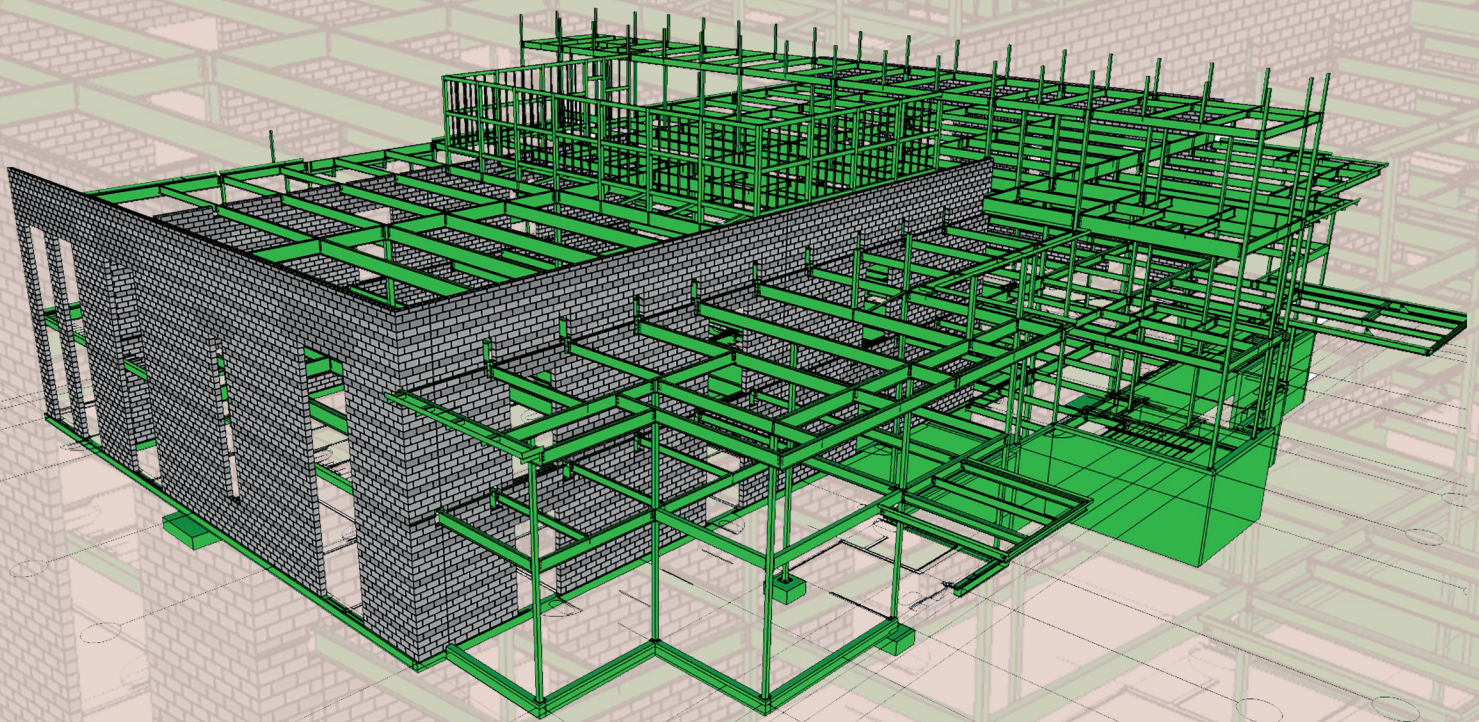




BIM-M

Building Information Modeling for Masonry

Deliverables for Masonry Contractors



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BIM-M

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History and Goals of BIM-M

In 2013, the masonry industry came together and started the Building Information Modeling for Masonry (BIM-M) Initiative. The initial sponsors and members that form the Executive Committee of this effort include the International Masonry Institute (IMI), International Union of Bricklayers and Allied Craftworkers (IUBAC), Mason Contractors Association of America (MCAA), National Concrete Masonry Association (NCMA), The Masonry Society (TMS), Brick Industry Association (BIA), and Western States Clay Products (WSCPA). Since its formation, BIM-M has been joined by a number of groups as sponsors and supporters.

To begin, BIM-M retained the Digital Building Lab at the Georgia Institute of Technology to develop a Road Map to guide the process of advancing BIM in the masonry industry. The initial road map, the updated road map completed in 2015, and all of the associated projects can be viewed on the BIM-M website bimformasonry.org.

The mission statement for BIM-M is “Unify the masonry industry and all supporting industries through the development and implementation of BIM for masonry software to facilitate smoother work flows and collaboration across all disciplines from owner, architect, engineer, manufacturer, mason contractor, construction manager and maintenance professionals.”

In accordance with the BIM Mission Statement and Project 4 from the BIM Road Map, this document highlights:

1. Why BIM is important to the mason contractor
2. How to get started in BIM
3. What a BIM Execution Plan is and how to develop one

4. Examples of software being used by mason contractors to work in the BIM environment
5. Deliverables that provide a return on investment for contractors that are willing to invest the time and resources
6. Where to go for educational opportunities for modeling with the appropriate software

This document deals strictly with building information modeling for the mason contractor. It does not deal with the use of, or implementation of, a federated model. A federated model is usually created by the construction manager (CM) or BIM Coordinator. It incorporates all of the individual design and construction models into one “federated model.” A federated model might have structural components, mechanicals, exterior wall systems, and interior wall systems as well as masonry. This makes working with the model very cumbersome because there is so much information. There are individual cases where a CM/general contractor (GC) has required mason contractors participate in the BIM process, and therefore be part of a federated model. This is not yet prevalent in today’s marketplace. In most cases, the BIM used by the design team or CM/BIM Coordinator is not made available to the mason contractor.

This document will highlight the benefits that can be derived by the mason contractor by creating a model for its use.

