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Building Information Modeling: From Design Tool To Project Delivery Method

Building Information Modeling (BIM) has been hailed as a technological panacea for owners, designers and contractors that will revolutionize and transform traditional design and construction. In theory, BIM will eliminate design errors and cost overruns, streamline estimating and coordination, simplify the shop drawing and fabrication process, and promote cost-efficient facility management during the life of the building. The simple reality, however, is that BIM is an adaptable design tool with seemingly limitless potential yet untapped by the construction industry.

What is BIM?

In a general sense, BIM is a series of technologies that create a 3D "virtual building" from a database of electronic information. Traditional 3D modeling, known as polygonal surface modeling, limited users to viewing the completed structure from various angles. The BIM platform, otherwise known as parametric modeling, allows users to view a 3D model created by databases that contain information about the actual elements of a building and their respective relationships to each other. These "intelligent" models are capable of generating space calculations, energy efficiency analysis, structural details, and design documents.

From the 3D parametric model, users can include information on sequencing (4D modeling), sequencing and cost estimating (5D modeling), and sequencing, cost estimating, buildability, accessibility, sustainability, mantainability, acoustics, and lighting and thermal requirements (nD modeling).

Benefits of BIM

From the federal government to small local developers, project owners increasingly require designers and contractors to utilize BIM in design, construction, and building management. The potential benefits of BIM are numerous: consolidated and reliable design bases for multiple user input and access; constructability reviews, planning, and logistics; cost estimating and take-offs; early conflict identification and resolution; compliance with building codes; front-end LEED and Green Building analysis; coordination and scheduling; development of shop drawings and reduction of fabrication costs;

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real-time structural engineering; fewer change order requests and RFIs; elimination of project delays and cost overruns; and the potential for efficient management and operation of the facility post-construction. These benefits offer project owners the opportunity to streamline the design and construction process while creating a template for future facility management.

Risk v. Reward

While the benefits of BIM are abundantly clear, the risks associated with this evolving technology are not and may create significant exposure for all parties without proper identification and reallocation. Chief among these risks are the commercial application of BIM to the modern construction industry, technological limitations, legal pitfalls, and insurance coverage. All participants must address these issues internally and among the several parties when considering the use of BIM as a project delivery method.

While the application of BIM to traditional design and construction is gaining momentum, the construction industry business model has not evolved to appreciate fully the advantages. Historically, project owners, designers, and contractors have been dependent on clearly defined roles and responsibilites so that each party understands where one's responsibilities end and another's begin. The use of BIM blurs these lines and its success depends deeply on project collaboration and concepts of shared exposures and benefits. Project agreements must be properly tailored to include provisions to address these issues.

Technological limitations have played a key role in slowing the evolution of BIM from design tool to project delivery method. Interoperability, the ability of multiple users to extract and import data from the consolidated and reliable design base, is a primary concern. The key to interoperability is the development of universal BIM standards used to create "intelligent models." This concern is being addressed by industry groups, but progress has been slow. Concurrently, efforts to create computer software to realize BIM's potential fully have been slowed. The parties must address these limitations before engaging in a BIM project.

New paradigms for addressing legal concerns must be resolved through contract negotiation and complementary project agreements. Standard contract terms must be revised to reflect a fair allocation of risks, to develop a framework for collaboration and performance, and to encourage reliance on the data contained within the model. The role and definition of a designer must be revised to reflect multiple user input to the design process, delegation of design elements and decision-making from the designer to contractors and computer programs and third-party reliance on data from within the "intelligent model." Finally, the administration of intellectual property and the 3D design model must be addressed to ensure confidentiality of proprietary information and to protect the ownership interests of the parties.

The insurance industry has made efforts to adapt to the changing roles and responsibilities of the parties to the design and construction process. Insurance has always tracked legal liability. With clearly defined roles and responsibilities, tracking coverage and determining liability has been less difficult. In the BIM world, roles and responsibilities have been merged, blended, and mixed to create difficulty in determining liability. The parties must ensure proper professional liability coverage for their evolving roles and responsibilities on BIM projects.

