The Benefits of BIM

How harnessing the power of BIM technology can boost an electrical contractor's bottom line

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EXECUTIVE SUMMARY

A BOOST IN BUILDING INTELLIGENCE

Why digital collaboration tools are revolutionizing the life cycle of today's construction projects

By Ellen Parson,
Editor-in-Chief, *EC&M*

Although the beginnings of computer-aided design (CAD) and computer-aided machining (CAM) can be traced back to the 1950s, these concepts would not transform into what we recognize as today's virtual construction tools until much later. Introduced as an official term in the late '80s or early '90s, building information modeling (BIM) didn't start to become a buzzword until the early 2000s when 3D design software came on the scene, offering simulation and collaboration capabilities that had previously been pegged as "pie in the sky" technology. Since that time, BIM has continued to become much more mainstream. In fact, according to a report from Zion Market Research, analysts estimated the global BIM market at $3.52 billion in 2016 and expect that number to hit $10.36 billion by the end of 2022, increasing at a CAGR of more than 19% from 2017 to 2022. What used to be employed by only a handful of the most progressive electrical contractors and design firms is now the norm on many modern construction projects.

EC&M readers have reiterated that message loud and clear in the results of our most recent Top 50 Electrical Contractors survey (September 2019). When asked about augmented reality (AR) and virtual reality (VR) adoption, the consensus is definitely trending upward. For example, when it comes to AR implementation, the majority of Top 50 companies (nearly 75%) say they are either already using the technology or see it as a viable component of their electrical work in the next three years. How are firms actually incorporating AR and VR solutions into their business? Survey respondents consistently named training, collaboration with subcontractors/general contractors, and pre-construction planning as their top areas for implementing virtual construction techniques, followed by collaboration with clients, design modifications, accident prevention/safety-related simulations, and product/equipment testing. Similarly, when asked what challenges they faced most in the field that affected job outcome, more than 70% named "poor design" or "change orders" as having the greatest impact on their company's ability to get a job done on time and within budget — both obstacles BIM has historically demonstrated an ability to overcome.

The editors of *EC&M* and ABB are pleased to bring you this compilation of articles. By selecting a handful of pieces targeted to help electrical professionals harness the power of collaboration more effectively, this e-book provides you with examples of how BIM is being used in the real world to bridge the gap between varying degrees of modeling dimensions (2D up to 6D environments), resulting in greater optimization of collaboration among architects, engineers, and contractors on the job as well as a boost in building intelligence.

FIVE WAYS TO UNLEASH THE POWER OF BIM

Although contractors have turned to prefabrication for years to improve efficiency on the job site, here's why BIM has become even more prevalent on electrical construction projects recently.

By Amy Florence Fischbach

Paper plans and tape measures were once staples on a construction site. Today, however, firms that aren't arming their employees with the latest electronic tools and leveraging the power of building information modeling (BIM) may be losing out on work." Soon firms who do not use BIM will not be able to win jobs as more and more clients and contractors are requiring BIM deliverables for their projects," says John T. Grady II, the corporate BIM manager for CRB in St. Louis.

John Grady with CRB Builders, LLC works on the coordination of the Mars candy project in Topeka, Kan.

While more contractors, engineers, and subcontractors may be using BIM on job sites nationwide, the majority of these firms are just scratching the surface of this technology, says Darin Marsden, director of virtual construction for Faith Technologies, headquartered in Menasha, Wis.

Those companies that are embracing the technology, however, are discovering new ways to save time, improve efficiency, and protect their field workforce on a construction project. Here are five ways they have unraveled the mystery of BIM and tapped its true potential.

1. CREATE A STRONG TEAM

BIM may offer a wide range of capabilities, but the real power of the technology and its application lies within the knowledge and experience of the people using it, says David Morris, director of virtual construction for EMCOR, headquartered in Norwalk, Conn. He attributes 90% of the success of BIM to the users. EMCOR's team of more than 400 BIM-trained employees are networked via an EMCOR virtual construction peer group.

"While the computers and the programs by themselves are very powerful, they are a small component of being successful with BIM," says Morris. "We depend on highly skilled tradespeople — oftentimes with 20 to 30 years of experience — to perform this type of work. They may join the BIM team after managing workers out in the field."

Faith Technologies electricians review a model in the field using BIM in a Box.