The information contained here comes from contractor case studies and survey information as the result of Project 4, Contractor Outreach which is part of the Road Map.

Why BIM is Important to Mason Contractors

There are various reasons why mason contractors need to implement BIM. The primary reason is that the construction industry has adopted BIM as the delivery method of the future. There has been a high rate of acceptance, and it continues to grow. BIM is a tool that successful masonry companies must learn to use to remain competitive in the 21st century.

The second, and very important, reason to implement BIM is financial. Experienced BIM users do so because it improves their profitability. In a subsequent section of this guide, there will be a discussion on the return on investment (ROI), which illustrates how BIM can help to increase profits.

For mason contractors who have been early adopters of this technology, there are several benefits credited to BIM:

- Increased opportunities for promoting masonry construction
- Increased profitability using digital tools for interactive scheduling and coordination

- Improved safety with management tools
- Improved communications with architects and engineers and construction managers
- Fewer problems during construction through “clash detection” of models

Some mason contractors may not fully embrace the concept. They view BIM as an inconvenience or simply a requirement that needs to be satisfied for a specific project. However, past results indicate that the benefits are best derived by those who adopt the BIM process within their corporate culture.

One aspect of BIM that has proven essential is the need for senior management to embrace the process change that is BIM. BIM can't be left to junior staff to make it work. Lack of commitment will result in failure and wasted effort.

How to Get Started in BIM

Are you prepared to get started? Are you trying to get through that first project and you've never used BIM before? Or, are you looking to fully understand the BIM process to improve your business in the long term?

BIM-M recommends mason contractors embrace BIM and develop a long-term BIM plan. This effort may come before your first project or after you have completed one or more projects and you now want to develop in-house capabilities. Some tips include:

- Do your research. Meet with others who have taken this step. Visit the BIM-M website for background information, presentations and reports.
- Do your due diligence and decide what level of BIM is right for you. Will you retain BIM modelers or develop full BIM capabilities in-house? Will you only develop 3D modeling in-house and use consultants for full BIM models? Will you expand your use of digital tools to help with the scheduling, budgeting, and project management?
- Get training.
- Create your own corporate BIM Execution Plan. This forms your plan for using BIM, even when projects might not require it.

The following are two links to articles you should review before making the decision whether BIM is right for you, and at what level.

The first article is "Developing a Business Case for BIM Integration in Your Company." dpw-group.com/business-case-for-bim-part-1/



Business integration of BIM. SOURCE: dpw-group.com

The second article is "The Future of 3-D modeling for Concrete Contractors" by Carl Taylor in the September 2015 issue of *Concrete International*. The article can be accessed at: concreteinternational.com.

Although this second article deals with concrete, the concepts are applicable to masonry and any other discipline. Here are a few excerpts:

- Those that don't model (BIM) will find themselves at a competitive disadvantage
- 3D models lead to better structures, less waste, lower contingencies and more efficiency
- 3D modeling doesn't require establishing a BIM department
- Contractors found early on that design models are not detailed enough and of little use to them, thus requiring them to create their own construction model
- Regardless of contractual requirements, modeling improves work process and improves efficiency
- You can also model 4D (schedule) and 5D (cost) when you become proficient

Developing a BIM Execution Plan

Most of the information available about BIM Execution Plans is intended to assist in the development of a plan at the start of each project. These concepts can be reviewed in their entirety at *BIM Project Execution Planning Guide 2.0* found at: engr.psu.edu/bim/PxP

Several highlights from this guide that can be used to formulate a BIM Execution Plan (BXP) for your company include:

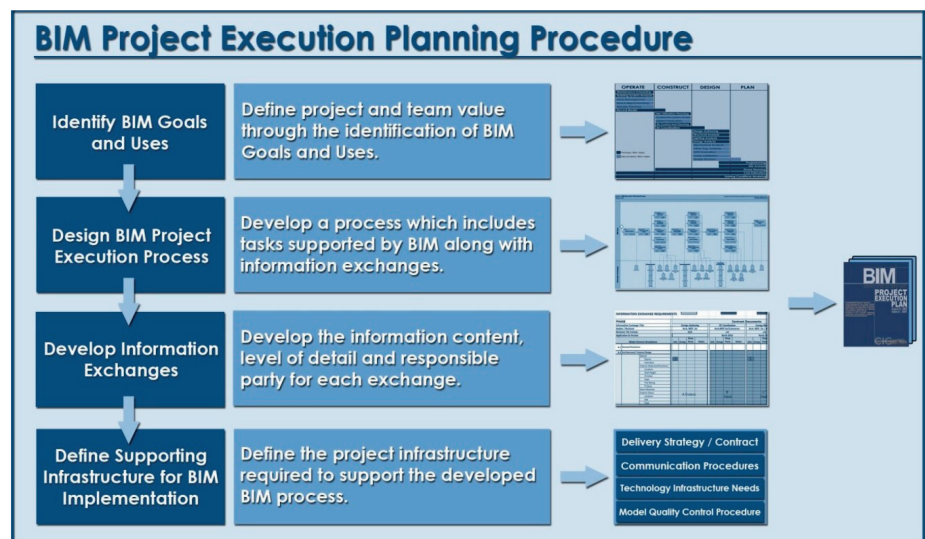
1. By developing an execution plan, you must formalize what information you want to get from your models, how you will use them, and with whom you will share your information. The plan will help you maximize the usable information you obtain from your models.
2. Three concepts that are applicable to a company BXP:
 - Identify BIM Goals and Uses
 - Design BIM Project Execution Process
 - Develop Information Exchanges
3. The goals can include improving schedule, productivity, and quality. After you have identified your goals, you can decide how to use your models to obtain the information to attain your goals.

