What About BIM?

By Wanda Edwards, PE

In 1974, Congress established the National Institute for Building Science (NIBS) to interface between government and the private sector in advancing building science and technology for a better built environment. The Institute has a number of councils and committees working on various projects. One of the councils, the buildingSMART® alliance, is charged with developing digital tools and standards to make the industry more efficient through use of building information modeling (BIM), which allows buildings to be "built" electronically before they are built physically.[1]

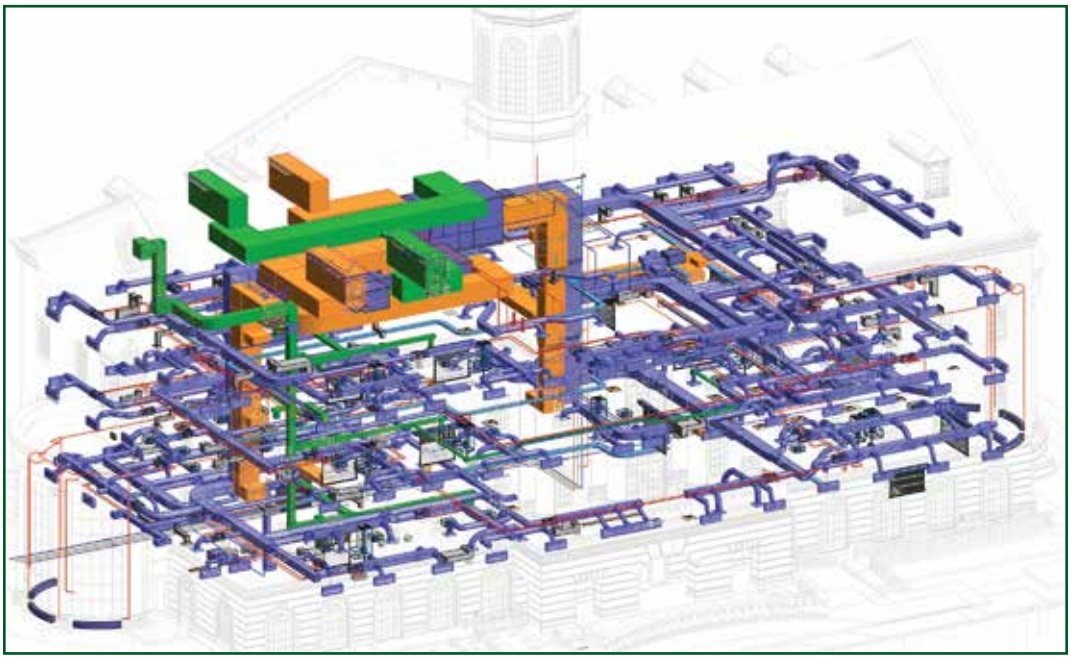

Figure 1 – BIM technology means a change anywhere is a change everywhere. Graphic courtesy of Purdy-McGuire.

As first defined in the *National BIM Standard–United States®* (*NBIMS-US™*), a BIM is "a digital representation of physical and functional characteristics of a facility. As such, it serves as a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its life cycle from inception onward."

The buildingSMART alliance published its latest edition (*NBIMS-US V3*) in May 2015. The document, which effectively doubled the scope of the standard, consists of 19 reference standards, terms, and definitions; nine information exchange standards; and eight practice guidelines to support users in their implementation of open BIM standards-based deliverables. *NBIMS-US V3* is available at no cost as a downloadable PDF. To download a copy, visit www.nationalbimstandard.org.[2]

NBIMS-US provides consensus-based standards through referencing existing standards, documenting information exchanges, and delivering best business practices for the entire built environment. With open BIM standards, we can build detailed models, then deliver accurate products that can be used during commissioning and operation to ensure functionality throughout the life of the facility and to deliver high-performance, carbon-neutral, and net-zero energy-based buildings.[3]

What began as 3-D modeling has since become much more (*Figure 2*). By using BIM, nearly every piece of information that

