PTI JOURNAL *Viewpoints*

BUILDING INFORMATION MODELING IN 2017 AND BEYOND: A DESIGN ENGINEER'S PERSPECTIVE

By

BY FRANK S. MALITS

POST-TENSIONING INSTITUTE ®

Authorized reprint from: December 2016 issue of the PTI *JOURNAL*

BUILDING INFORMATION MODELING IN 2017 AND BEYOND: A DESIGN ENGINEER'S PERSPECTIVE

BY FRANK S. MALITS

Building information modeling (BIM) is a rapidly emerging three-dimensional (3-D) parametric modeling technology that can be used to assist in the design, construction, and maintenance of structures. By now, most design firms are at least aware of this technology. Many firms, now a solid majority by most credible estimates, are at least dabbling in its use. Other firms have developed advanced proficiency.

As I travel around the country to support our firm's projects, or participate in professional committees for organizations such as PTI, I get the chance to speak with many practicing engineers. When the discussion turns to BIM use, I find that firms generally fall into one of three broad categories: the early adapters who have been actively modeling for a decade or more; the up-and-comers who are somewhere on the implementation path (these firms are typically modeling some percentage of their office volume while still running traditional two-dimensional [2-D] CAD platforms); and the holdouts—those firms who prefer 2-D applications and are not moving or planning to move to BIM. My personal observation is that this last category has shrunk markedly in recent years.

BIM will become the norm for the clear majority of projects. The decision will not be ours to make. The transition to a BIM world will be an Owner requirement in much the same way as the transition from hand drafting to CAD occurred decades ago. Do you recall when Owners first realized the benefits they banked when receiving digitized 2-D plans? It didn't take long for them to realize the value of using digital files to speed initial construction, provide data for ongoing maintenance, and provide a baseline for future renovation. Owners soon contractually required CAD as a project delivery platform. Design firms were forced to adapt to the new paradigm or risk losing market share, or worse. As designers, we realized the change also provided direct benefits to us, improving document quality, increasing productivity, and ultimately helping our bottom line after we absorbed initial hardware, software, and training costs.

The migration to BIM delivery seems certain to follow the same path. Owners are now again realizing the added value they gain when projects are modeled, including higher-quality design documents, the ability to take advantage of advanced construction methodologies, and higher construction quality. Fewer field fit-up problems and less conflict during both design and construction is saving time, money, and courtroom battles. Less time is wasted addressing conflicts that can now be identified in early stages and mitigated in a virtual environment where they are comparatively simple to resolve.

These advantages already have many owners contractually requiring designs to be developed using a BIM platform. Most government agencies and institutional owners, such as medical and university systems, are already recognizing the added value and requiring BIM. Where Owners do not yet require BIM, prime design professionals are stepping forward with requirements of their own as they realize the benefits of modeling when practiced throughout the entire design team—higher-quality documents, better coordination among disciplines, and fewer errors and omissions.

At present, most contractual BIM requirements we encounter involve constructing a BIM model that is used to create the contract documents but ultimately is intended to execute clash detection algorithms. On most projects, a well-defined line remains between design and construction modeling.

General contractors and design builders are using modeling on their own accord to provide better quality, increase productivity, and in some cases to gain a competitive advantage. Contractor-based models can be used to produce more precise estimates and quantity takeoffs, resulting in less uncertainty and potentially advantageous numbers on bid day. Models can be time-loaded, providing a tool to assist with planning for staging, procurement and delivery, and real-time record keeping. BIM models can be used to expedite preparation of shop drawings and material fabrication, making the process faster and more cost-effective with fewer errors interpreting design documents.

Owners are also coming to grasp the construction-side advantages of modeling. We have begun to see requirements pop up in construction contracts requiring modeling by the general contractor and its subcontractors. As this trend gains momentum, a more direct interaction between design and construction models will surely become more common.

It should be noted that the transition to BIM is uneven across design disciplines and industries within the construction community. Generally, software is more developed and capable when addressing architectural components and construction activities. These areas have received more attention from product developers, and rightfully so as they make up a larger percentage of the industry. The engineering disciplines have lagged somewhat, but are advancing, and should be expected to continue to advance especially as other components mature.

For structural engineering systems specifically, the structural steel industry is leading in modeling development by a significant margin, with capabilities that can transition from design to shop fabrication to erection and beyond. The concrete industry lags. Most concrete structural models remain limited to definition of concrete geometry intended primarily for clash detection purposes. Although the capability does exist to model embedded reinforcement in some software systems, the practice is still neither commonly available or commonly implemented throughout the structural design community. As a subset of the concrete industry, the post-tensioning industry is practically nonexistent within the BIM community. Modeling of tendons, profiles, and anchorages in 3-D space is being carried out only by a very small percentage of the early adapters. Eventually, the concrete and post-tensioning industries must catch up, or be faced with the potential of losing market share to other framing systems.

It is clear that more and more design professionals, contractors, subcontractors, and suppliers will face a growing demand for project delivery using BIM. Design firms not already making the transition will again be forced to embrace a new paradigm or risk losing market share. Contractors and their suppliers seem certain to face the same pressures.

FRANK S. MALITS, PE, FACI *is a Principal Engineer with Cagley & Associates, Inc., located in Rockville, MD. He has over 29 years of experience in all phases of structural engineering for buildings. He is a licensed professional engineer in 16 states and the District of Columbia.*

He is a member of PTI and serves on two PTI committees: DC-110 Building Information Modeling, and PM-200, Professional Member Committee.

He is a Fellow of the American Concrete Institute, currently serving as a member of ACI Committee 301, Specifications for Structural Concrete, and Subcommittee 318-A, General, Concrete, and Construction, responsible for Chapters 19 and 26 of ACI 318.