Not Your Parents' Way of Doing Business

Approaches to Transforming the Construction Industry
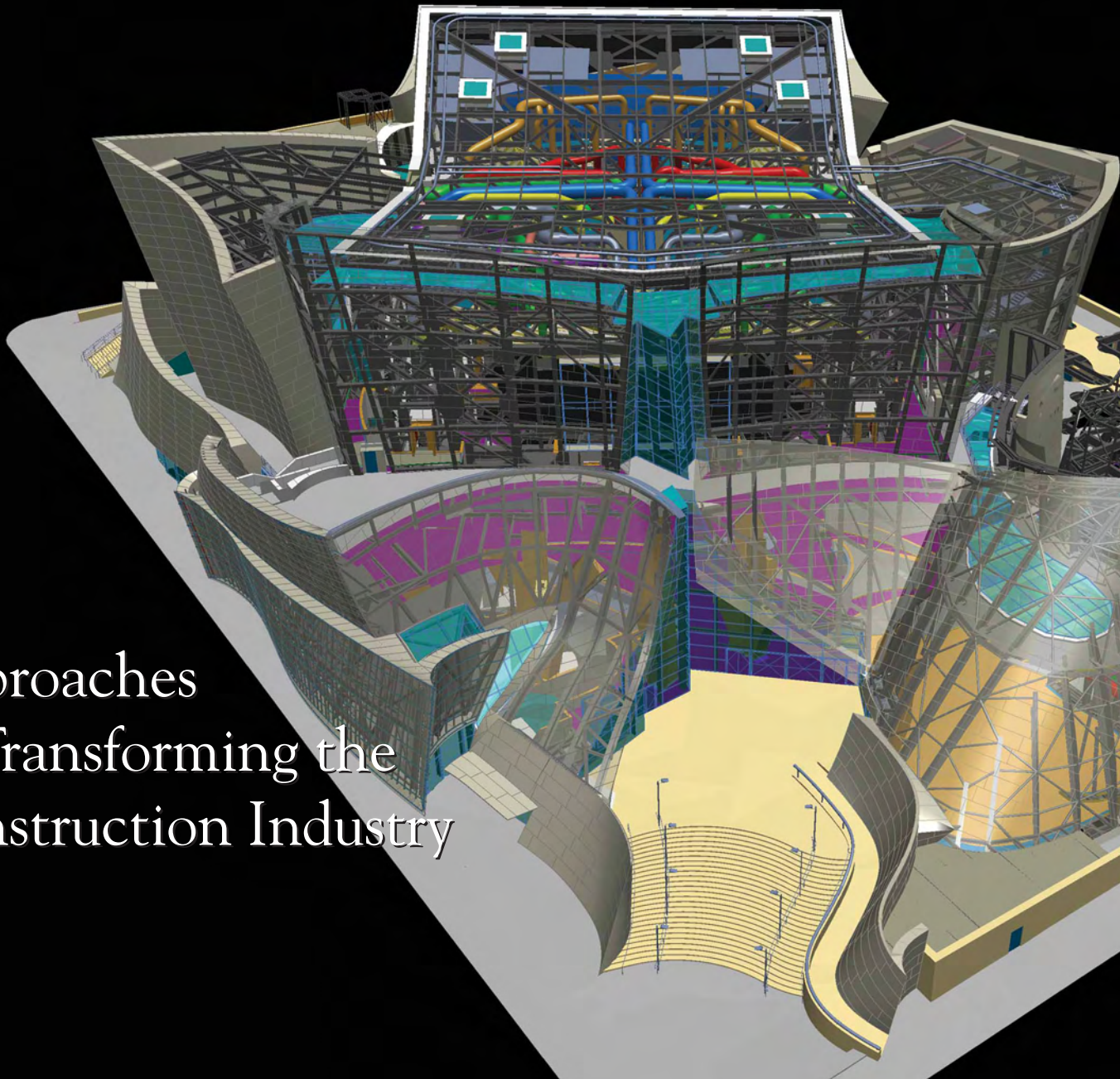
LEAN, Green and Seen

The issues of societal needs, business drivers and converging technologies are making BIM an inevitable method of delivery and management of the built environment

By **Dianne Davis,** Scoping Chair National BIM Standards

"*YOU CAN'T BOIL THE OCEAN*" is a phrase often used when a task seems too large to accomplish. It's a phrase that's been used for many years regarding change in the AEC industry. However, during the last few years it has been seen that humanity has the real potential to boil the oceans.

