BIM-M Masonry Wall Project and Revit Guide

November 13, 2015

BIM-M
Building Information Modeling for Masonry

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• BIM-M Initiative
• MUD
• LOD for Masonry
• Modeling
• Limitations
• The Guide
• Contractors/
  Downstream Use

MISSION STATEMENT

To unify the masonry industry and all supporting industries through the development and implementation of BIM for masonry software to facilitate smoother workflows and collaboration across all disciplines from owner, architect, engineer, manufacturer, mason, contractor, construction manager, and maintenance professionals.
THE PROJECTS

- Project 1: Masonry Unit Model Definition (MUD)
  - Jeff Elder of Interstate Brick is the PM
- Project 2: Masonry BIM Benchmark
  - David Biggs of Biggs Consulting Engineering is the PM
- Project 3: Masonry Wall Definition
  - Jamie Davis of Ryan Biggs | Clark Davis is the PM
- Project 4: BIM-M Contractor Input
  - Fred Kinateder of Kinateder Consulting is the PM

Contractor  
LOD  
BIM-M  
The MUD  
The Guide

Masonry Unit Database

- Naming Convention
- Basic Unit Shapes
- Properties
- Material Suppliers
Names and Families

CU.8816.stretch.gray

Parent = Stretcher
Child 1: Single Bullnose
Child 2: Double Bullnose Short Side
Child 3: Double Bullnose Long Side

Generic vs. Specific Units

- Simple representation for BIM
- You cannot buy this unit because no supplier is identified
- Physical properties are not provided
- Generic color and texture are provided

G = generic units, parametrically generated
C = custom units, non-parametrically generated
S = specific units with manufacturer data (not part of Phase III MUD)

Shapes Generator

AutoCad | Rhino | SketchUp

Wall Builder

Web

Unit Builder

Validation

G = generic units, parametrically generated
C = custom units, non-parametrically generated
S = specific units with manufacturer data (not part of Phase III MUD)

Excel Template or Web App

BIM-M / GT Task

MUD FOR BIM PLUG-INS

Basalt

Oldcastle

York

88DCSFH
The MUD
Contractor
LOD
The MUD
The Guide

Level of Development
What is your LOD?

THE MASONRY WALL SYSTEM
How much is enough in BIM?

BIM vs BIM

The Process:
- 3D collaboration
- Element/Data Based
- Transfer of Data Downstream

BIM vs BIM

The Model
- Produced with a BIM platform (Revit)
- Contains 3D and 2D elements
- Content used to produce Construction Documents

THE BIM

3D content + 2D content = The BIM

- 3D ELEMENTS
- 2D LIVE
- 2D DUMB
BUILDING INFORMATION MODELING VS CONSTRUCTION DOCUMENTS

So...how much has to be 3-D content?

LOD

3-D Content
Requirements for Materials
- LOD 100
- LOD 200
- LOD 300
- LOD 350
- LOD 400
LOD 100

• The Model Element may be graphically represented in the Model with a symbol, but does not have any indication of actual physical geometry. Information related to the Model Element (i.e. cost per square foot, tonnage of HVAC, etc.) can be derived from other Model Elements represented in the Model and other Project data.

LOD 200

• The Model Element is graphically represented within the Model as a generic system, object, or assembly with approximate quantities, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.

LOD 300

• The Model Element is graphically represented within the Model as a specific system, object or assembly accurate in terms of quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.

LOD 350: DETAILED COORDINATION

• NEW! The Model Element is graphically represented within the Model as a specific system, object, or assembly in terms of quantity, size, shape, orientation, and interfaces with other building systems. Non-graphic information may also be attached to the Model Element.
LOD 400: FABRICATION ASSEMBLIES

• The Model Element is graphically represented within the Model as a specific system, object or assembly that is accurate in terms of size, shape, location, quantity, and orientation with detailing, fabrication, assembly, and installation information. Non-graphic information may also be attached to the Model Element.

