

JBIM
Spring 2008

Journal of Building Information Modeling

An official publication of the National BIM Standard (NBIMS) and the National Institute of Building Sciences (NIBS)

buildingSMARTalliance™



There's a
Storm
Brewing in the
Construction Industry...
are you Ready?

BIM and Stellar Architecture: Lessons From the First Three Years of the AIA TAP BIM Awards

By **Stephen R. Hagan, FAIA**, 2006 Chair of AIA Technology in Architectural Practice Knowledge Community and Member of the AIA Board Knowledge Committee

Figure 1.

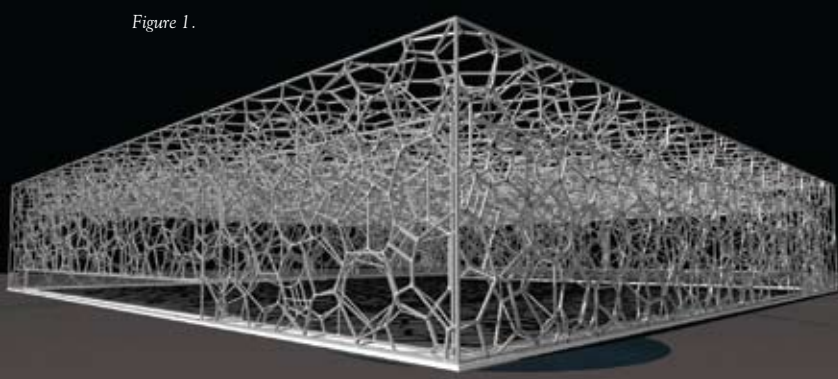


Figure 2. Beijing Olympics 2008 : The Watercube images courtesy of Arup-PTW-CCDI.



BUILDING INFORMATION MODELING (BIM) can be the means to achieving brilliantly conceived, exquisitely designed and meticulously constructed projects that demonstrate truly stellar architecture.

That message, contrary to the prevalent belief that a BIM has a “techno-centric” and “project-delivery” focused purpose, emerged over the past three years’ submissions in the American Institute of Architects (AIA) Technology in Architectural Practice (TAP) BIM Awards. Category “A” of the BIM Awards program was titled “Creating Stellar Architecture Using BIM”, one of seven categories in the awards process:

- Arup, in 2005 (the first year of the BIM Awards), won the award for the Beijing National Swimming Centre for the 2008 Summer Olympics in China.
- M.A. Mortenson Company, in 2006, won the award for the Denver Art Museum.

- Kieran/Timberlake, in 2007, won the award for the Loblolly House.

THE STORY BEGINS IN 2004...

The TAP advisory group met during 2004 and subsequently developed the notion that three inevitable technologies were going to drive the design profession and construction industry forward in the 21st century:

- Collaboration;
- Interoperability; and
- Building information modeling.

But how could we find out what the current state of the industry was in, in terms of those three technologies and, in particular, BIM? Conferences and symposium certainly can show some examples of technologies and projects, but the sample that could be seen at a conference or symposia was by its nature relatively limited and tended to be invited pre-selected conference planners, not a broad sweep of the state-of-the- industry.

A BIM Awards Program emerged as an intriguing project, though it was admittedly high risk from TAP’s perspective. After all, what if you created a BIM Awards Program and no one submitted?

Luckily this was not the case. Launched at the end of 2004, we received 22 very interesting and varied submissions.

ARUP AND THE BEIJING NATIONAL SWIMMING CENTRE

Arup’s submission for the Beijing Olympics immediately stood out as a winner in the category of stellar architecture. Indeed, Arup’s team stated in their narrative that the full design intent, technically complex and visually exquisite, could not have been realized without BIM technology.

The design concept to simulate “foam” and “water bubbles” (**Figure 1** and **Figure 2**) was artistically challenging from the outset, and required remarkable skill with BIM technology for the Arup team to create, analyze and document.

