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The Impact of BIM

Building Information
Modeling has grown in
prevalence and power
and is changing the way
buildings are designed
and built. Page 108

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BIM Means Business

By Daniel Hughes

There are at least two reasons that Building Information Modeling (BIM) processes are determining the winners and leaders in both the plumbing design and contracting markets.

(1) BIM Mandates (Public & Private)

(2) BIM's Core Support Digital Design, Construction & Maintenance Processes

BIM Mandates require all project members to use BIM and show proof that members can meet the BIM competency requirements –to join the project team. Several trending and more efficient MEP design, fabrication and construction processes, depend on using the BIM process.

Early BIM Mandates - Public owners and big projects (2001-2006)

Public (Federal, State) design and construction projects created many of the first BIM-mandated projects. Mandates stipulated that all project team members must use the same BIM software for designing and constructing the building. Upon completion of construction, the as-built BIM files would be turned over to the public facility owner's FM Department.

Public BIM-mandates began delivering these business values to the design and construction team:

1. Basic benefits of better coordinated construction document sets
2. Time-saving benefits from a more collaborative, integrated design and construction team
3. Simulation and phasing of a project's construction resources and processes
4. Functional, as-built construction models that served the owners' FM Department's roles of facility management, operations, and maintenance

BIM Mandates Mature - Project firms and private owners (2007-present)

Design and construction project firms have both public and private facility owner clients. The BIM benefits achieved from their public projects were adapted to their private projects. The BIM process and team members became a competitive force for improving overall design documentation, reducing construction time and cost overruns while improving client satisfaction.

Project firms began building cost and time-saving BIM-based processes that made their design and construction processes more efficient. If the team wanted to achieve the benefits (financial, time and quality) of using BIM; all project members needed to be using BIM processes. Team members using CAD and/or paper processes clearly disrupted the efficiency of a BIM process.

Their BIM dependence began defining BIM mandates. Basically, all project participants, from design through construction; must demonstrate a proven record of BIM

literacy, proficiency and competency.

Here are just three ways a project firm may measure team members' BIM competency:

- Provide a portfolio of your past BIM-project deliverables.
- References. Who can vouch for your successful BIM-project team collaboration?
- Who are your BIM-qualified project leaders and what are their credentials?

More facility owners are contractually mandating BIM deliverables for use in their FM Department. Design and construction firms that lack BIM competency face the easy choice of being disqualified from the project team.

The global contractor, Balfour Beatty, issued a statement in December 2012. The statement said, "We are trimming our supply chain companies from 15,000 to 10,000 over the next year. BIM proficiency will serve as the 'qualifier'

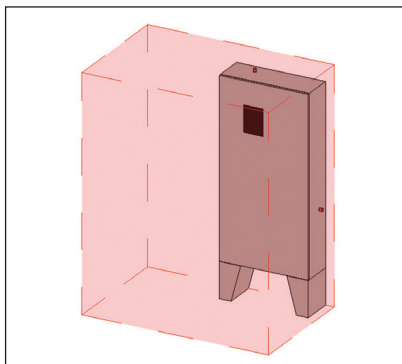


The Design Build Institute of America (DBIA) reports the design-build process represents 40 percent of the U.S. construction market. Courtesy of Skanska USA Building Inc., 2013

to remain in consideration for the Balfour Beatty supply chain."

How can architects, engineers, contractors and subcontractors participate on these projects; without BIM competency and proficiency? They can't.

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The BIM file of a tankless water heater has a clearance box (in red) that represents the clearance required to open the door to service the heater once it has been installed.

Each year *Building Design + Construction* magazine updates its "Giants 300 Ranking Lists" of the nation's architectural, engineering and contracting firms. More than two dozen lists are broken into three categories:

- (1) Rankings by Discipline
- (2) Rankings by Specialty and
- (3) Rankings by Building Sector.

One list, the BIM Report List, is found under "Rankings by Specialty" and includes a list of firms for each discipline that are using BIM. These firms have adopted and integrated BIM mandates into their global business structure.

BIM for construction now exceeds BIM for design

Based on McGraw-Hill's 2012 survey, "Business Value of BIM in North America," the construction market sector is the leader for using BIM processes. The survey reports that growth of BIM has created opportunities to integrate BIM with several other project delivery processes. Together, they're helping the project team to reduce construction time, improve project quality, provide labor savings, while increasing worker safety.

BIM serves as a core process for

these leading project delivery processes. Processes are:

1. Design-build (D-B)
2. Green building design and construction
3. Integrated project delivery (IPD)
4. Prefabrication
5. Modularization
6. Lean construction
7. Mobile data for construction processes

McGraw-Hill SmartMarket Reports compiled three (2013) BIM construction-integration reports: The Business Value of BIM for Construction | How Contractors are Driving Innovation With BIM; Lean Construction | Leveraging Collaboration & Advanced Practices (BIM) to Increase Project Efficiency; and Information Mobility | Improving Team Collaboration Through Mobile Project Information. These BIM Reports are more than 50 pages of easy reading. They incorporate project case study snippets, project managers' quotes and basic value statements of time savings, improved quality and reduced construction time.

The Design Build Institute of America (DBIA) reports the design-build process represents 40 percent of the U.S. construction market. In 2005, design-build represented 30 percent of the U.S. construction market. Fifty percent of design-build projects are valued at over \$10 million. D-B projects are increasingly dependent on using BIM to drive plumbing and HVAC prefabrication to meet project deadlines and budget.

