

State of the AEC Industry 2006

BIM solutions are changing the AEC landscape.

By H. Edward Goldberg, AIA

WE CAN'T DISCUSS digital design in the AEC industry without mentioning BIM, but I believe that BIM has not yet been well defined. In defense of this statement, I propose my own definition of BIM.

I distinguish between the building information model and building information modeling, or virtual modeling. The building information model is an entire virtual building project, including all information about that project contained within the property lines from the sky to the center of the Earth. This information includes the structures and associated information, weather history, taxes, ground compaction, utilities, equipment and more—any information one could eventually want to query about the project. Building information modeling (or virtual modeling) is the process of creating the information database for the project. This database might appear as a building or as simple data, depending on its use.

In my opinion, the building information model is of little importance for single residences but is of great significance to owners of large complexes and buildings. As I see it, the main benefit of building information modeling for architects, engineers and contractors is that it's a more productive way to create, engineer, estimate, illustrate and construct building projects. The biggest benefit from the building information model itself goes to large building or complex managers who must manage a multitude of buildings.

Major AEC software companies recognize that BIM, which I'll use to refer to building information modeling, affects the entire building lifecycle, and they are responding. Autodesk, Bentley, Graphisoft and Gehry Technologies have been busy either acquiring or integrating technology such as engineering, MEP and construction management solutions. Autodesk and Bentley offer FM (facilities management) solutions (but surprisingly, Graphisoft discontinued its FM solution). What follows is a quick update on the latest in BIM software.

Nemetschek North America VectorWorks Architect 12

www.vectorworks.net

VectorWorks Architect's mantra is "BIM software for the smart-sized firm." VectorWorks provides professional design solutions for the AEC industry and counts around 200,000 installed seats worldwide. This product carries the lowest price among BIM products mentioned here, starting at \$1,395. This price is an effect of the VectorWorks business model. The

company sells its products directly instead of through resellers. It's also one of only two products discussed here to work on both Windows and Macintosh operating systems.

VectorWorks Architect meets the criteria for a BIM application by providing parametrically defined, interacting building objects with simultaneous 2D/3D/parametric viewing and editing and integrated reporting of nongraphical data. Released on October 24, 2005, VectorWorks Architect 12 is a big update with many improvements. See the review on p. 36 for more details.

As of v12.01, VectorWorks users can import SketchUp models into VectorWorks Architect. Users can start initial conceptual design work in SketchUp and continue with more complex aspects of the design process in VectorWorks Architect.

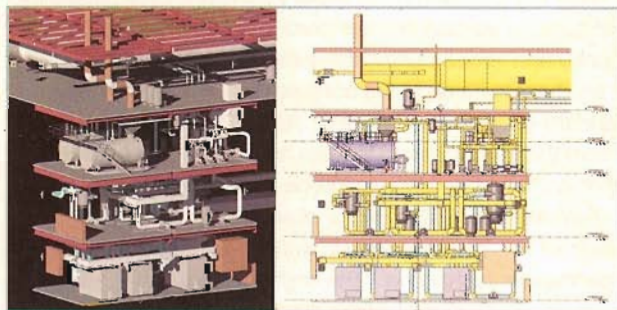
Autodesk

www.autodesk.com

Not only does Autodesk develop two AEC applications—Architectural Desktop, an object-oriented program, and Revit Building, its BIM tool—but it also has expanded solutions portfolio with applications for MEP (mechanical, electrical, plumbing) and structural engineering.

This year, Autodesk introduced Revit Systems (Revit-based MEP) and announced the acquisitions of Constructware, an Internet-based construction project management tool, and FM Desktop, a facilities management application. This portfolio demonstrates that Autodesk is committed to creating a complete BIM solution from conception to construction to building maintenance.

Adhering to Autodesk's 12-month upgrade cycle, all these



The new Revit Systems features built-in calculations and MEP system autorouting. Images courtesy of Dal Pos Architects and Robson Woese Consulting Engineers.

