Building Information Modeling - BIM: Contractual Risks are Changing with Technology

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A New Era in Design

The everlasting quest to exceed Owners' expectations is driving innovation in the construction industry. Owners are demanding that complex projects be completed more quickly and cheaply. These demands, plus a desire to avoid claims, have led designers to think beyond two dimensional blue-prints and to develop three dimensional Building Information Modeling (BIM). This article will focus on the legal issues facing designers, owners, and contractors who use this technology, but first, we'll examine the developing state of the art that has led to these new methods.

The concept of BIM is relatively simple yet revolutionary. The theory is that if every piece of data required to design and construct a project were entered and developed within a single online system, we could construct the project in the virtual world first. The system could create dependable 3-D models and add additional fourth and fifth dimensions of schedule and cost. Attaching cost estimates to various design and schedule options will allow the team to do cost-time-benefit analysis of different designs and construction sequences, almost instantaneously. The product of a team's collaborative effort would include shop fabrication drawings, constructability analysis, structural models available in 2 and 3-D, energy and air flow analysis, mechanical and structural collision identification, as well as operation and maintenance reports. Basically, the model's output would produce all the documentation that the team members would otherwise have to create in isolation and duplication, without the model.

In this collaborative BIM environment, team members would be able to solve problems before they manifest themselves onsite and require expensive solutions. For example, HVAC designers would be able to work with structural fabricators to solve interferences, long before any material was procured. Solutions developed with the use of 4-D and 5-D models allow for an ongoing time vs. cost analysis. In effect, the project becomes one continuous work-stream, from conception to commissioning, without redundant effort.

The efficiency created through the use and reuse of constantly updated data is the fantasy of many designers and project managers. Fortunately, the fantasy of yesterday's designer has become the tool of today's collaborative project team. The General Services Administration (GSA) has completed several pilot projects and is utilizing BIM technology from seven different vendors in an effort to streamline its construction process. Taking its commitment to BIM even further, GSA announced that BIM will be required for the phase I design of all new projects in 2006. In private construction, a large national contractor credits BIM technology with its successful completion of the Denver Art Museum addition, which resembled an erector's geometric nightmare. The latest endorsement of 3-D technology was announced in Engineering News Record's (ENR) July 10, 2006 issue where it was reported that General Motors committed to using the technology on all of its renovation and construction projects. "Designing and building facilities this way allows GM to be more flexible in adjusting to the ever-changing vehicle market," explains Jim Wiemels, vice president and general manager for GM Manufacturing and Engineering. *Id*. He says the approach has proven itself by helping the company build faster, better and safer and with less cost and risk. August Oliver, director of capital projects adds, "We're going to do all of our work in 3-D from now on." *Id*.

The technology's application to real life projects, however, has been more challenging than the theory. Problems originate due to the fact that BIM programs have evolved in pursuit of different solutions and separately from advanced project management tools. As a result, they do not always interface well. For example, some BIM models were developed for structural steel fabrication and separate ones for erection sequences. Two of the largest challenges being actively addressed by technology developers and end-users are the interoperability of existing BIM programs and the creation of multiple accurate models to fulfill specific purposes.

Interoperability is the ability for the different systems and models to interface without creating inaccuracies or requiring inefficient data re-entry that is prone to error and data aging. Although these technical interferences have limited BIM's application, the tools are effectively being used within their capability. Further information on how the International Alliance of Interoperability (IAI) is overcoming these challenges can be found at www.iai-na.org.

The apparent industry consensus is that there needs to be a set of standards, from which all future BIM technology can relate. The National Institute of Building Sciences (NIBS) is in the process of creating National BIM Standards that will encompass a project from early design to life-cycle analysis. In addition, the GSA is due to release guidelines on 3D and 4D BIM in August according to ENR's June 5, 2006 article.

Currently, the models used by the steel industry are leading examples of accuracy and application for a specific purpose. These models are accurate within tolerances suitable for fabrication and reliance in the pricing and proposal process. The American Institute of Steel Construction has even updated contracts to make the model controlling over other documents. *See* www.aisc.org.

Rocks in the Road

Problems arise when a model designed for a specific purpose, such as steel fabrication, is used for another purpose, such as curtain wall procurement. If the BIM generated data is not entirely accurate for its purpose, the result could be disastrous. Often times these models will be labeled "for reference only" or with some other disclaimer of accuracy because designers are not willing to assume the risk associated with warranting their use. Obviously, the more disclaimers, the less likely people will be to use the technology. Furthermore, designers have not necessarily received additional compensation for the efficiency and savings created when the BIM technology is used; therefore, they have less motivation to utilize the system to its full potential.

