Outline

New BIM Focus
Integrating BIM into Curriculum
Research in BIM
Student Activities
USC FM
• First course offered on BIM at the Civil & Environmental Engineering Dept.
• 20 students from Architecture, Civil Engineering, Construction Management & Business Administration
• 2 Undergrad, 18 Grads
• Combination of lectures, research papers, case studies and hands on software training
<table>
<thead>
<tr>
<th>Team 4 - USC</th>
</tr>
</thead>
<tbody>
<tr>
<td>(001A) Campus DoD - Hoffman Block 2 - Class A 500,000 SF 10-19 story office building</td>
</tr>
<tr>
<td>(001A) Multi or Single Building GSA - Hoffman Block 2 - Class A 500,000 SF 10-19 story office building</td>
</tr>
<tr>
<td>(001B) Campus GSA - MRP Realty Landbay H Polynesian Yard - Class A, 1 million SF campus with 2-4 buildings (Landbay H)</td>
</tr>
<tr>
<td>(002A) Multi or Single Building DoD - Hoffman Block 2 and 3 - Class A 1 Million SF office building and parking structure</td>
</tr>
<tr>
<td>(002D) Multi or Single Building GSA - Duke Mark Center - Class A 1 million SF office building</td>
</tr>
<tr>
<td>(004A) Historic - Washington Masonic Temple</td>
</tr>
<tr>
<td>(004E) Historic - City Hall</td>
</tr>
<tr>
<td>(006E) Historic - Gadby Tavern</td>
</tr>
<tr>
<td>(006C) Cultural Resources - Contraband and Freedwomen's Cemetery Memorial</td>
</tr>
<tr>
<td>(007A) Transit - King Street Train and Metro Station</td>
</tr>
<tr>
<td>(008E) Hotel on Waterfront Old Town - 4 or 5 Star, dock access, combined retail or mixed use</td>
</tr>
</tbody>
</table>

Search Projects / Schemes By Name / ID: 

<table>
<thead>
<tr>
<th>Name of Scheme</th>
<th>Last Updated</th>
<th>Scheme Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>(001A) Campus DoD - Hoffman Block 2 - Class A 500,000 SF 10-19 story office building</td>
<td>09-11-2008</td>
<td>Hamid Haji</td>
</tr>
<tr>
<td>(001A) Multi or Single Building GSA - Hoffman Block 2 - Class A 500,000 SF 10-19 story office building</td>
<td>09-12-2008</td>
<td>Hamid Haji</td>
</tr>
<tr>
<td>(001B) Campus GSA - MRP Realty Landbay H Polynesian Yard - Class A, 1 million SF campus with 2-4 buildings (Landbay H)</td>
<td>09-11-2008</td>
<td>Hamid Haji</td>
</tr>
<tr>
<td>(002A) Multi or Single Building DoD - Hoffman Block 2 and 3 - Class A 1 Million SF office building and parking structure</td>
<td>09-11-2008</td>
<td>Hamid Haji</td>
</tr>
<tr>
<td>(002D) Multi or Single Building GSA - Duke Mark Center - Class A 1 million SF office building</td>
<td>09-11-2008</td>
<td>Hamid Haji</td>
</tr>
<tr>
<td>(004A) Historic - Washington Masonic Temple</td>
<td>09-11-2008</td>
<td>Hamid Haji</td>
</tr>
<tr>
<td>(004E) Historic - City Hall</td>
<td>09-11-2008</td>
<td>Hamid Haji</td>
</tr>
<tr>
<td>(006E) Historic - Gadby Tavern</td>
<td>09-11-2008</td>
<td>Hamid Haji</td>
</tr>
<tr>
<td>(006C) Cultural Resources - Contraband and Freedwomen's Cemetery Memorial</td>
<td>09-11-2008</td>
<td>Hamid Haji</td>
</tr>
<tr>
<td>(007A) Transit - King Street Train and Metro Station</td>
<td>09-11-2008</td>
<td>Hamid Haji</td>
</tr>
<tr>
<td>(008E) Hotel on Waterfront Old Town - 4 or 5 Star, dock access, combined retail or mixed use</td>
<td>09-11-2008</td>
<td>Hamid Haji</td>
</tr>
</tbody>
</table>

