

Beyond Blocks and Bricks

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CAD, BIM, and unfunded mandates

Most of us know only Windows, Mac, Word, Access, Excel, and PowerPoint, not realizing that there are other choices—Linux, WordPerfect, Corel, Lotus, QuatroPro—for running a computer or an office. In the land of computer-aided drafting (CAD) and building information management (BIM), AutoCad and Bentley are the big dogs. There are other programs available to those who don't need the power of a big dog, cannot afford to buy a big dog, or cannot manage the long-term cost of feeding a big dog (The unfunded mandate).

Glen-Gery was one of the first in the industry to draw shapes using CAD and has used AutoDesk's AutoCad since the mid-1980's. GG upgrades this programming regularly. Upgrades are often just upgrades and relatively modestly priced. Every few years, though, AutoDesk completely redesigns the program (The cynic: Or completely repackages...) and the cost of a single seat—installation of the programming on one computer—is \$3K or \$4K. Of course, BIM is extra.

Again, upgrades are often just upgrades and usually will work in the existing computer. New editions often require more RAM. Also, new editions may not work on older operating systems, which must be replaced. Since Windows 7 does not work well on most XP machines, the upgrade to a current CAD/BIM program may require a new computer (An unfunded mandate).

Why is this important? The trend is all parties involved with a building working within a BIM framework.

Perhaps this means that vendors selling bricks and brick shapes must provide documents—product documentation and shapes drawings—that are compatible with one or another BIM system. Often a vendor's suppliers will provide this documentation, but some suppliers cannot or will not and the vendor has to prepare the documents. Sometimes the vendor is the supplier—a brick distributor sawing arches. Sometimes the vendor wants to be the sole contact point.

If you are going to develop your own capability to do this work, Steve Ross's thoughts about all this may be helpful. Don't be put off by Ross's use of the words "design" and

“designers.” When you craft a shapes drawing in your office that is exactly what you are doing; designing. Although some of the advice is very specific to design firms, much is useful for others who are going to invest in BIM. At the least, it raises issues that are not particularly obvious.

Ross writes in the online version of Engineering News-Record.

Before You Upgrade CAD: Questions to Ask

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By Steve Ross

Engineering News-Record

Thinking about finally adding computer-aided design software to your workflow? Maybe you want to expand your existing CAD investment into facilities management, or what we now call BIM (Building Information Management) software.

In this two-part article, I'll explain some important questions you need to ask yourself and your CAD vendor or vendors before you buy.

Start by remembering that the design process is a thinking process. If your software gets in the way of your thinking, it may not be right for you.

That said, a CAD or facilities management package is nothing more than a database program with a very fancy interface. Each line in the drawing is nothing more than a multicolumn data entry. There are the coordinates (in 2D or 3D space) for the line's beginning and end. There's a mathematical formula that defines the shape of a curve -- a line that isn't straight -- and a notation of the curve's orientation in space.

Anything more is just embellishment. There might be data that tells the line it is part of a larger object. There can be data that defines the material the object is made out of, and what its weight, strength, surface finish, cost and other properties might be. That's what makes CAD software "Building Information Management" software. Once you design a building element in BIM, you can duplicate it throughout the structure. If you have to modify the object, you can allow the modification to propagate through your design automatically. That saves time and reduces errors.

1. How well can you draw with it?

Some designers like to rough out a sketch first. Some go right to hard-line drawings. Some work only in 2D; many younger designers only work in 3D. As I reviewed software for architects, I was amazed at the variations in technique I saw. You can download and try almost all packages these days. Narrow your choices by what feels right. **(This suggests that the person actually doing the drawing must be involved with the decision. rjh)**

2. Does it fit your office needs?

You may practice out of multiple offices, require a mobile workstation, or need to accommodate client-side desires like 3D visualization and photorealistic rendering. Your practice may be in landscape design, HVAC, civil, or mechanical. Don't assume one package is the best for all.

3. Can you afford it (or find a way to afford it)?

Licensing terms vary and are often negotiable. Do you need a laptop install? Must you accommodate a colleague in another practice for a month? Or install software at the client's location during a build?

Remember, too, that the initial price you pay for the software and the equipment to run it is usually small compared to the overall cost over three to five years for updates, and equipment upgrades. Look for the right deals. I just updated the graphics card on my big server. The price was \$30 for a perfectly suitable "48 core" [Intel processor] closeout that sold for \$129 just a year ago. With a rebate, the final cost was ten bucks. Although vendor support these days is good, you'll need to seek out more. Is there a local user group to join? Does the local university or community college offer courses in the package you are considering?

4. Can the new software add deliverables that you can upsell for new business?

Yes, the eventual owners might actually pay for a "building information management" package at the handover. Or they might simply make design with a BIM-capable software package a requirement, a box you have to check to get the business. Either way, you need to design with CAD software that that is compatible with what the client, or the client's client wants. Building owners and their tenants often use sophisticated facilities management software these days. Is your software compatible with what they use? Can you translate the entire "as-built" design into a separate file that can be read directly into FM, for an extra fee?

