Sustainable BIM

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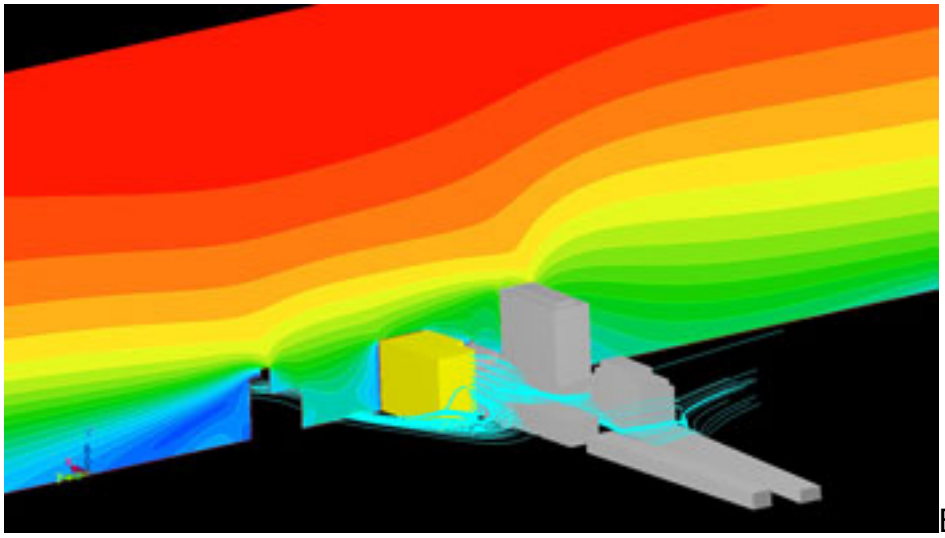

Building information modeling (BIM), now a standard tool throughout most architecture sectors, is critical for complex building types like healthcare and lab projects. Clients are finding great use for these models in facilities maintenance and long-term campus facilities planning. Owners also see great benefit with BIM, as many are interested in the long-term maintenance and scheduling abilities it offers. Others are more interested in increased accuracy in documentation, resulting in fewer unforeseen conflicts during the construction process.

The benefits of efficiency and coordination are just the tip of the iceberg for BIM.

While foundationally a software, the distinction between BIM as software or as a process is important.

“The same tools can be used either way,” says Chris Blomquist, Payette. “But for the BIM to be useful and intelligent, one must approach it as a process.”

This is very clear when A/E/C firms look at the way their design processes have changed as a result of BIM software. Most use the same model from the earliest design massing studies through completion of construction. Using one model throughout all phases of the project allow it to gather intelligence and refinement throughout the process.

“At times the design team may extract model geometry from Revit to plug into parametric analysis software like Grasshopper for façade studies or software like Autodesk Ecotect for specific tasks,” says Blomquist. “These programs allow us to study design alternatives for aesthetics or rough energy efficiency and daylighting performance.”

And while most people think of BIM as Autodesk’s Revit, it’s much more.

“There are many software options that contribute to BIM before and after the design and building elements make their way into the primary documentation software,” says Cara Pomeranz, Payette. “When a design concept makes its way from a napkin sketch to the CNC router, that’s BIM in action.”

BIM and collaboration

The BIM approach varies from project to project and can be driven by a number of project-specific constraints or requirements. Whether the project requires a year-long collocation effort involving the design team and key trade contractors, or a week-long session to focus on one element of a project, great value is seen by A/E/C firms in this collaborative approach.

With a BIM approach, design firms can share a model with a structure steel fabricator or façade detailer on a weekly, even daily, schedule. The result: real-time coordination and a streamline shop drawing review process.

“There are instances where a specialized trade contractor is brought into an office for a one-week working session to focus on a particular project piece,” says Blomquist. “This type of collaboration eliminates the design team’s guessing as to how something might be fabricated.”

With BIM, a whole design-build team is able to work through the details, fabrication and understand any impacts to the design from the people who are doing the fabrication early on which eliminated surprises in the shop drawing phase.

Overall, BIM allows multiple disciplines access to the same body of information in real time, as most models are housed in a central location like the cloud. It enhances collaboration by streamlining the amount of time it takes for changes across disciplines to appear in drawings.

