

Communicating in a BIM World

By Dr. Kristopher Dane and Mike Bolduc, P.E.

As early as 1962, Douglas Englehart presaged BIM as “an ever-more-detailed, interlinked structure, which represents the maturing thought behind the actual design.” Since this early vision, building designers have wholeheartedly adopted building information modeling (BIM), software-based design, and 3-D modeling. While BIM adoption has been praised for bringing efficiency to the construction process and benefits in coordination, it has also placed a new set of pressures on the structural designer.

Effective communication between architects and engineers has always been critical to developing design concepts into construction drawings. Traditionally, printed drawings were exchanged at key milestones where they could be reviewed by design partners to inform their own work. Drawing coordination was a laborious process that required overlays via physical lightboxes, so a heavy emphasis was placed on communication “outside the drawings.”

Integrated BIM Falls Short

Pressure on the AEC industry to innovate and improve efficiency has forced changes for the past 20+ years. Some people may challenge the comparison between traditional manufacturing and AEC as unfair because every structure is unique and customized. However, there is no debate that the AEC market demands shorter schedules and requires structural engineers to produce earlier design packages to jumpstart construction.

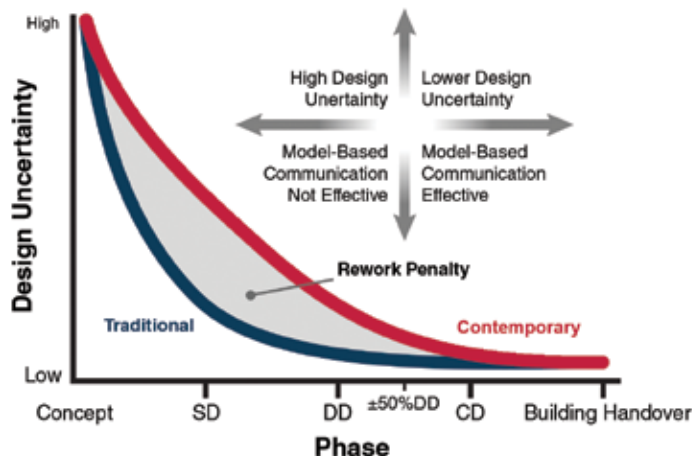
In response to this schedule pressure, software vendors have touted BIM as the panacea to produce designs with less effort and reduced design conflicts. While it is true that some of the tedium of document management has been reduced (e.g., manually coordinating wall elevations with plans) and coordination has improved, the reality of BIM still does not match the integrated vision that we have been promised. The development of sophisticated “truly integrated” design tools has been limited to high-profile design projects, whereas the more widely adopted tools have not lived up to the hype.

Shortened Design Cycle

Uncertainty in the design process is changing (see *Figure*). In the past, the basic design of a structure “locked-in” during the Design Development (DD) phase and the Construction Documentation (CD) phase was then spent coordinating and detailing the design (blue line). Wholesale changes were rare after the DD phase. Now, shorter schedules require early progress with more frequent iterations. Designs are developed with less information, which carries uncertainty further into the design process (red line). The resulting design iteration adds pressure on the designers to rapidly respond to significant changes and highlights the challenges with our BIM-based workflows. Simply using BIM is not enough to address the schedule pressures and pace of design changes.

BIM is not the Design Platform

While this push to show progress earlier affects all disciplines in the design process, structural designers are placed at a distinct disadvantage because of how they use BIM. The analytical design model is often a simplified version of the coordinated BIM, containing just what is needed to understand the structural behavior. The BIM platform is



Uncertainty is now carried late into design.

typically separate from the multiple required structural analysis tools, which requires designers to develop processes to move information from BIM to analysis and back again.

This challenge was acknowledged in the McGraw Hill's *Business Value of BIM* survey (2012), “Structural analysis rates among the most difficult activities...indicating a critical need for the industry to address ways to make it easier.” Since 2012, however, few tools have been developed to help couple BIM with structural analysis compared to the number of tools aimed at improving contractor workflows. Even with interoperability tools, such as Konstru, the engineer still has to “leave” BIM to do their engineering work.

The Model is not the Deliverable

Compounding the issue above is that the design model is rarely the actual deliverable. Project contracts often include language limiting the reliance on the model while emphasizing that the contract deliverable is still a set of 2-D drawings. This poses a challenge in maintaining the responsibility to deliver a complete structural construction document set. The potential to miss critical details that are not modeled is introduced as daily work processes become more model-driven, and less time is spent looking at the drawings.

The Model does not Capture Design Status

In the past, early concept sketches were clearly identifiable as conceptual and preliminary. The team members understood that the ideas presented were subject to change. Now, however, models can appear to be very complete even at an early stage of design. It is harder to convey the preliminary and fluid nature of the design within BIM elements.

Software is available to help track changes, either with 2-D PDF overlays or with 3-D model comparisons. These tools help designers identify what has changed, but they do not convey designers’ intent or priority for the change. The architectural intent and priority will direct how a structural designer responds and addresses a potentially long list of changes.

The Model does not Talk

Too often, statements such as “it’s in the model” are made. Rather than communicating design intent or priorities “outside the model,” engineers and other consultants are asked to both find and react to

changes in real-time, without the context for “why” the change happened. The result is that tracking and reacting to changes has nearly become a full-time job for consultants. The challenges of change-tracking are getting worse as it becomes easier to exchange models. Model transfers have increased in frequency from monthly to weekly, to daily, to live models.

Decide How to Communicate

Many cloud-based communication and change tracking tools are targeted at contractors who are engaged when the design is less subject to significant changes.

During design, BIM may be hindering communication if the design teams let the models communicate intentions that used to be communicated verbally.

Every project team should decide how they want to communicate design changes and ensure that the tools selected serve the project's needs and best fit the schedule. The tools should not dictate the communication process.

Summary

Technology is creating and providing tools for designers and engineers to live and work in a hyper-fast design environment. As technology advances, the personal and human nature of design must not be forgotten. Understanding the design intent and the priorities of design elements is a critical piece of coordination between trades. If models are simply shared without context and without communicating, then designers are at the mercy of the software they manipulate. The software cannot be allowed to control how individual design processes are approached. The human element of the SE profession is still paramount to creating coordinated and meaningful designs.

As structural engineers, we can adopt the following strategies to respond to these challenges:

- Explain to architectural clients that the structural design process happens outside BIM and show that “frozen background” deadlines are critical to minimizing uncertainty and creating efficient designs.
- Lean on software vendors and look internally to find efficiency so that structural analysis is no longer an outlier in BIM integration.
- Proactively open lines of communication with the design team when sharing models and reviewing changes.
- Set communication guidelines early in the design process to engender a collaborative environment.
- Avoid letting the model to speak for us and adopt the right tools at each phase of design.
- Understand that communication is a crucial component of successful collaboration in a BIM world.

Adopting these strategies will help designers minimize the rework penalty, stay efficient in a slowing economy, and prepare for a future where BIM is the deliverable.■

References are included in the PDF version of the article at **STRUCTUREmag.org**.



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