According to a May 15, 2006 ENR article, the Denver Art Museum project dealt with these issues by contractually allocating precedence to the 2-D documents and using "specific, detailed subcontractor language on generation and hand-off of electronic data." The downside is that if the model is expressly subordinate to traditional construction documents, the model cannot be relied upon during the pricing or construction process and traditional 2D documents must be duplicated, significantly decreasing the value of the model.

The line between designer and constructor also blurs in a world of design-build online virtual project collaboration where individual parties work off of a common data set. Architects build erection sequences into their designs, and contractors add constructability analysis to the design selection. As collaboration increases, the traditional lines of responsibility dissolve, and industry standard form contracts do not adequately allocate risk and responsibility between the parties. Model improvement, industry standards, and interoperability are issues for the software developers, NIBS, and the IAI to address. But, it is the

responsibility of contracting parties and their lawyers to create contractual language that will foster collaboration and appropriately allocate risk and compensation for a project utilizing BIM technology. For this to be accomplished, it may take a paradigm shift in the way we think about industry roles and delivery systems. The design-build delivery system helped the industry take a step toward a more collaborative project environment. Proponents believe that the integration of BIM technology into the process will be the industry's next evolutionary step.

Legal Issues

For all the efficiencies and savings that BIM technology can provide, its use is not without risk. One of the first issues to determine is ownership of the BIM data and how to protect it through copyright and other laws. In the *March 2001 Briefing Paper* on e-Construction, we predicted some of the issues that would develop from the electronic communication of construction designs. For example, if the Owner is paying for the design, then the Owner may feel entitled to own it, but if team members are providing proprietary information for use on the project, their propriety information needs to be protected as well. Thus, there is no simple answer to the question of data ownership; it requires a unique response to every project depending on the participants' needs. The goal is to avoid inhibitions or disincentives that discourage participants from fully realizing the model's potential.

When project team members, other than the owner and A/E, contribute data that is integrated into the BIM, licensing issues can arise. For example, equipment and material vendors offer designs associated with their products for the convenience of the lead designer in hopes of inducing the designer to specify the vendor's equipment. While this practice might be good for business, licensing issues can nevertheless arise if the vendor's design was produced by a designer not licensed in the location of the project.

Another issue to address is who will control the entry of data into the model and be responsible for any inaccuracies in it. Taking responsibility for updating BIM data and ensuring its accuracy entails a great deal of risk. Requests for complicated indemnities by BIM *users* and the offer of limited warranties and disclaimers of liability by *designers* will be essential negotiation points that need to be resolved before BIM technology is utilized. It also requires more time spent imputing and reviewing BIM data, which is a new cost in the design and project administration process. Although these new costs may be more than offset by efficiency and schedule gains, they are still a cost that someone on the project team - probably the designers - will have to bear. Thus, before BIM technology can be fully utilized, the risks of its use must not only be identified and allocated, but the cost of its implementation must be paid for as well.

As the dimensions of cost and schedule are layered onto the 3D model, responsibility for the proper technological interface among various programs becomes an issue. Many sophisticated contracting teams require subcontractors to submit detailed CPM schedules and cost breakdowns itemized by line items of work prior to the start of the project. The prime contractor then compiles that data, creating a master schedule and cost breakdown for the entire project. When the subcontractors and prime contractor use the same software, the integration can be fluid. In cases where the data is incomplete or is submitted in a variety of scheduling and costing programs, a team member - usually a general contractor or construction manager - must re-enter and update a master scheduling and costing program. That program may be a BIM module or another program that will be integrated with the 3-D model. At present, most of these project management tools and the 3-D models have been developed in isolation. Responsibility for the accuracy and coordination of cost and scheduling data must be contractually addressed.

The fluidity and speed by which an electronic design can be changed is both exciting and troubling. When is the ever-evolving electronic design upon which contractors are bidding finalized? Does instantaneous notice of a design change equate to instantaneous knowledge of and agreement to the change? Communications or agreements entered into over the Internet *can* be binding if made in conformance with the Electronic Records and Signatures in Global and National Commerce Act enacted by Congress on October 1, 2000. In order to avoid disputes, some definition of the design for the project and a protocol for sending binding communications must be developed or the project participants may not have a meeting of the minds concerning what has been offered and what has been accepted.

These important issues need to be addressed in supplements to standard industry contracts that were developed before BIM technology.

Conclusion

At first glance, BIM technology appears to have opened a door of new possibilities which the industry cannot ignore. Without dampening enthusiasm for the new technology, it is nevertheless prudent to be aware of the risks involved in this new paradigm. This article has touched on only some of the potential issues associated with an excursion into a BIM designed project. Thoughtful planning and appropriate contract language can serve as a good road map to make your venture a success.

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