True to form for an engineering firm, not only did the BIM Award narrative illustrate the brilliant artistic design aspects, it also documented thoughtfully how BIM had a return on investment as a technology in the design process.

The 2005 BIM jury noted the Arup submission’s award-winning qualities: “... *Use of BIM integrating design and analysis, demonstrating that simultaneous refinement of both quantitative and aesthetic aspects can be a factor in the next generation of architectural design.*”

MORTENSON CONSTRUCTION AND THE DENVER ART MUSEUM

If it seemed to be out of the ordinary to give the 2005 Stellar Architecture BIM award to an engineer, it was truly extraordinary to

Figure 6. Loblolly House images courtesy of Kieran/Timberlake Architects.



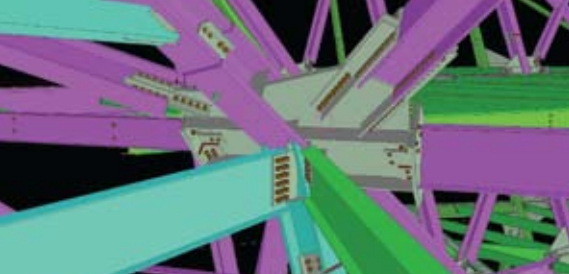


Figure 3. Denver Art Museum. Images for Figure 3 and Figure 4 courtesy of Mortenson Construction and the Denver Art Museum.



Figure 4.



Figure 5. The completed Denver Art Museum. Photo courtesy of Fred J. Fuhrmeister/Time Frame Images.

give the 2006 BIM Creating Stellar Architecture Award to a constructor, Mortenson Construction. Indeed, the story of a construction contractor inheriting two-dimensional designs both from the design excellence architect (Daniel Libeskind) and the production firm (Davis Architects), and developing multiple 3D, 4D and special-purpose BIM models on their own is a central focus of the 2nd year awards.

The BIM jury citation summarized how the Denver Art Museum was, "...a terrific example of how building information modeling can enhance and enable first-rate architecture."

But the submission was also about deep integration of team collaboration into the construction process, utilizing BIM and models as the focus of the team's efforts. The Mortenson submission highlighted the power of BIM, not just for clash-detection and architectural, mechanical and electrical trade coordination, but also as a powerful visualization tool for the client and various project stakeholders, including local officials and art museum donors. Much of that collaboration, viewing the BIM models projected on screens, took place right in the construction trailer.

In addition to collaboration, the Denver Art Museum was also a terrific example of utilizing demonstration of the American Institute of Steel Construction (AISC) interoperable Standard of Practice for design, engineering, fabrication and final erection. Utilizing the CIMSteel Integration Standard, Release 2 (CIS/2) for the exchange of structured information for 3D modeling, the project able

to enable virtually error free installation, an unheard of accomplishment for any project, not to mention one as architecturally daring and complex as this one.

As Derek Cunz, Director of Project Development for Mortenson noted, "BIM helped expedite the structural steel to such a degree that it was completed three months ahead of schedule. Amazing, considering the complexity of the structure. For the future, we're focused on using BIM to simulate all aspects of the process: design, planning, preconstruction, scheduling, safety, sustainability, construction and operations."

See **Figure 3**, **Figure 4**, and **Figure 5** for views of the building.

KIERAN/TIMBERLAKE AND THE LOBLOLLY HOUSE

The 2007 Award Winner for Stellar Architecture by Stephen Kieran and James Timberlake dispelled any notion that BIM is only for complex building types and large firms with unlimited resources. A single family residence, albeit a second home in an idyllic and picturesque location (**Figure 6**), clearly established a benchmark for BIM in several dimensions:

- Fully integrated and complete BIM, with all dimensions, components and building elements in a fully integrated model;
- A design and construction process with a strategic supply chain approach;
- A delineation of both the constructability and de-constructability of the house

and all of its components, clearly demonstrating a true sense of sustainability in the complete life cycle of a building;

- Nevertheless, a jewel of a design.

