

Migrating from AutoCAD to Autodesk Building Systems

Make the move from AutoCAD® software to the productivity, accuracy, and coordination of Autodesk® Building Systems painlessly with a phased approach

Okay, so you bought Autodesk Building Systems. You saw the demonstrations where the presenters made it look easy. You saw how fast they made construction documents. You may have even seen how quickly they were able to respond to changes and make revisions. But now you have installed the product and are staring at your screen wondering where to start.

Chances are that your version of AutoCAD has been highly customized over the years to be ideally suited to your company's practices and office standards. Autodesk Building Systems, on the other hand, appears generalized to appeal to all companies. So how do you make Autodesk Building Systems as easy to use as your customized version of AutoCAD was while leaving the days, weeks, and months of customization behind?

This paper is about making the migration from AutoCAD to Autodesk Building Systems. It recommends a phased approach where you adopt only the features that have benefits that make the most sense to you and your firm. Ultimately, if you follow through to the end, you will read how you can reap the most benefits from migrating to Autodesk Building Systems.

What to Expect: Improving the Process

Adopting Autodesk Building Systems is about improving the process. With AutoCAD, you essentially recreate electronically what you used to do on the drafting board with a pencil. Lines, arcs, and circles represent system routing, fittings, and equipment. With Building Systems, you work with objects that are "intelligent," meaning they know what they are – a duct is a duct, a pipe is a pipe – and how they connect together to create systems. These intelligent objects enable you to assemble systems in your drawings exactly as they would be installed during construction. Since these systems in turn inherit the intelligence of the objects they are made up, systems can respond to changes propagating modifications through runs to give you powerful modify capabilities. As you continue to create your systems, you will eventually build a full 3D systems model that accurately represents what is to be constructed in the field. It is this 3D systems model that enables you to quickly generate a set of construction documents. You simply "look" at the model in different ways to create the necessary views and plans rather than completely drawing something new.

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Let me guess, after hearing all that you are asking yourself is this really an improvement to the process or a change in the way we work? With Building Systems you are improving the process by making changes to the way you work – the process is different. Rest assured Building Systems is specially engineered to help you to boost your productivity, improve your accuracy, and ensure discipline coordination across your projects.

Since the process is different, the timing and duration of the common phases in a project are different as well:

- **Schematic Design and Design Development (Model Creation):** You are creating an intelligent systems model that results in adding a lot more information to the drawing.
- **Design Development and Construction Documentation:** You are refining your design and are able to react to changes fast with the powerful modify tools – *you can save time, plus manage changes more easily.*
- **Construction Documentation:** You are developing different views and plans for your sheets based on the systems model you already built – *time can be saved, plus changes are automatically updated on the sheets.*
- **Post Project and Construction Administration:** You are responding to field changes and requests for information based on the set of construction documents you released – *significant time can be saved. Having produced a more accurate set of construction documents directly from the 3D systems model, you will experience far fewer field changes and requests for information since coordination issues have already been addressed.*

NOTE: It is highly recommended that you first roll-out Building Systems on a pilot project to assess how this software can make the best improvements to your existing design process. For more information on these and other aspects of implementing Building Systems, go to www.autodesk.com/buildingsystems and download the “How to Successfully Implement Autodesk Building Systems” white paper.

Approach Migration in Stages

As with anything new, the best approach is a phased approach. Migrating from AutoCAD to Building Systems can be approached in three main stages:

- **Stage 1:** Productivity – Faster than AutoCAD
- **Stage 2:** Productivity and Accuracy – Going Beyond AutoCAD
- **Stage 3:** Productivity, Accuracy, and Coordination – Going Well Beyond AutoCAD

Success in migrating from AutoCAD is relative. There is no requirement to become proficient at all three stages. The question, “Why did you buy Autodesk Building Systems?” will likely determine which stage you ultimately want to achieve. Some may decide that just the productivity gains from Stage 1 are sufficient for them. Others may be looking for a high level of coordination and progress all the way through Stage 3. In either case, each stage has shown to be successful in reducing the cost of doing business as an engineering firm.