EMCOR, like many other companies, has discovered it's far easier and more effective to teach a veteran electrician how to use a modeling program than to try to teach fresh technical school graduates without years of first-hand experience about the world of electrical construction.

With that being said, however, EMCOR often hires technical school graduates to work alongside the trade experts and help to output files. But other companies are plugging these new employees in the lead role as the manager of the construction process, which creates many challenges on a project, says Morris.

"Segments of the industry are only relying on technical people, and they're pulling the whole team down to their level," says Morris. "Sometimes you can train them, and other times, it's a battle from day one all the way out to the end."

Ten Strategies for Success on BIM Projects

Here are 10 ways your company can get the most out of BIM on a construction project.

1. Get buy-in from the field. BIM can take the guesswork out of installation. To help its electricians visualize what their electrical system should look like when completed, Faith Technologies built the "BIM in a Box," which is a gang box equipped with a large monitor and computer (see Photo). The electricians can pull the container into an electrical room, turn on the computer, and then see exactly what they are going to install in that room.

"They can look at models in real time out in the field," says Darin Marsden, director of virtual construction for Faith Technologies. "They can roll a gang box out and spin and twist the model to get a better picture of what they are doing out in the field. They can't do that with a plan view."

2. Provide hands-on training. Oftentimes, firms pull in veteran electricians to work on their BIM team. While they may be well

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To prevent this from happening, some electrical contracting firms are building their BIM teams with a blend of engineers and electricians and then training them through a peer mentoring program. For example, at Faith Technologies, engineers teach the master electricians about modeling, and, in turn, the electricians share their field experience. The 18 employees in the virtual construction department have a total of 218 years of electrical experience, and 95% of them have worked out in the field.

Engineering and construction management firms have also discovered the advantages of hiring experienced field professionals. CRB Consulting Engineers, Inc., and CRB Builders, LLC are hiring electrical detailers from the trades to work on preconstruction and design detailing. They send their engineers out into the field to interact with the electricians who are installing the systems they design.

"This allows field knowledge to be incorporated into the early design and estimating phases of the project and ensures the most cost-effective constructible solutions are provided to clients, specialty contractors, and contractors," says Grady.

This image shows the alignment of the model and the real-world conditions for a pipe and electrical rack for a project in Topeka, Kan.

2. COLLABORATE AND COMMUNICATE

To yield the best results, both the design and construction team must be strong in BIM, says Daric Hess, senior principal for Heapy Engineering in Dayton, Ohio.

"If any of the parties don't work in BIM or don't accurately model their portion of the work, the results of any coordination may not be useful because of the missing or wrong information," he says.

Oftentimes, not all of the project partners are at the same level of experience and expertise. In some cases, companies may not be able to do BIM at all. In those situations, the general contractor may create a model and pass on the cost to them.

Once the companies create their models, they must be willing to share them to help versed in construction, they often aren't proficient in software. To help them through the learning process, Faith Technologies continually grades them on their software proficiency and rotates them through different types of projects so they can gain experience.

3. Dig deeper. Assign one person on your virtual construction team to look for ways to make your BIM tools and software more efficient. By adding more detail into BIM and using its full capabilities, companies can save time and money in the long run.

4. Move efficiencies to the front of a project. Instead of using record drawings just at the end of a job, instead use them at the beginning so you can reap the benefits of all the information inside these drawings and use them as a map during the project. That way, you can work out the bugs ahead of time, saving money and labor hours in the field.

"We try to use a holistic approach," says Marsden. "The goal is to draw it once and use it for multiple purposes."

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with coordination during the planning, design, and construction phases. That doesn't always happen, though, says Marsden.

"We're still trying to shift the mindset of companies that are hesitant to share models with project partners," says Marsden. "Sometimes we have to recreate models to do our portion of the work."

To eliminate this problem, CRB uses an electronic files agreement and a model progression specification based on the U.S. Army Corps of Engineers (USACE) BIM Minimum Modeling Matrix (M3). That way, all team members understand how much detail will be provided within the design intent models.

"It eliminates a lot of the guesswork," says Grady. "We also found that by providing the models during the bidding phase, it helps ensure that the project scope was fully realized by all bidders."