MASSONRY LOD

LOD 300: Collaboration
  • Independent wythes so backup can adjust to structure
  • “Smart” wallpaper for coursing coordination - plan, section, elevation

LOD 350: Collaboration and Analysis
  • Bond beams and vert. reinf. shown for intelligent clash detection
  • Control joints break wall panels
  • Structural usage tags more intelligent for clash and transfer to analytical programs

LOD 400: Shop Drawings and Construction
  • Individual units
  • Cavity information
  • Tie
  • Joint reinf.
  • Laps
  • Grout sequence
LOD – 3-D CONTENT IN BIM NOT CONSTRUCTION DOCUMENT CONTENT

**LOD 200**
Single Wythe Concrete Masonry Wall

**VERTICALLY REINFORCED & GROUTED CELLS**

**HORIZONTALLY REINFORCED & GROUTED BOND BEAM**

**CONTROL JOINT**

**STRUCTURAL USAGE TAG** FOR WALL SYSTEM

**LOD 300**
Single Wythe Concrete Masonry Wall
LOD 400

GROUTING SEQUENCE
CONTROL JOINT GASKETS
BAR LAP SPLICE INFORMATION
HORIZONTAL JOINT REINFORCEMENT MESH FOR GROUT STOP
INDIVIDUAL MASONRY UNITS MODELED; SPECIFY COLOR & FINISH
FLASHING & WEEP COMPONENTS
SEALANT & BACKER ROD

Single Wythe Concrete Masonry Wall

LOD 300

LoD Single Wythe Concrete Masonry Wall

WALL

Brick and Block Cavity Wall

LOD 300

VE NEER WYTHE
BACKUP WYTHE
HATCH PATTERN
WALLPAPER USED AS BOND PATTERN
COURSING
THERMAL CONTROL LAYER

Brick and Block Cavity Wall
BIM-M Recommendations incorporated into BIMForum LOD Specification in 2014

- Coursing
- Graphics
- Properties
- Wythe Adjustments
- Bond Beams
- Reinforcing
- Special shapes
- Wall Ownership
- Clash detection
- Downstream use
THE IMPERIAL LIBRARY

ELEMENT DATABASE

NOT SO MUCH FOR WALLS......

MATERIAL ??
HOW ABOUT COLD-FORMED?

THEY HAVE A PLUG-IN....

FROM LOD 300 TO LOD 400
FROM LOD 300 TO LOD 400

- Most common estimating programs
- CAD based
- Models every block
- Can not read Revit file

WE NEED BETTER TOOLS

- Very difficult to achieve our LOD recommendations with current REVIT tools
- Need ability to adjust height of separate wythes without duplicate modeling
- Need ‘Smart’ wallpaper for coursing collaboration
- Better graphics for section and plan views
- Ability to easily define bond beam locations within a wall
- Ability to insert intelligent control joints
- Better structural usage tags to flag walls for clash and to identify wythes that push downstream to analytical programs
- INTELLIGENT data that we can push downstream
- Plug-ins to get us to LOD 400

WE NEED A GUIDE

- Tools for modeling masonry using current technology
- Based on Revit tools
- Examples of how other firms approach masonry

- Currently in review by TMS TAC
- Due out at end of the year
- Tool for modeling masonry buildings
- LOD
- Reference for BXP
- Tips for numerous masonry features and conditions
- Sample BIMs from Integris and CTC
- Wish list for better modeling tools
How To Guide for Advanced Modeling to Increase LOD

- Bonding Patterns
- Changes in Bond Patterns
- Masonry Openings and Lintels
- Stone Accents
- Arches
- Reinforcing
- Bond Beams
- Control Joints

Who owns the walls?

- **Architect** owns all walls – Structural Engineer uses underlay and detail lines for headers.
- **Structural Engineer** owns all masonry bearing walls. Non-bearing walls in Architect model.
- Architect and SE **both** own walls. Everything duplicate modeled, including openings.
- Architect owns all walls – SE models bond beams and shear walls only for ‘smart clash’.
- **Independent** wall model is created and shared by Architect and SE.

MODELING PRACTICES

Federated models with load-bearing wall construction?

… a model consisting of linked but distinct component models, drawings derived from the models, texts, and other data sources that do not lose their identity or integrity by being so linked, so that a change to one component model in a federated model does not create a change in another component model in that federated model.

ARCHITECT OWNS ALL WALLS

Architect models all masonry walls. Structural uses Architectural model as underlay for drawing creation. Structural headers shown with detail lines.

