S500 BIM Best Practices: Case Studies

Ecobuild America and AEC-ST Conference
May 22, 2008 Anaheim, CA
Presentation Topics

- Cathedral Hill Hospital Project
- Integrated Form of agreement (IFOA)
- Design Assist Approach
- Project Tools
- Software Tools Used
- Group Training
- Prefab
- Delivery Staging
- Experimentation with BIM
Cathedral Hill Hospital

- New Hospital to be constructed in San Francisco
- Proposed Building Statistics
  - 865,000 sf
  - 17 Stories
  - 555 beds
  - 24 Labor, Delivery and Rooms
  - 19 ORs
  - 34 ER Treatment Rooms
Collocation of Trade Partners

BIM

IFOA
Integrated Form of Agreement

- One agreement signed by OAC
- No separate general conditions
- Provides formation of team elements
  - Core teams
    - Core group for Project
    - Core group for BIM
- Integrated Project Delivery Team (IPDT)
- Senior Management Team
- Incentive Sharing Plan
Design Assist Approach

- Prequalify the subcontractors
  - Do they have VDC capabilities
- Engage the subcontractors on the project early
  - Constructability Review During Design
- Collocation work environment
Project Tools

Value Stream Mapping
Last Planner System® (LPS)
Value Stream Mapping

- It is a Lean technique used to analyze the flow of materials and information currently required to bring a product or service to a consumer.
- Used to identify opportunities for improvement in lead time.
- Capture Current State or Traditional method.
- Create Future State with Emphasis on Removing Waste.
Mapping Sessions
Electronic Capture of VSM
Last Planner System®

- PPC Tracking of Reliable Promises
- Plus / Delta Practice
- Share Learning Across the Project
- One week of work at a time
- Done in a collaborative meeting
### Weekly Work Plan

#### Integrated Project Delivery Team

<table>
<thead>
<tr>
<th>Project</th>
<th>Weekly Work Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cathedral Hill Hospital 02-21-2008 WWP</td>
<td>CPMC - Cathedral Hill Hospital</td>
</tr>
</tbody>
</table>

#### Categories of Variance

<table>
<thead>
<tr>
<th>Category</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Variance</td>
<td>9 In-House Time Variance</td>
</tr>
<tr>
<td>N/A</td>
<td>0 N/A Complete</td>
</tr>
<tr>
<td>Percent</td>
<td>19 Off-Project Demands</td>
</tr>
<tr>
<td>Planned Complete</td>
<td>N/A</td>
</tr>
<tr>
<td>PoE</td>
<td>12 Other Project Demands</td>
</tr>
<tr>
<td>As Planned</td>
<td></td>
</tr>
<tr>
<td>Staff Not Available</td>
<td>13 Not Available</td>
</tr>
<tr>
<td>Repeat</td>
<td>8 Repeat</td>
</tr>
<tr>
<td>Materials Not Available</td>
<td>14 Repeat More Than Once</td>
</tr>
<tr>
<td>Not Available</td>
<td>7 Released at Risk</td>
</tr>
<tr>
<td>Status</td>
<td>Aborted</td>
</tr>
</tbody>
</table>

#### Schedules

<table>
<thead>
<tr>
<th>Schedule Number</th>
<th>Task Description</th>
<th>Assignee</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sutter Medical Group Meeting</td>
<td>Merv D</td>
</tr>
<tr>
<td>2</td>
<td>Follow-up with 3rd Party Plan Review Meeting Date</td>
<td>Merv D</td>
</tr>
<tr>
<td>3</td>
<td>Workforce Development Plan</td>
<td>Merv D</td>
</tr>
<tr>
<td>4</td>
<td>Workforce Development Plan</td>
<td>Merv D</td>
</tr>
<tr>
<td>5</td>
<td>Workforce Development Plan</td>
<td>Merv D</td>
</tr>
<tr>
<td>6</td>
<td>Workforce Development Plan</td>
<td>Merv D</td>
</tr>
<tr>
<td>7</td>
<td>Workforce Development Plan</td>
<td>Merv D</td>
</tr>
</tbody>
</table>