By learning more about the constructability of a building earlier on in the construction process, design firms can make better decisions, says Dmitri Alferieff, senior director of virtual construction for Associated General Contractors (AGC), Arlington, Va. Traditionally, the transfer of information has been very linear. For example, a designer passed a drawing on to a general contractor, which feeds it to the subcontractor. By the time the specialty contractors finally obtained the information, it was already set in stone. Today, teams are having greater input earlier on in the process, and they're working together toward a common goal.

AGC started the BIMForum within its building division in 2006. While many general contractors belong to the BIMForum, it is open to all sectors of the industry. To be successful, it requires participation from planners, designers, and subcontractors.

"We look at each topic from a cross-industry perspective, and we are not just dealing with issues relevant to contractors or engineers," says Alferieff, director of the BIMForum. "It's really meant as a forum for all the participants within the industry to understand how BIM is changing the construction industry."

To help the industry better collaborate, the BIMForum and the American Institute of Architects created the Level of Detail (LOD) specification, which helps a construction team to effectively communicate the gargantuan amount of information in a 3D model.

"BIM allows people to produce an infinite amount of data about a building," he says. "Once you have that much information, you must be able to locate it, communicate to others about it, and determine what's the most important. You also must make sure that everyone has the same understanding of how to interpret that information."

5. Create a plan. CRB Builders, LLC creates individual execution plans for the specific BIM uses during the design phase so everyone can stay on the same page. In addition, the company schedules one-hour coordination meetings to resolve issues.

6. Be proactive rather than reactive. Rather than waiting for your electricians to discover a problem out in the field, instead try to solve it virtually before it even becomes an issue. Through BIM, all the trades can have a coordination meeting each week to discuss clashes out in the field.

"We are talking about solutions as opposed to finding problems," says Marsden. "A lot of the things said about BIM is clash detection. I like to think of it as clash avoidance. For example, if I'm in a car, I would rather brake and not hit someone than hit another car and then figure out what went wrong."

7. Gain a competitive edge. By knowing the ins and outs of BIM and being able to effectively build virtual models on a construction project, a company may be able to win a contract. If a company is not adept at the technology, then the firm can slow others down.

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3. STICK TO A SCHEDULE

To use BIM successfully on a job site, project partners must not only collaborate, but they must also create and adhere to a schedule. Otherwise, team members may move from a proactive approach to a reactionary mode, which is never a good thing, explains Morris.

"One of the largest challenges I see industrywide is the lack of scheduling and logistics on the part of the people who control these things," says Morris. "Sometimes, we are along for the ride as the subcontractors, and the overall schedule comes from the owners and the construction managers. Other times, when we're coordinating the project as a result of managing the BIM, we're in charge of the scheduling."

On about half of the jobs, Morris sees a disconnect between the data in the BIM system and the available tool sets and a lack of adoption.

"It starts falling apart if you don't put the same diligence into logistics and scheduling that you would with a 3D model," says Morris. "The entire construction process is much more successful where there is an orderly application of a digital schedule."

Some companies, however, are still writing their three-week look ahead on a legal pad, which can lead to a lot of arm waving and finger pointing, notes Morris. By using a digital schedule on a BIM project, however, everyone often abides by it — and it's a very orderly process.

Marsden agrees, saying that when you work on a BIM project, having a schedule is paramount.

"Scheduling is near and dear to my heart because you never want to start too early, and you don't want to start too late," he says. "If you go too early, you'll have to do rework. If you do it late, you'll have extra guys tripping all over each other. We do things at the right time so we don't do them twice, and we don't do them carelessly."

4. REDUCE RISKS

Through the advent of BIM, construction teams can reduce the risk of installation through better visualization and the ability to build a project virtually before it is constructed in the field, says Morris. Following is a quick case in point. EMCOR is now a leader in the health-care market and works on some of the largest hospital projects in the world. Yet, 10 years ago, the company found this to be a very difficult market due to repeated challenges with the amount of wiring and conduit compressed into the ceilings.

"Years ago, we would do a job walk, and they would have a dozen ceiling tiles popped out," says Morris. "You would get on a ladder, take photos of the rat's nest, and then put a bid on it."

8. Protect your field workforce. To prevent electricians from being on ladders and lifts as much as possible, Faith Technologies relies on BIM and subsequent prefabrication. For example, instead of requiring the electricians to measure and cut in the field, they just need to lift and install, reducing the amount of time they are working at an elevated height.

9. Eliminate waste. Through BIM, construction teams can determine the exact lengths and required amount of items from couplings to conduit to lighting fixtures. That way, they can deliver the precise amount of material to the job site at exactly the right time.