Some examples of uses (or “deliverables”) that could be taken from the models include:

- Site logistic planning (site utilization)
- Phase planning (visual sequencing)
- Quantity takeoff
- Virtual mock ups
- Scaffolding plans, masonry lift drawings and work instructions
- Digital fabrication and prefabrication

This is not an all-inclusive list, however it provides examples of the information available through BIM. These are illustrated in the Examples section of this document.

Once goals and uses are identified, you can complete the last two steps BXP by developing a Work Flow Plan that will develop a process of gathering the information needed, when it's needed, who is responsible for it, and to whom it's disseminated.



The BIM Project Execution Planning Procedure. SOURCE: *BIM Project Execution Planning Guide*

Software in the BIM Environment

BIM and BIM-related software fit into several categories. These include:

1. 3D modeling
2. BIM software
3. Accessory programs for scheduling, estimating, budgeting, safety, etc. that are sometimes provided by service providers.

The following are some examples of the software packages that are currently being used by mason contractors, and some of the attributes of each software package. BIM-M recognizes the BIM design market is heavily invested in Autodesk Revit, and emphasizes the need for masonry compatibility with that product.

BIM-M is providing a range of options to investigate. Pick the software that meets the needs of your company and accomplishes the goals of your BIM Execution Plan. Our intent is to provide a resource to help you start working in the BIM environment. These options are not all inclusive, but are meant to be a starting point to conduct your own research.

3D MODELING

There are several programs in this category. Primarily, they produce geometry-based models that don't have the power of BIM software that includes data on the model. Here are some programs, features, and potential uses for contractors.

SketchUp Pro by Trimble sketchup.com

- Download and try a free trial
- Reasonable price for Pro version
- Widely used by contractors in masonry and concrete
- Relatively easy to learn and use

- Create 2D drawings from your models
- Show masonry coursing, bond patterns and grout and rebar placement in the models
- Numerous tutorials and YouTube videos are available online for learning
- Export PDFs 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
- Has a future potential for plugins or add-ins for Revit
- For more information, see SketchUpPro.com.

Potential Uses:

Mason contractors will find this software useful for creating 2D drawings and 3D models for RFIs, virtual mock ups, and details.

See illustrations at the end of the document for examples of how contractors are using SketchUp for 2D and 3D drawings.

Autodesk Formit 360 by Autodesk

autodesk.com/products/formit-360/overview

- Free trial available from website
- Create web-based models that are stored in the cloud for easy access
- Relatively easy to learn and use
- Native Revit interoperability
- Intuitive 2D sketching tools
- Real-time collaboration
- Reasonable price for Pro version
- For more information, see Autodesk.com/360

Potential Uses:

Mason contractors will find this software useful for creating 2D and 3D models for RFIs, virtual mock ups, and details.

AutoCAD by Autodesk

autodesk.com/products/autocad/overview

AutoCAD has been on the market for years as a computer-aided drafting software package. It has 3D capabilities, but not full BIM capabilities. Attributes include:

- Free trial version
- Requires significant training to learn and use
- Create 2D and 3D designs
- Native Revit interoperability
- For more information, see autodesk.com

BIM SOFTWARE

Autodesk Revit by Autodesk

autodesk.com/products/revit-family/overview

Revit is the Autodesk product used by approximately 70% to 80% of the design community and many construction managers. It is expensive, and is much more difficult to use for modeling masonry than the programs previously mentioned. It currently does not accurately portray coursing or bond patterns. Grout and rebar can be shown through the use of sweeps that require extra modeling effort. BIM-M has a guide for modeling masonry titled, *"Modeling Masonry Buildings in Autodesk Revit."* This guide demonstrates modeling methods not easily found within Revit and highlights development needs.

BIM-M is developing YouTube videos, a content library, plug-ins, and add-ins for Revit that will be available later in 2016. Long term, BIM-M has a masonry unit database under development.

To see some case examples using this software, see autodesk.com/suites/building-design-suite/case-studies.

While the examples shown there are not masonry projects, they do indicate the power of the software.

ACCESSORY PROGRAMS AND SERVICE PROVIDERS

There are a number of third-party vendors that develop building information models on a contract basis. Those models could provide you the lay out and information to order your materials. One such vendor is CAD BLOX from St. Louis, caddblox.com. They have been a BIM-M supporter and provide valuable services to many manufacturers and contractors. Their models are developed using 3D modeling techniques and are very detailed. Not only can you receive a lay out shop drawing, but they provide information to create a detailed purchase order.

Another third-party provider is CTC. They were a presenter at the 2015 BIM-M Symposium in St. Louis. You can view their services on their website cadtechnologycenter.com.

Some accessory programs include:

Tradesmens Software — tradesmens.com

- Widely used masonry-specific estimating software
- 3D representation of building
- Not easily exportable to Revit. Contact Tradesmens for assistance
- Upcoming version will feature some deliverables previously highlighted
- Includes strong masonry database
- User-friendly for mason contractors

CostX Estimating Software — exactal.com

- Supports scanned PDF or CAD drawings as input
- Supports BIM
- Powerful spreadsheet-based workbooks
- Revision mode compares drawings and highlights changes
- Report writer produces customized reports
- Network capabilities allow multiple users to work on a project at the same time
- Range of products depending on needs
- Not masonry specific

Examples of BIM Deliverables Being Utilized by Mason Contractors

While the ultimate goal of BIM is to work with a federated model that everyone can use, that is not feasible at this time.

For that to happen, there has to be a sharing of the design model, which typically only happens on Integrated Project Delivery (IPD) projects and constitutes only about 2% of the market.

The level of development (LOD) has to be a minimum of 350 for it to be of any use to contractors. This is not the case with many design models.

Therefore, we are suggesting that contractors make their own model. By using the information from your company's BXP, you can create a model that has what you need. It is not necessary to model any more than what you need.

