

# Building Information Modeling

A Structural Engineering Perspective

By James G. Jacobi, P.E.

The AEC industry is currently experiencing a rapidly growing interest in a new and improved approach to project delivery often referred to as Building Information Modeling (BIM). This technology promises to create a much more effective means for collaboration between the many design and contracting entities that are part of the project supply chain.

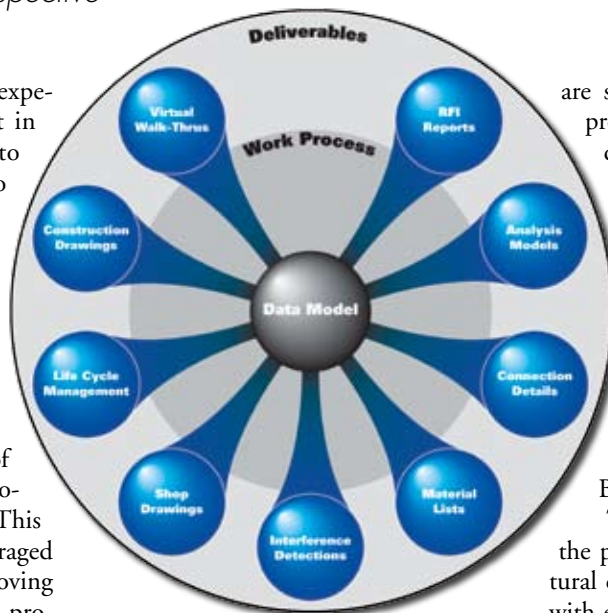
In addition, the BIM methodology can provide a rich association of digital information with each component placed in the building model. This digital information can then be leveraged by downstream users, further improving productivity and the quality of the process. For example:

- Information on steel structural components can be passed directly to fabricators.
- Contractors can use the BIM to extract material quantity reports and use this information as a check on their estimates.
- The various disciplines involved in a project — such as architectural, structural, mechanical, fire protection, etc. — can use the geometry information contained in their models to improve coordination and detect and manage interferences between discipline components well in advance of final design.

There is so much interest in BIM, in so many areas, that one naturally wonders if it is just hype. Well, get ready, because this is real. While the AEC industry is still in the early adopter phase of this technology, the benefits have been proven in other industries in years past. The tools and procedures developed in the process, aeronautical and automobile industries can provide more than a few lessons learned for those wanting to participate now.

## One Model vs. Many Documents

Structural engineers should adapt well to this new way of doing business, as they already possess an elevated '3D IQ'. Although BIM is much more than the application



Data diagram – BIM Provides a Data Centric Approach to Design

of 3D modeling techniques, structural engineers have been working with three-dimensional, information-based models for decades on the analytical side. However, our traditional process generally calls for the analytical model to be ultimately transferred to the project supply chain using a very document-centric approach. The engineer works with designers or drafters to convey the design intent for the structural system via 2D CAD drawings. In most instances, the analytical models containing the actual geometry and member design are not directly linked to these drawings.

This disconnect can often prove problematic. The BIM approach improves and streamlines the process. While drawings

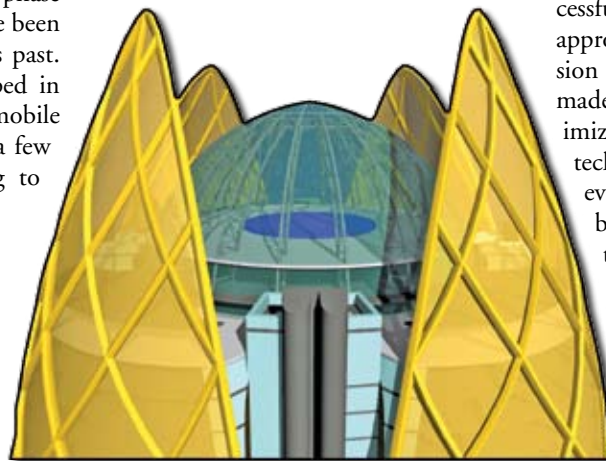
are still produced using the BIM approach, these documents are extracted directly from the BIM model, often referred to as the physical model. The BIM model provides a much more realistic view of the structural system, not just a simple single-line representation. Many of today's technology systems can create the analytical model concurrently with the physical model. In this case, the analytical model can be extracted from the BIM as well.

Theoretically, this approach holds the promise of keeping all of the structural design elements in synchronization with each other, as all are extracted from the BIM. If engineers get the BIM correct, the follow-on deliverables will also be correct. In addition to improving the quality of the design process, this methodology can also lead to streamlining the drawing production process.

