BIM DELIVERABLES FOR MASON CONTRACTORS VOLUMES I & II

Prepared by Fred Kinateder Kinateder Consulting
CONTRIBUTORS

- Adrian Siverson R & D Masonry
- Mike Kinateder, KMI Construction
- Ricardo Kahn, Mortenson Construction
- Paul Oldham, Ollier Masonry
- Mike Madone Mountain Masonry LLC
- Austin Norberg & Justin Wenger Seedorf Masonry
- Shaun Hester & Kevin Kendellen Mortenson Construction
- Cameron Weinbrenner JP Cullen
- John Smith John J Smith Masonry
- Ed Davenport Davenport Masonry
- Tom Cunieo CAD BLOX
HISTORY OF BIM-M AND GOALS

• Started BIM-M in 2013
• BIM-M Original Sponsors:
  • International Masonry Institute (IMI)
  • International Union of Bricklayers and Allied Craftworkers (BAC)
  • Mason Contractors Association of America (MCAA)
  • National Concrete Masonry Association (NCMA)
  • The Masonry Society (TMS)
  • Brick Industry Association (BIA)
  • Western States Clay products (WSCPA)
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.”

HISTORY OF BIM-M AND GOALS

Goals of this Document:

▪ Establish importance of BIM to mason contractors
▪ Share resources of how to get started in BIM
▪ Explain the function of a BIM Execution Plan (BXP)
▪ Give examples of softwares currently being used by mason contractors in BIM environment
▪ Deliverables for mason contractors
▪ Educational opportunities for modeling with BIM software
BIM-M PROJECTS

- Revit Content Library available Version II being Beta Tested
- Masonry Unit Database (MUD) available May 2017
- Sketchup Wall Library (under development) Available Fall 2017
- BIM Deliverables Guide for Masonry Contractors Vol.II available now
WHY IS BIM IMPORTANT TO MASON CONTRACTORS?

- 70%-80% of the industry is using BIM
- Increased profitability
- Promote masonry materials and construction
- Improved safety and management tools
- Improved communication
- Avoid problems, clash detection
DELIVERABLES USED BY MASON CONTRACTORS

- Material Quantities for Purchase Orders
- Shop Drawings
- Virtual Mock Ups
- Create RFI’s for Unworkable Details
- Layout
- Rebar Size & Placement
- Heights & Coursing
- Lift Drawings/ Working drawings
- Equipment & Scaffold Requirements
- Site Logistics
RETURN ON INVESTMENT (ROI) THROUGH BIM

Factors affecting ROI

• Level of Participation
• How many “Deliverables” do you incorporate into work flows/processes?
• Buy in from principals, field, your company culture
• Who created the Model, in house or third party
There are contractors that make use of all of the “Deliverables” outlined previously and have realized gains in production of up to 10% Examples:

• RFI’s answered before you are on the job
• Lay Out, Lift drawings answer questions eliminate down time on project
• Virtual Mock Ups help solve problems eliminate out of sequence work
• Problems are addressed before you get there
• Logistic problems addressed eliminate trade stacking
Supply Chain Improvements have produced savings in the 3%-7% range through:

• Eliminating Shortages that cause costly delays
• Eliminating overages
• Allowing just in time delivery improving cash flow
## RETURN ON INVESTMENT (ROI) THROUGH BIM

Theoretical ROI Assumptions Based on Conservative Projections In House Model:

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Base Costs:</td>
<td>1,000,000.00</td>
</tr>
<tr>
<td>Assumed Materials:</td>
<td>400,000.00</td>
</tr>
<tr>
<td>Assumed Labor:</td>
<td>600,000.00</td>
</tr>
<tr>
<td>Assumed Material Savings (3%)</td>
<td>12,000.00</td>
</tr>
<tr>
<td>Assumed Labor Savings (5%)</td>
<td>30,000.00</td>
</tr>
<tr>
<td>Gross Savings:</td>
<td>42,000.00</td>
</tr>
<tr>
<td>Modeling Costs (40 Hours @ 90.00):</td>
<td>(3,600.00)</td>
</tr>
<tr>
<td>Software Investment:</td>
<td>(1,000.00)</td>
</tr>
<tr>
<td>Potential Net Savings:</td>
<td>37,400.00</td>
</tr>
</tbody>
</table>

