. They include selections of both contractors and architects as well as how to screen the potential contractor. For the architects and contractors it's nice because you can include an image of your work and gear yourself towards you preferred target projects. They also have a message base where you can get a name for yourself as an expert advice person.

Lastly, if your firm belongs to the AIA, you might want to check out both your local and the national web sites to see the latest changes. Take a look at http://www.aiaonline.com/ to see the latest information. The AIA is currently spending tons-o-cash to get clients to use them to find a local architect by placing ads in both print and TV. On the web site there is a finder for finding the architect that is in your locality and that matches your criterion. I tried it to search for a few things and found it lacking in various ways, including a far too short of list. For example I tried to search for an architect that designs residential homes and came up with only 1 person in the next town over, when I know for a fact that there are well over 50 architects locally that do this. Also it lacks email and web links in the information given, something that I consider a priority for a web based guide.