BIM Design & Construction Requirements

Follow-up Seminar

September 10, 2009

www.indiana.edu/~uao/iubim.html
Two years ago Indiana University began the process of embracing the use of Building Information Modeling (BIM) Technologies for its facility design, construction and management needs. It believes the application of these principles will help sustain its place in the community, underscore its commitment to stewardship of public funds, enhance its commitment to sustainable design for the future and ensure it continues to provide the highest quality education opportunities for all.

Early this year, IU commissioned SHP Leading Design to develop “standards” for transitioning into a BIM environment. The objective was to create an approach for moving the institution and the marketplace from one set of delivery models to a new set that are built upon the foundation of BIM. This is the start of a process not the end. As BIM matures, so will the skills of those whose embrace its potential. This seminar is offered to help advance the application of these principles. Your feedback in support of IU’s objectives is encouraged and welcome.
Agenda

Section 1 - Opening Comments - Overview of Proceedings
(+/- 1:00 PM to 1:20 PM)

Section 2 - Measuring Market Capabilities
(+/- 1:20 PM to 1:45 PM - Q&A to 2:00 PM)
- BIM Proficiency Matrix (BPM)
  Measures the Present - Informs the Future

Section 3 - Recording Roles & Responsibilities - BIM Execution Plan (BEP)/Integrated Project Delivery (IPD) Plan
(+/- 2:00 PM to 3:00 - Q&A to 3:10 PM)
- Defines Project Parameters
- Establishes Baseline for Fees
- Establishes Team Performance Objectives
- Establishes Contract Obligations
Agenda

Break - (15 Min.)
(+/- 3:10 PM to 3:25 PM)

Section 4 - Collision Reporting / Concurrent As-Built Documentation
(+/- 3:25 PM to 4:00 PM - Q&A to 4:15 PM

  Goals and Objectives
  Technology Applications
  Cost / Benefit Models
  Contract Responsibilities

Section 5 Timing / Roll-out / Resources
(+/- 4:15 PM to 4:30 PM)

Section 6 - Questions & Answers
(+/- 4:30 PM to 5:00 PM)
Today’s Discussion

- Information Sharing - Updates and Refinements to Proposed Guidelines
- Q & A at the end
- This is NOT a forum to debate Indiana University's commitment to this transition.
- Questions not answered due to time will be documented and answered in a follow up communication and/or posted on IU website.
- This is the start of the transition process, not the end. Refinement and adjustment are inevitable.
- IU is grateful for your attendance and interest and welcomes constructive feedback.
- Please direct all questions through IU, specifically, Ms. Theresa Thompson, Director of In-House Projects / Spatial and Project Information  ththomp@indiana.edu
SHP Leading Design

- 108 years old – 135 employees – 3 Ohio offices
- Full Service Arch / Interiors - MEP with Full Revit Production all Disciplines - All Consultants
- $900,000,000M+ in completed work in Revit All disciplines - 150+ projects
- 70 LEED AP’s on staff – USGBC national trainer – 1000+ trained as of 08/09
- Tenth year of Integrated Design and Construction Practice called 2enCompass
- Ongoing FM Services Company inside SHP last five years - PointGuard
- Consultant to Autodesk
- Strategic Partner with Avatech

www.shp.com
Key Influences on Growth of BIM

- Economy / Environment / Technology Driving the Transition
- Growing Trend of Consolidated Design Service methodologies
- Design moving from Parts & Pieces to Holistic Virtual Analysis Platform
- Convergence of Design, Construction and Facility Management Services
- Growing demand / recognition of the value of Integrated Project Delivery (IPD)
  (Maximization of BIM demands Integrated Project Delivery (IPD))
- The increasing performance objectives for LEED and sustainable practices and applications
Industry Changing Initiatives

- GSA adoption of BIM requirements for all future work - recent BIM standards request
- The Army Corps of Engineers
- DOD, DOE, DOJ, NASA and others
- The State of Wisconsin
- The State of Texas
- Major Commercial / Industrial players
- Major Higher Education Institutions
  - USC
  - MIT
  - Princeton and others.............
Goals & Objectives