There is an overall secret to successful migration, which is to leverage the AutoCAD-like features of Building Systems that will quickly appeal to most users and can be mastered with limited training. Since Building Systems contains all of the AutoCAD functionality, your existing customized routines will still work. Use these routines where they make sense. As you become more familiar with Building Systems, particularly by moving through the migration stages, you will begin to learn about additional features that can replace these customized routines and save you a ton of time by using them right out of the box. To help you identify which Building Systems features are best leveraged during the different stages, refer to **Table 1: From AutoCAD to Autodesk Building Systems** on page 8.

Stage 1: Productivity – Faster than AutoCAD

The most common concern following the purchase of Building Systems is achieving a quick return on investment without becoming bogged down in training. Generally speaking, users don't want to, nor do they have the time to, learn every feature of Building Systems just to get started; however they expect to see some immediate return on their investment. Stage 1 is focused on just that – immediate return on investment through increased CAD productivity.

The users in Stage 1 can be considered quite experienced with AutoCAD, but only a beginner on Building Systems with minimal training, one to two days at best. This stage, on average, lasts three to six months and often occurs in parallel with a pilot project that is exploring all the capabilities of Building Systems. You will not create a perfect 3D systems model in this stage. In fact, the resulting model of your design may not necessarily make sense when viewed in 3D. Instead, you will set up a comfortable user interface that makes sense to the type of work you do and begin to use the basic Building Systems tools in order to produce construction documents in plan. Let's take a step-by-step look into how this can be accomplished.

Step 1

The first thing you will want to do is to customize the tool palettes. Building Systems comes out of the box with generic tools that are designed help you find features and content. But, for new users, finding the right tool to get started on these tool palettes can often be confusing. And, since most of your users do not have Building Systems experience, you do not want them fumbling around with settings and data that they may not understand.

Building Systems tools feature robust capabilities that enable them to be specific to the task at hand. For example, out of the box, the Building Systems “Add Device” tool can add any device available in the style content libraries (Figure 1). In Figure 1 notice the options in the dialog box are generic and provide the user with no direction as to where to go next.

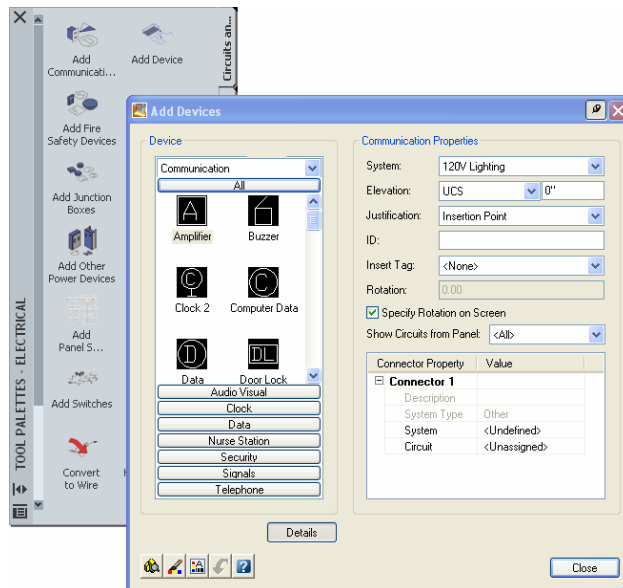


Figure 1: Generic out-of-the-box tool

However, the tool can be easily customized to add only one specific device (Figure 2). In Figure 2 the options in the dialog box are specific to the device, helping to guide the user towards what to do next – settings are pre-configured, options are locked. Customizing tools for specific tasks keeps users focused on the task at hand and on the specific Building Systems functionality they are using.

