Super Models

With all the talk about BIM—building information models—some confusion is inevitable. Here's a state-of-the-union update on the current BIM situation.

BY LUKE FAULKNER

EVERYONE'S TALKING BIM, BUT SOME PEOPLE AREN'T QUITE SURE WHAT THE TERM ACTUALLY MEANS, OR WHAT IT EVEN ACCOMPLISHES. Those that do have a handle on what interoperability entails are still curious as to how the industry will prepare for the coming changes that BIM may require.

A building information model (BIM) is the ultimate compilation of construction and design information, housed in a database and graphically represented. The concept is simple: By first constructing a building in a virtual environment, interferences are discovered early, before impacting the final cost of a building. With the use of intelligent objects, clashes and interferences are found by software programs, rather than by the trades in the field.

As a business practice, BIM not only stands to benefit those in the design and construction fields, but also to owners as well. Already, sophisticated facility owners are realizing the benefits of BIM. Higher initial design costs are mitigated by drastically reduced schedules, lower construction costs, fewer change orders, and lower facility maintenance costs.

What's the Hold-Up?

There are several different barriers that impede the wide scale implementation of BIM. If they are to be overcome, each one must be understood and addressed. At AISC's 2006 eCommerce Roundtable, John Cross, AISC's vice president of marketing, addressed these issues as seen from the AEC community.

The first obstacle is a lack of understanding of what exactly constitutes "BIM." A building information model is not the same as a 3-D rendering of a building. An owner presented with a 3-D model may be led to believe that he or she is looking at a design that has already addressed interferences between systems; in fact, they are looking at nothing more than a representation of a building shell. Compounding the problem is the fact that there is no standard dictating the contents of a building information model. While there is currently an effort underway to create a national BIM standard, the problem will persist until a reasonable definition or standard is created or adapted by the industry.

The design and construction industry requires an established, standardized process to successfully exchange and update model information. In this way, the lack of organization in the current project process acts as another barrier to the widespread implementation of BIM. To fully automate the data exchange related to BIM, we must first organize how and when the data is transferred. Version control—who made what changes, and when—will need to be addressed. The ability of software to accurately track changes is contingent upon the establishment of standards process of exchanging data. Cross stressed the F.O.T.A. rule: first organize, then automate.

Fear of financial loss is yet another barrier to the use of BIM. This feeling is most prevalent among structural engineers, though certainly not unique to them. With a new, more technologically complex process, a new compensation structure would be expected. BIM pools more data than has ever been aggregated on traditional projects. Handling extra data requires a greater time commitment from both engineers and architects; both are concerned about recovering cost and asking for larger fees that would accompany a new methodology.

The final barrier is the lack of understanding how BIM saves on project costs. In essence, BIM is a way to construct a building virtually, before building it in the real world. It is a method to identify space, schedule, and operational conflicts before they impact cost. While this ultimately produces a significantly more cost-effective building, it requires more front-end design effort. When working with a virtual building, team members are assembled and reassembled numerous times to resolve conflicts and clashes. This leads to a greater up-front time investment from designers and contractors, the benefits of which far outweigh the costs. The barrier in this instance is convincing owners and developers that the greater up-front cost is indeed in their best interests, and is the first step of more efficient process.

What Does It Look Like?

Within the industry, opinions vary on what constitutes BIM, with various concepts of what the model will ultimately look like. Project teams have had success with different versions of a project model and different visions of what information is housed in a model.