10. Work with team members nationwide. Through BIM and meeting software, teams can work on the same project from multiple locations.

"I can have five guys in five different cities work on the same project, and at the click of a button, see the updates that everyone has used," says Marsden. "We can then push a PDF, model, or other relevant documents out into the field and mark them up in real time." ●

Rather than just doing a visual inspection, EMCOR now is able to capture data through a variety of methods, including BIM authoring tools and 3D scanners. These technologies have made the difference between success and failure in the health-care market, says Morris.

For EMCOR, these types of devices help cut through the complexity. For example, the company worked on a retrofit project for a higher education facility, which required a very complex installation. Instead of going out in the field with a pencil and pad of paper, the team was equipped with digital tools and scanning and surveying equipment. The contractor could then work hand in hand with the architect and engineer to deliver a successful project.

"While it was small, the complexity drove us to use the tool and ultimately gave us the positive outcome," says Morris. "Five or 10 years before, it would not have been the same process, and we would have probably ended up with claims for additional time and work. With the technology and our trained personnel, we could use that to our advantage."

5. PERFORM PRECISE PREFABRICATION

Because electrical contractors work on multiple projects at one time, it's vital to schedule the work flow so your prefabrication facility can be efficient and productive, says Morris. This improved efficiency is a key payback for the additional time and effort companies put into a BIM.

Technological Advancements of BIM

Over the last 10 years, BIM has evolved. Not too long ago, 3D smart CAD evolved into BIM. But in the beginning, the trades weren't able to collaborate with other team members and work within the same virtual environment. Today, BIM allows firms to plan ahead, work together, and improve productivity. Here are some ways the technology has evolved over the last few years.

1. Improvements in hardware and software. Today's technology is light years ahead of where it was 10 years ago, says David Morris, director of virtual construction for EMCOR. Oftentimes, the software pushes the computers beyond their capabilities, but he says the hardware and software industry have made tremendous leaps forward in the speed and power of the computers and the feature sets of the software.

2. More efficient storage. Another trend that Dmitri Alferieff of Associated General Contractors is seeing is a shift toward more cloud-based software, which enables faster collaboration, decentralized storage, easier transfer of large files, and more flexible computing power.

3. Enhanced mobility. Mobility allows for greater collaboration between firms and encourages team members to discuss issues before they become big problems, says John T. Grady II, corporate BIM manager for CRB. For example, many field crews now carry iPads loaded with the most up-to-date drawings and models, which allows them to be connected to the right information at the right time.

"The use of iPads, BIM 360 Glue, and Field is taking BIM out of the trailer and putting it right into the hands of the tradesmen," says Grady.

4. Increased industry participation. More and more manufacturers are creating 3D representations of their equipment and, in some cases, they are embedding technical information, which allows for more accurate representation of the equipment and connections in the model, says Daric Hess of Heapy Engineering, Dayton, Ohio.

"Creating the BIM represents an up-front investment, but the return is in multiples and comes from field productivity and safety improvements," says Morris. "If you don't have a schedule, it's chaos, and people tend to just push everything through their shop. Then they dump it in a pile on the job site, and dig through it later. This is far less efficient than just-in-time delivery."

Although some aspects of prefabrication can be decided during the construction phase without impact to design, to maximize the amount of prefabrication, companies should have this discussion during the design phase, says Hess. For example, some prefabrication requires additional bracing to allow transport to the site, which may require more space when installed. Those extra inches could have a tremendous impact to the design.

On a BIM-based project, however, the construction team is equipped with detailed information about the order and type of the components that will be installed to streamline prefabrication and installation.

"When you go through the digital process, you have the ability to then prefabricate with impunity," says Morris. "You know for a fact that your pieces will fit, so you can prebuild a good portion of the job and modularize it."

As a direct result of BIM, Alferieff says he sees the amount of prefabrication increasing. For prefabrication, it requires accuracy and assurance that the elements within the model are correct, and BIM allows users to test and validate things on multiple levels.

"You have greater assurance that if you fabricate something off site and bring it to the site to install it, it will work," he says. "With all the planning and modeling tools and capabilities, you can divide the work in more ways to be prefabricated, and there are a lot of advantages to that."

