ATC 81 Development of IFCs for Concrete

Practitioners Focus Groups

Task 1, Research: Summary of Interviews

April 27, 2010 revision

The individual interviews have been summarized; this document is intended to capture the main themes that participants have discussed. Twenty two professionals were interviewed in-depth; seven were general contractors, five were engineers, five were in fabricating or detailing, one a research professional and four from a provider of rebar detailing software.

Concept and use of BIM:

The large GCs have embraced BIM, and most report quantifiable cost savings from the practice; one GC estimates 6-10% cost savings per project. They commonly use a neutral construction software as a portal to coordinate the various models. The engineers are accustomed to modeling for analysis purposes and are moving into BIM. Fabricators seem to take data "downstream", for the most part, and have very limited opportunities to utilize interoperability due to software package restrictions. On the whole, they seem to be exploring software, with the knowledge that they need to be ready to deal with BIM but a perceived lack of options for software appropriate to their use. Some have been modeling in 3D for a period, but not with the added BIM capabilities. The research professional who participated in an interview currently works to develop tools for GCs to facilitate use of BIM, and so has a hand in many proprietary and open source software packages.

Some firms reported that they currently "share and compile" rather than utilize direct transfer of models. One firm is outsourcing as model experts for other firms and has found that some would rather hire experts than invest in software and training for their own staff.

One firm discussed using BIM as part of the "Public Private Partnership" concept of project development, where a government entity contracts with a consortium of public firms to design, construct and operate a facility. In those types of projects, BIM is an invaluable tool. That participant also identified new revenue streams from offering enhanced as-built models including things like door hardware, paint color and maintenance schedules to the end user.

BIM implementation strategies:

One group reported hiring a special BIM group to implement and develop templates and standards to be adopted firm-wide. Others began by implementing BIM firm-wide with new projects as of a certain date, and are modeling all new projects in BIM. One firm implemented BIM as a communication tool in the field first, and loaded that historical data prior to implementing as a design and management tool. One firm has a BIM group that assesses projects for BIM use based on cost return or higher risk, and invests the resources on those projects only.

Some groups are finding that new employees are coming from trade school, or even high school, with modeling and/or BIM training already, sometimes replacing 2D CAD training completely. One rebar detailer discussed the difference between training a detailer to model and training a modeler to detail; their feeling was that some people will not be able to make the transition from 2D to 3D.

Observations about BIM software:

Most agreed that database-based software is better equipped to handle the large volume of data required to deal with rebar, as well as cost and schedule information. A suggestion was made that IFC be developed to a point where it could be the database that forms the foundation for new software packages, which would naturally ensure interoperability. Another suggestion was that multiple database sources be anchored to the same model, so that wildly varying types of data can be captured and transferred meaningfully.

One participant noted that the introduction of BIM has made designers follow through to a higher level of detail than they have in the past.

Another believes that the retooling of the work process that needs to take place to accommodate BIM and standardize the work flow is significant. One participant characterized it as understanding BIM as a process rather than a technology.

One participant observed that the automotive and aerospace industries can be pointed to as case studies of the concepts behind BIM being implemented and showing demonstrable return.

Obstacles and Remedies:

The lack of standards for describing shapes and rebar – even to the level that fabrication shops often have their own specific sets of shapes and descriptions, there is no standard for communicating shapes and types of concrete forms or rebar, or concrete strength, rebar density, etc. The industry organizations could develop such a standard.

Separate, competing software packages – the point was raised that mechanical software files (SolidWorks, ProE, Inventor) are generally very exchangeable, and it's in the design world that software does not communicate well. Compliance with IFC protocols would address this issue.

Unwieldy file size – many report difficulty using BIM past a certain level of detail due to the file size, especially when discussing rebar. Some offer the database-based software notion as a way around the issue; alternatively, BIM servers are coming into play in some projects.

Lack of data richness – some found that the only data that is reliable is geometry, and that transfers lose the richer information that once was attached to modeled pieces. One suggestion was wider availability of custom fields.

Difficulty staying "up to date" – one participant noted that the rebar industry often has turnaround times on the order of 1-2 days, and that keeping current is difficult with BIM.

Timing – some rebar and detailing participants felt that they are generally not engaged early enough in the process to gain any benefit from BIM. They felt that the solution would be an early teaming, where they are involved and can help with arrangement and constructability from the beginning.

Trust issues – the issue of trusting other professions to a) use the model with the same purposes in mind, b) enter accurate data in the appropriate manner and c) interpret data as intended were expressed. The remedy seems to be early adoption of a collaborative paradigm. Doubts about fidelity can be addressed through start-to-finish coordination, where many practitioners use and review the model all the time. One GC indicated that they take off a model unit 12 to 15 times before it is built, which represents continuous checking and discovery

of any errors. Additionally, the AIA's Level of Detail definitions go a long way toward defining the uses and expectations of a model at various points in the project life, which should offer all stakeholders a uniform playbook to work from.

