

Save Money with CAD Tools

Who doesn't want to save a little money these days? Here are some tips on how CAD can help.

BY ROBERT GREEN

It's no secret that times are tough for engineering companies right now. And when times are tough, we all come under fire to be thrifty and squeeze every bit of savings from our operating environment. So where can we find those savings? How about CAD tools?

By examining new CAD tools and optimizing how you use them, you might be surprised to find a lot of cost-saving CAD opportunities out there.

No matter what CAD tools you use, they can save you money only if they're solving problems and saving you time. Therefore, you'll need to be proactive in finding the areas where savings can be achieved in your company. Once you've identified a potential savings (created by saving time), you can quantify the savings using the Savings and Return on Investment Calculator equations (see next page). I've never found a better way to understand which CAD tools are worth pursuing than evaluating them for their savings potential. And believe me when I say that senior management will approve purchases that have documented savings long before they approve purchases based on speculation.

So where might the savings be?

Consider Specific 2D CAD Tools

Let's say you're an electrical/controls engineer who is responsible for creating process and instrumentation diagrams (P&IDs) for a variety of industrial projects. Are you using a plain vanilla 2D CAD system, like AutoCAD or MicroStation, to tackle this discipline-specific job? Have you struggled to get a consistent set of symbols and standards for creating your drawings? If so, how much time have you spent trying to pull all these pieces of information together? You might not like the answer you arrive at when tallying up the man hours.

Why not consider using an industry-specific tool like Autodesk's AutoCAD P&ID or Bentley's AutoPLANT P&ID to speed the process along? While these types of applications cost a little more than their plain-vanilla counterparts, they

deliver real man-hour savings and great return on investment.

In the past year, Autodesk and Bentley have both augmented their AutoCAD and AutoPLANT product lines, respectively, to include a wide variety of plant design, mechanical design, and architectural tools. Using familiar CAD tools, like AutoCAD and MicroStation, mean training and costs are minimal so savings can be realized quickly.

Go 3D, If You Can

In the past, engineers have drawn designs on drafting boards and, more recently, 2D CAD systems, but the benefits of designing in 3D CAD software simply

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can't be ignored. Take the example of modeling a building's structural and mechanical systems to create a building information model to assist in design analysis. For architects and MEP engineers, the modeling paradigm of BIM allows detection of interferences (like a beam going through a wall) and computation of energy loads so mechanical systems can be properly sized and fit into building shells. And as the building's systems take shape, 3D structural modeling programs can take all the building loads into consideration to automatically size structural steel members.

Mechanical equipment engineers can use design tools like Autodesk's Inventor or Solidworks Corp.'s Solidworks programs to not only create fabrication drawings but to also perform stress analysis and compute mass properties like weights and moments. And with the design's material properties entered, deformations and thermal loads can be simulated as well.

But 3D design isn't just for buildings or machines. Civil engineers can reap the benefits of modeling their designs in 3D space as well. Tools like Autodesk's Civil 3D allow rapid terrain mapping and design

with earth calculations, alignments, and cross-sections automatically produced from the 3D model.

No matter how you look at it, 3D design processes allow users to examine far more scenarios and catch errors early in the project. And any engineer can attest to how expensive it can be to fix mistakes in the field rather than find them during design. 3D saves you money by preventing errors before they can become a costly reality.

Digital Prototyping and Printing

Another benefit of modeling everything in 3D CAD is the ability to analyze packaging and cosmetic considerations like materials, colors, and alternate configurations while they are still just electrons, not expensive prototypes. By exploring more scenarios early, you're more likely to achieve an optimal design before creating physical prototypes. And with 3D printing from companies like Z Corp., you can even create a scaled model of your design that allows field service personnel or your clients to actually experience your design.

And the best part is you'll save untold amounts of time because prototyping in software happens immediately—no more waiting weeks for physical models to be built. When engineering hours can be cut and prototyping costs substantially reduced, even \$50,000 3D printers can create enough savings to pay for themselves in short order.

The Fourth Dimension

Now that you're designing in 3D, why not make the leap to 4D and include the timeline of your project with your CAD design? Traditionally, time studies have been the domain of schedulers using complex project management systems,



like Oracle's Primavera on the high end or Microsoft Project for smaller jobs. But using separate scheduling packages can lead to embarrassing project mix-ups, like not being able to fit equipment past already installed beams in buildings or having to excavate utility access under already installed concrete pads.

