BIM
A TOOL FOR COLLABORATION

MIAPPA Winter Conference

Bob Varga, AIA, LEED AP
Rick Thoman, AIA
Brad Reuther, PE
Agenda

I  What is BIM

II  DESIGN and BIM

III  What’s in it for YOU

IV  Questions and Answers
What is BIM?

- **Building Information Model**
- A **database** of project design information
- BIM is an “**object oriented**” approach to CAD
  - Design collaborators work primarily with architectural elements instead of vector based graphic primitives
  - Objects have “intelligence” that provide a degree of automation
- 2D, 3D and schedule **views** are produced from the model
- A BIM is not just “3D CAD”
What is **Building Information Modeling (BIM)**?

**Industry Definition:**

A Building Information Model (BIM) is a *digital* representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its lifecycle from inception onward.

*From “Integrated Project Delivery: A Working Definition” by AIA CC*
What is BIM?

The AIA defines building information modeling (BIM) as a tool, not a process. It is a model-based technology linked with a database of project information. BIM is the catalyst for fundamental industry changes in the way projects are built and the way project stakeholders communicate with each other.
## What is BIM?

<table>
<thead>
<tr>
<th>Traditional CAD</th>
<th>BIM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Draw using graphic primitives such as Lines, Arcs and Circles:</strong></td>
<td><strong>Graphics</strong></td>
</tr>
<tr>
<td>.. an electronic pencil</td>
<td><strong>Place “real world” components such as walls, doors, slabs etc</strong></td>
</tr>
<tr>
<td><strong>None</strong></td>
<td><strong>…”object oriented CAD”</strong></td>
</tr>
<tr>
<td><strong>2D and 3D views are generated separately</strong></td>
<td><strong>Intelligence</strong></td>
</tr>
<tr>
<td><strong>Typically a collection of individual AutoCAD .dwg files</strong></td>
<td><strong>Objects interact with one another:</strong> Doors automatically break walls, wall intersections automatically cleanup</td>
</tr>
<tr>
<td><strong>Created manually… minimal automation. One way data flow</strong></td>
<td><strong>2D and 3D views generated from the same model:</strong> A virtual model of the building</td>
</tr>
<tr>
<td><strong>File Types</strong></td>
<td><strong>Revit database files</strong></td>
</tr>
<tr>
<td><strong>Reports / Schedules</strong></td>
<td><strong>Generated from the database, fully integrated with the model. Two way data flow</strong></td>
</tr>
</tbody>
</table>
Vector based CAD uses graphic primitives such as:

- LINES
- ARCS
- CIRCLES
Typically designers work in either 2D or 3D mode.

Data is in "attributed blocks".

Schedules are "one way".
Revit Based BIM

Designers work in 2D and 3D simultaneously
Revit Based BIM

Designers work in 2D and 3D simultaneously.
Revit Based BIM

Designers work with “objects” such as walls, doors and windows.
Schedules such as those used to describe doors are simply report "views" generated from the BIM database.
SmithGroup’s BIM Experience

SG has over 85 projects either complete or in progress in a broad range of project types including learning, healthcare, research and workplace.

SmithGroup began transitioning CAD practices to BIM in 2005
SmithGroup’s BIM Toolset

Revit Architecture, MEP and Structural: Primary BIM Authoring applications

SketchUP, FORM Z, RHINO, 3DS MAX, VIZ, for early design studies and visualization

Navisworks for aggregation and clash detection

Other dedicated tools in support of engineering, environmental design and specs.

Now moving to 64-bit OS and workstations with 8G of RAM typical for Revit
Core Benefits of using BIM

- Better understanding of design through creation of a virtual building model
- **Improved communication** with key stakeholders and design collaborators
- Enhanced visualization
- Improved coordination through automation
- Improved accuracy and efficiency
- Facilitates use of special study tools such as estimating and energy analysis
Examples of BIM Project Use

MEP System Visualization
W.L Gore Medical Equipment Products RDP Facility
Examples of BIM Project Use

Design Visualization Studies
Examples of BIM Project Use

Building System Collision Detection
LBNL Helios Lab
Examples of BIM Project Use

Collaboration through Model Aggregation

UCSF CVRB
Examples of BIM Project Use

*March 21, 9am – Overcast Conditions*
Examples of BIM Project Use

Daylighting Studies
LBNL Helios Laboratory
How is BIM changing project delivery?

BIM technology is serving as a catalyst for many changes in the AE industry.

Construction Users Roundtable graph summarizes difference between conventional and BIM enabled project delivery.
How is BIM changing project delivery?

Use of BIM in the context of Integrated practice enables and encourages major decisions early in the project development cycle.
How is BIM changing project delivery?

BIM Projects tend involve the builder earlier in the design process. BIM serves as a “tool for collaboration”.

Building Information Model - an Integrated Team Approach

Traditional Phasing:

Modified Phasing:

- Concept
- SD
- DD
- CD
- Construction
- Administration
- Early Completion
- Construction
- Administration

- Designer
- Builder
How is BIM changing project delivery?

BIM technology is serving as a catalyst for many changes in the AE industry.

Construction Users Roundtable graph summarizes difference between conventional and BIM enabled project delivery

**Increased collaboration: Integrated Project Delivery**

- The AIA has issued an IPD guide
- New types of agreements and alliances between Owner / Architect + Engineer / Builder
How is BIM changing project delivery?

Integrated Project Delivery
CPMC Cathedral Hill Hospital

Project Executive Management Group

Client
California Pacific Medical Center
A Sutter Health Affiliate

Contractor
Hernero Boldt and Subcontractors

Architect
SmithGroup and Consultants

Building Information Model (BIM)
For Design and Construction of Building

Cathedral Hill Hospital

Create / Predict Cycles

Deliver Project
How is BIM changing project delivery?

