BIM & MASONRY CASE STUDIES: BIM - A DESIGNERS PERSPECTIVE

Presenter: Morgan Wiese, PE
Robert Grant, BIM Manager
Presenters

• Morgan Wiese, PE

• Rob Grant, BIM Manager
Integrus Architecture

- Integrus focuses on K-12, Higher Education, and Civic Design
- Integrus Architecture was an early adopter of BIM having worked in Revit since 2006.
- Integrus offers Architectural, Structural, and Interior Design Services.
Presentation Outline

• Case Studies:
  • Park Place Middle School
  • Whitworth Music Facility

• Our Process:
  • What is in our Revit model
  • Modeling Techniques
  • Current industry tools
Park Place Middle School

- New Middle School
- Retrofit and New School
Park Place Middle School

- Load Bearing CMU + Veneer
Park Place Middle School

- Red squares indicate original mechanical location.
- Able to handle issues before they arise.
- This was revised to align, but we did not send a final coordination model.
Park Place Middle School

- We missed the location by an inch…. That is ok.
  - Caught ahead of time
  - Makes other disciplines aware
Park Place Middle School

12" CMU

MECH OPENING
GC VFY SIZE & LOCATION

BIM-M
Building Information Modeling for Masonry
Park Place Middle School

- We do not model everything
Park Place Middle School

- Model with a purpose
- Other projects have modeled more for quantity take-offs, etc.
Park Place Middle School

- Enhanced detailing
• Enhanced detailing
Park Place Middle School

- Detailing based on the model
  - Helps with accuracy
  - Make sure everything can fit
Park Place Middle School
Park Place Middle School

- Detailing based on the model and As-Builts.
- Coordinate the existing conditions to a survey (Existing building was off by 4").
Park Place Middle School
Whitworth Music Facility

- New Music Facility to help with the program outgrowing its space
Whitworth Music Facility

- Load bearing CMU + Veneer
Whitworth Music Facility

- Double Cantilever Lentil
Whitworth Music Facility

- Double Cantilever Lentil
  - Used Revit to coordinate with all disciplines for anything that may penetrate this lentil
- Also has a veneer attachment supported by the Lentil
Whitworth Music Facility
Whitworth Music Facility
Whitworth Music Facility

- Veneer Support / Metal Cap Piece
  - (Left is structural detail, Right is architectural modeled family)
- Modeling insured all underside of CMU conditions were covered (multiple types modeled)
Whitworth Music Facility
Whitworth Music Facility

- Veneer entryway to give the appearance it is floating
Whitworth Music Facility
Whitworth Music Facility
Whitworth Music Facility
Design Process
Coordination

• Consultant was using 2D AutoCAD only
• Multiple penetrations not shown in the structural elevation
Coordination

- Consultant was using 2d AutoCAD only
- Becoming industry standard for more consultants to be doing more in Revit
- The more that can be coordinated the better
Coordination

- Architects had a high window that would have conflicted with a beam pocket.
- Architectural window was coordinated with beam height and during design the issue was noticed issues through the building.
“One Model”

- We utilize Architecture, Interiors, and Structural all working on one model at the same time
  - Reduces duplication
  - Forces more collaboration
  - More cohesive team
“One Model”

- Helps prevent errors
  - The Architectural slab edge did not follow the same edge-of-slab line as the floor below. Structural was identical to the floor below.
Reinforcing

- We still use 2D reinforcing.
  - Requires extra coordination time, but faster to draw
  - We do not utilize 3D reinforcing due to:
    - Changes
    - Time
    - Model size
  - It still provides benefits over no BIM
- We are not a contractor
Detailing

- Use 2 live sections at once to create these separate details
**Detailing**

- Use one section cut to detail one portion (i.e. Elevation)
- Copy detail items and detail other portion (i.e. Plan)
- Copy back to original and check alignments
- Also can use 3D then trace with components or use live detail
Modeling

- Wall sweeps for sills
  - Helps with coordination and detailing
- 3d model lines for vertical control joints
  - Makes visible in all views
  - Do not accidently have multiple people modeling the same thing
Modeling

- Wall sweeps helped with coordination of support
- Stone sill required additional steel to support
Modeling Custom Families

- Build your own families to depict whatever you need
- Examples: Stepped footings, Lintels, etc.
Modeling

- Keep it simple
  - What happens if you leave that project team
- Keep it lean
- But do not be afraid to explore
  - How else will you learn something new?
Deliverables

• We mainly perform Design/Bid/Build and Design/Build projects
• Most projects do not have the additional benefit for going beyond an LOD 300/350.
• Private sector work may make more sense
• Getting building officials on board is also an issue
Current Industry Tools

- BIM Software (Revit, ArchiCAD, Vectorworks, etc.)
- BIM for Masonry Revit Users Guide
- Plug-ins (Dynamo, Express tools, Hatch22 etc).
- BIM Managers
Current Industry Tools

- Hatch Patterns
- Pencil & Paper
- Hatch22
- Create a library

DEFINING A LINE IN A PATTERN

typical single line in a pattern

Four lines are required for the pattern shown below
The horizontal lines have different spacing, so two definitions are required, but the spacing between the different coloured lines is the same. The difference between the two is only the Y (vertical) offset.

The vertical lines have the same spacing in the X direction, but are different lengths, so two definitions are required. They start at different places and have different lengths for the lines and spacing. The spaces in the one are the same as the lines in the other.

<table>
<thead>
<tr>
<th>Angle</th>
<th>0</th>
<th>0</th>
<th>90</th>
<th>90</th>
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<tbody>
<tr>
<td>Origin X</td>
<td>0</td>
<td>0</td>
<td>225</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Shift</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Offset</td>
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<td>300</td>
<td>450</td>
<td>450</td>
</tr>
<tr>
<td>Dash</td>
<td>100</td>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space</td>
<td>-200</td>
<td>-100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Blue lines
- Angle is horizontal (0°), starts at 0.0, consecutive lines start at the same place (Y axis), consecutive lines are at 300mm spacing, they are continuous so no dashes or spaces.

Red lines
- Angle is horizontal (0°), starts at 0.100 (100mm from the X axis), consecutive lines start at the same place (Y axis), consecutive lines are at 300mm spacing, continuous so no dashes or spaces

Green lines
- Angle is vertical (90°), starts at 0.0, consecutive lines are at the same distance from the Y axis, consecutive lines are at 450mm spacing, the lines are 100mm long and the spaces are 200mm

Magenta lines
- Angle is vertical (90°), starts at 225.0 (225mm from the Y axis), consecutive lines start at the same place, consecutive lines are at 450mm spacing, the lines are 200mm long and the spaces are 100mm.
Current Industry Tools

• Export Revit to an analytical model
  • Typically grids only
  • Experimented with more
  • Error tracing can become tedious
  • Autodesk is working on a project for Robot (structural analysis software) to make this more seamless
Continuing Education

- Go to conferences
  - Get free Revit templates, etc.
- Listen to webinars / watch Youtube
- Teach others
Future

- Eventually we will get to a point where everything will be modeled down to the last fastener.
- Until then, we will see programs and their capabilities continue to grow.
Thank You!