Conclusion

Building information modeling represents an important development in the design of a project and may represent a fundamental change in the way projects are delivered. Continued success in the design and construction industry will depend largely on the ability of owners, designers, and contractors to evolve and address complicated commercial, technological, legal, and insurance issues.

Brendan O'Rourke

Indemnity - By Whom, For Whom, and To What Extent

Most construction contracts contain indemnification provisions. But the precise meaning of the indemnitor's obligation frequently is only vaguely understood.

The obligation to indemnify is a duty to compensate another for damages the other has suffered. In tort law, for example, if Smith crashes into Jones' car, and the crash is due to Smith's negligence, Smith will be liable for all damages to Smith's car (at the very least). Smith's obligation to pay Jones is involuntary. If however, Smith agrees to pay for any and all damages to Jones' car regardless of whether Smith caused such damages, this obligation would be voluntary and, thus, an "indemnity."

Such voluntary obligations are commonplace and, in fact, *de rigueur*, in contracts between owners, developers, contractors, subcontractors, suppliers, architects, engineers, and other parties to construction contracts. State law, though, may limit the extent to which one party can indemnify another for certain acts of negligence.

In New York, for example, General Obligations Law section 5-322.1 prohibits, as against public policy, a construction agreement (including moving, demolition, and excavation) that purports to require Party A to indemnify Party B for bodily injury or property damage caused by Party B's own negligence. However, the statute does not prevent Party A from indemnifying the negligence of a third party (Party C) whether or not Party B is partially negligent. Many states have enacted "anti-indemnity" statues similar to that of New York.

What does an indemnity provision look like that purports to indemnify a party for its own negligence?

Some owners, wishing to impose maximum liability upon a contractor, and to be indemnified for their own negligence, choose the following kind of indemnity:

> Contractor shall indemnify, defend and hold Owner harmless from and against any losses, liabilities, judgments, penalties, fines, damages and costs, including attorneys' fees and expenses, suffered or incurred by Owner as a result of, in connection with, or arising from Contractor's work under this agreement, regardless of whether caused in whole or in part by Owner.

The language "whether caused in whole or in part by Owner" is quite onerous to the contractor. It means that the contractor assumes total liability for loss or damage even if the owner himself was completely responsible for such loss or damage. This is precisely the type of indemnity that New York G.O.L. § 5-322.1 prohibits – the indemnification of another for its own negligence. Generally, however, New York courts have held that this kind of provision will not be voided by operation of law if the drafter includes language limiting or authorizing the indemnitor's obligation to "that permitted by law" or "to the fullest extent permitted by law." If this language is present, New York courts will uphold the indemnification provision, but exclude that portion of liability which is attributable to the indemnitee's negligence.

Some New York courts have upheld indemnification provisions similar to the one above without such qualification language (and not thrown out the entire indemnification provision as unenforceable) where the indemnitee itself is free of any negligence. Other New York courts have held that, under the anti-indemnity statute, an indemnitee in a construction agreement must prove itself to be free of negligence in order to recover anything under an indemnification provision. The safest approach, however, is always to include the qualification language rather than just a blanket indemnity that would include indemnification for the indemnitee's negligence.

Parties who are more equally situated in terms of negotiating power may choose to use indemnification provisions that clearly limit the extent of the indemnitor's obligation. For example, a pro-contractor indemnification provision might be as follows:

> Contractor shall indemnify and hold Owner harmless from and against . . ., but only to the extent of Contractor's negligent or willful acts or omissions.

In this provision, the contractor will be liable for those losses and damages caused only by its negligence or willful acts or omissions. The contractor will not be liable for any losses or damages caused by the owner's acts or omissions or that of any other party. Rather, the liability will be apportioned strictly according to fault. Thus, if the contractor was 60% responsible for the harm, the owner was 30% responsible, and third parties were 10% responsible, the contractor would be held liable to the owner for only 60% of the loss or damage.