### Herrick

- Put together a ROM for reinforced column wrap
- Update the cost model

### Herrero/Biddle

- Update Draft Construction Date to March 2024
- Update Draft Master Schedule to Collaboration Site
- Create Base Bid Estimate
- Issue the RFP for 3rd party testing
- Interview for/sub with DSM scope
- Review Draft Proposals and Schedule Final Interviews
- Finish RCIP through May 12, 2008 to CPMC
- Draft RFP for Metal Panel Contractor

### Marchese

- Provide Update on Access to DBC for 3rd Party Testing
- But together a ROM for reinforced column wrap
- Provide Schedule Input to Hakan
- Confirm Paul K Baseline Spread

### Bovadin Electric Inc.

- Provide MEP Focus at TDO Meeting drawings
- Complete Electrical Version of Order A2
- Silverman and Light
| #1100 | | Weekly Work Plan | | CPMC - Cathedral Hill Hospital |
| --- | --- | --- | --- |
| **Integrated Project Delivery Team** | **Weekly Work Plan** | | |
| **SmithGroup** | | | |
| 1. Send RfP to B2B to Prepare Proposal | Arlee M | | X |
| 2. Finalize RfP by May 12, 2016 to CPMC | Janette M | | |
| 3. Schedule turnover of typical rooms in MEP | Matt D | X | X |
| | | X | |
| **Southland Industries** | | | |
| 1. Prepare for MEP Focus at TVD Meeting | Mike N | X | X |
| 2. Complete LCD Manufacturer Interview | Mike N | X | X |
| **Ted Jacob Engineering Group** | | | |
| 1. Confirm layout of P4 tanks and access to 400-Ton for Art | Shular M | X | X | X |
| | | X | |
| | | | |
| | | | |
| **Core Group** | | | |
### Workable Backlog

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>MON</th>
<th>TUE</th>
<th>WED</th>
<th>THU</th>
<th>FRI</th>
<th>SAT</th>
<th>SUN</th>
<th>DISCUSSION</th>
<th>REASON FOR VARIANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule Meeting with SF Fire Marshal</td>
<td>Aline M</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Present on the Function/Interaction of the Core Group at Next Last Planner</td>
<td>David L</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Prepare Overview of TVG Plan to Tuesday TVG Meeting</td>
<td>John K</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Provide Commissioning Plan Update to Care Group</td>
<td>John K</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Provide HQ Document Checklist to sheet M</td>
<td>Mary G</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow-up to Expedite Payment Process</td>
<td>Paul R</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>A3 for Aluminum Caster</td>
<td>Paul R</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Proposal to IPDT how Escalation Adjustments will be Handled</td>
<td>Paul R</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Prepare Subcontracting Process with Legal Council</td>
<td>Rob P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finalize to provide update on Hospital proposal engagement timeline</td>
<td>Scott M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final utility rates water, gas, electric based on current CPMC utility usage</td>
<td>Tony B</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Meeting Parking Lot

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>ORIGINATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunnel construction, which project is in Hospital or MEDX?</td>
<td>Check K</td>
</tr>
</tbody>
</table>
Software Tools Used

- Revit
  - Architectural
  - Structural
- AutoCAD
  - Third Party
- NavisWorks
- Innovaya
- TimberLine Estimating
- Desktop Take Off
- Primavera P6
- Free Software
  - Autodesk Design review
  - NavisWorks Freedom Viewer
Sample of Design Review Usage
Group Training

- Software Training with Multiple Companies
  - Split cost
  - Fill class
- Class for Project Managers
- Train the Trainers
- What we have done so far
Using the Model for Prefabrication

Production Planning
CNC Part Cutting
Fabrication of Assemblies
Staging Delivery to Field
Model Used for Production Planning

Prefabrication Sheets Directly from the 3d Model.

Above: Sheet Metal for CNC Cutting
Left: Electrical Prefabrication
Model Used for Automatic Part Creation

Today’s current practice uses CNC control for automatic cutting of part.