BIM-M's goal is to illustrate the deliverables that will be available to you when you build the project virtually before you build it on site. ***"Build it before you build it."***

It is suggested that while you might want to incorporate all of the deliverables that will be illustrated here into your BXP, it is sometimes better to incorporate the deliverables by phases or functions and to start slow. You can expand or revise your BXP at any time.

Deliverables:

- Material Quantities for purchase orders
- Shop drawings
- Virtual mock ups
- Create RFIs for Unworkable Details
- Layout
- Rebar size and placement
- Heights and coursing
- Create lift/working drawings
- Equipment and scaffold requirements
- Site logistics

Virtual mock ups allow the contractor to "build" the mock up virtually and find the problems or conflicts before building the physical mock up.

The model is created after the contract is awarded and during the procurement and start-up phases of the project. This allows for improved supply chain management of materials, generation of RFIs, building layout, virtual mock ups, and creation of lift drawings. All of these will go directly toward improving productivity.

Drawing and Model Examples

The following pages contain models that were created using SketchUp, unless otherwise noted. They were created by either mason contractors or general contractors who self-perform masonry. Each example of various projects provides a deliverable or deliverables that can be used by the contractor. Please note that these examples vary and are driven by the information the individual contractor deemed relevant to each project.



Figure 1

Example of BIM brick layout and BIM-generated template created in Autodesk at the Harley-Davidson Museum in Milwaukee, WI. The template was used to cut the bricks for the letters and maintain the stacked bond brick pattern. *(Courtesy of Mortenson Construction, Kinatader Masonry)*



The team went to work creating a template process that involved overlaying the Harley-Davidson font onto the wall elevation in an Autodesk platform and incorporating the stacked brick layout onto the text. Each brick was then assigned a code incorporating the course number, brick number, and brick color. The bricks were laid out three to a sheet and printed at full scale allowing for the shape to be easily transferred onto the brick. After cutting out the template and transferring the shape to the physical brick, the brick was cut on site to match the desired shape. **Each piece was labeled according to the code assigned and installed according to the plan.**

This process was very successful. It ensured an exceptional appearance and a documented way to ensure Harley-Davidson's proper font and layout was incorporated into the three walls. **By utilizing computer software, each piece of brick was shaped to the exact specifications required by the design.**

The project team was dedicated to fulfilling Harley-Davidson's vision for their Museum and exceeding their expectations in every way. Working together, the design and construction team collaboratively **protected the buildings' design intent** while providing **lower delivery costs**.

- The design of the Museum is meant to be a direct reflection of the Harley-Davidson brand. The owner desired an open concept free of complex architectural elements and visual obstructions such as MEP systems. The team was challenged to minimize obstructions and hide MEP systems, thus requiring them to be consolidated into areas that had ceiling coverage, within the walls, and within the floors. **By planning the layout and routing of the systems within these pre-defined, no-fly zones in the BIM model, the brand's reflection through the architecture remained intact.**

Figure 2

3D CMU Model created to include all CMU walls. *(Courtesy of Mortenson Construction)*