James Timberlake, FAIA, in his keynote presentation on December 2, 2008 in Washington DC at the Future of Professional Practice conference, commented on the impact that BIM and, in particular, this project had on their firm. He noted that many of the firm's professionals were quite wary that BIM technology would stifle innovative and creative thinking. It really took this project to work all the way through the process and make them believers.

LESSONS LEARNED AND THOUGHTS FORWARD

One question that arose from the BIM Awards program and the Stellar Architecture category was how mature is the current BIM technology. Deke Smith, FAIA, Executive Director, buildingSMART alliance™, with Patrick Suermann and his team at University of Florida, utilized the TAP BIM Awards submissions as a test of the Capability Maturity Model (CMM) they were developing. In Smith's words, "we wanted to provide some hard metrics to delineate why these projects were award winners. We also wanted others to aspire to the same levels of quality in their models. I am pleased with the outcome at this early stage of the CMM."

But is the Stellar Architecture category just a beauty contest? The category criteria includes:

- Project is built or under construction;
- Independent architectural merit awards;
- Jury assessment of architectural quality; and
- Architectural expression which could not have been realized in other ways.

Stephen Kieran, FAIA, in his role as a BIM Awards juror in 2006, challenged the profession to begin thinking about BIM as not just “representation”, or “expression”, as the above criteria suggested, but encouraged practitioners and the technologies technologists to begin moving toward better integration and ultimately “simulation.”

David C. Mortenson, a Jury Member of the 2008 TAP BIM Awards, added, “the use of BIM technology is finally gaining enough wide spread use and acceptance that we can do more than just adopt a new better tool to do what we have always done, we can actually start to use the tool to fundamentally change how we design and build facilities.”

That raises the question of when will BIM, as a virtual design and construction tool, address how well the building will perform (in advance of completed design, construction and occupancy), in areas such as:

- Client programmatic needs;
- Energy;
- Building enclosure integrity despite unique and daring designs;
- Life safety;
- Sustainability; and
- Security.

Ultimately this will result in not just “stellar architecture” but more appropriately “BIM enabling a stellar performing building” in a multitude of dimensions. ■

Stephen R. Hagan has worked extensively in the design and construction industry to integrate information technology into programs and projects. He has lectured extensively and led symposiums on the subject of the digital revolution in design and construction.

REFERENCES:

TAP BIM Award Winners for BIM Creating Stellar Architecture
 2005, Arup, Beijing National Swimming Centre: www.aia.org/SiteObjects/files/arup.pdf
 2006, M. A. Mortenson Company, Denver Art Museum: www.aia.org/tap_a_200607_bimawardees
 2007, Kieran/Timberlake Loblolly House, www.aia.org/aiarchitect/thisweek07/0824/0824n_bim.cfm

THE WEIDT GROUP®

Providing energy modeling services and pioneering software design for utility companies, manufacturers, architects and engineers.

Object-oriented Software since 1995

We make modeling work.™

30
YEARS

DECISION SUPPORT
 DESIGN SUPPORT
 VERIFICATION SUPPORT



MINNEAPOLIS
 BERKELEY
 DENVER

DES MOINES
 MONTPELIER
 TWGI.COM



BIM: A Healthy Disruption to a Fragmented and Broken Process

By David Jordani, FAIA, Jordani Consulting Group

I HAVE HEARD THE terms BIM and *disruptive* used together quite often lately. Some tend to think of disruption as a sign of trouble. My preferred connotation for the term is *unsettling*. Is BIM the catalyst to unsettle and shake-up the construction industry? I hope so...and it's about time.

Much has been said and written about the inefficiencies of the construction industry. Fragmented in its makeup and slow to adopt change, statistics from the U.S. Bureau of Labor Statistics suggest that the construction industry productivity not only lags behind other industries, but is also in decline. The costs of these inefficiencies are palpable, costing billions of dollars annually.

Let's be clear, BIM is not the salvation of the construction industry. Efforts on many fronts will be needed to address

issues that have gone unattended far too long. But there's good reason to believe that the introduction of BIM will serve as a catalyst for many of the necessary changes to unfold. The signs are already there.

