

Communicating with Architectural Software

Mark Robins, Senior Editor, Posted 10/04/2011



Architects use software to communicate tasks, drawings, documentation, and overall design intent and specifications. Traditionally done by hand, communicating with software is an efficient and accurate process resulting in reduced errors and omissions. Once an architect has completed his or her work electronically, in most cases the work is still printed on paper to distribute to the contractors, sub-contractors, suppliers and building product manufacturers. However, this traditional paper approach is now being enhanced with electronic files distribution allowing automatic quantity take-off, automated estimation and extraction of data to spreadsheets.

"We are seeing the distribution of the visual information as photo realistic renderings and animations that make it easier for the contractors to understand the architects' and engineers' design intent," says Dennis

Neeley, senior vice president, SMARTBIM, Norcross, Ga.

Enhanced architectural software improves the amount of detail architects communicate to contractors. "A best practice for any person or team working with architectural software is to discuss how to organize the model, details and final drawings to provide the most detail and convey the design intent so all parties understand them," says Robert Warr, director of engineering services in the Atlanta office of ClarkDietrich Engineering Services.

Architectural software lets architects and engineers quickly and easily communicate upfront about the feasibility and flexibility of a design, and understand how different products work together. "Architectural software helps teams communicate on a higher level of accuracy that was previously difficult to express," says Mike Murzyn, technical product and marketing manager at West Chester, Ohio-based ClarkDietrich Engineering Services.

Historically, 2-D drawings were printed and then sent to the owner, because the design contract was with the owner. Then, the owner provided them to the construction contractor to develop a bid. This is the design-bid-build approach. "This is giving way to many more creative approaches, from design-build, where one contract is awarded to a firm to both design and build the facility, and integrated project delivery where all parties work collaboratively on a project to include operations and maintenance contractors," says Dana "Deke" K. Smith, FAIA, executive director, buildingSMART alliance, National Institute of Building Sciences, Washington, D.C.

This has also supported the advent of Building Information Modeling which works in 3-D and allows all parties to collaborate. In more sophisticated applications there are instances where traditional drawings are never produced and pre-fabrication occurs directly from model data. This is mostly found in duct manufacture, piping and steel fabrication. Today the full gamut of options in between these 2-D and 3-D modeling extremes is seen. The best way is to work in three dimensions is where everyone understands what is attempting to be conveyed and the information is not re-entered at each step but is simply re-purposed."

Software is helping contractors and builders communicate at the World Trade Center site. "Turner staff working at the World Trade Center site in New York City use Google SketchUp's efficient, flexible, even customizable modeling tools to enable the onsite BIM team to provide daily rapid 3-D studies for project stakeholders," says Ben Ferrer, BIM Engineer for New York City-based Turner Construction Co. "Turner's SketchUp models provide information during the decision making process and support the overall management and control of the construction activities at the site.

BIM aids communication

BIM is quickly becoming an instrumental and powerful software communication tool. It benefits architects letting them fully construct a building virtually and in detail, then communicate this information to contractors. BIM presents and visualizes building components, construction sequences, resource allocation and other disciplines of the construction process.

"BIM offers the promise of a single integrated process for building design and construction that crosses disciplines and brings diverse stakeholders together around a common building model," says John Bacus, product manager, Google SketchUp, Mountain View, Calif.

BIM creates and communicates an accurate project model with objects (doors, windows and equipment) and assemblies (walls, floors and ceilings), along with all of the associated data (manufacturer input, electrical requirements, sizes and weights). Via this communication, each contributor to the project can add their information. The result is a project model that is graphically correct with data that can be extracted and communicated for quantity takeoffs, analysis, visualization and ordering.

"The use of BIM has had a positive impact on all who are part of the design, construction, building operations and maintenance process," Neeley says. "Better visualization leads to better design. BIM leads to accurate take-offs and ordering. BIM leads to a database of information that can be used throughout the life of the building."

One of the most valuable elements of BIM's communication functions is helping architects and contractors avoid installation clashes. Design and construction teams save time and money on a project by eliminating the number of change orders.

