



Lessons Learned: Harnessing the Momentum of BIM

At a recent convention, Daniel Friedman, FAIA acted as moderator of a featured panel of owners and principals from several distinguished design firms. He asked the following question, "What are your views on the use of the Building Information Modeling (BIM) design process and by what means can the architects accelerate their understanding of this technology and all its implications of practice?"

Here are some of the answers:

"By doing it...by thinking of the positives and not thinking of the hurdles...by thinking how can I, rather than thinking how, can't I."

**William P. Tibbit,
Construction Users Roundtable**

"This is happening...get with it or get over it ...if you don't do this; I don't believe we're going to be in business."

Patrick MacLeamy, AIA, CEO, HOK

"You should encourage, lobby your local architectural school; your alumna mater to invest in this technology and possibly more radically...start teaching engineering design and construction management and start integrating it into the studio."

**Joseph Burns, PE, SE, FAIA Managing
Principal Thornton-Tomasetti Group**

"Survival. If you want to survive you're going to change. If you don't, you're going to perish. It's as simple as that....You are not going to practice architecture; unless you are up to speed with this."

**Thom Mayne, FAIA,
Principal Morphosis**

BIM Goes Beyond Visualization

BIM has a much broader use than just being a visualization tool. This article, we will review some practical uses of the BIM design process as they have evolved within the last two years. Who's really

using a BIM design process? Why are they using BIM, and what has been their results using this design process? Who are the leading providers of BIM technology?

Who is Using BIM

1,266 architects were surveyed by a joint committee of American Institute of Architects (AIA) and Associated General Contractors of America (AGC). The results of this survey demonstrate that:

- 74% of U.S. architecture firms are using 3D or BIM for at least one phase of their work.
- 98% use the tools for renderings and presentation graphics related to conceptual design.
- 34% are using it as a construction resource, for tasks like conflict identification (those same people are still producing 2D drawings for permitting, shop drawings, record drawings, and client review).
- 34% are using it for "intelligent modeling" or for generating information like cost / quantity data.
- 12% are using it for facility management.

Designers use BIM models to analyze and validate the performance of their design options. Computer simulation inexpensively simulates the post construction lifecycle maintenance of the building prior to construction and building occupancy.

Industry standard, rules-based software currently analyzes the BIM model and/or building design options. Several analysis packages revise the BIM model after running their calculations. This provides a method for bi-directional model editing. Engineering designers are analyzing and simulating their design options using the BIM model for the following engineering tasks:

- Space & Lease Planning (area & volume) and facility management (BOMA)

- Structural analysis
- Sustainable and energy analysis
- Heating and Cooling Loads
- Lighting and electrical load analysis

A BIM design process includes contractors as part of the initial design meetings to share their expertise; which is crucial to maintaining construction schedules and design budget. BIM is positively influencing the following construction tasks that maintain project scheduling and budgeting.

- Fabrication-Shop Drawings
- Quantity and material take-offs- Reducing time spent producing RFIs
- Cost Estimating, Material Ordering and Purchasing

Civil and site engineering have been using 3D topography for years. The means now exist to connect BIM (3D building data) to 3D site data. New methods for inputting site data into the BIM model now include:

- Importing point data from survey data collectors.
- Importing Autodesk (DWG) and Microstation (DGN) file formats: 2D/3D surface-TIN modeling.
- Linking Google Earth site models.

Obtaining green space and preliminary cut-fill calculations are now conceivable benefits obtained directly from the BIM model.

Within the commercial marketplace, outside forces are driving client expectations to revise their building design deliverables towards BIM. Services provided by a local home improvement superstore is just one example. They can layout a kitchen plan, list the cabinet and countertop materials, price them, print several three dimensional views of the proposed kitchen and leave the client with a price for their custom design. Commercial

(Continued on page 40)

Lessons Learned: Harnessing the Momentum of BIM

(Continued from page 39)

client expectations regarding their design deliverables are further heightened by:

- Their access to or use of 3D video games.
- Viewing movies and videos created using computer animation.
- TV home improvement programs that use computer visualization during their broadcast.
- The volume of 3D, information rich content available to make decisions via the Internet.