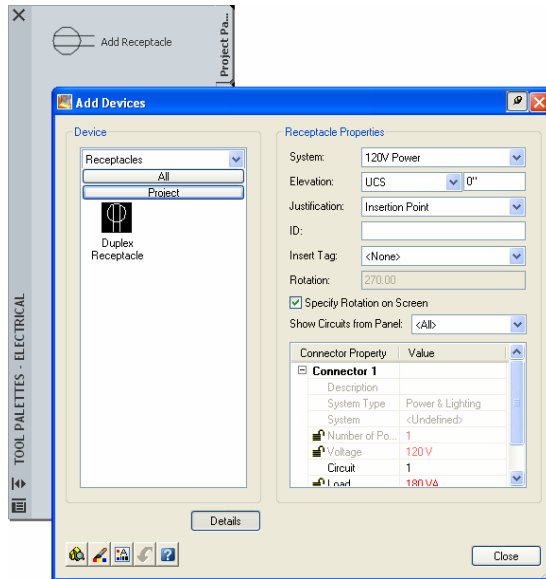


Figure 2: Customized tool for specific task

“Autodesk Building Systems has created the next jump in productivity. It’s definitely faster for creating drawings, eliminating mistakes, and saving on drafting time. With Autodesk Building Systems, we estimate our engineers are creating construction documents 50% faster and modifying those 70% quicker.”

Reg Monteyne,
Senior Vice President,
Flack+Kurtz

Step 2

These tools, in turn, can be organized on customized tool palettes to reflect the drawing process being utilized by the users. For example, the out-of-the-box electrical tool palettes are generic and include every possible tool for electrical design work in logical sequence (Figure 3). If you split your work between an electrical designer and electrical engineer, you can quickly create two unique tool palettes that arrange the specific tools required by each in a logical sequence for their work (Figure 4, Figure 5).

The tool palette in Figure 4 has been set up for the electrical designer and follows the drafting process of laying out a 120-volt circuit – place the receptacles, wire them together, add the home-run tag and the panel. On the other hand, the tool palette in Figure 5 has been set up for the electrical engineer and follows the process for adding intelligence to the receptacles, wires, and panel added by the designer. Because each palette is unique, each keeps the user focused on their specific tasks at hand.

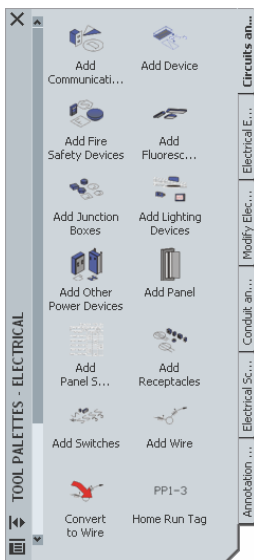


Figure 3: Out-of-the-box generic electrical tool palette

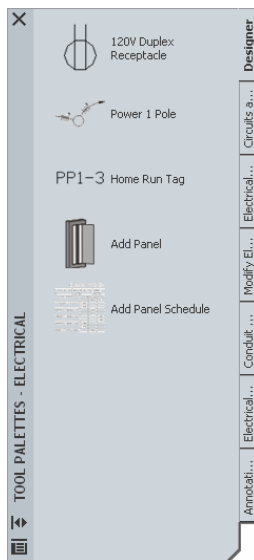


Figure 4: Optimized for the electrical designer

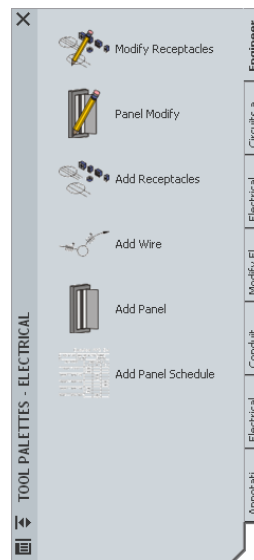


Figure 5: Optimized for the electrical engineer

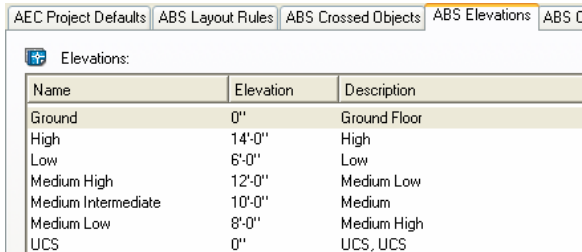
Step 3

The fundamental basis of any Building Systems drawing consists of the objects used to make up the design. Objects in Building Systems represent their real-world counterparts and are assembled in your drawing exactly as they are installed in the field. Building Systems makes it easy to work with objects similar to the way AutoCAD makes it easy to work with lines, arc, and circles. However, there are significant advantages to using objects over simple linework and basic geometry. The most powerful advantages of using objects during Stage 1 include:

- Objects know what they are and always draw correctly – a duct is a duct, a pipe is a pipe
- Fittings are inserted automatically and layout options are suggested on the fly
- CAD standards, like layers, displays, and linetypes, are set by default
- Objects can be stretched and moved into place using grip editing
- Annotation, such as dashed or haloed lines for crossing objects, and rise or drop graphics, are added automatically

Building Systems is designed to enable you to draw in a 2D plan view, while the application takes care of the 3D view automatically for you. Since users in this stage are typically most comfortable working only in 2D, Building Systems removes the worry of drawing in 3D right from the start. However, to gain the benefits of the 3D at this stage, such as hidden or haloed lines for crossing objects, you do need to consider working with pre-set elevations. Now don't get alarmed, this still means you do not have to work in 3D.

The secret is to set up a simplified elevation scheme. Start "simple," say, with only five or six elevations (Figure 6). The elevations act as a type of vertical snap when you are drawing your systems.



| Name | Elevation | Description |
|---------------------|-----------|--------------|
| Ground | 0" | Ground Floor |
| High | 14'-0" | High |
| Low | 6'-0" | Low |
| Medium High | 12'-0" | Medium Low |
| Medium Intermediate | 10'-0" | Medium |
| Medium Low | 8'-0" | Medium High |
| UCS | 0" | UCS, UCS |

Figure 6: Simplified elevation scheme for Building Systems Elevations accessed in Options

For example, if you know that your sprinkler system is almost always above your supply duct system, then draw the supply at the Medium Low elevation and draw the sprinklers at the Medium elevation (Figure 7). Remember, the point of working with pre-set elevations is simply to achieve those automated haloed lines in plan.

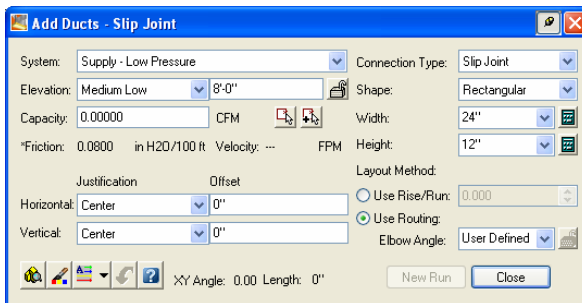


Figure 7: Selecting elevations in the Add dialog boxes

Not a big deal? Don't forget that the real power of Building Systems is in the modify functions. Grab a grip, move a system and the haloed lines automatically update. Try that with AutoCAD!

"With Autodesk Building Systems you're creating a model just like what is constructed in the field. It's a more natural way to put a project together. We've increased our productivity and have quickly realized ROI."

Joe Hosanna, Vice President and Chief Engineer, Consoer Townsend Envirodyne Engineers

Step 4

When you have completed drawing your systems and are ready to annotate to create construction documents, use the “Export to AutoCAD” feature. This feature makes a flattened AutoCAD drawing with full visual fidelity to the model. As with many projects, this is the final deliverable. You will want to wait as long as possible before doing this – there is no going back to the intelligent model, which means that you lose the powerful modify capabilities of Building Systems at this point.

Also to be Considered

You may also consider starting to leverage some of the more simple engineering features provided by Building Systems where significant time savings can be achieved with little effort.

- **E-spaces:** Since many architectural backgrounds or base plans are typically 2D AutoCAD floor plans, E-spaces (engineering spaces) are designed to capture the length, width, and even height information of the spaces contained in these drawings. E-spaces translate a simple space created by linework into intelligent rooms so there is no need to perform manual calculations to determine room sizes.
- **gbXML Support:** Having created e-spaces complete with room data, you can now use the “Export to gbXML” feature to export the intelligent space data to third-party applications to get a jump start on your engineering analyses, such as Trane® Trace™ 700 for heat load analysis. Users who have taken advantage of this functionality in Building Systems, particularly those working on big projects with lots of dissimilar rooms, were able to reduce the time for a load analysis from several days of tedious data entry to just a few hours.

NOTE: Building Systems can interface with any load analysis application that uses the gbXML file format. For more information about gbXML, go to www.gbxml.org.

Stage 2: Productivity and Accuracy – Going Beyond AutoCAD.