Today, project teams can prefabricate everything from duct systems to pipe racks to modular bathrooms. While companies have turned to prefabrication for years to improve efficiency, BIM helps make it easier, more accessible, and more prevalent on a job site, says Alferieff.

Faith Technologies often takes advantage of as many prefabrication opportunities as possible. For example, if they are working on an electrical room that requires a lot of conduit with multiple bends, they can have one of their pipe bending experts bend, tag, and ship the conduit to the site, and then the electricians can easily hook it up.

"We are moving some of the installation into a very controlled environment," says Marsden. "That way, we don't have to ramp up the on-site electricians so those individuals can focus on installation services."

Through BIM, electrical contractors and engineers can improve efficiency, reduce risks, and better collaborate with all the project partners. By being able to better visualize a construction project, they can meet project deadlines, streamline work processes, and work together toward a common goal.

Fischbach is a freelance writer based in Overland Park, Kan. She can be reached at amyfischbach@gmail.com.

ADDITIONAL RESOURCES

When diving into the world of BIM, design and construction firms can check out these websites to learn more information about best practices for virtual construction.

- *Achieving Spatial Coordination Through BIM: A Guide for Specialty Contractors* is available on the National Electrical Contractors Association's Web site at www.necanet.org.
- To learn more about the BIMForum and the LOD specification, visit www.bimforum.org and www.nationalbimstandard.org.

Because sometimes the best tools are not found in the toolbox

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PUTTING BIM TECHNOLOGY TO WORK IN THE FIELD

How one electrical contractor changed its model to counter the labor shortage, increase efficiencies, and create safer environments.

By Jad Chalhoub and Fred Meeske

Rosendin bridges the gaps of two dimensional visual content with three-dimensional environments.

Rosendin, the largest employee-owned electrical contractor in the United States and headquartered in San Jose, Calif., employs more than 1,000 office workers and 6,000 field personnel. In an effort to counter the labor shortage, increase efficiencies, and create safer environments for its electrical contractors, the company recently took some significant steps to boost its building information modeling (BIM) capabilities. In fact, over the last seven years, Rosendin's BIM department has grown from six people in 2012 to more than 200 in 2019.

This department is responsible for creating 3D, information-rich models to enable the construction of complex structures: electrical panels, conduits, and equipment containing corresponding cost, material, and schedule information. The model is used throughout the phases of construction for coordination with different trades — creating construction documents, supporting quality control and assurance, and inclusion in project turnover documents. In short, the model aims to serve as the one truth to be referred to throughout the life cycle of the project.

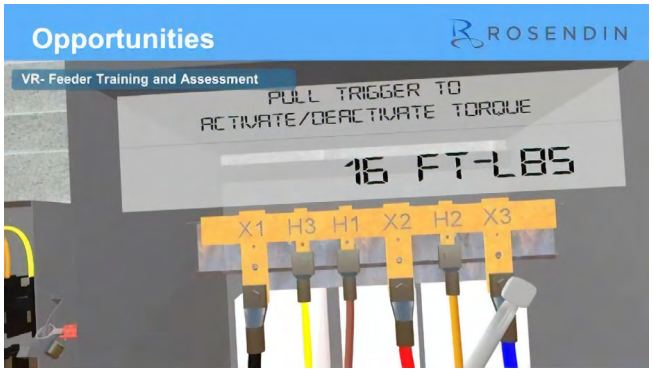
One of the main phases of the BIM process is the coordination phase, during which coordinators ensure that each building trade has exclusive space for its installation. However, during construction, many components tend to shift and often end up in space "reserved" for other trades. Since electrical is often one of the last systems to be built, the foremen and their teams typically go on site and compare the model to the field conditions to conclude whether the model can be constructed as-modeled before prefabrication begins. This process is time-consuming and often inaccurate because it's unreasonable to pull every dimension from every angle to ensure the modeled content fits the available space.

One possible solution is to place the model in space at full scale using augmented reality (AR) and to visually compare the model to its potential placement. This theoretically increases the accuracy and reduces rework that would, in turn, save time and money. The key word here is "theoretically."

A pilot study was conducted at one of Rosendin's job sites to ensure that the solution was viable and to quantify potential savings before company-wide deployment was initiated. The

following synopsis summarizes some of the lessons learned during this pilot study.

