

Building Product Manufacturers & Fabricators and the BIM Intersection

CIMdata Commentary

Key takeaways:

- *A revolution is underway throughout much of the architecture, engineering, and construction industry that requires today's building products manufacturers and fabricators to adopt a new way of working.*
- *Building information modeling (BIM) is playing a major role in this revolution.*
- *Autodesk is well positioned to support both the product development and BIM needs of building products manufacturers and fabricators of all types and sizes.*

The BIM Revolution

A revolution is underway throughout the architecture, engineering, and construction (AEC) industry. Many industry leaders are promoting and nurturing a shift from building to assembling. This is a fundamental shift from a business-operating model where everything is unique to a paradigm where much is repeatable and off the shelf. One in which building products are pre-packaged and assembled rather than being designed, manufactured, delivered, and installed for a single use. In this new paradigm, Building Information Modeling (BIM) plays a core role in the development, execution, and support of what is designed, built, and maintained. Building products manufacturers and fabricators, as well as designers and builders of the world's infrastructure, stand to gain significant benefits from this shift in thinking and working in this historically slow to evolve industry.

The AEC industry designs and constructs everything from houses to apartment complexes, schools, office buildings, skyscrapers, refineries, power plants, bridges, dams, and factories; in short: any and all structures. Some of their finest work is flat on the ground, as airports, freeways, and mass-transit rail systems. Underground, AEC deals with subway systems, water mains, gas pipeline networks, electrical conduits and associated infrastructure, sewer lines, and storm-drainage tunnels and supporting facilities. All of these require close and consistent collaboration with building products manufacturers and fabricators. The incorporation of discretely manufactured products, e.g., windows, HVAC (heating, ventilation, and air conditioning) systems, and electrics, is pervasive throughout the structures designed and built by AEC firms. The coordination necessary from a design and assembly perspective is significant. Without a common collaboration and communication mechanism, the AEC industry will continue to deliver projects late and over budget to a greater extent than necessary. It is clear that the old way of working is no longer good enough.

Today's designed and built facilities are more complex than ever, requiring significantly more collaboration than before between the AEC firm and its building products manufacturers and fabricators. Such collaboration needs to start early in the process and be maintained throughout the facility's life. These facilities are becoming systems of systems, e.g., the HVAC system is connected to the security system, which is also connected to the lighting system. This interconnected system design enables advanced features such as selective heating and lighting of occupied areas. This approach often requires the integration of products from multiple manufacturers that are customized to meet specific in-field

requirements. Regulatory and various green building initiatives are also forcing AEC companies to rethink how facilities are designed, constructed, and importantly, operated. They can no longer only look at construction costs. They must also look at the long-term costs of operating the building. Furthermore, regulatory requirements are continually increasing across all areas, particularly in the public sector and power generation.

As in most industrial segments, customers (i.e., the facility owners and operators) want their product (i.e., the facility) delivered faster, at lower cost, and with higher first time quality. The bottom-line is that all stakeholders in the building products and fabrication industry must work together to achieve more speed and efficiency in design, procurement, construction, commissioning, maintenance, operation, and ultimately decommissioning and recycling.

As stated above, BIM will play a major role in this revolution. For many, BIM is the process involving the creation and management of a facility's digital representation (i.e., its digital definition). Autodesk defines BIM as "an integrated process built on coordinated, reliable information about a project from design through construction and into operations." As CIMdata see it, the model (i.e., the set of clear, concise, and valid information) is the common set of information upon which the virtual team responsible for the design, construction, and operation of a specific building relies to make its decisions from the building's earliest conceptual stage, through design and construction, then through its operational life before its eventual demolition and recycle. The model is the common construct for the project and the facility for its lifecycle. This means that it is critical for building products manufacturers and fabricators supporting a given project to ensure that their data is provided and included in the BIM. Over time this should ensure that the BIM grows to hold the entire definition of the given facility. In many ways, BIM is the AEC industry's product lifecycle management (PLM) approach—a lifecycle approach that integrates the people, processes, and information systems used to design, construct, and operate facilities. Because of this, BIM is quickly becoming both the way in which work is performed and a contractual obligation required in order to supply products to AEC firms.

The Benefits of BIM

The theory of BIM—centrally managing all of a building's intellectual property, i.e., all the information needed to design and maintain the building—is that every product or service has a lifecycle. This means BIM manages data objects about everything in a project's information workflow. This is how BIM ensures that all of a building's information is captured as it is created, transformed as required by successive owners, and delivered wherever and whenever needed to the appropriate users of that information. The BIM is the common information model of the project; drawings are no longer enough—it is the way AEC firms design and execute the project, and drives how building products manufacturers and fabricators deliver the right components, as and when needed, throughout the construction process. There are three key benefits of such an approach.

Better collaboration between all participants of the virtual team—all the architects and contractors, especially those that are small- and medium-sized, and the countless number of building products manufacturers and fabricators involved in any given project. This is the "build" phase of the project, when tens of thousands of CAD files, paper drawings, product specifications, regulatory requirements, and blueprints are brought together at the project site. In the area of structural and civil engineering, BIM accounts for the structure itself and all its connections to utilities (e.g., water, sewer, electric, gas, and steam). BIM also accounts for

ingress, egress, foot and vehicular traffic, zoning, building-code compliance, and security, among other things.