Legal concerns – Many participants have encountered reluctance to share data from a liability and/or intellectual property rights standpoint. One participant characterized this as a fear of new technology. He believes that the legal obligation and the ownership of data is the same as always, simply represented in a new format, and feels that the issue will resolve itself. It was suggested that this area needs to be addressed industry-wide.

Cost of software and training – it is prohibitive, and one firm suggested that they are hired as expert consultants by many firms who wish to avoid the cost of software and the software selection process.

Culture of "why?" (*resistance to change)* – all participants experienced the obstacle of resistance to change, and most considered it the biggest obstacle to implementation of BIM. One firm reported that the older field superintendants and estimators were the least welcoming of BIM due to a culture of "why?" However, the firm that first loaded the tool with historical data reported that those users were the most welcoming. They had time to get familiar with it as an aid only, and were only later asked to rely on it as a primary tool. The method of implementation is crucial.

Benefits of BIM reported:

Early clash detection
Early cost estimating
Change propagation
Automated construction document production
Schedule and materials management
Availability of quality historical data for use in future project planning
Availability of a building model for owner use
Value as a marketing tool
Use as a relationship-builder with owners and facilities managers

Thoughts on Future Direction:

Owner requirements for IDM have been an issue, in that some owners proscribe the BIM software to be used. For some firms this means purchasing and learning new software or being ineligible. Real interoperability, however, would allow delivery in any package required.

The suggestion was made that the software developed in the future should be database-based, and perhaps even using IFC as the prototype database.

It was also suggested that prefabrication and offsite fabrication will dominate the drive to BIM, rather than onsite fabrication, and the place for development is with suppliers.

All agreed that the investment in BIM will ultimately be recouped, though the fabricator in the group felt his profession would be one of the last to reach that threshold. Cost savings in construction seems to be the first and most quantifiable benefit, but ultimately the owner benefits the most when higher quality projects are delivered for less cost in less time. BIM has engendered a shift to a collaborative paradigm, allowing construction information to mesh into the early stages of design and eliminating the traditional extended iteration process.

Glossary of Terms:

BIM – Building Information Modeling is the process of generating and managing building data during its life cycle. Typically it uses three-dimensional, real-time, dynamic building modeling software to increase productivity in building design and construction. The process produces the Building Information Model (also abbreviated BIM), which encompasses building geometry, spatial relationships, geographic information, and quantities and properties of building components. *(definition from Wikipedia)*

IFCs – Industry Foundation Classes - The IFC data model is a neutral and open specification that is not controlled by a single vendor or group of vendors. It is an object oriented file format with a data model developed by buildingSMART (International Alliance for Interoperability, IAI) to facilitate interoperability in the building industry, and is a commonly used format for Building Information Modeling (BIM). The IFC model specification is open and available. *(definition from Wikipedia)*

Interoperability – With respect to software, the term interoperability is used to describe the capability of different programs to exchange data via a common set of exchange formats, to read and write the same file formats, and to use the same protocols. *(definition from Wikipedia)*

IDM – Integrated Data Management is a tools approach to facilitate data management and improve performance. IDM consists of an integrated, modular environment to manage enterprise application data, and optimize data-driven applications. It manages data over its lifetime, from requirements to retirement. *(definition from Wikipedia)*

LOD (100 through 500) – Level of Development, as established by AIA. They consist of:

LOD 100 - Essentially the equivalent of conceptual design, the model would consist of overall building massing and the downstream users are authorized to perform whole building types of analysis (volume, building orientation, cost per square foot, etc.)

LOD 200 - Similar to schematic design or design development, the model would consist of "generalized systems or assemblies with approximate quantities, size, shape, location and orientation." Authorized uses would include "analysis of selected systems by application of generalized performance criteria."

LOD 300 - Model elements are suitable for the generation of traditional construction documents and shop drawings. As such, analysis and simulation is authorized for detailed elements and systems.

LOD 400 - This level of development is considered to be suitable for fabrication and assembly. The MEA (*model element author*) for this LOD is most likely to be the trade contractor or fabricator as it is usually outside the scope of the architect's or engineer's services or would constitute severe risk exposure if such parties are not adequately insured.

LOD 500 - The final level of development represents the project as it has been constructed - the as-built conditions. The model is suitable for maintenance and operations of the facility. *(definition from AIA E202)*

Interview Participants:

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Mahela Birley, Condor Rebar
Greg Hutchinson, Condor Rebar
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Jason Lien, Encon United
John Eddy, SSOE Group
Jim Dick, Pankow Builders
Luis Perez, Pankow Builders
Bill Klorman, Klorman Construction
Dennis Hunter, Gerdau Ameristeel
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