Before starting the study, the testing team was successfully able to determine the metrics to be tracked. They included the number of clashes per area, number of change orders per area, and associated costs. They were all tracked before and after the deployment of AR. The data collected enabled the team to later analyze before and after comparisons that clearly quantified the benefits of this use of AR and highlighted the success of this application.



Virtual reality view of training for wire termination and torquing.

Furthermore, a theoretical understanding of the benefits of this application was established with the entire field team early during the pilot; the project manager, superintendent, coordinators, and foremen were able to grasp the potential of this application. Having this initial buy-in was instrumental in the success of this pilot, since the site team provided continuous support while the application and underlying process was being refined. In fact, having end-user buy-in is the most important factor when introducing a new technology. Regardless of how good the technology is, it will only add value if the end-users actively use it.

On the other hand, the team faced multiple unexpected issues. First, although the AR tool was tested and worked effectively in an office setting, it lagged and shut down repeatedly on site due to unforeseen conditions like heat, lack of connectivity, and dim lighting. Before the actual testing could even begin, the tool and usage process had to be refined numerous times, and workarounds were invented to achieve the desired functionality. Once more, the construction team's insights into possible limitations and concerns enabled the development team to make the tool more functional and robust.

Another aspect that had to be revised was the exporting process from the original BIM authoring software to the device. The original process worked well on small models, but in practice, it required around 30 minutes of processing time on the computer before the model was ready to be displayed on the device. The loss of productivity while exporting was likely to offset some of the perceived benefits, so the team worked to optimize the exporting process, bringing it down to less than 5 minutes per export. The faster export not only immediately increased productivity, but it also streamlined the training process, which would later accelerate wider deployment.

Overall, the pilot for using AR for comparing the model with site conditions prior to installation was a resounding success. Not only was it well received by the field teams, but it was also shown to reduce spots that required rework to about a third per area and subsequently saved on cost and schedule overruns. In fact, the AR tool is in such high demand on the original testing job site that there is more need for the AR devices than the supplier can deliver. Generally, it is important to gauge expectations, but it is also important to be ready to capitalize on huge successes. Right now, a scheduling tool is put in place to check out the AR devices while waiting for the new devices to be delivered and the required software to be installed.

This is one of many examples of how Rosendin continues leveraging BIM to improve productivity, safety, and efficiency for its internal and external customers.

Meeske is the corporate BIM director and Dr. Chalhoub is the technology implementation lead in the BIM Department at Rosendin, San Jose, Calif. They can be reached at Fmeeske@rosendin.com and Jchalhoub@rosendin.com.

BIM GIVES SMALLER CONTRACTORS A COMPETITIVE ADVANTAGE

How construction-centric ERP software enables contractors to reap the benefits of new developments in construction.

By Kenny Ingram

Integrated building information modeling (BIM) is key for effective information management and can help contractors move into the revenue-generating areas of modular construction and aftermarket services. It also represents an opportunity for smaller construction businesses to compete against industry leaders, whose legacy enterprise resource planning (ERP) systems may not be able to keep up with the times.

ONLY DATA GETS THE JOB DONE

The objective of BIM is to provide better information management. However, the term can be misleading. It is not only applicable to buildings, but also used for industrial installations and infrastructure — giving project owners a structured set of data they can use to manage any built asset over its life cycle.

Data is the lifeblood of this process. Essential to the effectiveness of BIM is that the design software is data-driven rather than document-driven, which allows structured asset information to feed directly into the systems used to build and maintain it. This makes BIM different from simply a data modeling practice in a computer-aided design (CAD) system.

WHERE TRADITIONAL ERP FALLS SHORT

For BIM to run smoothly, it's key that asset data is structured and well organized — from proposal requests to contracts, design revisions, and serial numbers on each piece of capital equipment. But if contractors are only running finance or human resources software from their ERP system, asset data has nowhere to go. As traditional ERP solutions have their roots in human resources and finance, this is a task too large.

Overcoming this challenge requires a system capable of gathering and retaining all the information generated during materials procurement, construction, commissioning, operation, and maintenance. This also includes data from subcontractors, material testing services, and equipment vendors, as well as lot and batch information and serial traceability where required.

WHERE CONSTRUCTION-CENTRIC ERP OPENS DOORS TO GROWTH

Since all information about a built asset is of business-critical importance for the project owner, construction-centric ERP software, which provides the right structure and format to this data, can give them the 360° view they need. However, the benefits of more structured information management go beyond ensuring construction businesses comply with government and project owner mandates associated with BIM.

