W205 BIM Best Practices
December 9, 2008
Kurt D. Maldovan
kurt.maldovan@jacobs.com
BIM in Planning:
• Early Design Tool
• Links to Cost Model/Program

BIM in Design:
• 35 Active Full BIM Designs
• All Disciplines, All Phases
• Coordinated Designs

BIM in Construction:
• 7 Full BIM Designs in Construction
• 12 VDC Projects
• 2000-2005 – Pockets on BIM/4D
• November 2005 – Internal BIM and 4D Discussions
• January 2006 – Commissioned A BIM Task Force
• March 2006 – Best BIM Path Forward Project
• April 2006 – First Full BIM Project (All Disciplines/Phases)
• July 2006 – Committed to doing All Projects in BIM
• May 2007 – First three BIM Projects into Construction
• August 2007 – Developed Integrated VDC Scope and Approach – Began VDC Dialog with Clients
• October 2007 – Began aggressively proposing Integrated VDC Delivery – 12 Active Projects with varying levels of VDC Application
• November 2007 – 22 BIM Projects/ Today 35 Projects
Typical Scope Of BIM On 1st Projects

- All Disciplines Involved in BIM
- BIM Used In All Phases Of Project
- Majority Of Drawings Will Come From The Model
- Use Interference Detection/Management
- Model Will Be Used To Develop Quantities
- Use 4D Scheduling to Evaluate Constructability
- Design Reviews Done In The Model
- Design Model Used In Construction
Key Metrics For BIM/VDC:

1.) **Schedule Compression and Utilization:**
   - Accomplish more work in shorter time-frame
   - Focus more time on Design problem solving and project solutions

2.) **Design Quality and Constructability:**
   - Eliminate design related change orders in construction
   - Eliminate client review comments related to coordination

3.) **Deliver Solutions for the Lifecycle:**
   - Apply 6D delivery across all projects linking 3D visualization with cost, schedule, commissioning, and O&M
   - Exceed client expectations with an integrated practice model
What Works Well:

• Drawings From Models
• Coordination From Models
• Quantities From Models
• BIM as a Design/Engineering Tool
• The BIM-Based Work Process
• Team- Can Do Attitude

Challenges:

• The tools are perfect until you start to use them
• Models need to be accurate and up-to-date
• Model File Sizes and Tool Performance
• The Details – Standard Details in CAD, Model Detail required to create Drawing Details.
• Interoperability/ Multi Office/ Large Project Collab.
• Work Process Change is uncomfortable
Typical Scope Of BIM On 2nd Projects

- Imbed Manufacturers Data
  - Schedules
  - Procurement
  - O&M Baseline
- Design Automation
  - Routing
  - Layouts
  - Connections
- BIM Integration with Analysis
  - Structural
  - Sustainability
  - Lighting
  - Power
  - Code Analysis
What About My Drawings?
1.) Started Day One With Design Planning and Integrated Decision Making

2.) As Design Modeling Commenced, Visual Coordination Took Place

3.) Daily, Automated Interference Detections Were Run/Reported

4.) Design Team Collaborated to Resolve the Interferences and Optimize The Design
Design Reviews in BIM

- Utilized Model Review Technologies to provide design team the ability to Collaborate within the model
  - Walkinside – Virtual Hardhat reviews
  - Navisworks virtual Navigation and analysis environment
Quality Control of BIM

1.) Check- Model & Extracted Drawings
2.) Coordinate- Resolve System Interferences Prior to QC
3.) Develop QC-Specific Extractions to aide Review Teams
4.) Focus on Evaluating the Design Model’s Constructability & Operational aspects of each System
BIM + Schedule

• Use Model to Establish Schedule (in Design)
• Iterative Process to Optimize Approach
• Simulate Site Logistics, Evaluate Safety (Safe-D)
• Develop Detailed Short-term Look-ahead's
• Design for Construction
Utilizing Building Information Modeling in Design to Support Cost Estimating

Lin Quong Yang, Kurt Haldeman, and John Meenen

ABSTRACT

Building Information Modeling (BIM) can provide innovative approaches to building design, construction, and management. One area in which BIM provides improvements over traditional methods is in quantification and estimating. BIM includes information about building elements such as walls, doors, and windows, as well as information on element properties including length, height, and volume, which can all be used for estimating. This information contained within BIM makes it possible to extract parametrically intelligent building quantities.