As previously stated, BIM is not simply a 3-D rendering of a building. While a 3-D rendering can be produced from a model,

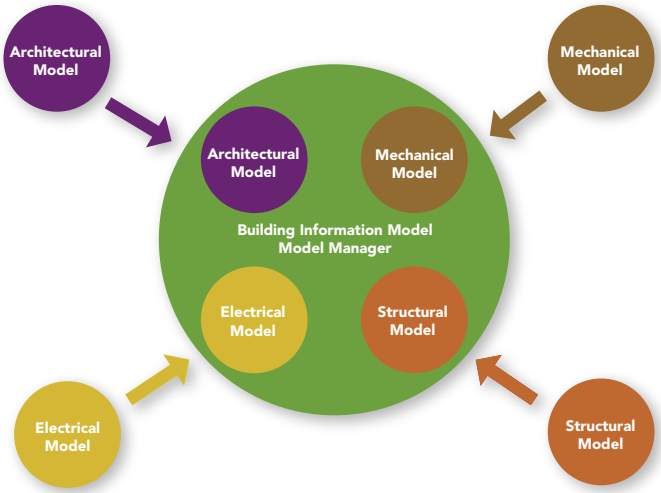

Figure 1. One BIM conceptual model integrates the model manager with the complete building information model. Information from the design team flows one way: into the model.

a true BIM carries intelligent data about all of its components. A steel beam, for example, is not just a drawing of a beam, but a graphical representation of the beam's properties.

BIM consists of enormous amounts of data; some of the data is relevant to project stake-holders, while other data is superfluous to team members. A diagram of this concept is shown in Figure 1.

In this conceptual model, information is exchanged, but ultimately flows in only one direction—into the model manager. The result is a giant mass of data, a majority of which is not needed by most team members.

A more likely scenario is a conceptual model that may resemble something like a large spider web, with a number of radii and a central hub. In this model, the central hub is still the model manager. This concept, however, allows for the exchange of information pertinent to one trade, while at the same time prevents an overflow of information that is of little or no use to a subcontractor. This concept is illustrated in Figure 2.

Managing the Model

Rooted in the center of this conceptual diagram is the model manager. The model manager is the person or entity ultimately responsible for compiling the information from the smaller models of other project members and disseminating it in a useful form to all project stake-holders. According to findings at the 2006 eCommerce Roundtable, the model manager's role will be analogous to that of a construction manager. The model manager is the builder of the virtual project, coordinating and defining what information populates the model.

To date, a number of projects have been completed with different project stakeholders successfully performing the role of model manager. As explored at the Roundtable, there are inherent advantages and disadvantages to each team member acting as model manager. In many cases, the role of model manager may be performed best by an independent body—an entity that doesn't carry other project responsibilities may be ideal in that they can remain neutral in the case of disputes. The independent model manager is more likely to be up-to-date on software development, more adept at version management, and better positioned to ensure a higher level of electronic security.

Still, an independent model manager is not without potential disadvantages. While the neutrality of an independent model manager can aide in disputes, it could also lead to a feeling of disconnection within the project team. A model manager without a stake in the actual performance of the project could possibly have no motivation to drive the success of the project.

Many team members have been proposed as an ideal model manager. The most often mentioned are: architect, general contractor, structural engineer, and steel detailer. Architects and general contractors offer a broad range of knowledge that is required of a model manager. Steel detailers and structural engineers, meanwhile, have gained an edge in model management via their use of the CIS/2 data exchange. Regarding steel models, Peter Carrato of Bechtel Corporation describes his ideal model manager, "The model managers we use are actually highly experienced detailers. The attributes for a model manager are:

- Must not be familiar just with the software, but must be a 'super user' with experience in hardware and network issues.
- Must be a team player, easy-going, and works well with others.
- Should have knowledge of the steel work process and architect, engineer, fabricator, and construction interfaces."

The roles and responsibilities of the model manager have varied from company to company and project to project. Within the AEC industry, there are myriad opinions on how the role of model manager may eventually look. What the AEC community does appear to agree on, is that for BIM use to expand, business practices will need to be documented and standardized.

Introducing BIM into the Industry

There's no doubt the technological concept of BIM has grabbed the attention of the AEC world. Yet it is not technological progress that prevents the widespread implementation of BIM. While some perceive BIM to be an amalgamation of design technologies that, when properly used, represent every building component in a virtual environment, others will argue that BIM is actually a business practice that requires cooperation and collaboration from all stakeholders.