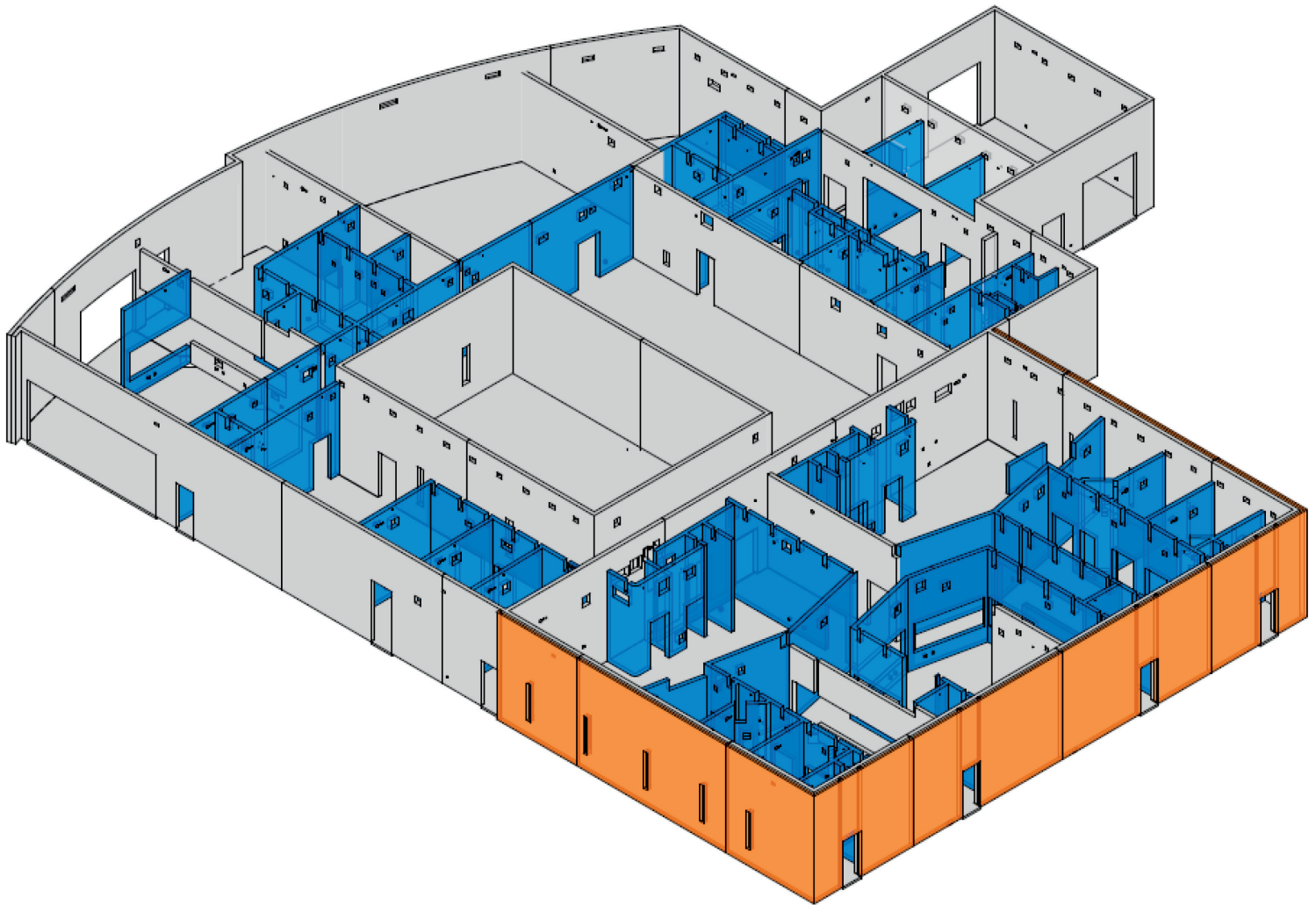


Figure 3

2D Floor Plan created from the 3D model in Figure 2, assigning wall elevations and showing structural and nonstructural walls. (Courtesy of Mortenson Construction)