HVAC and plumbing subcontractors incorporate BIM components into their prefabrication software, which spools the models and data to sheet metal and pipe fabrication equipment. MEP systems racks are prebuilt off-site and then trucked to the facility. Skanska defines this process as multi-trade prefabrication (MTP) that is completed in offsite construction facilities (OCF).

BIM software verifies there is enough room for all MEP systems to "fit" into a space; like a hallway ceiling. However, it may be impossible to efficiently fit all the required tradespeople and equipment into the space to install the systems.

MEP BIM components include
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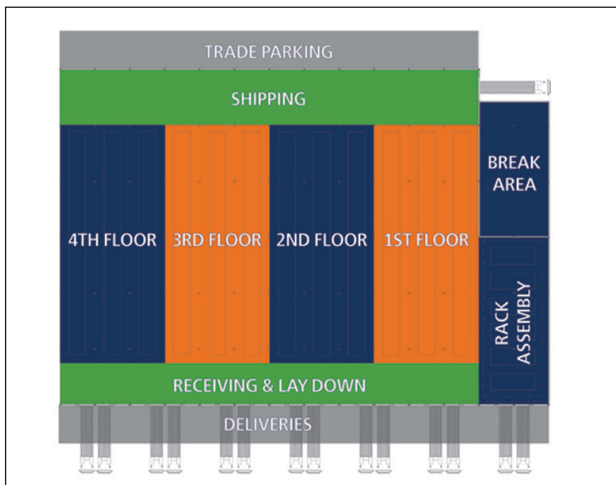
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HVAC and plumbing subcontractors incorporate BIM components into their prefabrication software, which spools the models and data to sheet metal and pipe fabrication equipment. Image courtesy of Skanska USA Building Inc., 2013.

“clearance boxes” around MEP equipment service areas to maintain “open space” around those areas for future access by the operations and maintenance department.

BIM helps create a bill of materials (BOM) of parts and fabricated components. The BOM with assembly drawings will be sent to the contractor’s fabrication floor. There, the MEP systems racks are more easily and safely assembled on the ground using a manufacturing methodology. Tradespeople are working in an environmentally controlled building that uses “lean and green” manufacturing processes. The systems are inspected, tested, labeled and tagged prior to being shipped to the construction site for final installation.

The BIM End Game- Operations and maintenance

The Mayo Clinic and the Carolina Healthcare System are just two facility owners that are transitioning the integration of their facility BIM files into their operations and maintenance systems.

The BIM file of a tankless water heater has a clearance box (in red) that represents the clearance required to open the door to service the heater once it has been installed. Construction firms, Gilbane and Mortenson, are two firms that are contractually delivering as-built model files with embedded clearance boxes around installed equipment.

Turner Construction: Safer, faster MEP hanger inserts installation process

Turner Construction is using a BIM-based construction process that delivers a dramatically faster process for installing MEP hanger inserts, while providing a substantially safer work environment for construction workers.

The BIM process has enabled sub-contractors to connect geographically positioned GPS technology and BIM facility files to create a way-finding, installation system. Turner teams collect hanger point locations from the GPS coordinated BIM file (in the office) for layout in the field.

Traditionally, MEP hanger inserts were installed from the underside of the deck after the concrete topping was

poured. We used a ladder (less safe), drilling up into the underside of concrete. One worker could install approximately 20 holes a day.

The GPS/BIM-enabled process, empowers a crew of three workers to install (from top of metal deck and walking with no ladder needed— safer) to install 750 hanger inserts/day.

Installation is much faster and safer – simply walk to a hanger insert location using the GPS device –and screw in the threaded rods for pipe hanger racks, cable tray, electrical conduit racks, etc.

This is an excellent example of a time-saving, safer and more efficient process to install 100,000 plus hanger inserts into metal deck before concrete topping is poured.

Navisworks file-neutral BIM viewer

Plumbing engineers and MEP contractors use BIM authoring software to create BIM files for design, prefabrication and construction. Contractors also use a BIM file-viewing tool called Navisworks. It is a “file-neutral” BIM file viewer that allows contractors to view BIM model files from several BIM authoring software packages.

Project BIM files may have been created in Autodesk Revit, Bentley Microstation, ArchiCAD, TEKLA, Vectorworks, AutoCAD 3D or Autodesk Civil 3D file formats. The MEP contractor will link the various BIM files together (HVAC, electrical, architectural and structural) to create a fully coordinated facility model.

Navisworks analyzes the coordinated facility model and verifies that the MEP content is not interfering with other building components. For example, Navisworks verifies the sprinkler heads are not occupying the same space as a light fixture. It verifies the hot water pipe is not running through a column. Both of these examples help coordinate the plumbing design and construction process “in the computer” prior to onsite construction.

Navisworks provides this automated “interference detection” between the trades models while providing 3D markup tools for enhanced communication between the designer and contractor.

We are no longer discussing if the BIM process is feasible for plumbing designers and contractors. The leaders are progressing with joint BIM coordination agreements between the plumbing engineer and plumbing contractor. While the plumbing engineer uses BIM for model-based systems design, the plumbing contractor uses BIM for model-based prefabrication. Their early-design collaboration seeks to reduce unnecessary modeling by the plumbing engineer so that more of their modeling remains useable for the plumbing contractor to take into fabrication.

Design-build, prefabrication, integrated project delivery and lean construction processes are all integrating the BIM process. As the total of successful BIM-based projects has grown from hundreds to thousands of projects, BIM continues to expand its core role for multiple project delivery models. ■

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