For example, modern construction ERP can prevent change orders further down the line in a project, as it makes it easier to identify incompatibilities or conflicts between elements handled by different trades and disciplines. Easily accessed BIM data can also support contractors as they transition into off-site or modular construction, while opening the door to aftermarket services. Service-based contracts, such as facilities management, can provide a higher margin than initial construction projects and make up for dips in revenue contractors often experience during volatile economic conditions.

TACKLING 3D MODEL DATA

Construction in an age of BIM requires contractors to use 3D model data and integrate the asset data model into ERP. This takes the "as-designed asset structure" and pushes it through all stages of the project execution process, resulting in an "as-built and maintained" structure.

Construction ERP can do this without the need for manual data manipulation or use of spreadsheets. It can seamlessly interact with 3D model data to automate unified data model creation, which can be used during construction, commissioning, years of operation and maintenance, as well as eventual decommissioning and replacement. The key for construction businesses is to integrate effective software that is structured to allow the BIM data from their chosen design tools to flow seamlessly into physical asset management processes.

BUILD ON BIM FOR 2020 AND BEYOND

BIM can provide construction project owners with all the information they need to effectively manage the life cycle of assets, but only if their ERP software is sophisticated enough to let data flow into physical asset management processes with ease.

Contractors running modern software applications can reap the benefits of BIM and challenge much larger competitors using more antiquated systems. But an inflexible solution that doesn't extend beyond finance and HR can have the opposite effect — rendering valuable data worthless and leaving contractors in the dark.

Ingram, based in Oxfordshire, United Kingdom, is the global industry director for engineering, construction, and infrastructure at IFS. He can be reached on LinkedIn at www.linkedin.com/in/kenny-ingram-6b22167/.

HOW TECHNOLOGY TRANSFORMS ESTIMATING FOR ELECTRICAL CONTRACTORS

Optimizing electrical estimating with the digital takeoff

By Paul Goldsmith

Most people in the construction industry view 3D modeling and building information modeling (BIM) as the future of building design and construction. The benefits of BIM extend far beyond simply having a visual representation of design intent. An information-rich model provides all stakeholders access to reliable information, making collaboration across the project much easier. This reduces rework, improves safety, and gives contractors a greater ability to control costs throughout the entire project life cycle — from design to post construction handover. For electrical contractors (ECs), BIM adoption is gaining momentum, thanks to its ability to communicate the design intent and to deliver real cost savings in terms of materials prefabrication. BIM also gives ECs the ability to check one installation move against another for conflicts, allowing them to avoid costly rework and to resolve problems before installation.

Despite ECs' move toward full BIM acceptance and more digitized processes from design to fabrication, there is still a large digital gap when it comes to bidding and preconstruction tasks. This gap is exaggerated for small and mid-size ECs that still primarily rely on Excel or other manual processes for construction takeoff activities. The fact remains that for hard money bids, even ECs leveraging a 3D model still deliver takeoffs in 2D PDF drawings.

Why the digital disconnect for takeoffs? Many believe roadblocks to embracing paperless takeoffs come, in part, from a historical stigma that often pegged the estimating process as largely an administrative exercise. Others point to a skills disparity and reluctance to change by some estimators that are used to conventional ways of viewing a project only on paper. In addition, smaller contractors with small estimating teams may not see the value in investing in technology to support more streamlined takeoffs.

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THE RISE OF DIGITAL TAKEOFFS

Despite these barriers along the virtual design construction spectrum, there are strong signals that the rise of streamlined estimating and digital takeoffs is here. Cloud computing continues to spur digital transformation across industries, and AEC is no exception. Secure cloud-based platforms like Google Cloud, Microsoft Azure, and AWS are making the adoption of 3D modeling and digital tools a reality for even small and mid-size contractors that have light IT staffs and distributed resources across regional offices. Other factors driving the digitization of design, estimating, and takeoffs is an emphasis toward integrated data-driven workflows; a push for greater collaboration among owners, contractors, and subcontractors; and a shift in employee demographics. Millennials are set to comprise 75% of the global workforce by 2025. As more digital-natives come into design, engineering, and preconstruction roles, their perspective on technology and demand for constant connectivity will certainly impact technology adoption in the enterprise.