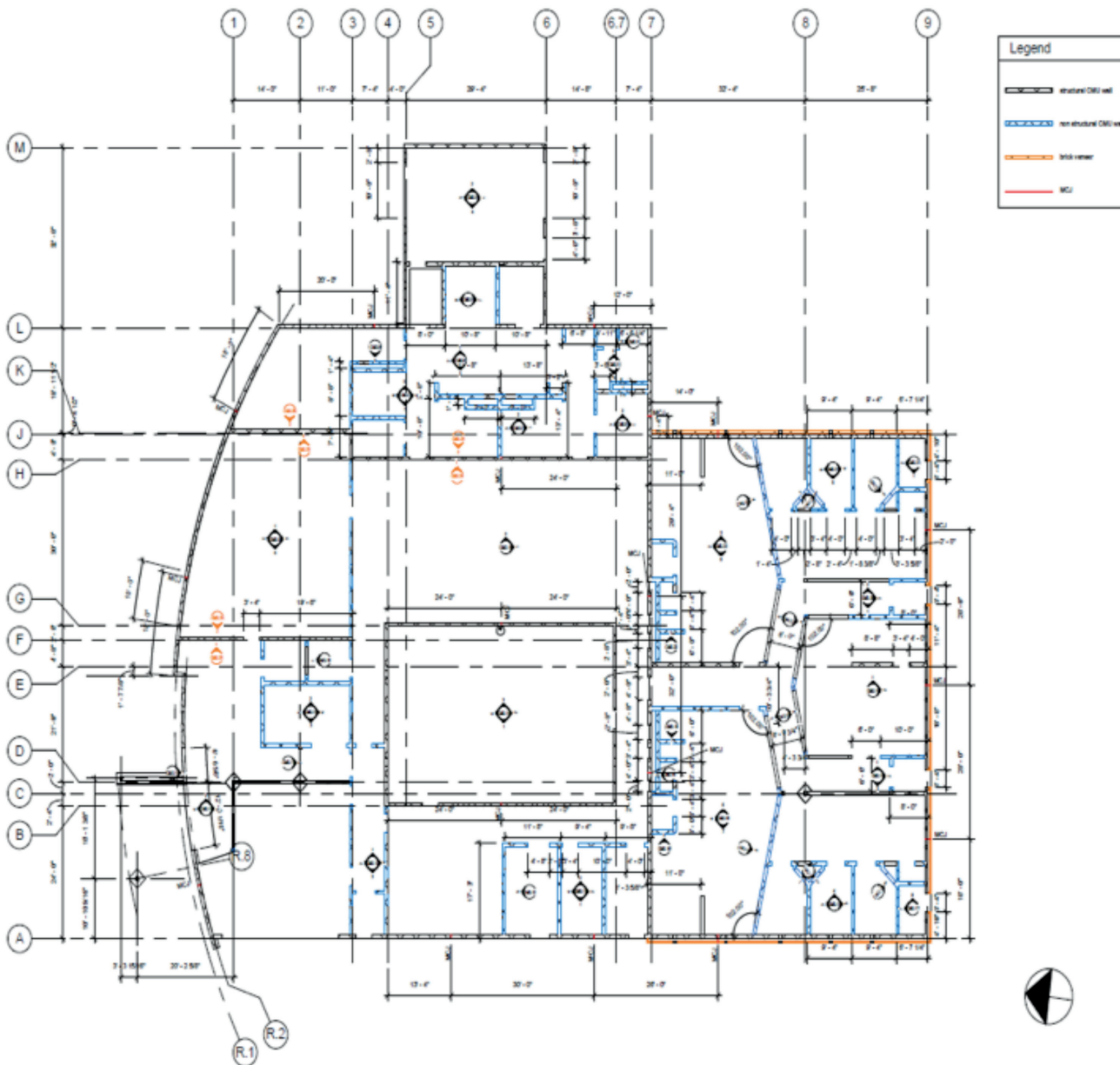
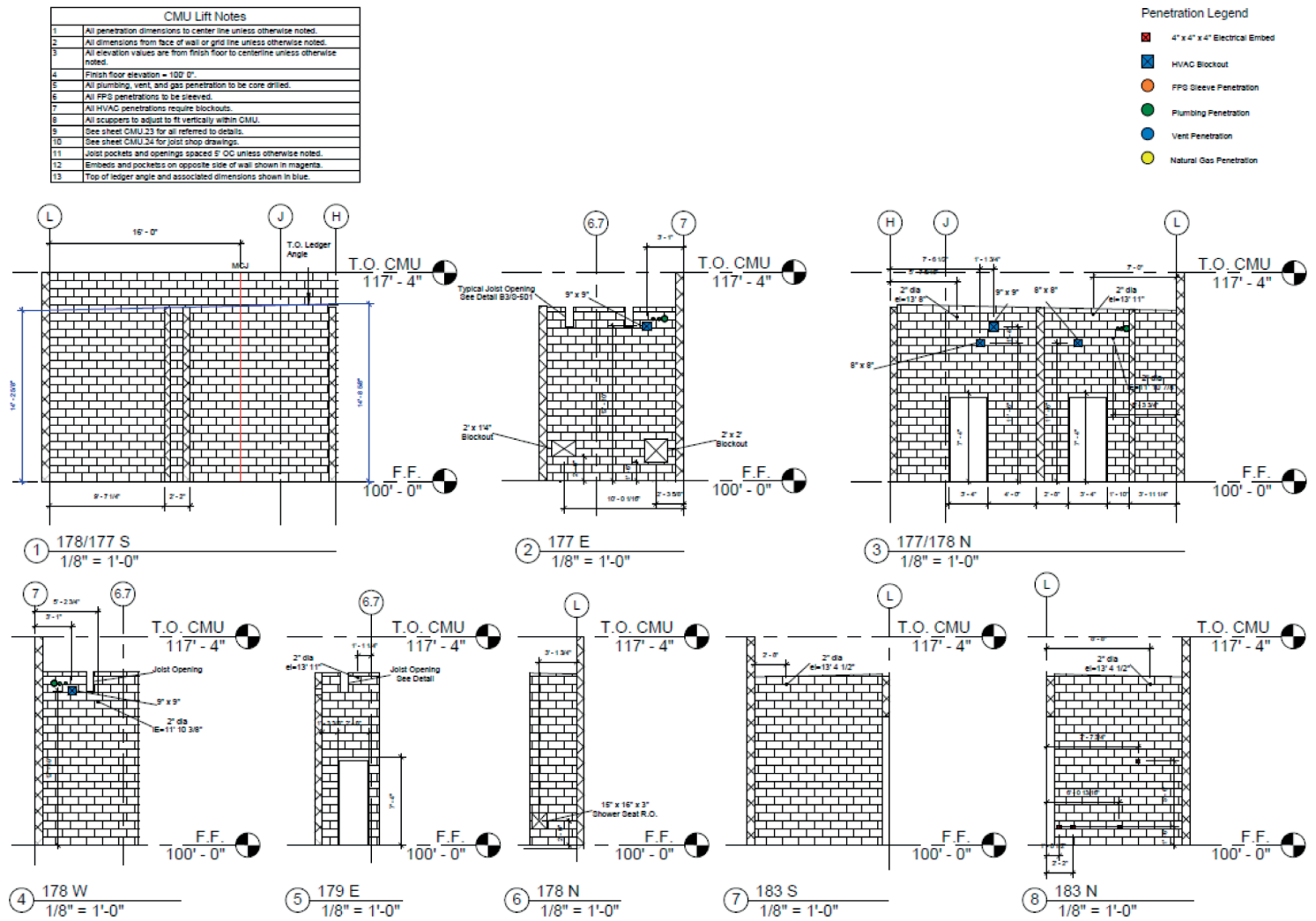
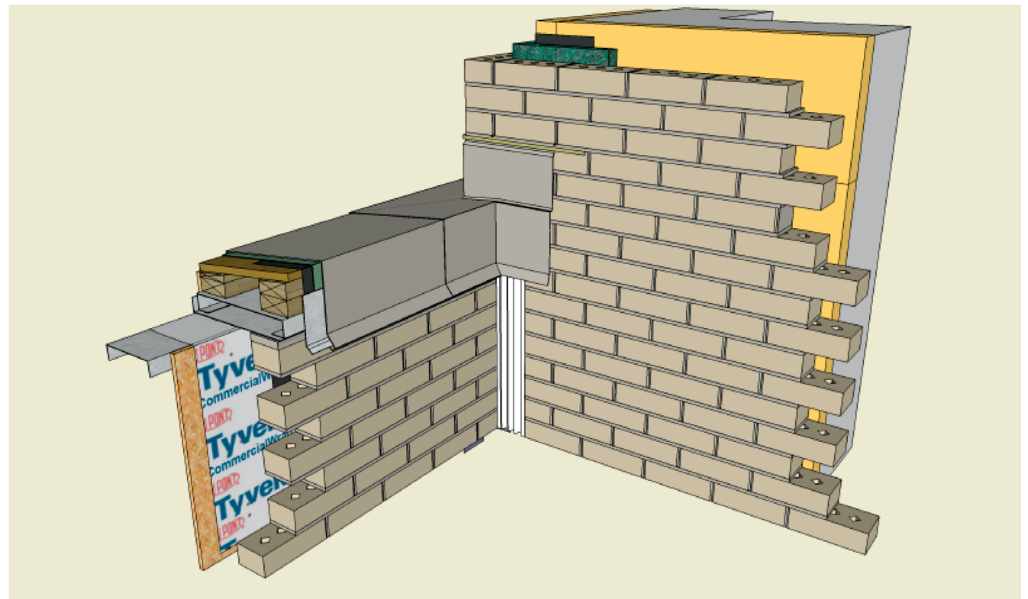
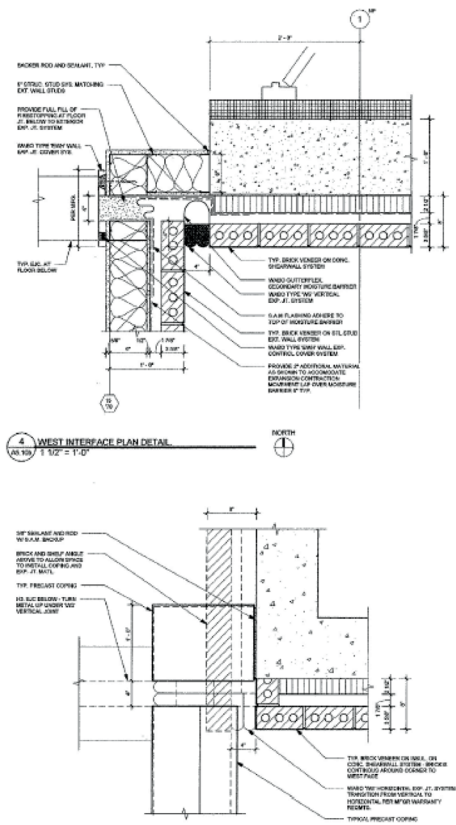


