Introduction to Computer-Aided Design

By Rob Minialoff

Computer-aided design, or CAD for short, is all around us today. It is quickly becoming one of the most important software tools in the roofing industry. Our business is all about a physical object called a roof and how we keep it watertight. It's also about rooftop features like curbs, drains, and vents. If our business were about written documents (like the legal field), our primary documenting tool would be a word processor. However, the things we need to document are not words but physical objects. A CAD program lets you document these objects.

Those not yet using a CAD program may feel a little out of date. For now, what is Computer-Aided Design?

Quite simply, CAD programs are software that allow the designer to draw on his or her computer screen, instead of with pencil and paper.

How does a CAD program work?

To understand how a CAD program works, it is necessary to think a little differently than one does with pencil and paper.

First of all, with a CAD program there is no longer a physical piece of paper in front of the designer. Instead, a computer screen displays a virtual piece of paper—"virtual" meaning an imaginary piece of paper. Instead of a pencil, the applicator uses a mouse and keyboard. They draw on this "virtual" paper with the mouse and keyboard.

Objects and X,Y coordinates

First of all, some terminology. Everything added to a drawing is known as an object. What have traditionally been called lines, circles, arcs, rectangles, symbols, etc. are referred to as "objects" in the CAD world.

So how do the objects drawn actually end up on the screen?

Basically, a CAD program draws objects on the screen by using x,y coordinates. Recall the x,y axis used for graphing things from back in high school geometry. Every CAD program maintains an unseen x,y axis in the background.

To draw a line, the designer chooses the line drawing tool, then positions the mouse pointer at the point on the screen where he wants the line to start. He then clicks the mouse. At this point the CAD program has the first x,y location for the line. Next, the mouse pointer is moved to the position on the screen where the line should end, and the mouse is clicked again. The CAD program now has the second x,y location.

The CAD program's brain will trace the coordinates of the line and let the designer know where they start and end: for instance, beginning at coordinate 20,20 and ending at 40,20. These two x,y coordinates are part of a package of information that is stored with each object drawn. Each piece of information is a "property" of the object. Two other properties a CAD program stores for the line are the line's thickness and its color.
Once a drawing is completed, the CAD program will have information on every object drawn. It is this information that allows the drawings to be recalled and printed. When a drawing that has been saved on a disk is recalled, the CAD program simply reads the information about each object and draws the object on the screen.

**CAD VERSUS PENCIL, PAPER, AND ERASER**

There are several advantages to drawing with a CAD program, versus pencil and paper.

**Reuse**

Of course, one of the big advantages of computers in general is the ability to create something once and reuse it.

Once a roof consultant is proficient with a CAD program, creating a new drawing from scratch will be faster than with pencil and paper. The real time-saver, however, is when things are reused.

For example, in a CAD program, a library of pre-drawn objects like curbs, drains, and scuppers can be saved. Then, when drawing a roof, if the designer needs a curb, he or she can just pick it from the library and add it to the drawing. Redrawing every line in the curb each time is not necessary.

CAD programs also make use of a feature called copy and paste. This allows duplication of objects on the drawing. For example, say the roof being drawn has a group of three curbs and a pitch pan. This group is repeated in ten locations across the roof. All the designer has to do is draw the first group, then copy and paste the entire group nine more times. Each time the “paste” command is given, the entire group (three curbs and a pitch pan) is duplicated at the location specified, thus saving the designer from drawing 30 individual curbs and ten pitch pans.

**Changes are faster**

It is faster and cleaner to make changes to a CAD drawing than with a pencil and paper drawing. Instead of erasing and redrawing things, a CAD program allows them to be changed. So if the designer wishes to change a line color, its thickness or its length, he or she can do so without having to redraw the line. Similarly, objects may be rotated and moved around the drawing without being redrawn.

The only downside is that after changes are made, the drawing will have to be reprinted. This is not an issue with small pages, but is slow with very large drawings because the program redraws the graphic.

**Storage and retrieval are easier**

One thing that computers do very well is mass storage of information. Thousands of drawings may be stored on a single computer, which obviously takes a lot less space than what thou-
sands of paper drawings would.

Once stored on the computer, the drawings do not degrade as paper drawings do; a drawing can be called up years later and it is the same as when it was stored. Copies of the files may also be made on tapes or disks for backup purposes. So if a computer crashes without a backup, files may be copied to another computer in a matter of minutes and the company is back in business.

If drawings are organized well on the computer disk, retrieval is simple. However, this is a big IF. In this writer’s experience, most offices do not organize their computer files well. This is a skill that is not difficult to learn and is crucial to being able to retrieve a drawing quickly.