Upper: Structural steel cutter.
Lower: Sheet metal cut from a plasma cutter.
Model Used for Prefabricated Assembly of Parts

Use of cut sheets to assemble parts

Above: Electrical fab  
Upper right: Structural steel fab.  
Lower right: Sheet metal fab.
Using the Model to Stage Deliveries to Project
VDC Glossary

- 3d: Computer graphics that use 3 dimensional representation of an object having length, width and height.
- ADT: is a version of Autodesk's flagship product, AutoCAD, with tools and functions specially suited to architectural work. The product line was renamed to AutoCAD Architecture in 2008.
- AEC: Architecture, Engineering and Construction
- AIA: American Institute of Architects
- AutoCAD: AutoCAD is a CAD software application for 2D and 3D design and drafting, developed and sold by Autodesk, Inc.
- BIM: Stands for both Building Information Model and Building Information Modeling. It is the process of generating and managing a building information model throughout the life cycle of a building.
- BuildingSMARTaliance: Formerly IAI. To create a format for open interoperability and full lifecycle implementation of building information models.
- CAD: Computer Aided Drafting
- CADD: Computer Aided Design and Drafting
- GSA: General Services Administration. An independent agency of the United States government, established in 1949 to help manage and support the basic functioning of federal agencies. The GSA supplies products and communications for U.S. government offices, provides transportation and office space to federal employees, and develops government wide cost-minimizing policies, among other management tasks.
- IAI: International Alliance for Interoperability
- IFC: Industry Foundation Classes. Data model that is a neutral and open specification that is not controlled by a singular vendor or group of vendors. It is an object oriented file format with a data model developed by the International Alliance for Interoperability (IAI) to facilitate interoperability in the building industry, and is a commonly used format for Building Information Modeling.
- IFOA: Integrated Form of Agreement Master Contract Agreement used on Sutter Health Projects signed by OAC.
- Integrated Practice or Integrated Project Delivery: Leveraging intellectual and physical resources using the best available tools to produce the highest quality product. It requires everyone on the team to share their knowledge with one another.
- LPS: Last Planner System®. System introduced by LCI to create and improve predictability of workflow on a project.
Level of Detail: The amount of data carried with in the modeled object.

MEP: Mechanical, Electrical and Plumbing

MEP-FP: Mechanical, Electrical, Plumbing and Fire Protection

Navis: NavisWorks JetStream is a 3D design review package for Microsoft Windows currently developed by Autodesk. JetStream allows users to open and combine 3D models, navigate around them in real-time and review the model using a set of tools including comments, redlining, viewpoint, and measurements. A selection of plug-ins enhances the package adding interference detection, 4D time simulation, photorealistic rendering and PDF-like publishing.

NCS: National CAD Standards. Standards for CAD drawn files.

NBIMS: The National Building Information Model Standard project

nD: Beyond 3d.

NIBS: National Institute for Building Sciences

NIST: National Institute of Standards and Technology

OCA: Office of Chief Architect

PBS: Public Buildings Service

Revit: Autodesk Revit is architectural BIM software for Microsoft Windows, currently developed by Autodesk, which allows the user to design with parametric modeling and drafting elements. BIM is a new CAD paradigm that allows for intelligent, 3D and parametric object-based design. In this way, Revit provides full bi-directional association. A change anywhere is a change everywhere, instantly, with no user interaction to manually update any view.

VBE: Virtual Building Environment. See VDC, same as.

VBR: Virtual Builders Roundtable. A group of construction practitioners that are committed to the development of virtual building process and technology within the construction environment.

VDC: Virtual Design and Construction. The use of integrated multi-disciplinary performance models of design-construction projects, including the Product (i.e., facilities), Work Processes and Organization of the design - construction - operation team in order to support explicit and public business objectives. “VDC models are virtual because they show computer-based descriptions of the project.” (Kunz & Fischer 2007)

Virtual Building: See VDC, same as.
Questions