Now that you and your team have had success getting some immediate productivity gains from Building Systems in Stage 1, it is time to move to the next stage. Stage 2 is characterized by using the data capabilities of objects. The typical user has completed Stage 1 and has reached a level of intermediate Building Systems skills. They may have also completed additional training, three to five days at best. This stage typically lasts 6 to 12 months and may continue to occur in parallel with a pilot project that is exploring all the capabilities of Building Systems.

As in Stage 1, you will not create a perfect 3D systems model in this stage. In fact, the resulting model of your design may not necessarily make sense when viewed in 3D. Instead, you will further your success in this stage by leveraging the intelligence of the objects, specifically the equipment objects, to access their inherent data for creating schedule tables. Let’s take a closer look at how that is accomplished.

Schedule tables in Building Systems are automatically populated as you draw. The information in the tables is the same data as the properties on the objects themselves, so that the objects in your drawing will always be in sync with the schedule tables (Figure 8).

| PUMP SCHEDULE | | | | | | | | | | | | |
|---------------|---------|--------|--------------|------------|------------|------------|-------|------|------|-------|-------|-----------|
| MARK NO. | MODEL | TYPE | MANUFACTURER | TDH (FEET) | FLOW (GPM) | MOTOR DATA | | | | | | REMARKS |
| | | | | | | AMPS | WATTS | HP | RPM | VOLTS | PHASE | |
| P-2-3 | P25-83Q | API 25 | BINGHAM | 900 | 225 | 60 | 90 | 500 | 1750 | 480 | 3 | LPSI PUMP |
| P-2-2 | P25-83Q | API 25 | BINGHAM | 900 | 225 | 75 | 700 | 500 | 1750 | 480 | 3 | LPSI PUMP |
| P-2-1 | P25-83Q | API 25 | BINGHAM | 900 | 225 | 75 | 3000 | 500 | 1750 | 480 | 3 | LPSI PUMP |
| P-1-3 | P25-84Q | API 25 | BINGHAM | 150 | 1200 | 200 | 3000 | 2000 | 1750 | 480 | 3 | LPSI PUMP |
| P-1-2 | P25-84Q | API 25 | BINGHAM | 250 | 1200 | 200 | 3500 | 2000 | 1750 | 480 | 3 | LPSI PUMP |
| P-1-1 | P25-84Q | API 25 | BINGHAM | 1250 | 750 | 1200 | 3500 | 2000 | 1750 | 480 | 3 | LPSI PUMP |

Figure 8: Schedule table populated with pump properties

Keep in mind that schedule tables are only as useful as the information they contain. Therefore, to successfully get to this stage you will have mastered configuring your own part catalogs. Even though all Building Systems objects in the box are based on manufacturer offerings, you will likely have added properties to those generic objects so that they represent specific parts that you have specified for your project. You may also have taken advantage of some of the manufacturer websites that offer parts that you can download and add to the Building Systems part catalogs. However you choose to create specific parts for your projects, be sure to rename the parts since the next version of Building Systems will also contain these generic parts with the same name.

Since in this stage you are not creating a scaled model of your systems, you cannot provide an accurate estimate of the length of duct, pipe, or even wiring that is needed to complete the project. Nor can the model be used as a basis for system wide analyses, such as a static regain calculation. However, let's look at what you have been successful with by this stage. You have made an excellent set of AutoCAD-based construction documents faster. You have provided consistent drawings and schedules that are useful for ordering specified parts, particularly long-lead time items. And, you have gained valuable insight into the costs and material requirements of your designs.

Stage 3: Productivity, Accuracy, and Coordination – Going Well Beyond AutoCAD

By now you have progressed through both Stages 1 and 2, have acquired a high level of Building Systems skills and are ready to tackle the final stage. Stage 3 requires the most effort, but also offers the greatest gains. In this stage you will build a complete 3D systems model while using Building Systems from both 2D and 3D perspectives. The typical user has acquired an advanced level of Building Systems skills, with some having up to two weeks of training.