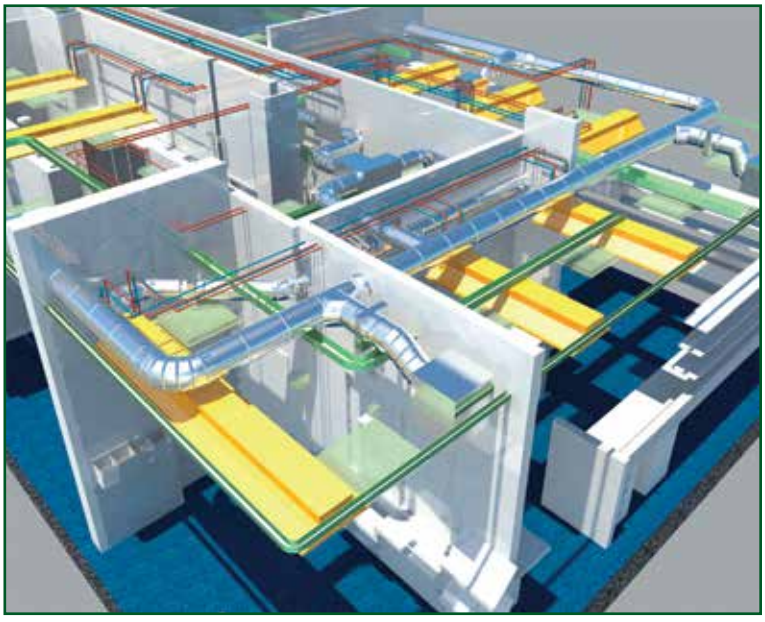

Figure 2 – What began as 3-D modeling has become much more. Courtesy of Building Services Research and Information Association (BSRIA).

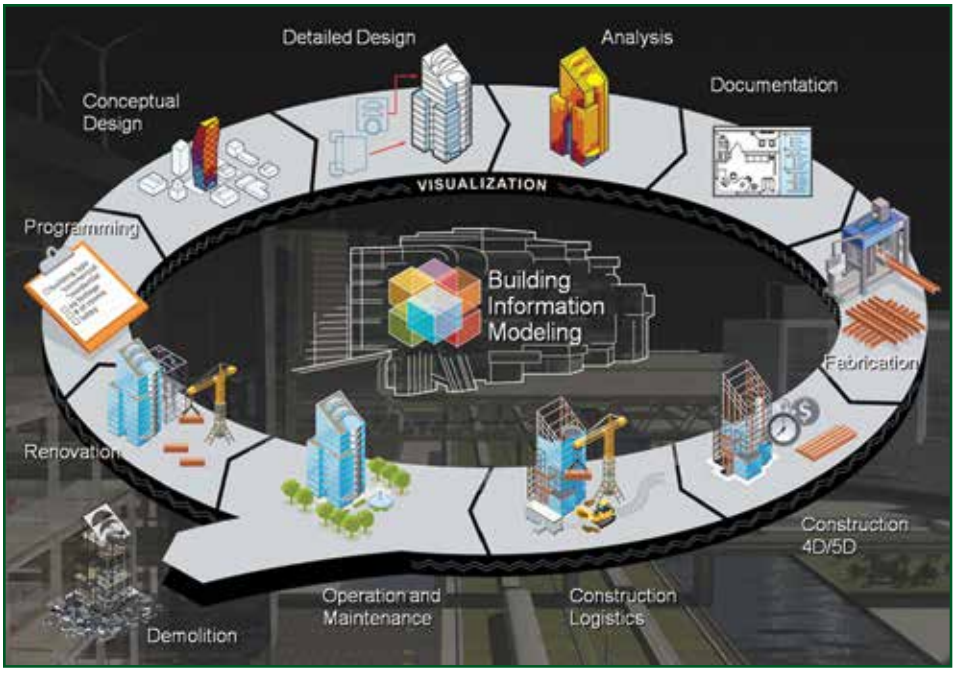

Figure 3 – The many uses of BIM. Courtesy of Laure Carsalade.

an owner needs about a facility throughout its life can be made available electronically. Not only do we have a three-dimensional visualization of the building, but users can also click on items and see all the underlying information about each item. BIM can be used for energy consumption modeling, cost estimating, quantity takeoff, and some types of engineering analyses.

Using BIM improves coordination and communication between designers and contractors, provides users the ability to do a virtual walk-through, allows for more shop fabrications, improves accuracy, and gives owners and facility managers access to critical information for operating and maintaining their buildings.

The purpose of *NBIMS-US* is to advance the art and science of the entire life cycle of the vertical and horizontal built environment by providing a means of organizing and classifying electronic object data and thereby fostering streamlined communication among owners, designers, material suppliers, constructors, facility managers, and all stakeholders associated with the built environment (*Figure 3*). Better communication, project execution, delivery, and contract specifications contribute to a more efficient project-delivery process. Staff resources are optimized, allowing consultants to perform more projects, and the project-delivery expectations become more standardized. The use of BIM works to mitigate risk by creating consistency and predictability across the project. BIM will decrease the overall time of a project, helping to eliminate delays because data is directly shared rather than recreated by each stakeholder. How many times have there been changes made to structural drawings that failed to be incorporated in the plumbing, mechanical, or electrical drawings?

BIM eliminates misinformation caused by multiple participants managing their related information within different systems and using different terminologies.[4]

The BIM standard is targeted to two groups: 1) software developers and vendors, and 2) designers, contractors, owners, and facilities maintenance personnel in order to have access to practice documents to aid in learning. The BIM standard provides reference standards to software developers to be used to create software products. The practice documents are to aid implementation within the building industry.