- Consolidates healthcare services from multiple campuses to a multistory hospital on Van Ness Avenue in San Francisco.
- Integrated project delivery team and Contract
- Revit Based BIM project

Integrated Project Delivery
CPMC Cathedral Hill Hospital
In a Perfect World…

There would be peace, harmony, and computer MODELS that…

Talk to each other work together intuitively

Allow me to make what I imagine, and then modify it at will!

Take only 30 seconds to save.
In a Perfect World...

The BIM software would communicate back and forth with other software

We currently use:

- AUTOCAD
- REVIT
- 3DS MAX
- VIZ
- SKETCHUP
- FORM Z
- RHINO
- MAYA
- LIGHTSCAPE
- RADIANCE
- ECOTECT
- TRANE TRACE 700
The Current Reality:  
*Mesa Community College*

*Southwest Physical Science Building*

**PROCESS**

SketchUp
- Programming thru Schematic Design

Revit + CadDuct and CadPipe by sub
- Design Development through Construction Documents
- Real-time square footage and quantities
- Integrated participation and coordination
The Current Reality:  

*Mesa Community College*  
*Southwest Physical Science Building*
The Current Reality:  Madonna University
Science & Media Building

FormZ
- Conceptual & Schematic Design

Lightscape
- Lighting analysis

Revit + ABS + AutoCAD
- Programming/ Lab Planning
- Design Development through Construction Documents
- Real-time square footage and quantities
- Integrated participation and coordination
The Current Reality: Madonna University
Science & Media Building
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Revit + ABS + AutoCAD
- Programming/ Lab Planning
- Design Development through Construction Documents
- Real-time square footage and quantities
- Integrated participation and coordination
Planning: The way we used to do it....
REALITY Planning and Programming
## Examples of BIM Project Use

### Program Validation and Area Studies

#### LBNL Helios Lab

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<th>Level</th>
<th>Department</th>
<th>Name</th>
<th>PPG Category</th>
<th>Program</th>
<th>Program Area</th>
<th>Actual Area</th>
<th>Delta</th>
<th>Assignable</th>
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Examples of BIM Project Use

Block and Stack Diagrams
Mortgage Bankers Association Tenant Improvements
REALITY Case Study: RED MOUNTAIN
**The Current Reality: PRODUCING AN ENERGY AND LIGHTING ANALYSIS**

**PRODUCING A LIGHTING ANALYSIS**

1. Export BIM or 3D model as .dwg file
2. Import model into RADIANCE and set it up to run analysis
3. Import Model from Autocad and Data from RADIANCE into ECOTECT
4. Run Visual analysis
5. Export images

**PRODUCING A PRELIMINARY ENERGY ANALYSIS**

1. Export BIM or 3D model as .gbxml file
2. Import .gbxml file into ECOTECT or Trace 700
3. Run analysis
4. Export images, reports, and .gbxml
5. Import .gbxml data back into the BIM model.
The Current Reality: Chandler City Hall

SketchUp + Autocad + 3DMax
- Conceptual & Schematic Design

Radiance
- Daylighting calculations

Ecotect
- Visual Daylighting results

Revit + ABS + AutoCAD
- Programming
- Design Development
The Current Reality:  Chandler City Hall – ECOTECT DATA
### The Current Reality:

Chandler City Hall – RADIANCE DATA

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</table>
The Current Reality:  

Chandler City Hall – ECOTECT DATA

12” Blade, 15” spacing, 15 deg tilt

Winter Solstice  
Spring Equinox

12” Blade, 18” spacing, 20 deg tilt

Winter Solstice  
Spring Equinox
The Current Reality:  Chandler City Hall – ECOTECT DATA

99% of Open Office Area Meets LEED EQ8.1
The Current Reality: Chandler City Hall – ECOTECT DATA

Chandler City Hall
Annual Energy Analysis, South Facing Open Office

<table>
<thead>
<tr>
<th>Zone</th>
<th>Illuminance (Lux)</th>
<th>Percentage of Occupied Year Lights Off</th>
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</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>2212</td>
<td>95%</td>
</tr>
<tr>
<td>Zone 2</td>
<td>1565</td>
<td>67%</td>
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<tr>
<td>Zone 3</td>
<td>2005</td>
<td>86%</td>
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</table>

Number of Hours Lights Off (Achieving 30fc with Daylight)
The Current Reality: MEP Design

Calculations can be run using the data.

Data from the BIM model can be exported for calculations.

Results from calculations can be imported for use during design.
Equipment “families” are modeled in 3D with embedded data fields called parameters.

Data in the BIM model can be viewed graphically as an object, or through schedules & reports.
In a Perfect World…

You could use the model after the building is finished
The dilemma...

Different projects, different methods and varying amounts of information in the model
And you can use it…

…to know what insulation is under your roof 15 years from now.
And you can use it…

…to know what type of glass the architect used when you need to replace some 25 years from now.
And you can use it…

…to know what your equipment is and where it is in the hidden spaces.

• Damper settings and locations
And you can use it...

...to know what lamps you need to order for each building or for all of your buildings.
And you can use it...

...to know what the exact product on the wall is
And you can use it...

“SMITHGROUP has more than 85 projects in BIM yet none of our clients have ever asked or told us to imbed specific data into the model so they could utilize it later.”
Some thoughts…

- If you intend to make it a living product, who will maintain it?

- If we embed specific products as data into the model, what happens with substitutions?

- What if there is a mistake in the data?

- What Software are you going to use?
QUESTIONS, COMMENTS