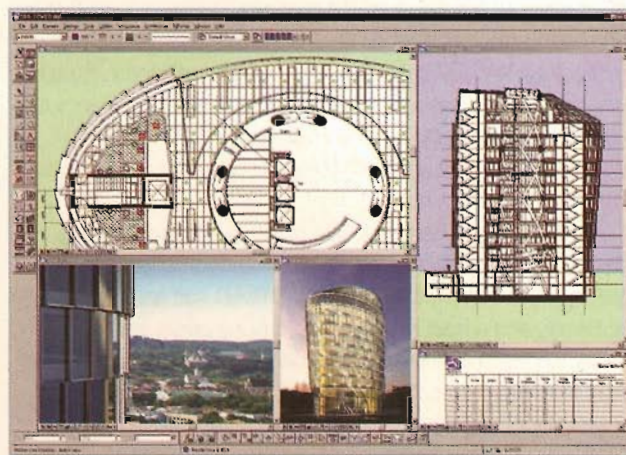
products continue to evolve. Architectural Desktop 2007, the latest version, is built on AutoCAD and so gains all the new AutoCAD features, including visual styles and a new rendering engine. One of the subtle changes that enhances Architectural Desktop's modeling capability is the ability to convert mass elements and solids to slabs and roof slabs. Space objects, which are responsible for extracting spatial information to the schedules, now can assume 3D shapes.

Revit Building 9 includes sun studies, a new detail library, material takeoff, keynoting, and IFC import and fully certified export. Revit Structure 3 has improved modeling and analysis, better construction documentation and greater multidiscipline interoperability. Revit Systems features built-in calculations and MEP system autorouting, optimized system design support, system modeling and design and documentation coordination with Revit Building. Watch for more detailed reviews of the Revit products in upcoming issues of *Cadalyst*.

Bentley Systems
www.bentley.com/bim

Bentley has been producing BIM applications based on Tri-Forma technology for several years. Bentley always takes a

considered and thorough approach to things, and the way it's brought BIM capabilities to its users is no exception. In 2005, BIM adoption in the MicroStation user base seems to have passed the tipping point. I hear that Bentley's BIM user base has more than tripled during the past two years.



Bentley Architecture provides powerful architecture BIM that is well integrated with engineering BIM solutions. Image courtesy of PLH arkitekter AS.



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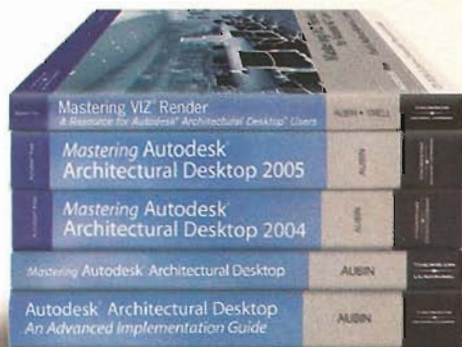
Last year was big for Bentley in terms of acquisitions. By buying two of the leading structural analysis and design applications—RAM and STAAD—Bentley cemented its clear head start in structural BIM and is now the 800-pound gorilla in this discipline. What's exciting to structural engineers is that these solutions complement each other functionally and integrate with the rest of the Bentley BIM portfolio. Bentley's lead in the engineering disciplines and upcoming new versions of its architectural and FM solutions make its BIM offerings attractive not only to MicroStation users but also to AutoCAD users who evaluate all their options. I expect Bentley's competitive upgrade pricing and aggressive marketing to AutoCAD users is fueling much of its growth.

At the center of Bentley's BIM portfolio are Architecture, Structural, Building Mechanical Systems and Building Electrical Systems. In addition, the RAM and STAAD software, Navigator, Rebar, and a host of other applications serve special needs. Bentley Facilities, the company's facility operations and asset management solution, is used worldwide at sites such as airports, nuclear facilities and automotive manufacturers.

All of these solutions are developed on a single technology platform, file format and user interface. Bentley supports certified IFC import and export as well as direct read and write of AutoCAD DWG and Adobe 3D PDF.

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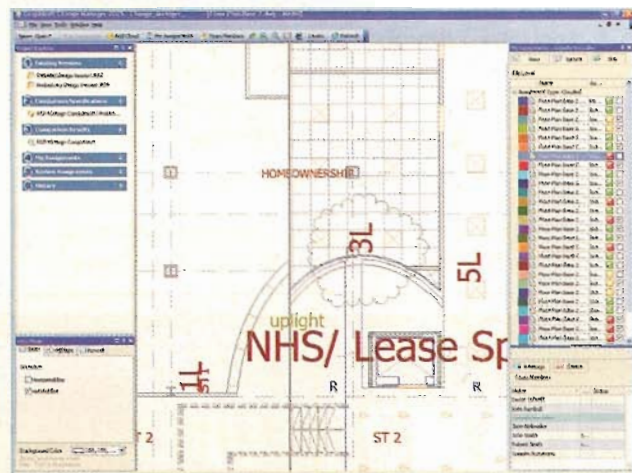


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www.graphisoft.com

Graphisoft was one of the first companies to implement BIM technology and embrace IFC file transfer. ArchiCAD users have completed more than one million BIM projects, according to Graphisoft estimates. This BIM system offers a solution for the entire design workflow. Starting with conceptual design (SketchUp integration) and organic modeling capabilities (Max-onForm), ArchiCAD 10 automatically generates construction documents. With its intelligent interface, it extends to most structural solutions (Tekla Structures, ETABS, SAP2000 and CBS Pro & FEM-Design) and to major energy analysis solutions (Energy+, Green Building Studio, VIPWEB CAD, Riuska and ArchiPhysik).