**ROI of $8.13/ $1.00**
**ROI CONTINUED**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Base Costs:</td>
<td>1,000,000.00</td>
</tr>
<tr>
<td>Assumed Materials:</td>
<td>400,000.00</td>
</tr>
<tr>
<td>Assumed Labor:</td>
<td>600,000.00</td>
</tr>
<tr>
<td>Assumed Material Savings(3%):</td>
<td>12,000.00</td>
</tr>
<tr>
<td>Assumed Labor Savings(5%)</td>
<td>30,000.00</td>
</tr>
<tr>
<td><strong>Gross Savings:</strong></td>
<td>42,000.00</td>
</tr>
<tr>
<td>Third Party Vendor: 40,000 Units @ .20/unit</td>
<td>(8,000.00)</td>
</tr>
<tr>
<td>Software Investment:</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Potential Net Savings:</strong></td>
<td>34,000.00</td>
</tr>
</tbody>
</table>

**ROI of $4.25/ $1.00**
HOW TO GET STARTED IN BIM

Resources:
- “Developing a Business Case for BIM Integration in Your Company”
- “The Future of 3-D modeling for Concrete Contractors”
- BIM-M and BIM forum websites
- Seminars and webinars
- BIM Deliverables Guide for Masonry Contractors

Research:
- Talk to other contractors
- Decide what level is right for you In house or third party
- Seminars and webinars
Software used in Volume I & II Case Studies

Types:

- 3D Modeling
  - Sketch Up by Trimble
  - AutoCad

- BIM Software
  - Revit by Autodesk (used by 70-80% of design community)
  - Tekla (widely used for concrete and rebar)
3D Modeling Software

Sketch Up Pro by Trimble [http://www.sketchup.com](http://www.sketchup.com)

- Free trial available
- Reasonable price for pro version
- Widely used by contractors in masonry and concrete business
- Relatively easy to learn and use
- Create 2D lift drawings from your models
- Shows masonry coursing, bond patterns and grout and rebar
- Numerous tutorials and You Tube videos available for on-line learning
- Export PDF’S and images
- Import models from Google Earth or Google Maps Street View for project site info
- Some BIM ready features
- Portions of models are exportable to Revit through IFC AND DWG formats
- Future potential for plugins or add-ins for Revit
- Future Masonry Unit Data Base (MUD) roll out Late 2016
- Free trial version
- Requires significant training to learn and use
- Create 2D and 3D designs
- Native Revit interoperability
BIM Software

- Used by 70%-80% of design community
- Expensive
- Difficult to use extensive training required
- Currently does not portray coursing or bond accurately
- Grout and Rebar require extra modeling
- BIM-M developing users guide and tools to make it easier for designers to design with masonry

Tekla by Trimble [http://www.Tekla.com](http://www.Tekla.com)
- Construction based software
- Used widely by concrete and rebar community
- Construction detail oriented
- More expensive than Sketchup or Formit 360
Vendors/Providers
There are a number of third party vendors that can provide 3D modeling services.
• CAD BLOX from St. Louis http://cadblox.com (see example below)

• CTC http://www.cadtechnologycenter.com
Both of these providers provide 3D models and BIM coordination services. Their models also provide:
• Lay Out
• Quantity takeoff
• Information for purchase orders

• BIMdata.org contact ericakoe@bellsouth.net
• Revit models
• Estimating, quantity takeoff
• Submittals

• Sanveo contact ngandhi@sanveo.com
• Revit Models
• BIM Coordination
BIM EXECUTION PLAN

Resource Guide for creating a BIM Execution Plan [http://www.engr.psu.edu/bim/PxP](http://www.engr.psu.edu/bim/PxP)

Concepts applicable for formulating a BIM execution plan (BXP) for your company
WHAT IS A BIM EXECUTION PLAN?