A pro-owner provision might read:

> Contractor shall indemnify and hold Owner harmless from and against . . ., suffered or incurred by Owner as a result of Contractor's negligent or willful acts or omissions, regardless of whether caused in part by Owner.

Here, the contractor will be liable for those losses and damages caused by its negligence or willful acts or omissions even if the owner was, in part, negligent, as well. Thus, if the contractor was 60% responsible for the harm, the owner was 30% responsible, and third parties were 10% responsible, the contractor would be held liable to the owner for 70% of the loss or damage.

Remember, the New York statute prohibits one party to a construction agreement from indemnifying the negligence —in whole or in part— of another party. The statute does not prevent the first party from indemnifying the negligence of a third party whether or not a second party is partially negligent.

As these sample provisions indicate, slight differences in the language of an indemnification provision can be critical. Parties executing agreements with such provisions should take care to understand the allocation of risk they are assuming, and be mindful of any applicable anti-indemnity statutes.

Emission Policies Will Impact the Future of Development Projects

As part of an amendment to the Clean Energy Act of 2007, Congress is considering requiring states to adopt aggressive energy standards for construction and renovation of new commercial and residential buildings. Many state and local governments have already enacted plans and policies to reduce Green House Gas (GHG) emissions from development projects. Citizen groups are also getting into the act as demonstrated by recent litigation in California seeking to force developers and permitting agencies to consider the climate change impacts of their new developments. Developers need to be aware of the existence of these laws and policies in their area and be prepared to mitigate the climate impacts of their new projects. This article offers a quick glimpse at some of the efforts taken on national and local levels to address the impacts on the climate from new development projects.

Clean Energy Act

An amendment to the Clean Energy Act of 2007 brought by Senator Charles Schumer (D-NY) would mandate that states adopt specific energy targets in their state building codes for all new construction of commercial and residential buildings. Specifically, the draft amendment would:

- Require all states and local governments to adopt ASHRAE 90.1 (2004) and 2006 International Energy Conservation Code energy standards within two years for new construction and renovation in both public and private buildings.
- Require all new and renovated buildings covered by the new code to be at least 90% in compliance in 3 years.

- Require states and local governments to adopt new energy codes every three years for new construction and renovations that will result in 30% more energy efficiency compared to ASHRAE 90.1 (2004) and the International Energy Conservation Code by 2015 and 50% more efficient by 2022.

This amendment is up for debate and likely to be controversial, as it would intrude into the traditional roles of state and local governments in the area of building code development. Other potential ramifications include increased costs to localities for enforcement which will translate into higher fees for developers and increased construction timelines.

Additionally, some commentators have suggested that this amendment will get in the way of efforts by city governments and others to encourage more energy efficient construction practices. Examples of some of the efforts undertaken on the state or local level to address climate impacts from development projects are discussed below.

The Massachusetts Green House Gas (GHG) Emissions Policy

In the wake of the Supreme Court's decision in *Massachusetts v. Environmental Protection Agency*, requiring the EPA to regulate CO2 emissions, the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) issued a GHG Emissions Policy, making Massachusetts the first state to require state agencies and private developers to assess GHG in their environmental review documents. The policy requires certain projects undergoing review by the Massachusetts Environmental Policy Act (MEPA) Office to quantify the GHG emissions associated with the project and to propose alternatives to avoid, minimize, or mitigate the emissions. An advisory committee convened by MEPA is expected to complete development of a standardized protocol for the emissions analysis this summer.

A project will be subject to this policy if an Environmental Impact Report (EIR) is required under MEPA and is proposed by a state agency, if the state or a state agency is providing financial assistance, if a project is privately funded but requires an air quality permit or, if a project is privately funded but will generate 3,000 or more new vehicle trips per day for office projects or 6,000 or more vehicle trips per day for mixed-use projects that are 25 % office space. The policy covers both direct and indirect emissions of the six GHGs covered by the Kyoto Protocol: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, and sulphur hexafluoride. The analysis will include both "direct" GHG emissions (e.g., stack and fugitive emissions from the proposed operation) and "indirect" emissions (e.g., emissions from vehicles driven by employees and generating plants supplying electricity to the proposed operation).