Figure 4

2D Lift Drawings showing penetration locations wall heights and control joint locations created from the BIM model. (Courtesy of Mortenson Construction)



Example of a Virtual Mock Up based upon design details. *(Courtesy of Mortenson Construction)*



DETAIL 1 VIRTUAL MOCKUP

NOT TO SCALE

$$\frac{A}{1}$$

5 WEST INTERFACE PLAN DETAIL
AS.108 1 1/2" = 1'-0"

A DESIGN REFERENCE DETAILS
2 REF: SHEET: A5.10b

Figure 6

Example of Virtual Mock Up based upon design details and RFI. (Courtesy of Mortenson Construction)

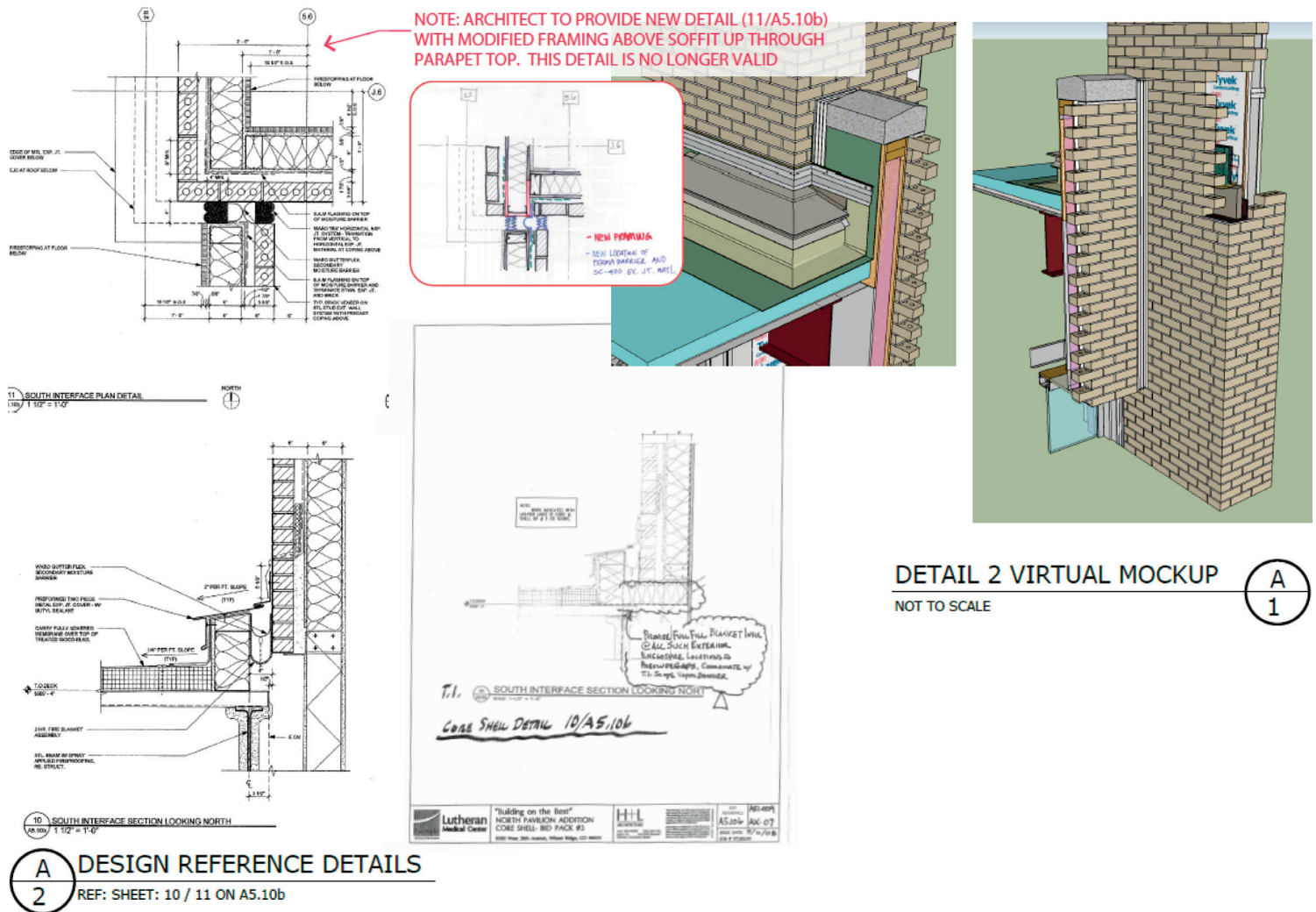


Figure 7

Example of Virtual Mock Up with Field Instructions. *(Courtesy of Mortenson Construction)*