A BIM Execution Plan formalizes what information you want to get from your models, how you will use that information and who you will share the information with.

Three concepts Applicable to a BIM Execution Plan:
• Identify BIM Goals and Uses
• Design BIM Project Execution Process
• Develop Information Exchanges

Examples of Deliverables from Model to achieve Goals:
• Site Logistic Planning (site utilization)
• Phase Planning (visual sequencing)
• Quantity takeoff (purchase order supply chain management)
• Virtual Mock Ups
• Develop scaffolding plans, masonry lift drawings, and work instructions
• Digital fabrication and prefabrication
IDENTIFY BIM GOALS & USES

▪ Improve Productivity
▪ Improve Schedule
▪ Improve Quality
▪ Improve Material Supply Chain
DESIGN BIM PROJECT EXECUTION PROCESS

- Identify Deliverables That Achieve Goals of BIM Execution Plan
  - Site Logistic Planning (Site Utilization)
  - Phase Planning (Virtual Sequencing)
  - Quantity Takeoff (Purchase Order Supply Chain Management)
  - Virtual Mock-Ups
  - Develop scaffolding plans, masonry lift drawings, and work instructions
  - Digital Fabrication and Prefabrication
COMMON GOALS FROM CASE STUDIES

• Improve Supply Chain
• Improve Productivity
• Improve Site Logistics
• Improve Schedule
• Clash Detection
DELIVERABLES USED BY MASON CONTRACTORS

- Material Quantities for Purchase Orders (Most Common Deliverable)
- Shop Drawings
- Virtual Mock Ups
- Create RFI’s for Unworkable Details
- Layout (Result of Material Quantities)
- Rebar Size & Placement
- Heights & Coursing (Result of Material Quantities)
- Lift Drawings/ Working drawings (Result of Material Quantities)
- Equipment & Scaffold Requirements
- Site Logistics

All of this information comes from the model that is in most cases created during the procurement/start up phase of the project.
## DEVELOP INFORMATION EXCHANGES

<table>
<thead>
<tr>
<th>Deliverables</th>
<th>Foreman</th>
<th>Labor Foreman</th>
<th>Material Supplier</th>
<th>CM/GC</th>
<th>Architect/Engineer</th>
<th>Sub Foreman</th>
<th>Equipment Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Quantities</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shop Drawings</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Virtual Mock Ups</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clash Detection</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unworkable Details</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lay Out</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rebar Size &amp; Placement</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heights &amp; Coursing</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>RFI’S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Lift Drawings &amp; Work Instructions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment &amp; Scaffold Requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This would be part of BXP (BIM Execution Plan)
EXAMPLES OF SUPPLY CHAIN IMPROVEMENT

- WMH Examples of Acoustic CMU and Burnished CMU
- Southeast Health Group Expansion Accurate CMU Quantities
- St Augustine School Burnished CMU Shapes and Quantities
- Washington High School Brick and Glazed CMU Quantities
3D CMU MODEL

Image Courtesy of KMI Construction
Image Courtesy of KMI Construction
# South Addition
## Piece Count by Elevation

<table>
<thead>
<tr>
<th>Block ID</th>
<th>Description</th>
<th>South Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Block ID</th>
<th>Description</th>
<th>South Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Block ID</th>
<th>Description</th>
<th>South Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

# North Addition
## Piece Count by Elevation

<table>
<thead>
<tr>
<th>Block ID</th>
<th>Description</th>
<th>North Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Block ID</th>
<th>Description</th>
<th>North Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Block ID</th>
<th>Description</th>
<th>North Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Image Courtesy of KMI Construction
3D MODEL FOR LAYOUT AND QUANTITIES

Image Courtesy of Mountain Masonry
3D MODEL SHOWING CMU TYPES

Image Courtesy of Ollier Masonry
BRICK & CMU MODEL

Image Courtesy of Ollier Masonry
BRICK SHOP DRAWINGS/LAYOUT

Image Courtesy of Mountain Masonry
Image Courtesy of KMI Construction
TYPICAL WALL ELEVATION - TWO OPENINGS

