

National Electrical Contractors Association

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BIM And The Electrical Industry



Thomas E. Glavinich, D.E., P.E.

Civil, Environmental, & Architectural Engineering

The University of Kansas

What Is BIM?

Building

Information

Modeling

Building Information Modeling

Building Information Modeling (BIM) is the development and use of a computer software model to simulate the construction and operation of a facility.

The Associated General Contractors of America, *The Contractors' Guide To BIM*, AGC Publication No. 2926, Edition One, 2007, p. 3.

Building Information Model

A Building Information Model is a data-rich, object oriented, intelligent and parametric digital representation of the facility, from which views and data appropriate to various users' needs can be extracted and analyzed to generate information that can be used to make decisions and improve the process of delivering the facility.

The Associated General Contractors of America, *The Contractors' Guide To BIM*, AGC Publication No. 2926, Edition One, 2007, p. 3.

Building Information Model

Key Model Concepts

- Intelligent
- Object Oriented
- Data Rich
- Parametric

Key BIM Model Concepts

Intelligent

- Building components can adapt to changing conditions through either a user interface or automatically based on rules associated with the the object.
- Rules determine how the object adapts to other associated objects, database calls, and user input parameters.
- Each object can represent the subset of an entity such as a manufacturer's product line and generate all characteristics, details, options, dimensions, and other data.

Key BIM Model Concepts

Object-Oriented

- The overall model is a collection of objects (sub-programs) that act on each other.
- Each object can receive data, process data, and send data to other objects.

Key BIM Model Concepts

Data-Rich

- Overall building information model and individual objects have information associated with them that describe their attributes.
- Art of modeling is understanding what to include and what not to include. Need to avoid both lack of needed detail and excessive unnecessary and redundant detail.

Avoid Data Rich & Information Poor

Key BIM Model Concepts

Intelligent Object Examples

- Molded Case Circuit Breakers
- Fuses
- Panelboards
- Combination Motor Starters
- Busways
- Fluorescent Troffers
- Other Examples

What Are The Attributes?

Key BIM Model Concepts

Parametric

- Software objects that reflect the real-world behaviors and attributes of construction materials, equipment, and assemblies.
- Parametric model is aware of the characteristics of construction materials, equipment, and assemblies and the interrelationship and interaction between them.
- Parametric model maintains consistent relationships between elements as the model is manipulated.

How Many Models Do We Currently Use To Describe A Single Building?

- Architectural
- Civil
- Structural
- HVAC
- Plumbing
- Power & Lighting
- Data & Communications
- Life Safety & Security
- Many Others
- Site Layout
- Construction Sequencing
- Budget
- Schedule
- Coordination
- Procurement
- Fabrication
- Commissioning
- Many Others

BIM Evolution

- 2D Flat Representation (Plans & Specs)
- 3D Three-Dimensional Representation
- 3.5D 3D Walk Through & Fly Through
- 4D 3D Plus Time (Virtual Construction)
- 5D 4D Plus Cost (Overall Project Mgt)
- XD Extended Application (BIM)

Single Vs. Multi Models

- All various subsystems are interrelated and interdependent in the physical world but are modeled “independently” in design process.
- A building information model is a single model consisting of a set of interrelated subsystems that can be used to describe a facility as well as reliability predict its operational characteristics and response to changing conditions.

Mechanical Designer Assumes A Certain Building Orientation & Skin Material During HVAC System Design. What Happens If Building Orientation And Skin Material Change During Design?

BIM & 21st C Buildings

- Purpose of a building is to provide a controlled environment for occupants.
- Building is a collection of systems that provide a controlled environment.
- Systems' integration is the key to effective and efficient building operations.
- Buildings will be optimized as a system.
- Traditional approach: optimize building subsystems leaving building suboptimal.
- Building quality will be measured by its ability to efficiently support the activity it houses - not its utility bills.

Single Model = Integrated Design

Electrical Contractor BIM Uses

- Estimating & Bidding
- Constructability & Value Engineering
- Determining Construction Means & Methods
- Planning & Scheduling
- Procurement & Expediting
- Project Management
- Fabrication & Prefabrication
- Change Analysis
- Commissioning & Closeout

Software Interoperability Is Ultimate BIM Goal

- BIM software is compatible with project management as well as design and simulation software.
- Software interoperability provides for a seamless exchange of data between software applications and platforms that reduces the need to reenter and reanalyze systems and data each time a change is made.