At its core, a BIM based methodology is built around the notion of *collaboration*—people and systems exchanging information about a facility throughout its life cycle. Embracing a collaborative model is the most effective way I can think of to address fragmentation. Adopting this approach requires and results in a number of positive changes in the industry. While technology may be the catalyst, business process reform and vision is required to create meaningful change.

So how do we get there, and what kinds of changes will we see along the way?

OWNERS WILL DEMAND IMPROVEMENTS

No longer willing to yield to a tradition of inefficiency, building owners will lead the charge for a smarter process. As change agents for the industry, both public and private owners will challenge their providers to deliver facilities faster, better, safer and at lower cost. Owners will require BIM to enable lean practices to identify and eliminate waste in the entire project cycle. They will expect their construction partners to be proactive in applying these concepts looking for early returns—tangible results from bid through implementation at the site.

NEW BUSINESS MODELS WILL EMERGE

The benefits of consolidating previously disjoint design and construction organizations will lead to mergers and acquisitions

in search of more cost effective business models for collaboration. These organizations will promote the benefits of being under one corporate umbrella as a distinct advantage they can translate into lean process benefits for the owners. The visionaries will extend their offerings into operations and maintenance support leveraging BIM through the full life cycle of a facility as they move towards managing total cost of ownership (TCO) as a service delivery model.

A host of new businesses will emerge to meet the needs of a digitally based process. Even at this early stage Googling *BIM Services* returns an international list of boutique providers ready to assist those in need. And BIM is rapidly a new tag line on AE print ads. Current services predominantly focus on the startup events as organizations struggle to get out the BIM starting gate, but that is about to change. I recently saw a demonstration of a Smart Codes™, an automated code compliance checking software being developed by the International Code Council. This application

and others like it will embed professional expertise to a far greater extent than ever before. Professional service organizations and associations will be able to encode their knowledge for use by others. Need to gain access to best practices for the layout of a surgical suite? Why not license it from subject matter experts? This and many other examples will likely be available as a web service in the not too distant future. With the computer acting as a design partner, the need to evaluate—perhaps certify—that software is properly contributing to a BIM will emerge. The benefits of quality controlling BIM project data for its proposed short and long term uses will be realized as well. This in turn will lead to new services for organizations with the professional and technical skills willing to take on that risk.

OWNERS WILL USE BIM AS A BUSINESS INTELLIGENCE MODEL

Owners now reaping the benefits that BIM yields through design and construction, will seek even greater value in the use of the BIM to manage

operations, maintenance, and renewal activities throughout the life cycle of the facility. For owners this forecasts a transition to a more meaningful BIM where *digital facility DNA* is used to tune and maintain a building and its systems. Owners will recognize the value of the information about their facilities as an asset in addition to the physical facility itself. An owners' BIM will morph into a *Business Intelligence Model* integrated with other corporate systems to maximize impact on corporate's operations and mission. The long sought opportunity to connect facilities to the corporate mission will be realized.

Owners look for partners who can take on a stewardship role for managing an expanding network of facilities data and step up to a new level of professional service.

SOFTWARE SUPPLIERS WILL PLAY NEW ROLES

Convergence of software products to meet the needs of industry will continue. Marketing distinctions between BIM, CAD, CAFM, WMIS, CMMS and

THE PRACTICAL APPROACH TO BUILDING INFORMATION MODELING
Integrated Practice done the right way!

BIG BIM

little bim

Finith Jernigan

Manage expectations & improve outcomes

HAVE A PLEASANT JOURNEY

LOWER RISK

... if every senior manager actually read this we'd find the industry moving forward at a much better, and unified, pace.

I'd recommend every practice to order a copy, read it, and act on the recommendations within.

Get on the fast track today!
BIMeducation.com for discounted books & programs
Order direct from 4sitesystems.com
Amazon.com for full-price delivery

Nigel Davies - www.eatyourcad.com