The AEC industry has a close connection to climate change. The built environment consumes 40 percent of global raw materials. In the United States 136M tons of construction waste and 65.2 percent of electrical power is consumed by buildings each year (according to the U.S. Department of the Interior).

As a global industry, in which the U.S. is only one of the consumption leaders, there is a huge need to reduce all types of waste, maximize and sustain all types of resources, and be able to show what we know to deliver products and services in the most effective ways possible. Reengineering how we think, work, share and use knowledge can produce the sustainability changes in industry processes, delivery and products allowing the AEC industry to go "green".

BACKGROUND ON PROCESS

The construction industry has suffered a 20 percent decline in productivity as compared to other industries. It is generally accepted that there is approximately 30 percent waste in our processes and delivery methods and a NIST study calculated a yearly loss of $15.8 billion dollars due to a lack of information sharing and process continuity (www.bfrl.nist.gov/oae/publications/gcrs/04867.pdf).

Statistically, information is re-created and/or re-entered five to eight times in a project lifecycle. Studies by Shell estimated that 16-17 percent of IT time could be eliminated if this re-entering of data could be eliminated from project execution. Some believe this statistic may be higher in the AEC industry because the building industry is not as highly organized as the process plant environment.

In the manufacturing world studies show a 30-40 percent waste in the design activity. Design waste occurs most often due to incomplete information, imperfect knowledge of requirements, available technologies, or of the market being addressed (www.ugs.com). There is a 30 percent wait-time for information calculated for the construction process.

This waste in time, human capital and IT capability is impacting the industry's ability to be efficient, to make better informed decisions and to be effective collaborators and information providers.

The AEC Industry is evolving:

FROM	TO
Paper-centric	Digitally enabled
Project-centric	Lifecycle sustainability
Stovepipes	Collaboration
Tracking time	Quantifying value
Supposition	Simulation
Outputs	Outcomes
Conversation	Communication
Info-centric	Knowledge management

If global sustainability is a significant reason *why* this industry should change, then LEAN methodologies, BIM and e-enabled business processes with open standards are *how* these changes can come about in a sustainable way supporting the entire building lifecycle.

By incorporating LEAN thinking[1] supported by new business processes, BIM and tools that simulate and enable more informed decisions faster and the automated creation of information, the industry can share the right information at the right time. LEAN, sustainability or green and BIM technologies and processes are the foundation of successful evolution within the industry.

LEAN THINKING, BIM AND SIMULATION

In 1990 Jones and Womack wrote "The Machine That Changed the World" in which they coined the phrase "LEAN Production" to describe the type of manufacturing methods and results found at Toyota. At its heart is LEAN Production. This is about creating value for the consuming customer and eliminating everything else that does not directly contribute to this value creation, i.e. waste.

To support this thinking about waste reduction, the manufacturing industry has moved to virtual simulation for LEAN product design. BIM and related technologies represent this comparable ability in the AEC industry. It is sometimes called Virtual Design and Construction (www.leanconstruction.org). This growing and diverse set of tools specifically around the AEC industry simulation needs are being produced all over the world. These form the foundation of new process approaches and in order to maximize and operations flexibility to use any tool open information standards are required. Another requirement is flexibility and change in process.

Culturally companies in the AEC industry have not seen IT on projects as core or a strategic business activity. This varies amongst the stakeholders, but the majority of AEC organizations purchasing BIM tools are still mimicking a manual process and have not taken this as an opportunity to re-structure internal methods of work to be more IT enabled, LEAN and collaborative.

Those moving to new processes and collaboration are developing these activities

internally or with a few select partners. It looks too large to manage at an industry scale.

LEAN thinking within design, construction and operations adjusts the culture to focus on the development of the right information at the right time. It is created in the most effective and efficient ways to support better decisions and information re-use at all levels of an enterprise and can be re-purposed across all stakeholders.