One of the key elements of the BIM standard is the OmniClass Construction Classification Standard (OmniClass™), published in 2001 by the Construction Specifications Institute (CSI) and Construction Specifications Canada. OmniClass™ is a classification system for the construction industry that can be used for organizing library materials, product literature, and project information.

OmniClass is designed to provide a standardized means of classifying and organizing construction information, including BIM objects and related information. This classification and organization allows for grouping and more refined analysis, storage, and retrieval, or presentation of that information, and can also aid in enhancing information exchanges and other forms of standardized data transfer. All individual OmniClass tables are capable of serving these purposes individually, but the tables are designed to work as a suite, enhancing each other's classifications by increasing the number of access points provided on any object so classified. As a result, increasing the number of OmniClass tables available within an NBIMS-US context will have a multiplicative effect on affected applications.

OmniClass consists of 15 hierarchical tables, each of which represents a different facet of construction information (*Table 1*). Each table can be used independently to classify a particular type of information, or entries on it can be combined with entries on other tables to classify more complex subjects. Thirteen of these tables were incorporated by consensus in the *NBIMS-US*.

Table 11	Construction Entities by Function
Table 12	Construction Entities by Form
Table 13	Spaces by Function
Table 21	Elements
Table 22	Work Results
Table 23	Products
Table 31	Phases
Table 32	Services
Table 33	Disciplines
Table 34	Organizational Roles
Table 36	Information
Table 41	Materials
Table 49	Properties

Table 1 – Listing of the Tables used in BIM.

Below is a brief synopsis of the material contained within each table:

- Table 11 – Classification by construction function
  - Examples: Single-family residence, department store, freezer storage facility, courthouse, hotel, convention center
- Table 12 – Construction by form
  - Examples: High-rise building, suspension bridge, platform, liquid storage tank
- Table 13 – Spaces by function
  - Examples: Kitchen, elevator shaft, office space, sidewalk
- Table 21 – Elements
  - Examples: Structural floors, exterior walls, storm sewer utility, stairs, roof framing, furniture and fittings, HVAC distribution
- Table 22 – Work results
  - Examples: Cast-in-place concrete, structural steel framing, finish carpentry, interior lighting
- Table 23 – Products
  - Examples: Concrete, common brick, door, metal window, curtain walls, pre-engineered structures
- Table 31 – Phases
  - Examples: Inception, conceptualization, criteria definition, design, implementation, handover, operation, closure
- Table 32 – Services
  - Examples: Programming, bidding, estimating, constructing, surveying, maintaining
- Table 33 – Disciplines
  - Examples: Architecture, interior design, mechanical engineering, finance, legal services
- Table 34 – Organizational Roles
  - Examples: Executive, supervisor, owner, architect, specifier, contractor, cost estimator
- Table 36 – Information
  - Examples: Guides, periodicals, design drawings, specifications, codes, leases, deeds
- Table 41 – Materials
  - Examples: Metals, igneous rock, coal tar pitch, glass, plastics, butyl rubber
- Table 49 – Properties
  - Examples: Color, width, length, thickness, depth, inside diameter, fire-resistance rating

Figure 4 – The Journal of Building Information Modeling *is published by NIBS.*

The tables give the reader an idea of the types of data that will be utilized with BIM. Software developers use this information to provide software that will create a 3-D virtual building in which data related to each element is embedded.

The second part of the BIM standard contains practice documents, including planning guides, practical contract requirements, and managing the information handover.

What does BIM mean to owners, designers/vendors, and occupants? To the owner, it means that all the information about how the building should perform and its operational requirements will be available throughout the life of the building. To the project team, it means projects are consistently defined to allow for information to move quickly between parties with less risk of errors or misinterpretation. With BIM, a change anywhere is a change everywhere. Building occupants can view data in three-dimensional pictures, see performance tables and potential energy consumption figures, and review equipment information.

In addition to the information about BIM provided on the NIBS website, information is available through a multitude of videos on www.youtube.com, online training programs, books, the National BIM Library, and training by software producers. Training courses can range from several hours to weeks. Some organizations offer different certifications. Additionally, colleges and universities are beginning to integrate BIM into their course curriculum. NIBS publishes the *Journal of Building Information Modeling* (*JBIM*), featuring peer-reviewed articles related to BIM (*Figure 4*).

REFERENCES

1. National Institute of Building Sciences, buildingSMARTalliance webpage, www.nibs.org.
2. Ibid.
3. National BIM standard webpage, www.nationalbimstandard.org.
4. National BIM Standard – United States version 3.
5. Ibid.

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