Model Driven Design and Construction

A Case Study in Masonry Technology
You have loved masonry for a long time!

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What’s not to love??
Flexibility = Complexity
Masonry is an Integrated System

- Bed Depth and Patterns
- Modular Penetrations
- Rebar Arrays, Control Joints
- Bond Beams
- Pipe, Conduit, Fixtures
- Beam Pockets, Anchors
- Field Cuts and Array Shifts

Modular Layout
The Masonry Headache...
### LOD and the Technology Gap

<table>
<thead>
<tr>
<th>300</th>
<th>Element modeling to include:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• floor element with design-specified locations and geometries</td>
</tr>
</tbody>
</table>

![43 B1010.10-LOD-300 Floor Structural Frame (Masonry Framing)]
## LOD and the Technology Gap

<table>
<thead>
<tr>
<th>350</th>
<th>Element modeling to include:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Members modeled at any interface with wall edges (top, bottom, sides) or opening through wall</td>
</tr>
<tr>
<td></td>
<td>• Any regions that would impact coordination with other systems such as but not limited to:</td>
</tr>
<tr>
<td></td>
<td>o Bond Beam &amp; Lintel Regions</td>
</tr>
<tr>
<td></td>
<td>o Reinforcing &amp; Embed Regions</td>
</tr>
<tr>
<td></td>
<td>o Jam Regions</td>
</tr>
<tr>
<td></td>
<td>o Any other grouted regions</td>
</tr>
</tbody>
</table>

44_B1010.10-LOD-350 Floor Structural Frame (Masonry Framing)
## LOD and the Technology Gap

<table>
<thead>
<tr>
<th>400</th>
<th>Element modeling to include:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Reinforcing</td>
</tr>
<tr>
<td></td>
<td>• Connections</td>
</tr>
<tr>
<td></td>
<td>• Grouting Material</td>
</tr>
<tr>
<td></td>
<td>• Jams</td>
</tr>
<tr>
<td></td>
<td>• Bond Beams</td>
</tr>
<tr>
<td></td>
<td>• lintels</td>
</tr>
<tr>
<td></td>
<td>• Member fabrication part number</td>
</tr>
<tr>
<td></td>
<td>• Any part required for complete installation</td>
</tr>
</tbody>
</table>

![Diagram of building construction elements]
The Technology Gap

Programming → Schematic Design → Design Development → Construction Documents → Construction

Power of BIM & Coordination

COST OF CHANGES
Fulton State Hospital

• 300 bed medium security mental health hospital
• 517,194 Square Feet
• $211M
• Architect: WSP|Parsons Brinkerhoff
• General Contractor: River City Construction
• Mason Contractor: John Smith Masonry
• Masonry BIM modeler: CAD BLOX LLC
LOD 400 Masonry Models
#1 Alignment of Doors and Windows to Bond

- Optimization of Field Cuts
- Relocation of Doors and Windows

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#2 Bond Specific Rebar Layout
#3 Under-slab Coordination
#4 HVAC Coordination with Bond Beams
#5 Lintel Redesign
#6 Plumbing and Fixture
#7 Structural Steel

- Set embed plates
- Locate beam pass throughs
- Locate beam pockets
- Produce shop drawing with steel and cmu
Embed plates in beam pockets
#8 Masonry Shop Drawings
#9 Model Ownership

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#10 Efficient Material Handling

- Production lead times – ACCURATE ORDERS!
- Staging deliveries
- Staging material on site

Control Schedule and Cost!
The Technology Gap

COST OF CHANGES

LOD 400

LOD 400

Programming
Schematic Design
Design Development
Construction Documents
Construction

Automated Modeling

Power of BIM & Coordination

#BIMForumED

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Automated Modeling for Masonry

- Standard Design Specification
  - Geometry
  - Materials
  - Structural Parameters

- LOD 350-400 Detailing
  - Layout
  - Bond Patterns
  - Material Rendering
  - Bond Beams and Rebar
  - Rough Opening Details
  - Control Joints

Rule Based Modeling Software

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Closing the Technology Gap
Now Let’s Have Some Fun...