ArchiCAD's Change Manager allows members of a project team to identify, communicate and manage changes in document sets.

Last year, Graphisoft introduced the world's first commercially available 5D virtual construction system. Graphisoft Constructor 2005 creates 3D construction models with a 4D sequencer that automatically links the construction model to the project schedule to allow schedule alternatives to be analyzed and communicated more effectively.

Graphisoft Estimator 2005 is a model-based estimating system that extracts quantity information from the construction model to produce estimates. It combines a traditional estimating system to support the transition from manual takeoff-based estimating to model-based estimating. Its 5D reporting capability uses the construction model as the link between cost and time to produce cost-loaded schedules for financial analysis.

Graphisoft Control is a unique location-based schedule and production control system with a flow-line view that integrates with Graphisoft Constructor and Estimator. Change Manager allows project team members to communicate and manage document changes that have material effects on time, cost and schedule. ArchiCAD is available for both Windows and Macintosh platforms.

Gehry Technologies
www.gehry technologies.com

Digital Project V1 R2 is the software that the office of Frank Gehry has been developing for 15 years. It's based on CATIA from Dassault Systèmes.

According to Dennis R. Shelden, chief technology officer for Gehry Technologies, the product supports the lifecycle of construction projects in a common digital environment from design and engineering to fabrication, construction project management and on-site construction activities. The software comprises nine modules:

Designer, Foundation, Viewer+, Structures, MEP, Knowledge Template, Knowledge Advisor, Project Manager and Primavera Integration.

Designer is a base product that includes more than 200 commands and functions. It supports high-quality geometric modeling from wire-frame and surface modeling through feature-based solid geometry. Foundation is the production and coordination component of Digital Project. Foundation provides basic geometry and knowledge-modeling capabilities for architects and engineers. Structures provides a comprehensive suite of tools and component catalogs for designing steel structures.

Knowledge Advisor and Knowledge Template are directed at CAD managers responsible for developing and implementing project standards and productivity tools for their organizations.

Project Manager enables the creation and extraction of AEC modeling and coordination information in the master model. Primavera integration allows digital project users to link 3D components to Primavera activities

and to simulate these activities in 3D (4D Navigation).

1ST Pricing
www.1STPricing.com

I've included 1ST Pricing here because it directly affects the concept of BIM. 1ST Pricing, which primarily serves California but is going nationwide, provides six automatic pricing quotes for windows and doors directly in its BIM software interface. This quotation is performed automatically

Current Window	Certified Contractor	F&B International	WMA Pricing	Sorrento Sorrento	JELD-WEN JELD-WEN	Superior
Milgard Classic Vinyl Half Vent Sliding Window Type: 60 Size: 32" x 48" Frame Type: Rail On Frame Color: White Grid Pattern: None Glass Type: Clear	\$193.64	\$170.58	\$270.74	\$198.00	\$191.81	\$192

1ST Pricing provides automatic pricing quotes for windows and doors directly in the BIM software interface.

through the company's Web site at no cost to the designer. Right now, this feature comes with TurboCAD and will soon be available in ArchiCAD. A downloadable plug-in for AutoCAD, Architectural Desktop and Autodesk Map 3D will create a detailed bill of materials, including real-time, comparative pricing from actual manufacturers combined with pricing and an online fulfillment capability.

This solution must be seen to realize its benefit. I've tried the software and was amazed when it immediately gave me alternate pricing for windows for my project. According to Tom Kemp, vice-president of the company, 1ST Pricing has the goal of providing quotes for all materials used in a building project created using BIM. ■

H. Edward Goldberg, AIA, NCARB, is a practicing licensed architect and AEC industry analyst. Ed's full-length book, Autodesk Architectural Desktop 2006: A Comprehensive Tutorial (Prentice Hall; www.prenhall.com) is now available. Ed provides online Architectural Desktop training delivered directly to the desktop. Visit www.hegra.org or e-mail ed.goldberg@cadalyst.com.

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