**SHARED SCHEMES**
- NA - Church LDS
- NA - Food For Thot Alexandria - Michael
- NA - Water Front Tast
- NA - Water Front Tast

**$2,800,000** Shared
BIM Exploration
BIMStorm

Project: Team 4 - USC
Scheme: (S65_366) (001A) Multi or Single Building GSA - Hoffman Block 2 - Class A 500,000 SF 10-15 story office building

Key: Buildings
1. (B65_932) Office Class A 220K
2. (B65_935) Transparent Structures
3. (B65_929) 90 Housing Units
4. (B65_942) Hotel
5. (B65_943) Hotel
6. (B65_944) Conference Center
7. (B65_945) Office 27 Floor + 3B
8. (B65_948) Office 27 Floor + 3B
9. (B65_052) Building C - 20 Classroom

Key: Floors
1. 8
2. 5
3. 6
4. 9
5. 9
6. 9
7. 30
8. 39
9. 2

Keys: Site Components
Building Attributes
Background Setting
Sketch
Import / Export

Hotkeys: Spacebar + Drag = Pan | Z = Zoom In
Shift + Z = Zoom Out | X = Extent
BIM Exploration
BIMStorm
BIM Exploration
ArchiCAD

ArchiCAD Educational version, not for resale. Courtesy of Graphisoft.
BIM Exploration
ArchiCAD
BIM Exploration
NavisWorks
# BIM Exploration

**NavisWorks**

## Clashes

### Report Batch

<table>
<thead>
<tr>
<th>MECH PLUMB Clash</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance</td>
<td>0.00ft</td>
</tr>
<tr>
<td>Simulation</td>
<td>none</td>
</tr>
<tr>
<td>Linkage</td>
<td>none</td>
</tr>
<tr>
<td>Simulation Step</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td></td>
</tr>
<tr>
<td>Self Intersect</td>
<td>0</td>
</tr>
<tr>
<td>Self Intersect</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
</tr>
<tr>
<td>New</td>
<td>0</td>
</tr>
<tr>
<td>Active</td>
<td>3</td>
</tr>
<tr>
<td>Approved</td>
<td>0</td>
</tr>
<tr>
<td>Resolved</td>
<td>0</td>
</tr>
<tr>
<td>Type</td>
<td>Hard</td>
</tr>
<tr>
<td>Status</td>
<td>OK</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Clash1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entity Handle</td>
<td>FgD1</td>
</tr>
<tr>
<td>Layer</td>
<td>E-Lite-Std</td>
</tr>
<tr>
<td>Item Name</td>
<td>E-Lite-Std</td>
</tr>
<tr>
<td>Item Type</td>
<td>3D Solid</td>
</tr>
<tr>
<td>Status</td>
<td></td>
</tr>
<tr>
<td>Clash Point</td>
<td>397.43ft, 781.543ft, 234.743ft</td>
</tr>
<tr>
<td>Date Created</td>
<td>2008/10/25 21:45:35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entity Handle</td>
</tr>
<tr>
<td>Layer</td>
</tr>
<tr>
<td>Item Name</td>
</tr>
<tr>
<td>Item Type</td>
</tr>
</tbody>
</table>
Research Papers

Product Life Cycle Management + BIM
Lean Design & Construction + BIM
Spatial Information Systems + BIM
Facilities Management + BIM
Mobile Field Technologies + BIM
Product Content Integration + BIM
Automation of Construction + BIM
Integrated Project Delivery + BIM
Gaming + BIM
Case Studies
Two buildings with same program: BIM vs. No-BIM

Cost/Schedule/Quality Comparison
  LEED Factor
  Learning Curve
  Inflation
  # of RFIs
  # & $ of Change Orders
Case Studies
Use of BIM in steel design, detailing and fabrication

Delivery in 23 months
Steel fabricator the main force behind BIM implementation
7 Steel structure packages – every 2-4 weeks
Collaboration between engineer, detailer, and fabricator
Case Studies
Complex and large structures

Large scope work – required BIM coordination
Live digital master model
Versioning process
Case Studies
Use of BIM in Construction and FM

Integration of FM software with BIM
Attach digital drawings and documents to model from intranet
Link real time building monitoring system to the model
Integration of BIM to Curriculum

- Project Controls: Budgeting and Estimating
- Project Controls: Scheduling
- Sustainable Design
- Building Information Management
- Special Topics on BIM for Integrated Project Delivery
Research in BIM