“The use of clash detection, which identifies areas of the model that need further coordination, allows teams to channel more energy into finding solutions to problems rather than finding the problem itself,” says Pomeranz.

BIM vs. CAD: Is there a clear winner?

A BIM is only as useful as the information put into it or extracted from it. The advantages lie in how it’s used.

BIM allows simultaneous collaboration with colleagues, consultants and trade contractors through the design process from the beginning of the design-assist process. The best BIM will eliminate change orders and conflicts during the construction phase. It will also, ideally, be the repository for all vital building information. BIM should be the archive owners go to for the life of the building.

“A well-organized BIM eliminates redundant drawing, which in turn increases consistency,” says Blomquist. “Drawing in 3-D allows you to quickly generate legible views to share with clients, and allows team members to understand how parts of the project they are working on affect their colleagues’ work

instantaneously."

The scheduling component of BIM allows users to produce equipment and finish schedules for the users.

BIM and sustainable design

BIM, by its definition, is an integrated approach focused on coordination between different trades. This allows design teams to set a comprehensive, sustainable agenda from the beginning site layouts to the final execution of a building's programmatic layout and its associated services.

"Initial site layout studies, with proper benchmarking, can provide project teams with a good understanding of the projected energy utilization for a project," says Rishi Nandi, Associate, Payette. "As a project develops, BIM studies help inform a project team of the most efficient layouts for individual spaces accounting for metrics, such as user thermal comfort, initial coordination with the structure and architecture of a space and actual physical appearance of the space."

As a part of the construction documents phase, BIM allows the project team to layout the core components of a space in a coordinate way, ensuring the usability of the space for the end users.

This aspect is critical when considering labs. Labs are energy-intensive facilities. By understanding the layout of the building within its site and the particular programmatic spaces, design teams can focus on energy-saving ideas like how to reduce static pressure within duct runs to reduce net fan energy to site layouts and the greatest benefit when considering renewables.

"Daylighting studies focused on building orientation can help inform a project team on the best way to maximize daylighting while effectively managing solar heat gain and cutting down on lighting energy usage," says Nandi. "All these benefits can be found through utilization of BIM, although there's no one platform/program that allows teams to do all these things simultaneously."

Sustainable BIM case study

Payette, at the Northeastern Interdisciplinary Sciences and Engineering Complex (ISEC) utilized BIM in a variety of ways.

Initial studies sited the building in a way that located high-energy-use spaces where the least amount of solar exposure was found, according to Nandi. The design then focused on the creation of a repetitive passive solar sunshading device that helped reduce the solar heat gain on the sides with the most exposure. This information was then transferred into an energy model which allowed the team to understand the expected energy usage of the facility.

Computational fluid dynamic models were then run on the assumed layouts within the spaces, resulting in the most efficient layout within the space and the highest level of user thermal comfort, according to Nandi.

All studies were conducted in four different programs and between three different firms on the design team side. The result: A LEED Gold-certified building currently trending Platinum. The building resulted in a total energy savings of over 40% when compared to an ASHRAE baseline building, and has a projected EUI of 103.

According to Pomeranz, she is working on a current project that's a nine-story, 170,000-sf lab building in an urban environment. Prior to having Payette's wind analysis consultant on board, the team was able to model the building in its context and perform an in-house CFD study to gain a better understanding of where air entrainment issues might occur.

"This early study gave us enough information to educate our client and make early design decisions regarding air intakes, massing and building placement," says Pomeranz. "Now, many months later, those early design decisions are still relevant."

BIM's sustainable future

While still in its infancy, the next step of BIM is to look beyond trade coordination to the creation of "intelligent" models where each component carries a certain amount of programmed information. "The result is more of a computational approach rather than the current drafting approach," says Nandi.

As known, lab buildings are one of the most system-intensive building types. With BIM firms are able to manage, organize and visualize data in models, significantly helping with coordination and project development efforts of a team.

"As we look toward the future, many teams are trending toward A/E/C collocation efforts with the primary goal of yet further improving the benefits of BIM coordination," says Pomeranz. "Design-assist effort with architects and contractors are also occurring earlier in the design process, and with more frequency."

With the widespread adoption of the process and its budgetary savings, the A/E/C industry will continue to pursue BIM in its design efforts.