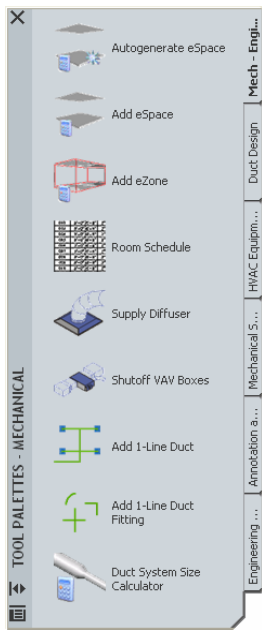
You may attempt this stage for many reasons, some of which include:

- Your clients are requiring 3D models as part of the deliverables
- You need to improve coordination between disciplines
- Your user base is skilled and able to realize all the benefits to 3D modeling, including generating all your sections from the model
- You need to leverage collision detection
- You want to know that your designs will fit before construction begins

In this phase, you will need to set up a project with the drawing management tools, specifically Project Navigator, complete with floors and divisions at the proper elevations. Project Navigator enables you to set up a complete building in a central location that automatically manages xrefs and controls multi-user access to the project. To ease any organization issues of drawings with multi-discipline projects, take advantage of setting up multiple categories by discipline under Constructs. In fact you may even choose to create separate constructs for each system for a single discipline. For example, a different construct for the mechanical supply, return, exhaust, vent, and support piping systems. This will also help when creating your views for your construction documents. Since views are designed to be a collection of constructs, you would simply create a complete mechanical view by overlaying each mechanical construct in a single view that then could be dragged onto a sheet. No more having to worry about which drawing contains which system, and what should be referenced by what when creating you sheets.

NOTE: Additional functionality in Building Systems enables you to export the same information used to populate schedule tables to Microsoft® Access or Excel to generate documents, such as bill of materials for cost studies or spec data for purchasing documents.

In addition to working with Project Navigator, in this stage you are also ready to leverage the entire feature set of Building Systems to help you get the project completed faster. Although Building Systems makes it easy to draw in 3D with features such as automatic fitting insertion and suggested layout path, most of the time, you can still draw in 2D as you have been doing in the preceding two stages. The only difference is in this stage you will be drawing to scale. You will want to make sure you are using an accurate base plan that reflects the space layout of the building, be sure you use your pre-set elevations to snap to correct vertical locations, and take advantage of features such as dynamic dimensions so your horizontal layouts are correct as well. Here is a typical process you might use in Building Systems that mirrors the engineering process used to create a mechanical design. Figure 9 illustrates the process when applied to a tool palette.



- Use e-Spaces to extract the dimensional information from the base plan
- Create e-Zones, export the e-Space data to perform a load analysis using third-party applications like Trane Trace 700, and import the results back into Building Systems updating the model
- Set up a schedule table that compares the requirements from air changes per hour with the air flow needed to heat and cool the spaces
- Based on air flow requirements for the spaces, place the ceiling diffusers and assign the appropriate flow values
- Sketch out preliminary systems using unsized single line duct without any shape – use the Building Systems modify tools to stretch the system into place
- Size the duct system based on flow required – use the Building Systems modify tools to make final adjustments to the system

Figure 9: Tool palette for mechanical design process

The biggest difference in this stage is that there is no reason to flatten the drawing by using the “Export to AutoCAD” tool when creating your final construction documents (except for any electronic delivery requirements). You can use all the annotation features of Building Systems including tags, labels, callouts, and even MText directly in the Views and Sheets to get the look and feel of a your old AutoCAD construction documents. Plus, additional tools, like the Section and Elevation tools, can now be used to automate the creation of your documents by creating views that are true to scale since they are based directly on the 3D model.

You can also leverage the 3D systems model beyond just the creation of the construction documents. A few of the additional benefits of completing Stage 3 include:

- Responding quickly to design changes with the powerful grip editing capabilities
- Detecting conflicts and interferences in the design with the Collision Detection feature
- Storing all the intelligence design data directly in the model for future reference or to export for further use such as fabrication or facility management

“With Building Systems, everybody has a higher level of confidence because everything is better coordinated. We have eliminated cost overruns by as much as 65% by reducing conflicts in the field and increased field installation production by 8%. There’s a significant savings in time, as well as cost to the owner and the contractor.”