Two examples of this type of thinking are the mission/business to facility and funding streams simulation through BIM models created as a pilot within the U.S. Coast Guard Roadmap.[2] Another example is General Motors use of Clash Detection Simulation to discover conflicts prior to actual field construction. By changing the process both organizations take advantage of the available tools and reduce waste in human capital, materials, design, construction and management costs.

In development are additional analysis tools by the International Code Council for Code Checking. GSA developed a guide and checking for space and others are working on ADA compliance checking and security checking.

As BIM models move beyond geometry creation for documentation and into the realm of decision support, the need for more intelligence and standardized information use becomes apparent.

These tools require specific data sets because it is the interrelationship of this data that produces the analysis. This makes IT and information at the center of the BIM process.

CHANGING AWARENESS

Over the last six years and since 9/11, the awareness of the convergence of activities supporting change within the industry has quickened but still remains extremely diverse and uneven. A Google search of "Building Information Modeling" produces 211 million listings, "Building Information Modeling and sustainability" produces 7.58 million listings, while a search representing activities underway to support this change "Building Information Modeling, BIM Guides, sustainable design, LEAN, IAI, AIA-TAP,

buildingSMART alliance™, and open standards," produces less than 100 listings.

This progression of Google listings represents a huge "buzz" around the technologies due to marketing; on the other hand it identifies a real gap concerning how and what is needed to implement BIM, LEAN and green.

The FMI/CMAA Sixth Annual Survey of Owners reported once again that problems with co-ordination and collaboration among team members was near the top of the list of concerns that keep owners awake at night. This survey of the largest building owners in the world states that "successful owners build a culture of ownership through the construction process to align the stakeholders and achieve desired project outcomes and program goals." A key ingredient in aligning stakeholders is efficient communication and collaboration.

By the 2007 report owners sited five critical areas: material costs, aging workforce, globalization, BIM, and LEED/Green Building absent a holistic strategy. All are big-picture strategic issues to address and resist tactical solutions. CMMA realized in
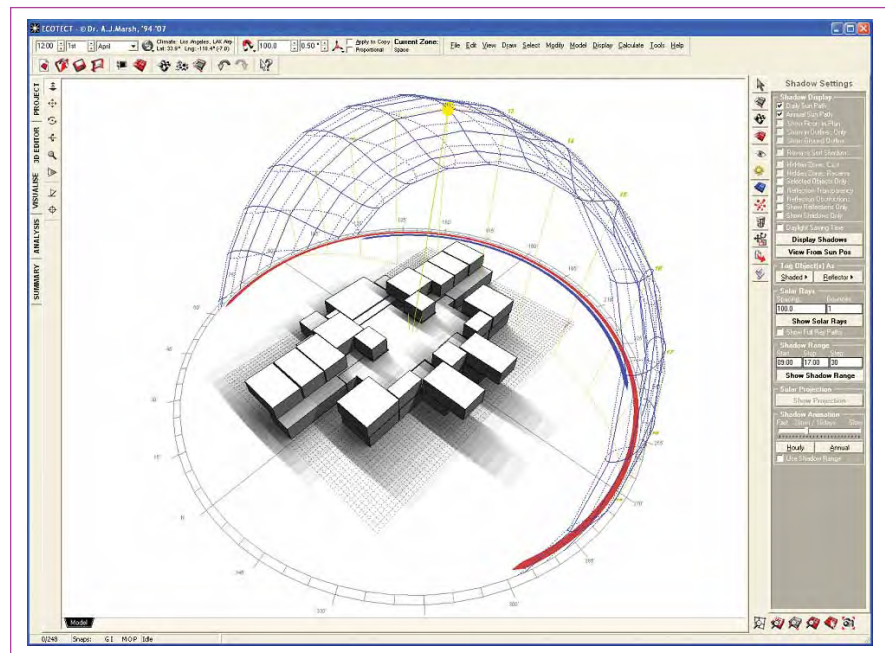
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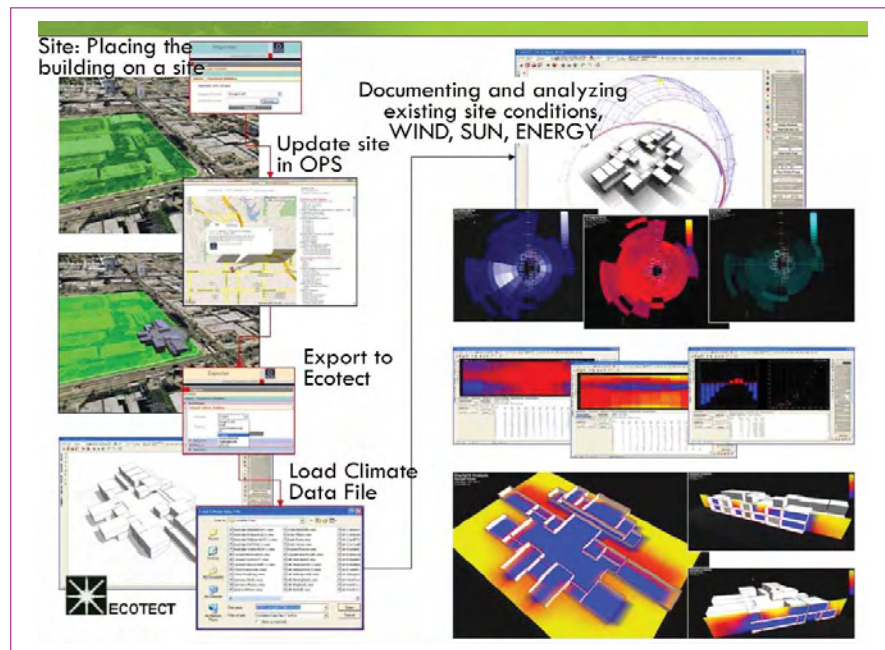
the report that owners, contractors, engineers, architects, construction managers, program managers and building material/equipment suppliers working collectively are much more likely to impact these issues than a single organization working alone (http://cmaanet.org).