Ensuring that building owners and management organizations know in detail what constitutes the physical property. This requires combining the BIM as-designed with the as-constructed information that can be almost anywhere in a myriad of formats. This combined information includes what has been done in maintenance, repairs to damage, replacement of discrete components and systems, leaseholder build-outs, plus renovations, and modifications. This as-constructed data is operations-focused; knowing “what,” “when” and “by whom” is essential. This requires BIM managers (usually those responsible for building maintenance) to keep the information models updated.

Record-keeping; the gathering and securing of information such as filings for regulators covering emissions, energy use, LEED certification for greenness, safety, property taxes and appeals, rezoning, and more. Maintaining the complete, clear, concise, and valid set of information is critical to ensuring that the facility is correctly designed and constructed to meet all customer and regulatory requirements.

Making all the pieces fit together at the construction site is the AEC industry’s biggest challenge, as well as the greatest challenge to implementing BIM. This is where the differences between the as-designed and the as-constructed emerge. Part of the contractor-to-owner hand-over of a large structure is tracking every discrepancy in the design data and BIM information. These discrepancies are tracked with “punch lists”—informal but legally binding agreements between the architect, contractor, and owner to correct anything the owner finds that is not “up to spec.” Much of this entails workarounds and modifications made on-the-fly. Punch lists run to hundreds of pages and are not always well documented. They have always been a stumbling block to building owners’ needs for comprehensive information, but this can be solved with an integrated approach to information management that starts during design.

The Missing Link

Until the advent of a lifecycle-focused BIM approach, what has been missing in AEC is a broader and deeper level of collaboration among architects, engineers, building products manufacturers and fabricators, on-site contractors and project owners. As an example, collaboration on specifications and capabilities is vital if electrical systems, heating, air-conditioning, elevators, and escalators are to be economically maintained over time. It is critical for building products manufacturers and fabricators to support a BIM approach. By doing so, they will be able to more quickly collaborate with their AEC partners, providing them the information they need quickly and efficiently, when and where needed, in the most appropriate format. Those that support BIM well will become preferred partners, and are more likely to be involved in the early specification stages of a project, which in turn should lead to more business as their products become designed into the facility.

Ultimately, BIM brings an enormous mass of information together for the benefit of building owners and managers. Their concerns span the building’s entire lifecycle; they start with the structure’s design concepts, which may be developed by architects years before a general contractor is hired and put to work. This is why BIM requires the integration of discrete product information from building products manufacturers and fabricators with the project information—that is, what was constructed. This is also why building products manufacturers and fabricators need to embrace the revolution underway in the AEC industry, and define and implement an integrated BIM approach—an approach that allows for the flow of information

from product concept to design, to current and future AEC partners, and finally to the appropriate building owners and operators. Following such an approach will allow partners, including architects and contractors, to access intelligent representations of product geometry and the physical footprint of the products being offered as well as other vital data such as performance, cost, and delivery schedules. This is an area where Autodesk excels.

Autodesk's Support

Fundamentally, Autodesk is well positioned to support both the product development needs as well as the BIM needs of building products manufacturers and fabricators of all types and sizes. Unlike most software providers that deliver BIM solutions to the AEC industry, Autodesk also offers a significant set of integrated software solutions that support complex electro-mechanical design of discrete products. Autodesk's Inventor 3D mechanical computer-aided design (MCAD) solution, for example, provides a rich set of functionality that can be used to bring together design data from all phases of product development in a single digital 3D model. With the proper adoption and use of Inventor and other associated digital prototyping solutions offered by Autodesk, building products manufacturers and fabricators can greatly simplify their process of designing, visualizing, and simulating products in the context of the facilities in which they will be installed. Additionally, companies can repurpose their manufacturing models to serve as the basis for BIM-ready content thereby greatly enhancing their ability to collaborate and partner with other BIM-ready organizations. This is possible because Autodesk's digital prototyping approach is designed to ensure seamless interoperability between Autodesk generated manufacturing, CAD, maintenance, and support models, and the BIM workflows being demanded by today's quickly evolving AEC organizations. Autodesk has taken steps to enhance the accessibility of these complimentary technologies through its introduction of suites, such as the Product Design Suite, Building Design Suite, and Factory Design Suite. Each of these suites encompasses elements of both BIM and Digital Prototyping solutions selected to support the workflows targeted by each suite and needed by designers, engineers, and detailers within this industry.

Finally, Autodesk's newest solution, Autodesk PLM 360, can be used to provide the collaborative glue that binds the firms that form virtual organizations that are defined and dissolved as projects come and go. The PLM applications being delivered—their integration, data management, and workflow support—provide the level of information and workflow interoperability required to operate in a highly distributed, competitive, and rapidly evolving market.

Building products manufacturers and fabricators who chose to implement an integrated BIM approach can achieve a competitive advantage. Those who do not will struggle to compete. As the BIM revolution progresses AEC firms will demand and reward those building products manufacturers and fabricators who join and embrace this new paradigm.

About CIMdata

CIMdata, an independent worldwide firm, provides strategic management consulting to maximize an enterprise's ability to design and deliver innovative products and services through the application of Product Lifecycle Management (PLM). CIMdata provides world-class knowledge, expertise, and best-practice methods on PLM. CIMdata also offers research, subscription services, publications, and education through international conferences. To learn more about CIMdata's services, visit our website at <http://www.CIMdata.com> or contact CIMdata at: 3909 Research Park Drive, Ann Arbor, MI

48108, USA. Tel: +1 734.668.9922. Fax: +1 734.668.1957; or at Oogststraat 20, 6004 CV Weert, The Netherlands. Tel: +31 (0) 495.533.666.