S500- BIM Best Practices
May 22, 2008
Building Information Modeling

Implementation, Innovation, and Lessons Learned
**BIM in Practice**

**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:**
- 5 Full BIM Designs in Construction
- BIM Goes to the Field
Jacobs BIM Timeline:

BIM Implementation Timeline:

- 2000-2005 – Pockets on BIM/4D Innovation
- November 2005 – Internal BIM and 4D Discussions
- January 2006 – Commissioned A BIM Task Force
- March 2006 – Best BIM Path Forward
- 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/$1.4B Construction
Why BIM/VDC At Jacobs?

• In the Long-term View:
  – The dissatisfaction of clients with the current performance of the design and construction industry is a critical factor.
  – Advent of the “Integrated Project Delivery” concepts and practices
  – The maturation of BIM technology, which enables continuous integration of design fabrication and assembly.

• In the Short-term View:
  – The escalation of construction costs, driven by material and labor inflation, and an increased level of construction activity taxing the industry’s capacity, is creating an urgent need for an alternative approach.
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
Scope of BIM In Design:

Structural

Mechanical

Piping

Lighting

Architecture

Building Information Model

Telecommunications

Embed Criteria
Advanced Planning
Design To Cost and Estimating
Design Solutions
Value Engineering
Coordination, Constructability
Design Review
Construction Documents
The BIM Learning Curve:

- Early BIM Learning Curve – 25/35
- Gaining Efficiency in Latter Phases
- Second BIM Project is More Efficient than CAD
Project/Team Expectation Timeline:

- **1**\textsuperscript{st} Project – Build Coordinated Model – Create Drawings
- **2**\textsuperscript{nd} Project – Maximize Usage of all BIM Capabilities
- **3**\textsuperscript{rd} Project – BIM Potential is now Project/Client Value
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
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?

**Design Model**
- Direction
- Cut Plane

**Drawings**
Comprehensive Models:

- Clash Detection
- Design Review
- Quantification
- 4D Constructability
Jacobs Viz Lab Technology

- Review and Evaluate the Design
- Reviews Enhanced thru Visualization
- 3D Printing for Virtual Prototyping

Manage Tenant Expectations – No Surprises
BIM Enhanced Design Reviews

Walkinside
1.) QC Process Focused On Checking both the Model and the Extracted Drawings
2.) Coordination- Resolved System Interferences Prior to QC Checks
3.) Developed QC-Specific Extractions to aide Review Teams
4.) Focused on Evaluating the Design Model’s Constructability and the Operational aspects of each System
5D - BIM and Cost:

BIM + Quantities/Cost

Utilizing Building Information Modeling in Design to Support Cost Estimating

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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 of building elements such as walls, doors, and windows, as well as design information from various elements including weight, height, and volume, which can all be used for estimating. This information contained within BIM makes it possible to enter parameters into intelligent building quantities.

Though BIM does not provide automatic cost estimations, one of the significant advantages over traditional 3D modeling based on estimation is that it can directly include design quantities. Detailed information in BIM is always consistent with the design, any change to the design can automatically update the takeoff and costs used by the estimator. This creates potential time savings and results in more accurate quantities and cost estimates. Traditional industry databases are still used to determine the estimated costs. By using BIM and accurately capturing quantities, estimations are given iterations to predict the "art of estimating." Software can now help design teams make more accurate estimations and support the cost estimating. BIM provides a unique opportunity to create more accurate quantities and cost estimates.

In this paper, two case studies are used to demonstrate how BIM can be used to support cost estimating in an architectural and engineering design firm. Challenges encountered regarding the practical implementation of BIM-automated estimating given the current data representation are also discussed. The benefits of linking BIM in design to support cost estimating and estimating along with the toolset are presented.

Keywords: Building Information Modeling, Quantification, Cost Estimating
6D - BIM for Commissioning and O&M:

The Key – Determining what data is needed (and when) for eventual facility operation

- O&M Data/Process Starts In Design Phase Model – Attributes for Spaces, Rooms, Components, and Materials
- “As-Designed BIM” Attributes Are Refined/Replaced in the Procurement, fabrication and assembly processes during Construction
- “As-Constructed BIM” Attributes in Digital Format usable by a Computerized Maintenance Management System (CMMS)
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.
### Building Assets

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<th>Quantity</th>
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Note: Mod 7, includes Chiller Room Modifications Phase 1 & 2.
VDC: Capturing Existing Facilities in BIM

Laser Scan for Existing Conditions

- Survey Effort is Reduced
- BIM is Used for New Design
- Coordinate thru Interference Management
- Eliminates Field Rework
Technology in the Trailer:
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