Owners have been vocal in their desire for better service and products and see technology use and process improvements supported by BIM and LEAN as a way of pushing service providers to meet their needs. In turn professionals are searching for a true understanding of what

BIM, collaboration, process change and data sustainability mean to their companies and risks on a project.

While some groups are moving rapidly into that 21st century info-centric value chain delivering new value as envisioned by the NIST report ideal, others are stepping carefully or refusing to change.

The professional organizations are each addressing these issues from their constituencies' vantage point. There are now at least six BIM guides and roadmaps addressing BIM and IT use from specific stakeholder perspectives. These are fine examples of

work but the collection of ideas and thoughts do not yet create a cohesive and sustainable enterprise process for the building lifecycle.

BuildingSMART and NBIMS represent activities which take a holistic or LEAN view of the issues and represents a level of harmonization blending all stakeholders' voices into a sustainable IT enabled process (www.facilityinformationcouncil.org/bim/pub lications.php) that can be enterprise or industry wide.

LEAN thinking applied to information creation changes our view of information services in the AEC industry. Data developed as BIM models is a strategic investment and asset for all involved. Information in a BIM is not a static snap shot as in 2D drawings. It is information capable of supporting reporting, more robust data aggregation than database tagging to 2D drawings and finally BIMs support simulation tool deployment.

These differences in process and approach allow the AEC industry to tackle the fundamental issues of change and problem solving. We can use BIMs and related technologies to answer questions not yet asked. BIM allows us to show what we know and to produce and document better more informed decisions faster. The re-use of information rather than its recreation reduces waste and maintains higher quality information in the delivery and management of each building. BIM data can be re-purposed beyond its current understood use breaking down the primary output into constituent parts for other uses.

This accumulation and consistent use of data about the built environment will allow us to move to a higher level of management, one building, one dataset, on information exchange at a time. That is how to boil the AEC ocean. ∎

Dianne Davis is Scoping Chair of NBIMS. She has been working with BIM implementation for twenty years and shared the FIATECH CETI Award for Technology in 2007 with Onuma, Inc.

REFERENCES
[1] Lean Thinking, James P. Womack and Daniel T. Jones.
[2] Simulation developed by AEC Infosystems with Data from Mactec using Archi-CAD, Vertex Data and Common Point Softwares.