**PROS:**
- Works as federated model; no duplication or possible discrepancies
- Architect typically drives the changes to wall placement/door and window locations
- Architect has all walls to host other elements

**CONS:**
- Differentiation between bearing and non-bearing walls for structural drawings
- Need a wall to host a wall footing
- Can’t transfer structural walls into analysis program
- More difficult to find subtle changes; Copymonitor could be used.
<table>
<thead>
<tr>
<th>STRUCTURAL ENGINEER OWNS ALL MASONRY BEARING WALLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural models only bearing walls. Architect models non-bearing walls and veneers. Architect uses Structural model as underlay for drawing creation.</td>
</tr>
<tr>
<td><strong>PROS:</strong></td>
</tr>
<tr>
<td>• Works as federated model</td>
</tr>
<tr>
<td>• Clear distinction between bearing and non-bearing. Will help with clash detection.</td>
</tr>
<tr>
<td>• Easy transition to analysis programs</td>
</tr>
<tr>
<td>• Engineer fully aware of any changes to walls</td>
</tr>
<tr>
<td><strong>CONS:</strong></td>
</tr>
<tr>
<td>• Duplication for exterior walls. Veneer by Architect, backup by Structural.</td>
</tr>
<tr>
<td>• Coordination more difficult for window and door placements and changes</td>
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<tr>
<td>• Wall hosting</td>
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<td><strong>PROS:</strong></td>
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<td>• Neither drawing set relies on an underlay model</td>
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<td>• Easy transition to analysis programs</td>
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<tr>
<td>• Easy for Architect to make changes to walls and openings</td>
</tr>
<tr>
<td><strong>CONS:</strong></td>
</tr>
<tr>
<td>• Not a true federated model; duplication of all bearing walls</td>
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<tr>
<td>• Chance for discrepancies between Architectural and Structural drawings (BIM?)</td>
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<tr>
<th>INDEPENDENT WALL MODEL</th>
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<tr>
<td>Independent model is created that has all masonry bearing walls. Central model is shared between Architect and Structural. Both Architect and Structural use wall model link to create drawings.</td>
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<td><strong>PROS:</strong></td>
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<td><strong>CONS:</strong></td>
</tr>
<tr>
<td>• Difficult unless wall central model is accessible to both</td>
</tr>
<tr>
<td>• Cumbersome to work in two models to make changes</td>
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<tr>
<td>• Control for changes too loose.</td>
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<th>VIDEOS AND PLUGINS</th>
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<tr>
<td>• Short videos showing modeling steps using Revit</td>
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<td>• First video will include:</td>
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<tr>
<td>• Adjusting and changing bond patterns</td>
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<tr>
<td>• Bond beams</td>
</tr>
<tr>
<td>• Vertical reinforcing</td>
</tr>
<tr>
<td>• Wall ownership for federated models</td>
</tr>
<tr>
<td>• Plugins for LOD 300:</td>
</tr>
<tr>
<td>• MUD/Bonding Plugin</td>
</tr>
<tr>
<td>• Split wythes</td>
</tr>
<tr>
<td>• Plugins for LOD 350:</td>
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<tr>
<td>• Bond beams</td>
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<tr>
<td>• Vert rain</td>
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Masonry Deliverables Guide through BIM
- History of BIM-M and goals
- Introduction of how to get started in BIM
- How to develop a BIM execution plan for your company
- Examples of Deliverables being used by contractors that are modeling their work
- How deliverables deliver return on investment
- Where to go for educational opportunities to help getting started

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DOWNSTREAM PROGRAMS
- Estimating
- Individual Units
- CAD based
- Can not read a Revit file
- Look to BIMForum LOD Specification for current masonry LOD recommendations
- BXP: Choose your LOD wisely – difficult with current tools to get beyond LOD 300
- BXP: Decide who will own the walls
- Look for the Guide, Videos, and Plug-Ins on BIM-M Website for Modeling Tips
- Look for MUD development and plug-ins
- Downstream Use - programs exist but not yet compatible with Revit models

TAKE-AWAYS
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BIM-M WEBSITE
WWW.BIMFORMASONRY.ORG