The biggest splash on the 4D scene lately has been Autodesk's acquisition of Navisworks, which has pioneered the integration of project scheduling and 3D design. And while Navisworks is new and the savings are harder to quantify, you have to save only one major foul up per project (like those mentioned above) to pay the modest purchase and training costs.

Customize, Program, and Standardize

Almost all CAD tools have the ability to create customized tool bars and user menus, and most also support a high-end programming language environment like

Visual Basic. These customization capabilities mean that motivated companies can actually produce custom CAD tools to handle repetitive jobs specific to their environment. The key to achieving savings is to use customization and programming to make things easier for CAD users and thus save time.

Simple ideas for customization include organizing libraries of details onto toolbars for easy insertion into drawings or creating custom menus for importing custom title frames. And when creating these libraries or title frames, don't forget to put everything on standard layers/levels so your CAD standards will be enforced as users utilize the custom tools. By organizing standard components into easy-to-use toolbars, you'll save CAD time to create drawings and cut rework later because standards compliance will be automatic.

The ultimate in productivity could be achieved by programming your own custom

routines to automate redundant design tasks in your company. If you or someone in your company has a knack for programming, you should definitely pursue this option.

Summing Up

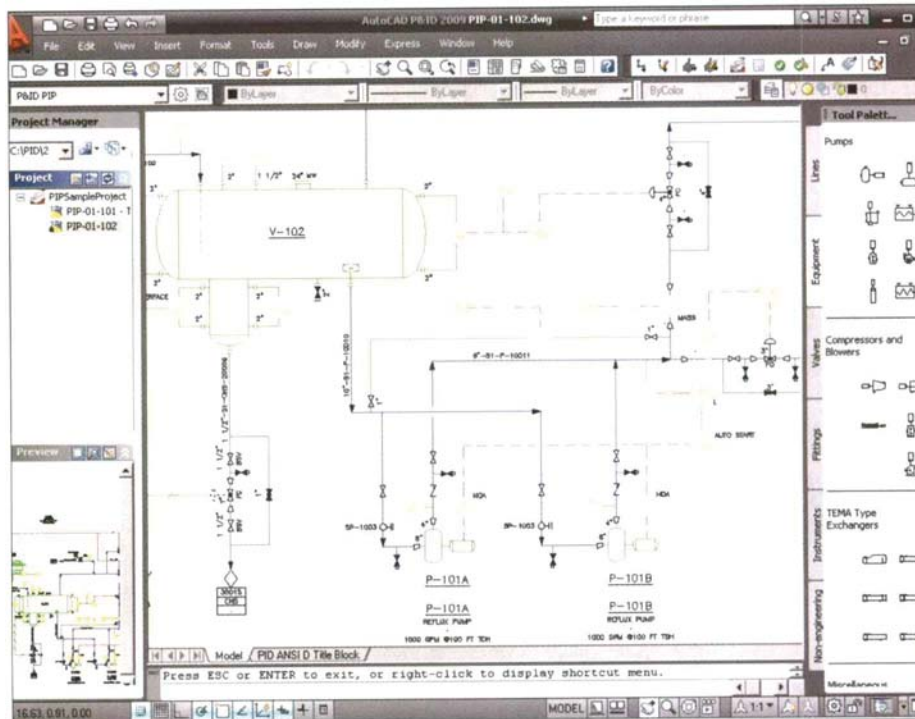
Admittedly using new CAD or customized CAD tools does require a new way of thinking and some upfront investment, but the savings you achieve in lowered man hours can more than make up for the initial expense. All it takes on your part is the willingness to dive in, learn, and make the CAD tools work in your environment. After all, you wouldn't erect a skyscraper with picks and shovels, so why would you stick to old CAD tools when you could be saving time and money instead?

Robert Green is a CAD consultant who works with clients throughout the U.S. and Canada to implement custom CAD tools. You can contact him through his Web site, www.cad-manager.com. PE



Web Links

Autodesk Inc.	www.autodesk.com
Bentley Inc.	www.bentley.com
Solidworks Corp.	www.solidworks.com
Z Corp.	www.zcorp.com



AUTODESK'S AUTOCAD P&ID CONTAINS EXTENSIVE LIBRARIES OF SYMBOLS AND DATABASE INTEGRATION ROUTINES TO BUILD EQUIPMENT LISTS, ORGANIZE PROJECTS, AND PRODUCE DRAWINGS, WHICH CAN SAVE DRAFTING AND ENGINEERING TIME.