In addition to the quantification of project-related GHG emissions, project proponents must also consider a project alternative in the EIR that incorporates measures to avoid, minimize, or mitigate such emissions. According to the EOEEA, these reduction measures may include:

1. Energy efficiency improvements in buildings, including: lighting, energy management systems, insulation, HVAC technology, windows, water heating technology, roofing, and other building materials;
2. Layout of the site and building orientation to make best use of natural light, natural heating and cooling, and solar energy potential;
3. Incorporation of low-impact development techniques (including green roofs) to reduce the amount of asphalt and provide greener shading;
4. Transportation demand management, including locating the project near mass transit, access to shuttle or bus services (preferably using alternative fuels), ridesharing programs, bicycle and pedestrian accommodations, and provision of Zip Car spaces;
5. Use of clean and alternative fuels; and
6. Establishment of systems for on-site reuse and recycling of construction and demolition materials and recycling of occupant waste materials.

This policy is sure to have significant impacts on future development in Massachusetts and will be closely monitored by other states considering GHG assessment policies of their own. Based on the list of mitigation measures, the policy encourages implementation of many of the same design techniques adopted by the United Stated Green Building Council (USGBC) as part of the LEED certification process.

Local Actions

The city of Boston actually stepped up to the plate prior to the Commonwealth. In January of this year, the Boston Zoning Commission adopted Article 37 into Boston's Zoning Code making Boston the first major U.S. city to require adherence to the LEED-certified standard as part of the private development review process. This article was introduced by Mayor Thomas M. Menino and requires that projects of more than 50,000 square feet meet a basic level of certification known as the level "certified," according to the LEED Building rating system. A project is considered certified if it earns at least 26 points using the LEED – New Construction standard.

Other cities are also developing strategies to encourage sustainable development and reduce GHG emissions. The City of Austin, Texas adopted a "Climate Action Plan" which contains strategic elements such as the use of a "Compact City." Portland, Oregon adopted its action plan to address global warming in 1993 which includes goals targeting land use planning, energy efficiency, and renewable energy. New York City's Mayor Michael Bloomberg has introduced "PlaNYC" which includes 127 initiatives to reduce carbon emissions including encouraging transit-oriented development.

California's Citizen Suits

Citizen groups in California have begun using the substantive provisions of the California Environmental Quality Act (CEQA) as a basis for suits seeking to force the state and local municipalities to require developers to mitigate the climate change impacts of any new development and to include consideration of climate change when reviewing permitting documents. The substantive provisions of CEQA prohibit agencies from authorizing actions with significant, unmitigated environmental impacts. In an action in San Bernardino County, the California Attorney General and environmental groups sued the County after it had issued its CEQA analysis for a comprehensive planning update intended to guide future development in this rapidly developing County. The suit claims that the County violated CEQA by failing to evaluate and disclose how the development anticipated by the plan would contribute to climate change and impact air quality and by failing to adopt measures to mitigate the climate change impacts of future development in the County.

Two other cases have been filed in San Bernardino County within the last seven months by The Center for Biological Diversity, a citizen group, alleging that local agencies failed to quantify GHG emissions when approving development projects. These suits make clear that in California, major development projects and planning efforts that fail to address climate change do so at their own risk.

Conclusion

Climate change initiatives are certain to significantly impact the planning and design of future major projects. Developers need to be aware of the existence of the laws and policies addressing climate change in their area and be prepared to mitigate the climate impacts of their new projects. While in most cases, standards or guidance concerning which emissions developers will be required to address and mitigate have yet to be developed, major developers should be prepared to assess the climate impacts of their projects and adjust their designs to incorporate GHG reducing options.

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Construction Practice News

Please visit Seyfarth Shaw at the 2007 Construction SuperConference in San Francisco, CA on December 12-14, 2007. On Friday, December 14, Seyfarth will participate with an owner, an architect, an engineer, and a contractor in a panel discussion about the risks and rewards of Building Information Modeling.

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