BIM is actually both. The perception that the AEC industry is going to proceed in the large-scale adoption of BIM technology

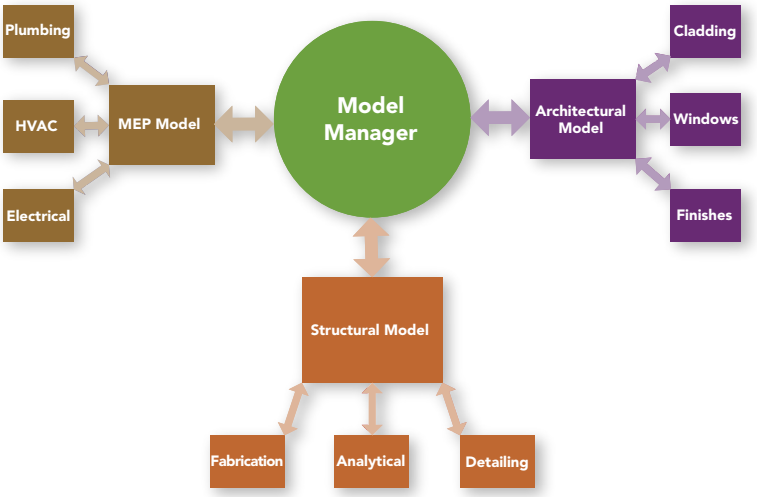

Figure 2. A more practical BIM conceptual model allows for the transfer of pertinent information to and from all relevant parties through a central model manager.

without first addressing the necessary changes in business practices is, at best, misguided. Currently, the responsibility for data and the amount of data exchanged vary on a project-to-project basis; as of yet, there are no established standards, best practices, or contract language to govern BIM technology.

There are now groups within the industry that have begun to address this. In 2005, AISC introduced Appendix A to its *Code of Standard Practice*. Appendix A was a milestone in that it permitted the electronic model to dictate disputes instead of paper drawings. By the end of 2006, the American Institute of Architects (AIA) will introduce an electronic data transaction agreement which specifically spells out the limitations of the use of electronic data, and addresses liability limitations and standard language. Additionally, the AIA will introduce the *Project Protocol Agreement*, an exhibit to the standard AIA contract documents.

In anticipation of the increased use of BIM, the National Institute of Building Sciences (NIBS) has endeavored to create a national standard relating to BIM and data exchange. The National BIM Standardization (NBIMS) will result in a functional definition of what information is required from each team member:

"A Building Information Model, or BIM, utilizes cutting-edge digital technology to establish a computable representation of all the physical and functional characteristics of a facility and its related project/life-cycle information, and is intended to be a repository of information for the facility owner/operator to use and maintain throughout the life cycle of a facility model"

NIBS will use a phased-approach method to establish a national BIM standard similar to the national CADD standard. The first version of the NBIMS will consist of a defined set of exchange requirements as outlined by the NIBS scoping committee. This first set of exchange requirements is expected to be presented by fall of 2006.

Other groups have begun to address the contractual and business practice requirements of BIM, including the Association of General Contractors (AGC), the Construction Users Roundtable (CURT), the General Services Administration (GSA), the National Institute of Standards and Technology (NIST), the Construction Engineering Research Laboratory (CERL), FIATECH, and the International Alliance for Interoperability (IAI); and a number of private companies have addressed BIM via either committee, publications or updated contract documents.

Looking Forward

In the time since NIST published its report on the cost of inadequate interoperability, the AEC industry seems to have all but forgotten that very term. Interoperability is no less important now than it was then—in fact, that it is a major component of BIM underscores just how quickly it is evolving. Beyond what it promises to deliver, what makes BIM such a significant development are the steps that have been taken across the industry to reach that ultimate goal. MSC

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