- Benefits of Change:
  - Capture Information Early / Throughout
  - Improved Change Management
  - Better Construction Documents
  - Enhanced As-Built Accuracy
  - Database Links to IU FM / Campus Management
  - Support Research Compliance Tracking (NIH, CDC, EH&S, etc)
  - Support Accreditation Documentation
  - Decrease Cost Of Managing Information / Facilities
  - Improved Energy Conservation / Simulation
  - Establish Standards for Future
Non-Negotiable Requirements

- IU BIM Guidelines for Architects, Engineers and Contractors
- COBIE data Inclusion in Model files - design and construction
- REVIT model deliverable at completion of project - scope to be determined by BIM Execution Plan (BEP)
- BEP and Integrated Project Delivery (IPD) Plans included in contract requirements
- Use of ProjectDox
- Clash Detection Verification / Design and Construction
- As-built Record Documents: (all IU projects as of 10.01.09)
  - CAD /pdf as-builts & COBIE design data - A/E Consultants
  - Scanned .tif files from field markup set by Contractor
  - O&M Manuals / COBIE data - Contractors
Section 1

Initial Applications

- New work (+/−$5M) and any subsequent additions / renovations
- Design-Bid-Build Contracts
- Design-Build Contracts
- Starting at Design (new construction & renovations)
- Starting Construction (from Bid Award)

Timing of Implementation

- Begin June 2009
- Initiated +/- 30-day Industry Feedback - June 2009 - Mid-July 2009
- Process Feedback Seminar September 10, 2009
- Adopt / Publish BIM Requirements - October 2009
- Goal - Full Transition by mid-2011
BIM Transition Categories

**WHO?**
WHO in the marketplace has the Skill Sets for BIM and at what level?

**WHAT?**
What is each Team member's role and responsibility in a project done in a BIM environment?

**HOW?**
What techniques for promoting / effecting an integrated delivery method is the team employing?
Key Elements of IU BIM Standards

- BIM Proficiency Matrix (BPM)
- BIM Execution Plan (BEP)
- Integrated Project Delivery (IPD) Process Plan
- IU ProjectDox Required (Web Project Collaboration)
- Clash Detection / Concurrent As-Built Documentation
- IU BIM Guidelines
http://www1.eere.energy.gov/buildings/qualified_software.html

- In addition to this list, the designer may also use the following DOE 2 based software:
  - Green Building Studios
  - Ecotect
  - eQuest

- Local weather data shall be obtained from TMY2 or TMY3 weather data tables. Weather files can be downloaded from the National Renewable Energy Laboratory website at the following link:
  http://rredc.nrel.gov/solar/old_data/nsrdb/tmy2/

### 2.5. Design Team Deliverable Schedule and Milestones

The submittal schedule along with the milestones for any given project is listed below:

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Deliverable</th>
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</thead>
<tbody>
<tr>
<td>Conceptualization Phase</td>
<td>Architectural Massing Model</td>
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<td>Preliminary Energy Model</td>
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<td>Schematic Design Phase</td>
<td>Architectural Model</td>
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<td>Schematic Energy Model</td>
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<td>Civil Model</td>
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<td>Initial Collision Report</td>
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<td>Square Foot Cost Estimate</td>
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<td>COBIE Design Data (worksheets 02-05)</td>
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<td>Design Development</td>
<td>Architectural Model</td>
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<td>Detailed Energy Model</td>
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<td>MEP Model or Models</td>
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<td>Structural Model</td>
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<td>Civil Model</td>
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<td></td>
<td>Discipline Collision Report</td>
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<td>System Cost Estimate</td>
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<td>Program Validation</td>
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<td>COBIE Design Data (worksheets 02-06)</td>
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<tr>
<td>Construction Documents</td>
<td>Architectural Model</td>
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<td>MEP Model or Models</td>
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<td>Structural Model</td>
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<td>Civil Model</td>
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<td>Pre-Bid Collision Report</td>
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<td>Quantity Estimate</td>
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<td>COBIE Design Data (worksheets 02-07)</td>
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</table>
The BIM Proficiency Matrix is used to assess the proficiency of a respondent’s skill at working in a BIM environment. It is one of many selection criteria for a given project.