Though BIM does not generate automatic cost estimates, one of its significant advantages over traditional 2D drafting-based cost estimating is that it streamlines the change management process. Since the information in BIM is always synchronized with the design, any changes to the design are automatically reflected in the takeoff and quantities used by the estimator. This can reduce potential human error and result in more accurate quantities and cost estimates. Traditional industry databases are still used to determine the estimated costs. By using BIM and accurately generated quantities, estimators are given more time to practice the "art of estimating." Estimators can now help designers think more about the constructability of their projects through sophisticated modeling and estimating tools.

In this paper, two case studies are used to illustrate how BIM can be used to support cost estimating in an architectural and engineering design firm. Challenges associated with the practical implementation of semi-automated estimating given the current data representation in the models are explored. The benefits of using BIM in design to support quantification and estimating along with lessons learned are provided.

Keywords: Building Information Modeling, Quantification, Cost Estimating

<table>
<thead>
<tr>
<th>Quantities From BIM</th>
<th>From BIM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply</strong></td>
<td><strong>Supply</strong></td>
</tr>
<tr>
<td>W1 (ft)</td>
<td>D1 (ft)</td>
</tr>
<tr>
<td>34</td>
<td>15</td>
</tr>
<tr>
<td>36</td>
<td>16</td>
</tr>
<tr>
<td>36</td>
<td>16</td>
</tr>
<tr>
<td>36</td>
<td>32</td>
</tr>
<tr>
<td>36</td>
<td>32</td>
</tr>
<tr>
<td>40</td>
<td>18</td>
</tr>
<tr>
<td>40</td>
<td>18</td>
</tr>
</tbody>
</table>

**HVAC - Ductwork**
The objective of the Construction-Operations Building Information Exchange (COBIE) project is to create an open-standard through which information created during design and construction can be transferred directly to facility operators, maintainers, and managers in useable electronic format.

---

**Contact Worksheet**

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Contents</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Contact</td>
<td>People/offices/companies referenced in this file.</td>
<td>All</td>
</tr>
</tbody>
</table>

**Design Worksheets**

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Contents</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Facility</td>
<td>Identification of facility(ies) referenced in a file</td>
<td>Designer</td>
</tr>
<tr>
<td>3</td>
<td>Floor</td>
<td>Description of vertical levels</td>
<td>Designer</td>
</tr>
<tr>
<td>4</td>
<td>Space</td>
<td>Spaces referenced in a project</td>
<td>Designer</td>
</tr>
<tr>
<td>5</td>
<td>System</td>
<td>Systems referenced in a project</td>
<td>Designer</td>
</tr>
<tr>
<td>6</td>
<td>Register</td>
<td>Material/equipment/etc. catalog (submittal register)</td>
<td>Designer</td>
</tr>
<tr>
<td>7</td>
<td>Component</td>
<td>Individually named materials and equipment</td>
<td>Designer</td>
</tr>
<tr>
<td>8</td>
<td>Attribute</td>
<td>Material/equipment/etc. properties</td>
<td>Designer</td>
</tr>
<tr>
<td>9</td>
<td>Coordinate</td>
<td>Location of spaces and components</td>
<td>Designer</td>
</tr>
</tbody>
</table>
Lesson Learned: Transitioning Model to Construction

- Owner Should be Conduit to Share the Model
- Model Should be Shared with Bidders
- Review Model at Pre-bid Conference
- Provide Model to Awarded GC
- Metrics- RFIs/ Change Orders/ CCGs

Raises Understanding and trust level
Reduces Contractors’ level of perceived risk
Bridging A/E BIM Design into Construction

The Line Between BIM Design and BIM Construction

- BIM-Based Design Models have **80%** of the Data that the Contractor needs for construction.
- Contractors need to add the Remaining **20%** of Data
  - Primarily Comes From *Sub-Contractors*
  - Sub-Contractor Models are Merged Into Design Models
- Design Model Data Changes
  - Based on Specific Sub-Contractor and Manufactures Submittals
  - Sub-Contractor Models Replace/Update Data In The Design Model
- Design/Construction Changes during actual assembly of building
  - Contractor Updates Design/Construction Data Based on Assembly
The BIM Integrator - A New Business Line
BIM Integration - Approach

Team Phases Delivery

Integrated BIM

A/E Models Design

Contractor Builds From The Model

Owner Operates From Model

Design Phase

Construction Phase

Operations Phase
Keys to Success

- BIM Execution Plan
- Controlling BIM Model Performance
- Fully Coordinated CD’s in BIM
- Visualization
Resources

- www.bimwiki.com
- USACE BIM Roadmap
- NBIMS V2.0
- WBDG
- Autodesk Communication Spec
- Consensus Docs
- AIA IPD Guide and Contract Language
Discussion

Contact:

Kurt Maldovan
BIM Integrator
571-218-1439

kurt.maldovan@jacobs.com