"Although BIM helps architects fully express their vision, it is critical that the model and drawings provided to other members of the design team are as complete and detailed as possible so the coordination between architects, contractors and subcontractors runs smoothly," says Warr. "With all the available 2-D and 3-D software options available, design teams should be more open to sharing information and collaborating."

Many architectural firms, construction management companies, large construction companies and government agencies are now requiring BIM type files from all disciplines so data can be communicated and shared by all parties before the project ever breaks ground. Smith believes that the construction industry is quickly transforming to a nearly exclusive BIM environment. "CAD simply automated an existing process-drafting-while BIM is transforming how the entire industry does business and relates to each other from the planner to the facility manager to include even first responders," he says. "That is simply what is happening."

Clear communication

There are many innovative architectural software methods that allow architects to communicate their designs to contractors. Before BIM, architects created and communicated their drawings and documentation using CAD tools and even hand drawings. "Architecture CAD software, such as AutoCAD LT, allows architects to produce precise 2-D technical drawings using lines, arcs and circles," says Joy Stark, architecture industry marketing manager at Autodesk, Waltham, Mass. "These drawings help contractors understand the architect's design intent."

Autodesk's Revit Architecture software clearly communicates designs to contractors via information- rich, intelligent 3-D models that represent an architect's designs. "Designs created in Revit Architecture are represented as a single model, so an architect or contractor can select any view of the model-in plan, section, or elevation-and be assured that the model view will be accurate and consistent with all other views," Stark says. "These detailed views help architects communicate to contractors exactly how building elements will come together in much greater detail."

To further aid communication, Revit Architecture software's built-in rendering tools let architects quickly create highly realistic visualizations of projects, which help the contractors better understand how the project should look when built. Revit has parametric modeling tools, so any change an architect makes to the design is automatically updated and communicated throughout every view of the design model, keeping

documentation coordinated.</p>

A software technique from Bentley Systems that aids communication "includes the creation of 3-D BIM and 2-D documentation for fabrication and construction purposes," says Huw Roberts, AIA, global marketing director, Bentley Systems Inc., Exton, Pa. "The plans and elevations are generated directly from the 3-D BIM. The use of dynamic views and clip volumes help isolate details of the design in order to communicate the design intent more efficiently to the fabricator. Multiple file formats can be produced including DGN, DWG, IFC 2x3, i-model and others."

Another software communication technique from Bentley easily creates and delivers a rich 3-D PDF of the design. The PDF is printed directly from the Bentley BIM and can include 3-D models, 2-D fabrication drawings and animations that can detail the fabrication and construction sequence, Roberts says.

QUESTware, like most metal building company legacy software, originally revolved around standard text type files. To improve software communication, "several years ago QUESTware refined our database structure to ODBC compliant type files and generated a true coordinate system," says Lewis Ellis, general manager, QUESTware Corp., Hendersonville, Tenn. "Today, nowhere in QUESTware's systems do you have to modify text files. All data entry, interactive designs, interactive bill of materials, system administration and database modeling are based and saved in real database structure."

Hypermodeling

To further aid communication, the design, fabrication and construction documentation created using Bentley's multidisciplinary BIM software can perform hypermodeling. "A hypermodel infuses the project's documentation into the 3-D model, automatically," says Rob Snyder, product manager at Bentley Systems. "The 3-D model is infused automatically and comprehensively on demand with the clarifying remarks and graphics of the project's documentation, the same documentation with which the project team has exerted itself clarifying the project."

This innovation makes the drawing medium (fabrication and construction documentation) better than before and enhances the modeling medium. The combination of a project's documentation in the 3-D model produces a new medium of communication that is rich in potential and more effective than either drawings or models alone. Hypermodeling improves 2-D drawings because the drawings are contextualized in the model that gives them meaning. Because of this communication software method, users can understand them more easily, quickly and thoroughly, and users are less likely to misunderstand and/or misinterpret them.