5. Compatibility?

As mentioned above, **compatibility can be a deal-breaker**. A good way to test different levels of compatibility: Move an existing file through a translation program for your client's current or proposed software. Then translate it back. Does it act the same? Often, the translation turns BIM "objects" back into dumb lines. Sometimes, it turns curves into a series of little straight lines that approximate the curve.

(In the last (and first) issue of ENR's FutureTech newsletter (which went out June 14), I discussed key pricing and compatibility issues to consider when buying new design software. But there are other issues to consider, which can include the usability of your drawings.)

A key test is a simple one: print out a detailed set of drawings for a job, in different sizes, on paper and in PDF or other format you might use for portable tablets and laptops. Is everything there? In the second half of this two-part article on CAD buying tips, here are more questions to ask yourself consider before you buy or upgrade.

1. Does the workflow fit your style, or is it cumbersome?

If you have to manually flag a warning note as you are designing, will you actually do so? Some packages make it easy. Others, especially add-on programs that sit on top of the base software, are cumbersome.

2. Are manufacturers' symbols handled consistently?

What counts are the symbols your office uses. Some are images with no intelligence attached except data. Others allow size adjustments within your software, while keeping full symbol intelligence. Others automatically suggest associated needs in the structure itself. Beams suggest bolts and rivets. Doors suggest frame details and place light switches... but not always!

3. What about client specifications? (Clients may require the use of AutoCad or may require the use of Bentley Systems. Is the software that you use compatible with the client's platform? An architect or engineer must comply, someone sending over a brochure, a test report, and half a dozen shapes drawings likely will not.)

It is generally wise to "lock in" hardware a client wants to use, before you start designing. If this is a common need in your office, you'll want software that can handle that.

4. Is migration to 3D an issue? (Migration involves working with drawings built with one program in another program.)

The biggest advantage to 3D software, in my opinion, is not the ability to do a neat design presentation for the client or the zoning board. I like the idea that 3D is somewhat unforgiving. If your lines don't quite meet in 2D, the drawing still "looks good enough" to follow. And if lines meet, the (3D) software wants to know exactly how you're handling the joint. This makes conversion of 2D legacy drawings to 3D dicey. Test the process on a few of your old artwork – some new CAD packages handle the errors easier than others, and different packages handle different errors. The latest version of AutoCAD directly imports 3D models from Catia and SolidWorks, but not from Autodesk's own Inventor package!

There's also the analysis factor. I narrated a segment of "Modern Marvels Engineering Disasters" on cable television a few years back. Seems a concave wall section of the Walt Disney Concert Hall in Los Angeles was magnifying and reflecting sunlight into a nearby residential block. The fix was easy—dull the wall finish—but the right 3D software would have made the check easy before the building was ever constructed.

5. Are there security issues?

Everyone knows enough about the design process to keep drawing files safe as they journey from one office to another. And almost all CAD software these days have ways to keep multiple designers from working on the same elements at the same time without knowing each other's actions. But simpler packages just allow one designer to change a drawing, and may lock out huge sections of the structure's design at one time. Does it matter? Not if you share files with only a restricted set of colleagues. But it can be a

huge problem when hundreds of people need to edit at once.

There's another big issue these days: Can you keep drawings from falling into the hands of potential terrorists? The security task is not trivial if you can't lock drawings on a laptop or tablet. Many clients now specify third-party add-on scrambler software. Don't ignore their concerns.

6. Is free software any good?

The short answer is that many "open source" design packages are terrific. But you have to know what you are doing, and where to get help fast if you need it. I love an open-source statistics package called "R," but I offer math help to other users who in return are better with interface questions. It took several years to make all the connections, and the connections evolve continually. The best bets: Open-source add-ons for mainstream proprietary CAD packages.

7. Is parametric design important? (Parametric design is a method of intelligently designing architectural objects based on relationships and rules using the computer. These are defined in parametric software and are easily manipulated to quickly generate multiple iterations of the design in 3D. Parametric design is a method of linking dimensions and variables to geometry in such a way that when the values change, the size and shape of the part change as well. A parameter is a variable to which other variables are related, and these other variables can be obtained by means of parametric equations. In this manner, design modifications and creation of a family of parts can be performed in remarkably quick time compared with the redrawing required by traditional CAD.)

It depends in part on how you work, and in part on client needs. If the client is presented with a lot of options or has to make a major use change in a structure, the whole redesign process is speeded up if the "design dependencies" are at least partially recalculated by the software itself. If a change in room width also changes the column spacing, does the roof beam's web increase in thickness?

All too many CAD packages claim parametrics abilities, but sometimes they are quite limited. Many basically allow the "if A is this and B is that, then C can be calculated." But what if C is fixed by the site and you have to back-calculate to A or B? Not all packages can handle that. Some can handle it in parts of a design, but not in others.

The bottom line: Just as manual drafters liked certain suppliers' paper, ink and nibs, the choice of computer-based design tools is a personal one, at least in part. Get the best fit, and you'll maximize productivity while minimizing errors.

Steve Ross has been using and reviewing CAD software since 1985. With degrees in physics and journalism, he has authored or edited 19 books, including one for ENR (Construction Disasters: Design Failures, Causes and Prevention, published in 1983). He has been honored by NSPE and by the New York State Society of Professional Engineers. You can write him directly at editorsteve@gmail.com.