Image Courtesy of KMI Construction
REBAR SHOP DRAWING

Image Courtesy of KMI Construction
Image Courtesy of R & D Masonry
BRICK PATTERN & SHAPE SHOP DRAWING

Image Courtesy of R & D Masonry
3D CMU MODEL WITH STEEL COORDINATION

Image Courtesy of R &D Masonry
2D LIFT DRAWING WITH STEEL COORDINATION

Image Courtesy of R & D Masonry)
LIFT DRAWINGS – 3D IMAGE

Image Courtesy of Mortenson Construction

ISSUED FOR CONSTRUCTION
LIFT DRAWINGS – 2D FLOOR PLAN

Image Courtesy of Mortenson Construction)
LIFT DRAWINGS – ELEVATION VIEW

ISSUED FOR CONSTRUCTION

Image Courtesy of Mortenson Construction
CMU MODEL INCORPORATED INTO NAVISWORKS

Image Courtesy of John Smith Masonry
WALL SECTIONS FROM MODEL

Image Courtesy of KMI Construction
3D MODEL USED FOR MASONRY PREFABRICATION

Image Courtesy of JP Cullen Construction
VIRTUAL MOCKUP

NOTE:
THIS SET OF DOCUMENTS ARE FOR REFERENCE ONLY TO AID IN CONSTRUCTION SEQUENCES. THIS DOCUMENT DOES NOT REPLACE THE CONTRACT DOCUMENTS. CONTRACT DOCUMENTS MUST BE ADHERED TO AND ANY CHANGES MUST BE APPROVED BY THE PROJECT ARCHITECTS. ALL DETAILS MUST BE VERIFIED BY RESPONSIBLE SUBCONTRACTOR TRADES.

Image Courtesy of Mortenson Construction
RFI GENERATION FROM VIRTUAL MOCKUP

NOTE: ARCHITECT TO PROVIDE NEW DETAIL (11/AS.106) WITH MODIFIED FRAMING ABOVE SOFFIT UP THROUGH PARAPET TOP. THIS DETAIL IS NO LONGER VALID.

NOT TO SCALE

NOTE: THIS SET OF DOCUMENTS ARE FOR REFERENCE ONLY TO AID IN CONSTRUCTION SEQUENCES. THIS DOCUMENT DOES NOT REPLACE THE CONTRACT DOCUMENTS. CONTRACT DOCUMENTS MUST BE ADHERED TO AND ANY CHANGES MUST BE APPROVED BY THE PROJECT ARCHITECTS. ALL DETAILS MUST BE VERIFIED BY RESPONSIBLE SUBCONTRACTOR TRades.

REVISION 1: 08-27-2009
MINOR CHANGES MADE PER SIGNOFF MEETING ON 08-26-2009

Image Courtesy of Mortenson Construction
RFI GENERATION – BOND OF CMU

- WMH Examples of Acoustic CMU and Burnished CMU

Image Courtesy of KMI Construction
Image Courtesy of KMI Construction
FIELD INSTRUCTIONS FROM VIRTUAL MOCKUP

1. WEEPS ADDED AND CORRECTED WATERPROOFING DETAILING

SC-400 EXPANSION JOINT FOLLOWS VERTICAL JOINT UP AND OVER THE TOP OF PARAPET AS SHOWN

Image Courtesy of Mortenson Construction
SITE LOGISTICS & PHASE PLANNING

Image Courtesy of Ollier Masonry
Example of BIM generated brick layout and template. The template was used to cut the brick letters and maintain the stacked bond brick pattern. (Courtesy of Mortenson Construction, Kinateder Masonry)
Who is using BIM?

• Precast Fabricators and Installers
• Structural Steel Contractors
• Steel Studs and Drywall Contractors
• Concrete Contractors
• Curtain Wall Contractors

Why Mason Contractors should use BIM?

• Stay abreast with our competition competitive advantage
• Increase market share
• Improve production and profitability, less waste more efficiency
• Improves work process, to better meet the needs of our customers
QUESTIONS?

Contact Information:
Fred Kinateder
fred@kinatederconsulting.com
Phone: (414)491-1425