<table>
<thead>
<tr>
<th>Category</th>
<th>A - Physical Accuracy of Model</th>
<th>B - IPD Methodology</th>
<th>C - FM Data Richness</th>
<th>D - Construction Data</th>
<th>E - As-Built Modeling</th>
<th>F - Content Creation</th>
<th>G - Location Awareness</th>
<th>H - Calculation Mentality</th>
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<tbody>
<tr>
<td>Number</td>
<td>1</td>
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<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
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<td>1</td>
<td>Basic Model Geometry</td>
<td>Creation of A BIM</td>
<td>Space Management Data</td>
<td>Quantity Takeoffs</td>
<td>Post Bid Model</td>
<td>Geometrically</td>
<td>Site Orientation</td>
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<td>Model Execution Plan</td>
<td>Execution Plan</td>
<td>Data</td>
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<td>Documentation</td>
<td>Correct Content</td>
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<td>Export (Disciplinary)</td>
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<td>Design Requirements</td>
<td>Introduction of</td>
<td>Asset Management</td>
<td>Object Scheduling</td>
<td>Coordination</td>
<td>Manufacturer's</td>
<td>Existing Environment</td>
<td>IPD Integration</td>
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<td>Structural and</td>
<td>Management</td>
<td>Modeling</td>
<td>Specific</td>
<td>Specific Awareness</td>
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<td>3</td>
<td>Design Side Collision Detection</td>
<td>Model Managers</td>
<td>Manufacturer Specific</td>
<td>Material Procurement</td>
<td>Recapturing Design</td>
<td>Design Intent</td>
<td>Global Accuracy</td>
<td>Interdisciplinary</td>
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<td>Role Defined</td>
<td>Information</td>
<td>Procurement</td>
<td>Intent</td>
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<td>Calculations</td>
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<tr>
<td>4</td>
<td>Model Accuracy Innovation</td>
<td>IPD Methodology</td>
<td>FM Data Innovation</td>
<td>Construction</td>
<td>As-Built Innovation</td>
<td>Content Innovation</td>
<td>Location Innovation</td>
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<table>
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<tr>
<th>BIM Maturity Category</th>
<th>Points Achieved</th>
<th>BIM Maturity Score</th>
<th>BIM Standard</th>
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</thead>
<tbody>
<tr>
<td>A - Physical Accuracy of Model</td>
<td>0</td>
<td>0</td>
<td>Working Towards BIM</td>
</tr>
<tr>
<td>B - IPD Methodology</td>
<td>0</td>
<td>0</td>
<td>Certified BIM</td>
</tr>
<tr>
<td>C - FM Data Richness</td>
<td>0</td>
<td>0</td>
<td>Silver</td>
</tr>
<tr>
<td>D - Construction Data</td>
<td>0</td>
<td>0</td>
<td>Gold</td>
</tr>
<tr>
<td>E - As-Built Modeling</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>F - Content Creation</td>
<td>0</td>
<td>0</td>
<td>Ideal</td>
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</tbody>
</table>
BIM Proficiency Matrix (BPM)

Key Concepts

- Evaluation Tool for BIM Proficiency in marketplace
- Communicates Owner intent regarding BIM objectives
- One piece of Selection Criteria
- Dynamic / Evaluative Tool
  - Will adjust as Industry matures
    - Simplified Matrix
    - Enhanced Matrix
- Adaptable to Project Needs
BIM Proficiency Matrix (BPM)

BPM Demonstration
BIM Execution Plan (BEP)

The BIM Execution Plan is used to record the roles, responsibilities and specific tasks of each team member participating in the BIM model for the purpose of the design and construction of a given project. The BEP is a required contract document.

By signature below, this BIM Execution Plan is herewith adopted and incorporated into the Agreement, dated __________, for Professional Design Services between __________ and Indiana University.

