

FEBRUARY 2010

# BIM: Latest Step in Project Delivery Integration

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*3-D rendering of mechanical systems in the penthouse of a laboratory building.*

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# BIM: Latest Step in Project Delivery Integration

— Bruce Wallmann, PE



*“3-D rendering of mechanical systems in the penthouse of a laboratory building”*

*Over the past 20 years, owners, contractors, and design professionals have driven the need for a more integrated approach to building design. The objective was to produce highly accurate drawings that reduced construction process changes. BIM (Building Information Modeling) is the latest, and likely not the last, evolution of three-dimensional (3-D) technologies.*

## **Simple CADD.**

Independent forms of 3-D technologies have existed since CADD (Computer-Aided Design and Drafting) became widely available and used by the A/E industry in the 1990s. One of the early

independent software technologies available was CAFM (Computer-Aided Facility Management). The software had several BIM capabilities, but it was used primarily for space management.

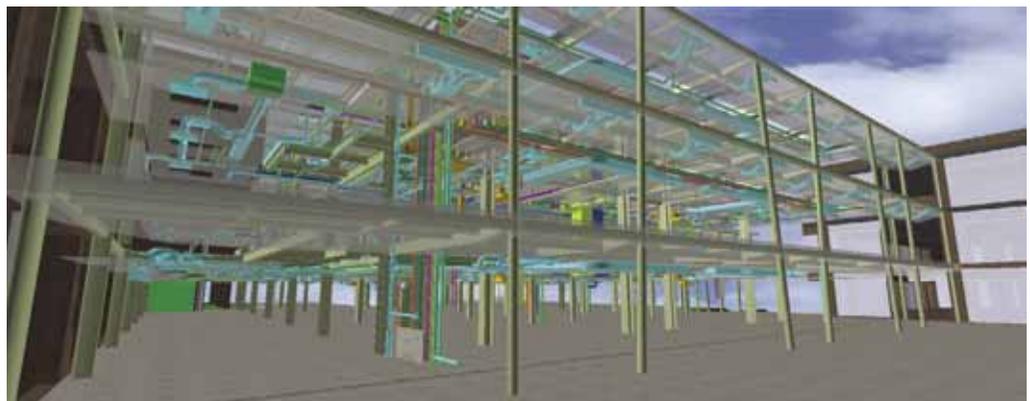
At the time, Erdman Anthony used laser-based equipment to measure all accessible spaces to one-eighth-inch accuracy and build interior architectural floor plans in 3-D. The resulting “model” could accurately represent the interior configuration of a building

with limited, if any, exterior shell. These plans were used by owners to better manage space allocation between departments/organizations. In addition, the A/E industry benefited by having actual architectural as-built conditions that increased drawing accuracy and decreased the time and fees to generate architectural base plans.

## **Lasers come into play.**

Laser technology continued to develop from the one-dimensional distance measurer to a full 3-D image capturer at the turn of the century. These laser scanners were initially used in land surveying but were also applicable in the building design industry. This new technology collected visible 3-D as-built information more safely, quickly, and accurately than traditional measuring tapes and paper. In addition, costly return trips to the field were minimized or eliminated because the image included all information, not selected items, as was the case with manual data collection.

This laser technology was applied to a large relocation/demolition project at Eastman Kodak Company’s 120-year-old, 1,000-acre manufacturing complex at Kodak Park. Laser scanning captured a vast amount of exterior utility and support information safely from the



*3-D rendering of building mechanical systems with structural and existing building references.*

ground, eliminating the need for lifts and working around sensitive systems. The scans were then used to generate 3-D drawings with elevations of critical elements for contractors. The benefits from this technology included expediting a project on a tight schedule, design information to fabricators, quantity take-offs and verifications, and tight bid results.

In conjunction with laser scanning, 3-D CADD software for mechanical and electrical systems was also developing rapidly. What was used largely in the industrial arena could now be effectively applied to high-technology buildings on college campuses. An example is the renovation of the former Acheson Hall at the University of Buffalo into the renamed Kapoor Hall, which consolidates School of Pharmacy and Pharmacology departments. The building's exterior and interior partitions were completely removed, leaving just columns, floor, and roof structure. The floor-to-floor heights were below present standards for a laboratory building, so 3-D software



*3-D representation of exterior utility piping.*



*Actual installation of exterior utility piping.*

was used in the conceptual phase to help evaluate feasible locations of main mechanical/electrical rooms and service shafts. Two-dimensional architectural plans were extrapolated into a 3-D model during the design phase to facilitate the utility coordination process with the existing structure and new floor plans.

**Bringing BIM to the process.** Our next design incorporated these previously used technologies with BIM architectural software for a science building addition at Binghamton University. Laser scanning technology was used to capture the existing conditions of a sub-grade structure, which would be used as the basement of the science building addition. The scans were then converted into CADD for use in demolition and relocation designs. Floor-

to-floor heights were again a challenge, as the client preferred that they match the heights of an adjacent building. Although the architectural and engineering teams were using 3-D modeling software, the software was different and could not be integrated directly. We initiated the use of third-party software as an integrated viewer to perform coordination tasks. The released construction documents resulted in the top six of seven general contractor bids being within 4% of the lowest bid and the average bid being 11% below budget.

Erdman Anthony is presently designing higher-education projects at the University of Buffalo, Buffalo State, Geneseo State, and Cornell University, as well as food market and transit projects, in the 3-D environment where the architectural

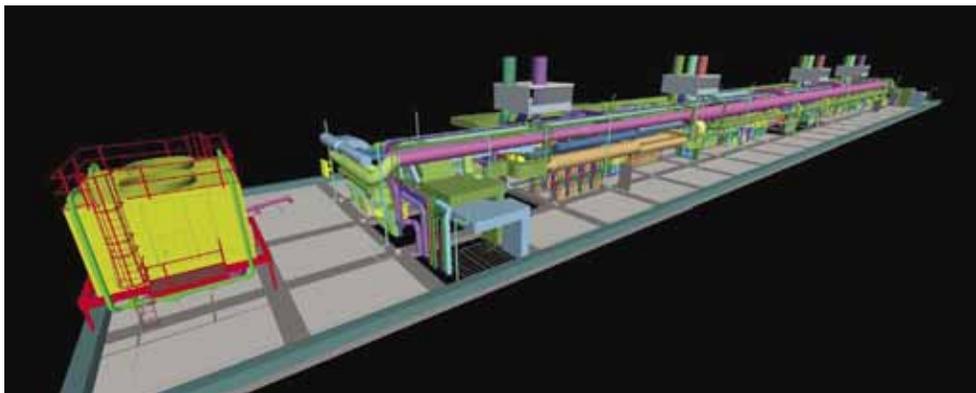
and engineering software platforms interchange files to fully take advantage of BIM.

**Web-based BIM.**

The next evolution is Web-based BIM. The software currently needed to view designs produces large files that are difficult to transfer, and multiple versions of the files are exchanged. Web-based technology has advanced rapidly, however, so that most up-to-date BIM models can be placed on a server for access through standard Internet protocols. This allows anyone with password-protected access to view the BIM file from an Internet-connected computer, eliminating the need for expensive CADD software, the transfer of large files, and the need for multiple files. One active file can now be viewed by the entire project team.

The efficiency, accuracy, and project management benefits of existing 3-D technologies over the last two decades have resulted in an integrated project delivery and management paradigm that benefits all. We can be certain that even more changes are in store ... We'll be waiting. □

*Bruce Wallmann, PE is a Principal Associate at Erdman Anthony*



*3-D rendering of composite mechanical systems in the penthouse of a laboratory building.*