Savings and Return on Investment Calculator Equations

$$\text{Year 1 Savings} = (\text{TS} * \text{LR}) - (\text{SC} + (\text{TT} * \text{LR}))$$

$$\text{Year 2 Savings} = (\text{TS} * \text{LR}) - \text{MC}$$

$$\text{Year 1 ROI} = \text{Year 1 Savings} / (\text{SC} + (\text{TT} * \text{LR}))$$

$$\text{Year 2 ROI} = \text{Year 2 Savings} / \text{MC}$$

Where

TS = Time saved in hours/year (use 48 weeks per year)

LR = Labor rate in dollars/hour

SC = Software purchase cost in dollars

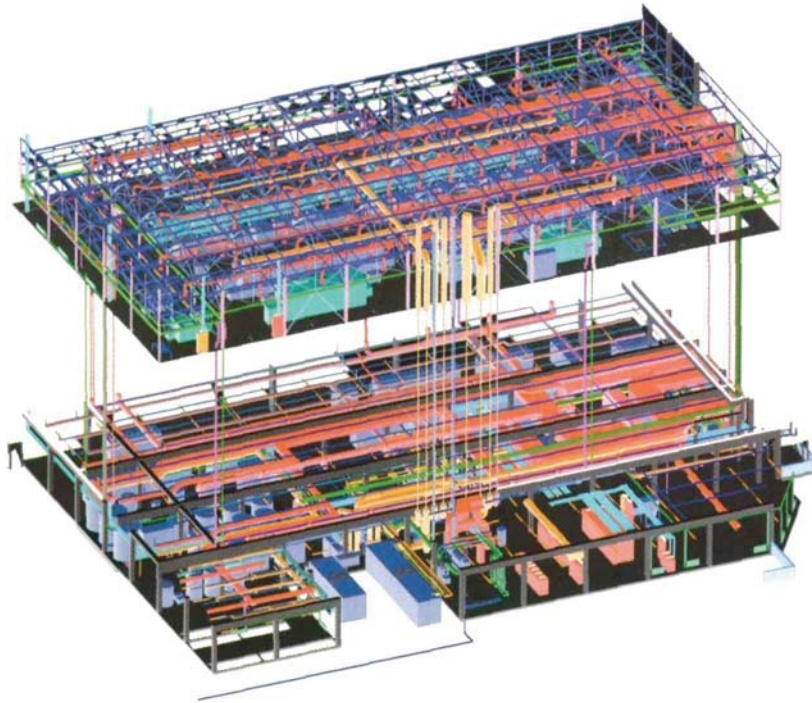
MC = Software maintenance cost in dollars/year

TT = Training time for software in hours

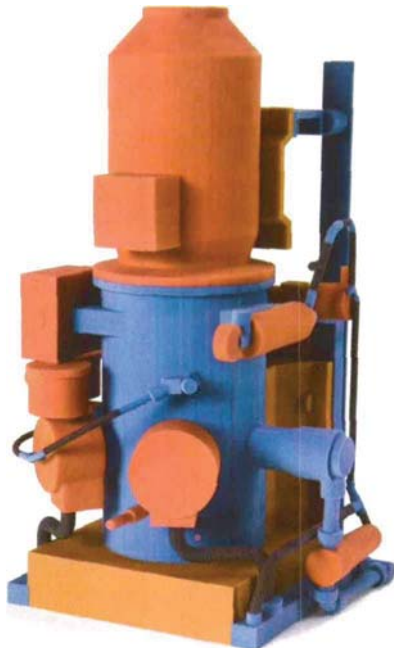
Notes:

Savings in the first year of a software purchase are offset by a high purchase price and user training, but subsequent years have lower software maintenance costs and essentially zero training costs.

ROI values for software are simply the savings produced during any given year divided by its cost that year.



BENTLEY'S BUILDING SYSTEMS AND STRUCTURAL APPLICATIONS ALLOW MODELING OF ALL A BUILDING'S VITAL SYSTEMS FOR THOROUGH SPACE ANALYSIS AND COLLISION DETECTION. THESE APPLICATIONS CAN SAVE MONEY BY DETECTING ERRORS BEFORE CONSTRUCTION BEGINS.



3D PRINTING ALLOWS THE 3D CAD MODEL TO BE RENDERED IN SCALE USING PLASTER OR PLASTICIZED MATERIALS. THESE 3D PRINTS ARE INVALUABLE IN EXAMINING ACCESS AND SERVICEABILITY ISSUES RELATING TO EQUIPMENT AMONG OTHER THINGS