Indiana University

Architect

Construction Manager
BIM Execution Plan (BEP)

- BEP Defines Roles & Responsibilities for all team regarding Model deliverable
- Defines Energy Modeling Process per Guideline Requirements
- Defines Collision Reporting Framework
- Defines COBIE Design Data Requirements
- Defines Information Manager Role as Architect - Model Manager Role required in each project
- Establishes Data Needs for future IU FM use
- BEP Template Provided by IU - Completion by Design Team - within 30 days of selection
- BEP Becomes an Integral Part of Construction Bid Documents - Defines Contractor Roles / Responsibilities regarding completed project model.
Section 3
Recording
Roles & Responsibilities

Post-Selection

BIM Execution Plan (BEP)

*BEP Demonstration*
Integrated Project Delivery Process Plan (IPD)

The IPD Plan documents the proposed method(s) the design team (including the Owner) will utilize to demonstrate increased integration of the design and construction processes from design concept through project completion. The IPD Plan is a required contract document.

IPD Process Proposal

Indiana University
University Architect’s Office

I. Overview

The intent of this IPD Process Proposal is to formalize a desire to see higher levels of integration within the design and construction process than traditional methods of design have historically produced. Filling out a BIM Execution Plan is the hard evidence of an underlying philosophy or approach to a team of professionals working in as integrated manner as the contract process will allow (Design / Bid / Build or Design / Build). While there are certain levels of integration implied by the BEP, the actual methods of integrating a design team are not. To that end, briefly explain your philosophy (individual or team) of Integrated Project Delivery. Criteria that will be used to evaluate the response may include but may not be limited to:
IPD Process Model
(Integrated Project Delivery)
# Integrated Project Delivery Process Plan (IPD)

## Reverse Phase Scheduling

### Section 3

**Recording Roles & Responsibilities**

**Post-Selection**

### Legend

<table>
<thead>
<tr>
<th>A</th>
<th>C</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>I</th>
<th>K</th>
<th>M</th>
<th>O</th>
<th>S</th>
<th>P</th>
</tr>
</thead>
</table>


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**Figure:** A table or chart illustrating reverse phase scheduling with specific dates and roles/permissions. The table includes columns for various dates ranging from 4/13 to 8/24, and rows detailing specific responsibilities or tasks for each date. The legend at the top of the table provides an interpretation of the colors used in the scheduling chart.
Critical Path Modeling

**Section 3**
**Recording Roles & Responsibilities**

**Post-Selection**
IU ProjectDox Required

- IU requires Navisworks in Construction
  - Clash Detection / Coordination
    - Posted on scheduled basis per BEP (recommended bi-weekly)
  - Post to ProjectDox site
  - Integrate with Revit model throughout construction - see BEP
    - Supported (enforced) by IU Project Team
Proof of Clash Detection
Design Phase

- Proof of clash detection required for release to go to Bid Process
- Reports shall be included in Bid Document information
- Frequency / Scope of Collision reporting defined in BEP
- Clash Detection in Design does NOT eliminate same requirement in construction.
Proof of Clash Detection - Construction Phase

- Clash detection in construction required - resolutions captured on ProjectDox and in REVIT
- Scan data transfer into or linked to Revit Model by Architect, Contractor or 3rd Party source - scope frequency defined in BEP
- Concurrent As-Built Documents Mandated - methodology at Contractor Discretion
Concurrent As-Built Documentation

Key Concept

- Record Documents by Architect by Contract to include:
  - O&M and As-built Documents by Contractor by contract
  - Phased Laser Scan of Completed Disciplines (See BEP for Scope)
  - Electronic submissions - all types: ASI’s, CO’s, Shop / fabrication drawings req’d. transfer to ProjectDox and/or Revit Model by Architect, Contractor or 3rd Party source.
  - 2D hard copy file
Thank You

Any Questions?
BIM Design / Construction Requirements

Transition Resources

- Autodesk
- Avatech Solutions
- SHP Leading Design- BIM Consulting
  - LEED Accreditation Test Training
  - Revit Modeling All Disciplines
- BIM / IPD Planning / Execution -
  (Architecture and/or Construction)