**CAD programs allow you to view and modify manufacturers’ details.**

Companies should have a computer file storage plan and stick to it. This will make retrieval of any computer file fast and easy.

**Exchange files with others**

Another big advantage of CAD is the ability to exchange drawings with others. If a customer’s roof drawing already exists in CAD format, the consultant will be able to not only view it with his CAD program but modify it as well. The same goes with details. There are literally thousands of pre-drawn details available. A lot of them are free of charge. Sources like the NRCA charge a small fee while manufacturers generally hand them out free.

The nice thing about this is that details are slow and tedious to draw, even with a CAD program. So if someone else’s details can be used and modified, the consultant is ahead of the game.

**WHAT CAD PROGRAM IS RIGHT FOR YOU?**

There are hundreds of CAD programs available on the market, ranging in price from $10 to over $5,000. What’s the difference? Pricing of software is an interesting thing. This writer has seen $40 CAD programs that have everything a $4,000 package has. The reason for the difference in price is simply a different marketing philosophy. The low-price company has decided it is better to sell more at a lower price, while the high-price company feels it can command a higher price, maybe because it is an established company.

Whatever the reason, it is best not to focus too much on price. This should not be the main selection criteria. Instead, focus on what program will do the job. Remember, very often the money saved in the initial purchase will be lost many times over if time is lost struggling with a program that doesn’t fit the company’s needs.

Also, as with most software purchases, the cost of the software is insignificant when compared to the time and money spent learning and implementing the program.

**What are your needs?**

Like any sales process, the first thing required is an analysis of the company’s needs. Who in the company will use the program, and what kind of work do they do? There are basically two kinds of people who make design drawings—those who make drawings all the time and those who only need to make drawings occasionally.

Some companies will have a dedicated draftsman in their office. This person’s needs and skills are usually quite different from the other people in the office. For example, they are probably already trained in the use of CAD programs and thus tend to...
want more features. However, some of the drawing that goes on in a consultant’s office is done by people who are not draftsmen. Drawing is just part of their job. This type of person is typically new to CAD.

As with most software programs, if the operator doesn’t use a CAD program regularly, he or she will tend to forget how to use it. This isn’t a problem for a dedicated draftsman because he uses the program every day. Therefore, a CAD program that is loaded with features and has a steep learning curve is not a problem.

However, for the other people in the office, a simple program with fewer features is more desirable because it is easy to learn and more importantly, it is more likely that they will remember how to use it.

**Generic versus industry-specific programs**

Okay, so what to buy?

There are two basic kinds of CAD packages available: general and industry-specific. A general CAD program is made for the masses: architects, engineers, circuit board designers, etc. Thus, there is no emphasis on roofing-specific features, but instead the product will often be a very mature, feature-rich one. The name most people probably recognize in this category is AutoCAD.

General CAD packages tend to be complex, and thus have a steep learning curve, but they do everything imaginable. For the dedicated draftsman, this may be perfect, but it may not be suitable for the rest of the company.

On the other end of the spectrum are industry-specific CAD programs. They have a much narrower focus. These tend to be specific to roofing only or they will cover roofing and a few other similar markets. Because of this focus, they tend to have roofing-friendly terminology and interfaces, which makes them easier to use. This type of product is better suited to the second category of person who doesn’t draw all the time. But because of its simplicity, it may not appeal to the dedicated draftsman.

Evaluate the people in the office to see into which group they fall.

**Quality Support**

Like any software package, support and updates are very important. Usually, for a modest fee, you can get updates to the program as they become available. This is an inexpensive way to keep up with the latest technology available.

In comparison, a general CAD package will add general features, while the industry-specific CAD package will add general features plus roofing-industry-specific features.

When it comes to support, ask for references and talk to them. Quality support is the key to solving problems and working successfully with the product.

Once again, the general CAD package will probably not have a support person who knows roofing, while the industry-specific package should. So when a roofing-specific problem comes up, the industry-specific package is more likely to solve the problem quickly.

**CONCLUSION**

The largest investment in CAD technology will come not in the initial purchase, but in the time invested after purchase. First be sure the company’s needs are clearly understood, then purchase a CAD program from the company that fits those needs, both with product and support.

A successful CAD implementation will change the way a roof consultant works and prepare him or her for the future. ■

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**About the Author**

**Rob Minialoff** is the President of True North Estimating Systems in Toronto, Ontario and a member of RCI. He was born into the third generation of a roofing family and has worked in all aspects of his family roofing business, starting with a pitch tear off on a windy day in 1977. Recognizing a lack of roofing-specific estimating software on the market, Rob started True North Estimating Systems in 1988. The company’s flagship products are Roofware and RoofCAD. Rob can be reached at (416) 778-0843 or rob@roof-ware.com.

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