"Hypermodeling improves 3-D models because the models are now unambiguous regarding a very essential differentiation (which was absent prior to Bentley's hypermodeling innovation)-the difference between locations in the model that are reliable and complete (enough), and all other locations that are not (or may not be) complete (enough)," Roberts says. "Therefore, with this distinction now clear, models may be delivered with confidence, authority and reliability."

The hypermodel innovation spans all project phases, from early design sketches, even hand

sketches, through development to delivery, through construction and into operations and maintenance. Likewise, it spans all infrastructure asset domains, from buildings to power plants, utility networks, road and rail applications, GIS and others.

Maturing communication software

Software is maturing more rapidly today than ever before to further aid communication and minimize mistakes. "The future will be most amazing," Neeley predicts. "Collaboration between designers, contractors, building product manufacturers and suppliers will become the standard of practice. BIM and visualization software will make 'seeing' and documenting the design more accurate. We are already seeing projects with substantial costs reductions when BIM and IPD are used. We are seeing projects with no change orders for construction conflicts. Software will lead to new roles and responsibilities."

Sidebar: Common software communication errors

Despite improved communication accuracy in software, errors can still arise. "Obviously, people are still involved in the process and people do >occasionally misinterpret things," says Dana "Deke" K. Smith, FAIA, executive director, buildingSMART alliance, National Institute of Building Sciences, Washington, D.C. "The beauty of 3-D visualization and conflict checkers is that the errors are identified prior to construction and so cost of change is significantly reduced, as it is inexpensive to move electrons."

There are typically two main sources of miscommunication when architects convey drawings to contractors. "The most frequent bottleneck is that there is often missing or incomplete data in the drawing," says Mike Murzyn, technical product and marketing manager at West Chester, Ohio-based ClarkDietrich Building Systems. "To this point, it is of the utmost importance that all individuals working on a project, including the architect, engineer, general contractor and builder all have the most up-to-date drawings and specifications. This will help alleviate inconsistencies and help streamline the building process."

A second source of miscommunication is that even if all data has been correctly entered into the drawing, often times there is variance between what products have been specified and what products truly work best in the field. "Fortunately, as the building community continues to embrace technology, there is software to seamlessly align these details and specifications," says Robert Warr, P.E., director of engineering services in the Atlanta office of ClarkDietrich Engineering Services. "Software tools such as ClarkDietrich's BIM Wall Creator intelligently incorporate detailed information on wall elements and design properties, such as UL assemblies based on fire rating requirements, STC sound ratings and limiting height design. This type of interactive platform, in which details have been linked together, is truly unparalleled and gives architects and contractors everything needed to successfully design even the most challenging wall assemblies. In our experience, miscommunication is due to a lack of communication during the design process. Therefore, the best way to reduce errors is to increase upfront communication in the design process."

Errors can frequently be found when communicating sustainability and environmental data via software. "While working on certified 'green' projects such as the USGBC's LEED program, the process of sustainable product selection based on environmental criteria is often completed at the contractor level when the original design intent is sometimes compromised by the availability of sustainability choices or materials," says Dennis Neeley, senior vice president, Owner Solutions, Norcross, Ga. "Too often there is not enough sustainability information available during the early design so that when the project settles for bid, the breakdown of information often leads to changes in budget or design."

"One of the ways this is being mitigated is by placing green information into the architectural software at the onset of design. Products like the ecoScorecard plug-in for Google's SketchUp program allows users to play with product selection and evaluate green choices against various rating systems before designs are even

final. The idea is to bring more information into the hands of the architect, engineer and designer long before it ever is sent to a contractor for bid. Embedding environmental information into the design and construction process makes it easier to carry the sustainability design intent all the way to the job site."

Selecting the correct set of software tools compatible with clearly defined interoperability capabilities could eliminate common communication software errors, but this could prove problematic. "Asset exchange between tools from different vendors is a problem, but standardizing on a tool chain supplied by a single vendor isn't always the best solution either," says John Bacus, product manager, Google SketchUp, Boulder, Colo. "What's really needed is an industry-supported vendor-neutral standard for interoperability. Industry Foundation Classes may supply the answer to this problem, but despite years of effort by many parties adoption isn't where it needs to be yet."