Similar To Excel Spreadsheet Auto Recalc

BIM Procurement

- Made-To-Stock
- Made-To-Order
- Engineered-To-Order

Building Information Modeling Benefits To Electrical Contractor

- Better Understanding Of Project
- Improved Scope Definition
- Improved Planning & Scheduling
- Ability To Quickly Perform “What If” Analyses
- More Accurate Quantity Estimates
- More Accurate Vendor Price Quotations
- Reduced Errors In The Field & Rework
- Better Trade Coordination - Collision Avoidance
- Increased Prefabrication Ability
- Reduced Risk
- Better Ability To Monitor & Control Project
- Other Benefits

Building Information Modeling Benefits To Owner

- Better Understanding Of Project
- More Accurate Bids With Less Spread
- Reduced Change Orders & Claims
- Reduced Budget & Schedule Risk
- Reduced Operational Risk
- Better Training Of Maintenance Personnel
- Improved Building Information & Accessibility
- Better O&M Information & Records
- Easier Moves, Adds, & Changes
- Reduced Down Time
- Other Benefits

Getting The Model

- **Collaborative Approach** Model is developed collaboratively with the owner, design team, construction team, and others contributing to the model development.
- **Traditional Approach** Model is not developed collaboratively and the construction team must develop its own model based on the information provided by the design team in the construction documents.

Collaborative Approach

- Best approach from construction team and owner viewpoint.
- Building information model evolves through the building life cycle:
 - Planning
 - Design
 - Preconstruction
 - Construction
 - Commissioning
 - Operation
 - Deconstruction
- Controlled “Wikipedia” approach to BIM.

Collaborative Approach Advantages

- Only one model developed and used throughout the building life cycle.
- Increased efficiency for the construction team because there is no need to reconstruct the model.
- Reduced cost to the owner due to elimination of reconstructing the model.
- Improved model accuracy and elimination of errors that occur when reconstructing the model.
- Design documents and construction record documents are reconciled during the construction process. The owner does not end up with two sets of un-reconciled construction documents at end of the project.
- Owner receives a single interrelated data base of at the end of the project with up to date project information that can be used to operate and maintain the facility as well as a reliable basis for future renovations and expansions.

American Institute of Architects Integrated Project Delivery (IPD)

- AIA released two new agreements to encourage IPD, promote information sharing, and require the use of BIM on May 15, 2008.
- The “Transition Agreements” utilize familiar owner-architect agreement with a shared general conditions that includes the architect’s design services and contractor’s pre-construction services as well as the terms and conditions for construction.
- The “Single Purpose Entity Agreement” provides for complete sharing of risk and reward where the owner, architect, and construction manager work together throughout the project to achieve predefined goals.

Traditional Approach

- Traditional BIM approach is similar to the way building information is exchanged today between design and construction teams.
- Design team prepares construction documents and then provides “dumb” documents for the construction team to use to bid and build the project.
- Construction team creates BIM documents from the “dumb” 2D or 3D information provided by the design team.
- Traditional approach requires a lot of redundant work on the part of the construction team.
- Number of reasons for traditional approach but main reasons are the design team’s concern about design ownership and liability when handing over the electronic files to the construction team.

Traditional Approach Disadvantages

- Creating a BIM model from a “dumb” 2D or 3D model increases both the construction team’s and owner’s costs.
- Redundant data input by the construction team results in the increased the risk of errors in the model.
- Not taking advantage of the full capabilities of BIM and the benefits that arise from an integrated approach to design and construction.

Owner Needs To Address BIM & Model Sharing In Its Contract With Design Professional

Methods Of Getting A Building Integrated Model From “Dumb” 2D & 3D Construction Documents

- Construction team designates one member of the team or retains an outside consultant to build the model for all construction team members to use.
- Each member of the construction team builds its own model.
- Everyone uses one trade’s model and modifies it for their own use.

Getting Started With BIM

- Understand the advantages that BIM would have for your firm.
- Understand where BIM is in your market and what your customers are doing.
- Select the right BIM software based on compatibility:
 - Internal needs and preferences.
 - Other software used.
 - Current and future customers and market.
- Get training for key people.
- Reengineer internal processes and procedures to take advantage of this new tool.

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Questions?