**Bill Hashman,
CAD/IT Manager,
Total Mechanical**

Conclusion

So there you have it, a phased approach to effectively migrating from AutoCAD to Autodesk Building Systems – three separate stages, each with distinctive benefits, each building upon the previous until you are reaping all the benefits of using Building Systems for the design and documentation of your projects. Remember success in migrating from AutoCAD is relative. Work to become proficient at the stages that make sense to you and your company, leverage the AutoCAD-like features of Building Systems to get you started, and work your way up to using the entire feature set of Building Systems to complete your projects faster.

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Leveraging Autodesk Building Systems Features

| Migration Stages | STAGE 1 Productivity <i>Faster Than AutoCAD</i> | STAGE 2 Productivity and Accuracy <i>Going Beyond AutoCAD</i> | STAGE 3 Productivity, Accuracy and Coordination <i>Going Well Beyond</i> |
|--|---|---|--|
| Training and Implementation | Beginner Minimal training 1-2 days | Intermediate 3-5 days | Advanced 12-18 days |
| Pilot to Production | Typically first 30 days | Typically first 3-6 months | Typically first 6-12 months |
| Productivity, Accuracy, and Coordination | <ul style="list-style-type: none"> • Making 2D drawing faster than with AutoCAD • Layers default to customizable standards • Powerful modifying tools prevent having to redraw when changes are required | <ul style="list-style-type: none"> • Schedule tables can be set up in any drawing and across an entire project • Schedule tables are automatically populated as you draw and make changes • Export capabilities to Access or Excel for bill of materials, etc. | <ul style="list-style-type: none"> • Set up a project of floors and wings based on elevations • Analyze and size systems through the entire building • Coordinate project files – xrefs are automatically managed • Automated collision detection across systems |
| For HVAC: Ducts, Fittings, and Equipment | <ul style="list-style-type: none"> • Sketch out systems using generic ducts, fittings, and equipment • Easily make changes using grips • Save as 2D AutoCAD dwg | <ul style="list-style-type: none"> • Sketch out systems using generic ducts, fittings, and equipment • Easily make changes using grips • Update the systems to manufacturer-based parts • Save as 2D AutoCAD dwg | <ul style="list-style-type: none"> • Sketch out systems using one line duct • Size systems converting to full 3D manufacturer-based parts • Easily make changes using grips • Save as 3D Building Systems dwg |
| For Piping: Pipes, Fittings, and Equipment | <ul style="list-style-type: none"> • Sketch out systems using generic pipes, fittings, and equipment • Easily make changes using grips • Save as 2D AutoCAD dwg | <ul style="list-style-type: none"> • Sketch out systems using generic pipes, fittings, and equipment • Easily make changes using grips • Update the systems to manufacturer-based parts • Save as 2D AutoCAD dwg | <ul style="list-style-type: none"> • Sketch out systems using one line pipe • Convert the system to full 3D manufacturer-based parts • Easily make changes using grips • Save as 3D Building Systems dwg |
| For Electrical: Wires, Devices, and Equipment | <ul style="list-style-type: none"> • Sketch out systems using wires, devices, and equipment • Easily make changes using grips • Save as 2D AutoCAD dwg | <ul style="list-style-type: none"> • Sketch out systems using wires, devices, and equipment • Easily make changes using grips • Establish circuits and panels • Publish panel schedules • Save as 2D AutoCAD dwg | <ul style="list-style-type: none"> • Sketch out systems using cable tray, conduit, devices, and equipment • Easily make changes using grips • Establish circuits and panels • Publish panel schedules • Save as 3D Building Systems dwg |
| For Plumbing: Schematic Pipes, Schematic Fittings, and Fixtures | <ul style="list-style-type: none"> • Sketch out systems using schematic pipes, schematic fittings, and fixtures • Easily make changes using grips • Save as 2D AutoCAD dwg | <ul style="list-style-type: none"> • Sketch out systems using schematic pipes, schematic fittings, and fixtures • Easily make changes using grips • Establish fixture tables • Publish fixture schedules • Save as 2D AutoCAD dwg | <ul style="list-style-type: none"> • Sketch out systems with piping, 3D plumbing fittings, and fixtures • Easily make changes using grips • Publish fixture schedules • Save as 3D Building Systems dwg |