- Number of NSF proposals in progress
- BIM -> CIM
  - Buildings to Regions to Cities
  - Building specific information as an input to complexity of cities
  - Natural resource consumption (fuel, electricity, water) and waste (wastewater, carbon footprint, recycling)
  - Research in collaboration with Architecture, Engineering and Public Policy & Dev.
- Use of field data acquisition systems for monitoring construction progress and for creating as-built BIMs
- Return on Investment of BIM
- Use of BIM in FM
Reno, Nevada – Feb 11-14, 2008
Organized by AGC’s Student Chapter
Students from engineering, architecture, business and PPD
50 students; 8 teams across 7 competitions (2 grad teams)
USC competes in: Graduate, Design-Build, Commercial, Residential/Multi-Family, Heavy Civil, LEED and BIM
Graduate team won 1st place in 2006 and 2nd place in 2008
Student Activities
Competitions > Sparks > AGC Student Competition > BIM Competition

Value through Innovation
Teams are required to create complete BIM and utilize it to solve construction problems
- Vico Constructor, Revit, Tekla, Navisworks
- Vico Control, MS Project, Primavera
- Navisworks, Synchro, 5D Presenter

Project documents in 2D and a project description provided

Criteria:
- LOD, CPM and Line of Balance schedules, LEED, Production control and schedule management, Architectural and structural coordination, logistics planning, civil/utilities coordination, estimate derived from quantities

Deliverables:
- BIM, Model based estimate & schedule, logistics plan, LEED credit analysis, coordinated utility relocation plan, constructability report
Student Activities
Competitions > Sparks > AGC Student Competition > BIM Competition
Student Activities
15th AGC Symposium on BIM and Integrated Practice

USC, Galen Center, April 21, 2009
Focus on design (architects), construction (builders) and management (owners) of buildings
Topics:
  Benefits of BIM through Integrated Practice ~ Applied Use of BIM for Design, MEPS
  Coordination, Scheduling, Estimating, Sustainable Design and Facilities Management ~
  IPD Contracts ~ Lean Building with BIM ~ Changing Workflow and Deliverables ~ Return
  on Investment ~ Future of IPD with BIM - - - - - -

www.uscsymposium.com
• In order to allow USC FM to better maintain the building
  – involvement early in the design and construction stages
  – specify building material and performance standards in the typical building specifications
  – request data requirements in the model files
• Intend to build bi-directional data links; not manual hyperlink
• Objectives:
  – use several databases or interfaces to find an object in the updated model, and proceed to analyze and trace the FM problem
  – populate FM databases from data in the model
  – have the Navisworks or IFC model change based on FM database changes or data from FM sensors in buildings throughout USC’s campuses
Idealized BIM-3D Facilities Management System

BIM Model Package
- Revit Architecture, Structure & MEP
- ArchiCAD
- Bentley Architecture
- etc.

CAD Model Package
- Autodesk AutoCAD
- AEC CADPipe
- Bentley Microstation
- etc.

NAVISWORKS

CMMS
- FAMIS

EDMS
- MERIDIAN

CAFM
- FAMIS Visual Map

EMS
- Honeywell
Central routing page hyperlink is attached to each piece of equipment.
Equipment Hyperlink from NavisWorks to CMMS (ex. FAMIS)

- Hyperlink on each piece of equipment is linked to Equipment Specs and Data in the CMMS system (ex. FAMIS).

- Data fields for equipment for each room is searchable and modifiable within the CMMS interface.

CMMS - FAMIS Database
Equipment Hyperlink from NavisWorks to EDMS (ex. Automanager MERIDIAN)

Equipment: AHU-1

- Hyperlink attached to each piece of equipment is linked to a view of the Equipment O&M manual in the EDMS system (ex. Meridian)

Equipment manuals can be opened and viewed individually in PDF format.
Equipment Hyperlink from NavisWorks to EMS (ex. Honeywell)

- Hyperlink attached to each piece of equipment is linked to the Energy Management System equipment monitoring interface.
- Equipment parameters such as temperatures, flow rates, etc. can be monitored.
BIM in Teaching and Research
Assistant Prof. Burcin Becerik-Gerber
becerik@usc.edu

University of Southern California
The Sonny Astani Department of Civil and Environmental Engineering