Why Use BIM

In 2005, *Value Redesigned: New Models for Professional Practice* was written by Kyle V. Davy, AIA and Susan L. Harris, PhD. It provides valuable insight for design firms that need to pay for a value-add process, such as BIM.

Excerpt: "A brutal fact of reality for architecture and engineering firms is that prevailing pricing and compensation methods—setting fees on the basis of direct labor cost (whether selling hours on a time-and-materials or lump-sum basis)—provide only minimal profits for most firms."

They also reinforce client perceptions that engineering, architecture, and design services are simply commodities to be purchased on the basis of lowest cost.

Association of General Contractors (AGC) printed an article written by Rick Lowe, a construction lawyer at Duane Morris LLP, Philadelphia. Rick is the Chair of AGC's PIAC BIM Forum Legal Subcommittee and a member of AGC's Contract Documents Committee. In his article, Rick made several observations regarding the use of a BIM design process:

- A 3D model offers more specific design information than 2D drawings.
- Given that the world is 3D and not 2D, how can that additional specificity be a bad thing for project liability?
- Most skeptics don't realize that the risks are no greater (and sometimes smaller) in the 3D world than in the traditional 2D world.
- ...as a practical matter, the use of 3D modeling fosters a broader

collaborative effort, especially when the contractor is invited into the process early.

- Design review and clash-review meetings bring everyone into the same room, working to solve a problem. This significantly reduces everyone's risk.

The following companies are the most recognized BIM software manufacturers. Their software can transfer their building model information via IFC (Industry Foundation Classes) file format to other BIM authoring software.

Autodesk:

- Revit Architecture, Revit Structure, Revit MEP
- AutoCAD Architecture (formerly Architectural Desktop)

Bentley:

- Bentley Architecture

Graphisoft:

- Archicad

The IFC file format is a requirement that the GSA is working towards for preliminary design analysis of all federal facility projects. Their expectations for using a BIM design process is for design, construction, and post construction maintenance of the building. BIM may provide a more objective means to manage the following:

- Space Management
- Schedule Conformance
- Program Adherence
- Cost Control
- Design Standards
- IFC Deliverables

Adjacent technologies are linking to the BIM model to provide design analysis and better coordinated construction documents. This includes construction specifications management and cost estimating.

E-specs software links intelligent BIM objects that include CSI Unifomat assembly codes. These codes can be linked to the CSI master format code that will automatically start producing the specifications. Specifications documents are managed and modified simultaneous to the creation of the model. Timberline, US Cost, and Innovaya use this same CSI

Unifomat assembly codes methodology to link their cost estimating solutions with the BIM model.

BIM is breathing new excitement and enthusiasm into existing and long-term players in the building design market. Excitement that is also crucial to attracting the next generation of design talent to the future opportunities of our markets.

Daniel Hughes has over nine years of practical experience in architecture and was an Autodesk Dealership owner for 15 years. He has knowledge in every version of AutoCAD since R1.x and has in-depth knowledge of the processes and needs of architectural firms and a long history with the Autodesk architectural products. Dan was a consultant to Autodesk's AutoCAD release 14 Development Team and a Network Engineer for Autodesk products-Network Versions / Network OS Windows NT/2000. He has sold and supported AutoCAD architectural solutions to architectural firms, A/E firms, contractors, residential homebuilders, and facility planning-engineering departments and is a Certified Instructor within the WI Vocational Technical College System for five different AutoCAD courses on eight campuses. Daniel is the author of the IMAGINiT Architectural Solutions Blog at www.rand.com/imaginitt/architecturalblog.

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1. What three methods can be used to input site data into a BIM model?
2. Name 4 factors by which commercial client design deliverable expectations are heightened.
3. What universal file format is used to exchange BIM models between different BIM software packages.
4. List 3 construction tasks that BIM is positively impacting to maintain project scheduling and budgeting.
5. List 3 BIM software manufacturers whose products are compliant to GSA requirements.
6. By what method does construction specifications and cost estimating link to the BIM model?
7. What book provides insight towards revising your business model; thereby changing client perceptions that engineering, architecture, and design services are commodity purchases?
8. List four tasks that are still being done using 2D drawings by those using BIM as a construction resource.
9. List five ways engineering designers are analyzing and simulating their design options using BIM.
10. List six items that GSA expects BIM to provide for a more objective means to manage their facilities projects.

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