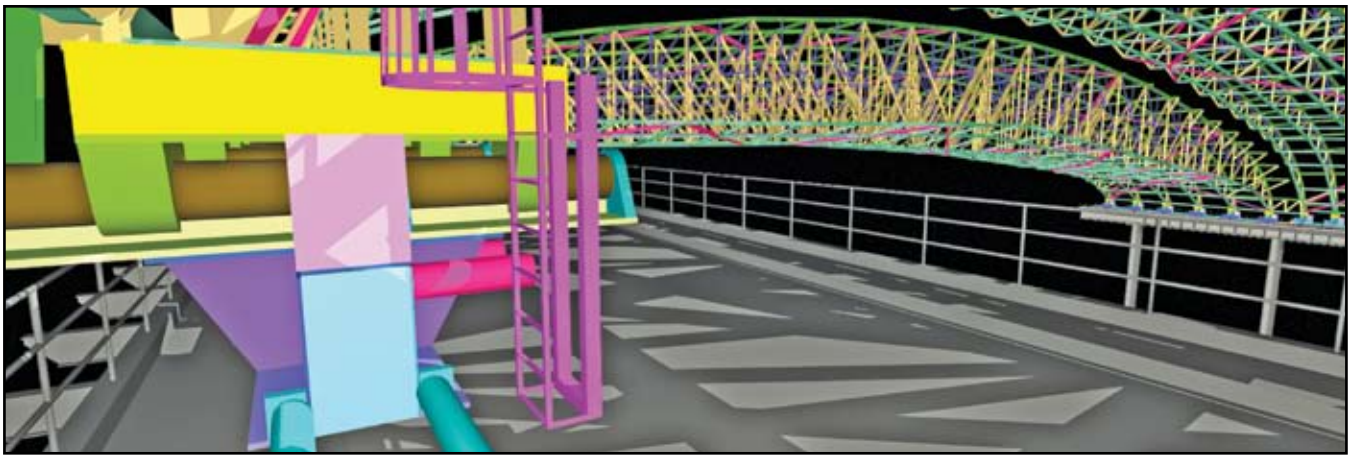
While there are still many challenges to be overcome, the future looks bright. The BIM process is a data-centric approach to design. It provides for a powerful paradigm shift by focusing the entire project team — owner, architect, engineers, general contractor, and subcontractors — on a single consistent digital representation of the building, instead of piles of drawings from each separate discipline.

## Setting the Stage

There are several considerations that should be acknowledged to ensure a successful project effort employing the BIM approach. First and foremost, the decision to execute using BIM should be made early in the project in order to maximize the benefits. While BIM modeling techniques can be initiated at any stage, even after the completion of CDs, the best benefit is achieved by starting at the beginning. The contract should be developed to include BIM specifications, terms and requirements, including language specific to the technology to be used, the disciplines that will participate, and each discipline's specific scope of work. Ownership of the informa-



Palm Tower Project – Design Visualization Greatly Enhanced



Stadium roof—BIM Enables Effective Multi Discipline Coordination

tion models produced and the intended use for these models should also be addressed.

An analysis of all major building elements should be performed to determine which ones should be included in the BIM, as well as those that are better suited to be covered by conventional construction documents. Finally, to ensure that the project benefits from an advanced level of collaboration, it is vital

that a specification be explicitly developed for project coordination. This specification should address BIM coordination/collision detection and required reporting among all disciplines. The specification should spell out the detailed process by which the project team members will participate in design review/coordination meetings and identify, communicate and track issue resolution.

## Conclusion

As mentioned before, the BIM process in the AEC industry is in the early adopter phase. Nevertheless, the approach offers significant near-term benefits for both the structural engineer and the project delivery process as a whole, and is very worthy of serious consideration. ■

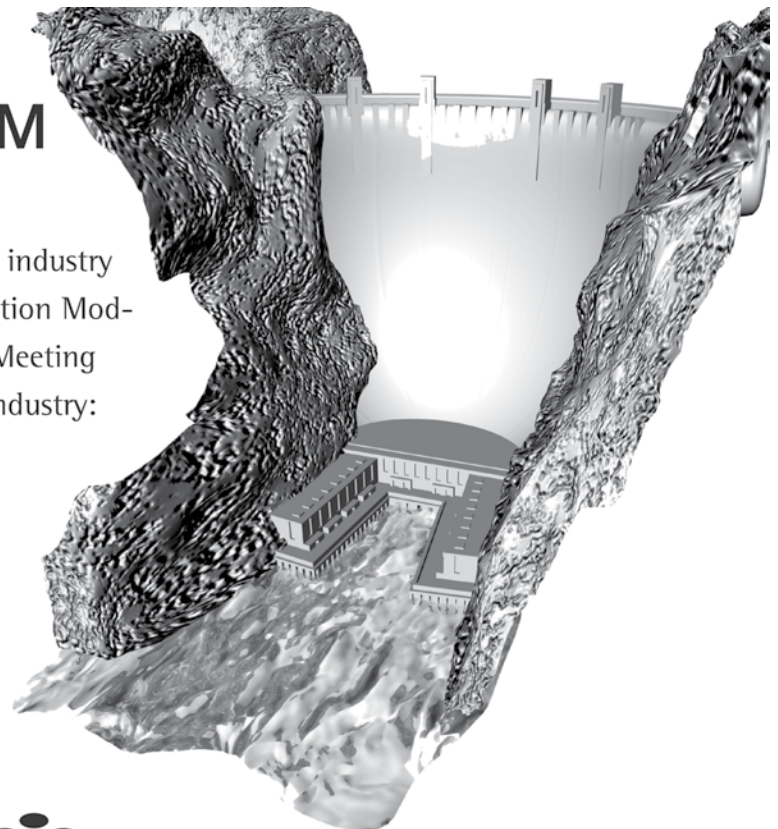
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## Industry leaders discuss downstream benefits of BIM

Last month, leaders from the design and construction industry debated the downstream benefits of Building Information Modeling. The panel discussion, hosted at the Tekla User Meeting in Las Vegas, included four representatives from the industry: Owner, Architect, General Contractor, and Structural Engineer.

To read more about this discussion at the 2006 Tekla User Meeting, visit: [www.tekla.us/um06](http://www.tekla.us/um06)



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