ESTIMATING BECOMES MORE STRATEGIC

As we see these workplace dynamics play out over the next several years, design-build will evolve to model-based estimating. The more precise the quantities recorded during takeoff, the more precise the estimate and schedule are overall. This makes contractors much more cost-aware in estimating, bidding, and winning jobs. A comprehensive estimating solution with digital takeoffs empowers estimators to include greater detail in the estimate, making it more accurate, valuable, and usable after the contract is won. By including a higher-level of detail in the estimate, the role of the estimator is also elevated. It gives them a more strategic seat at the table to impact the business and drive profits.

> "WE'RE REALIZING A CLEAR ROI. FOR SURE, WE'RE 20% TO 30% FASTER [ON THE ACTUAL TAKEOFF TIME] THAN TRADITIONAL METHODS."
>
> – Steve Burnett, director of preconstruction & estimating for Cochran

TELLING THE COST STORY IN THE FIELD

With the right estimating and digital takeoff applications, companies can effectively communicate the estimate intent directly to the field. This is important because it removes ambiguity around the estimate at all levels, saving time and injecting transparency to the estimating process. For instance, it may allow the estimator to clearly show that a costed feeder run needs to be moved in the field. This way, the field can initiate a change request if that move will cost substantially more.

Seattle-based Cochran, Inc., a family owned electrical and technology construction company, has seen the benefits, telling the entire cost story firsthand. After revamping parts of its bidding and preconstruction process and adding a digital takeoff tool, the contractor realized 20% to 30% faster takeoff compared to traditional methods. In addition, they've also taken the guess work out of bids, providing more cost context and allowing customers to see what's behind the numbers. Steve Burnett, director of preconstruction & estimating for Cochran, explains.

"On every job, there is some nugget of benefit. Our estimates are more accurate, more fluid with our estimating platform, which is a huge selling point, and we're realizing a clear ROI" he says. "For sure, we're 20% to 30% faster [on the actual takeoff time] than traditional methods. We've realized time savings as well [on the overall estimating workflow], though that's a little tougher to measure. Digital takeoff is invaluable to our estimating and project management teams, helping us track and tell the story of a project's progress from design through construction."

TIPS TO GET THERE

Although setting up a streamlined estimating and preconstruction process is no small task, ECs can start the journey by promoting a culture of collaboration and encouraging hesitant technology adopters to see the light. For those looking to digitize its paperless takeoff process, remember these top five considerations.

- **Leverage digital natives for training —** When used correctly, technology has great capacity to boost efficiency and productivity. The trick is getting teams to embrace estimating and digital takeoff tools so they "own" it and can keep improving on it. Look to digital natives on the team to champion a paperless digital takeoff process, and leverage them to train other estimators on the new path.
- **Tight integration with estimating tools —** Because many iterations of plans can be sent out during the bidding and final construction phase, tight integration between estimating tools and digital takeoff is critical. This integration ensures that modified drawings are reflected in the estimating program.
- **Bidirectional link is key —** A bidirectional link between raster drawing and the estimate is key in delivering streamlined, paperless digital takeoffs. This helps present the logic behind the proposed takeoff item and associated relationships. It also allows the estimator to provide greater detail in the estimate or schedule. Clients have more information about what makes up the estimate and design intent is communicated to the field accurately. A bidirectional link between the digital drawings and the estimating program also gives the estimator confidence knowing that a change made in the drawing is reflected in their estimate — and that any change in the estimate is linked back to the drawing.
- **Object-oriented tools drive productivity —** As the world becomes more visual and object-oriented, it's no surprise that estimating and takeoff applications are featuring more visual components versus descriptions of content. Digital takeoff tools that have symbol recognition capabilities are game changers because they allow for faster and easy identification of objects found in the drawings.
- **Don't underestimate dual screens —** While this may be standard practice for estimators today, the reality is that to emulate paper takeoff the estimator needs one large monitor to view the drawings and another monitor to run the estimating program. Using a single monitor and moving back and forth kills efficiency and will frustrate the estimator.

As ECs continue to look for greater benefits in productivity, safety, and cost reduction, the estimating and takeoff process is primed and ready for disruption. Digital estimation and takeoffs tools are becoming more sophisticated and can keep pace with BIM advancements, greatly streamlining preconstruction activities and helping to tell the complete project cost story from design through construction.

Goldsmith is the electrical/ICT segment manager for Trimble. He can be reached at paul_goldsmith@trimble.com.

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