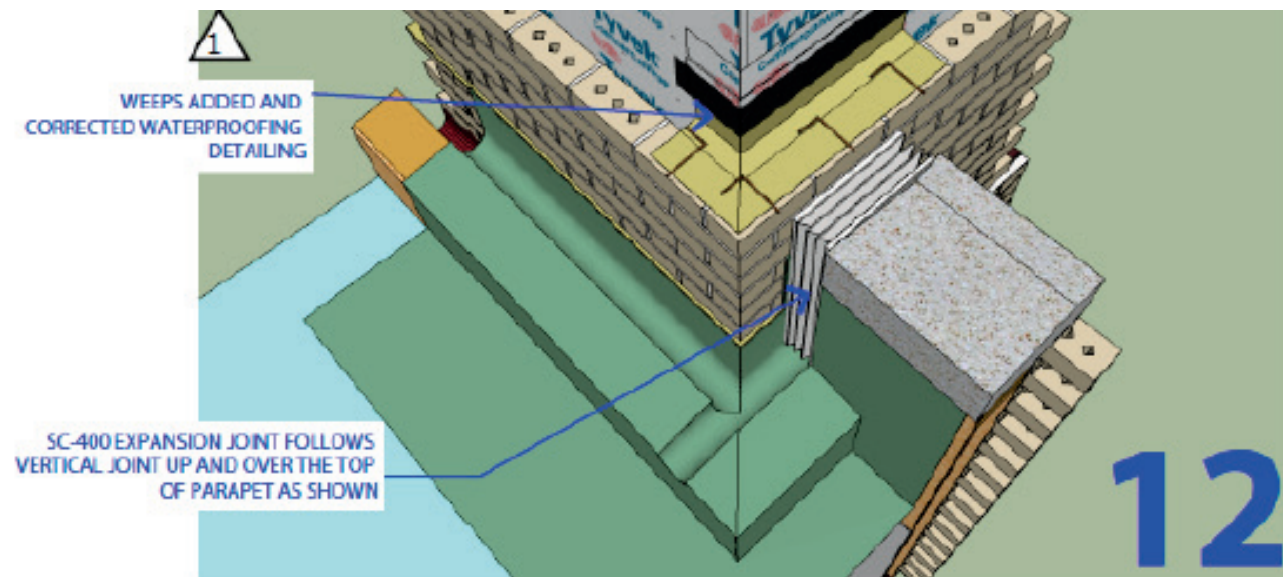
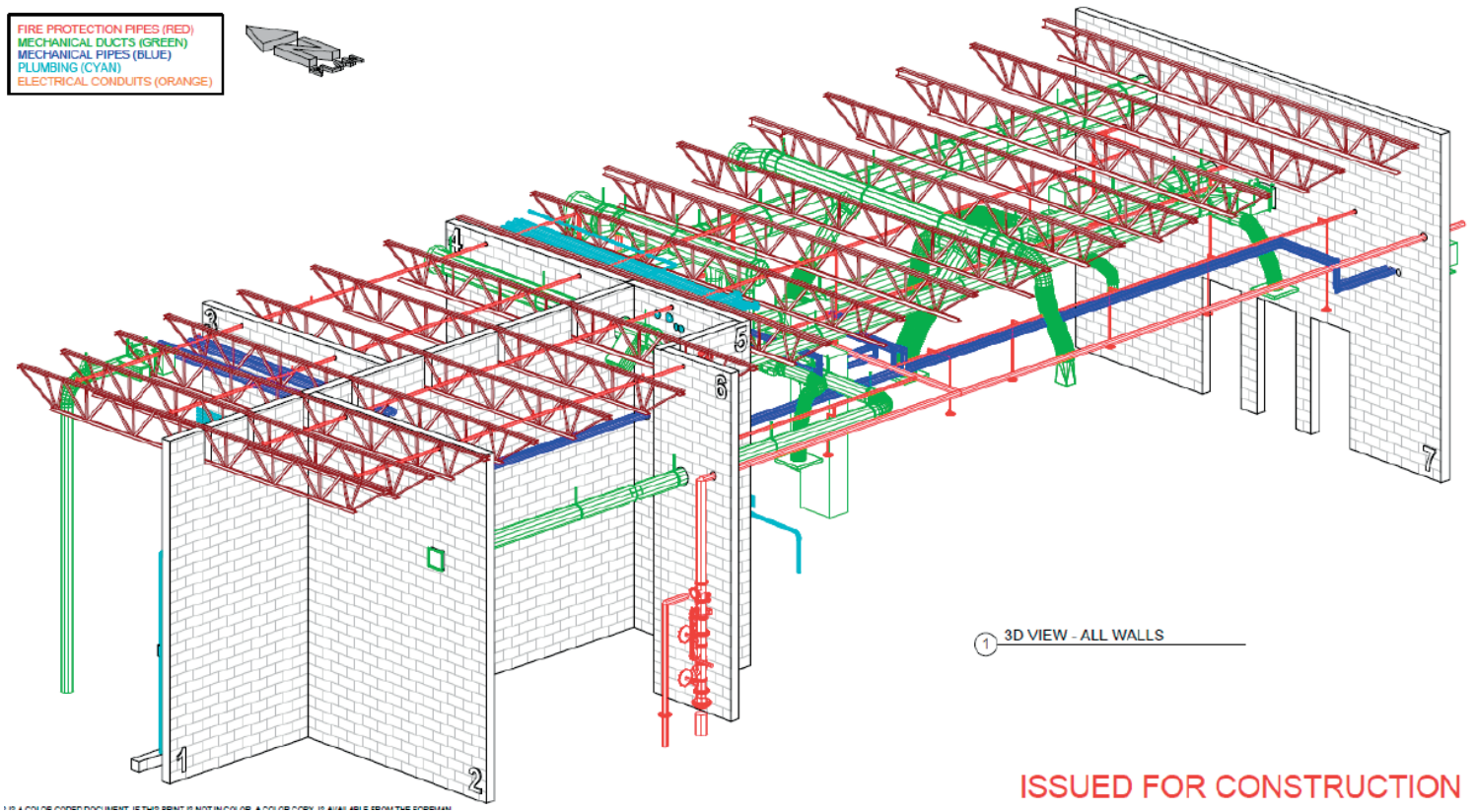
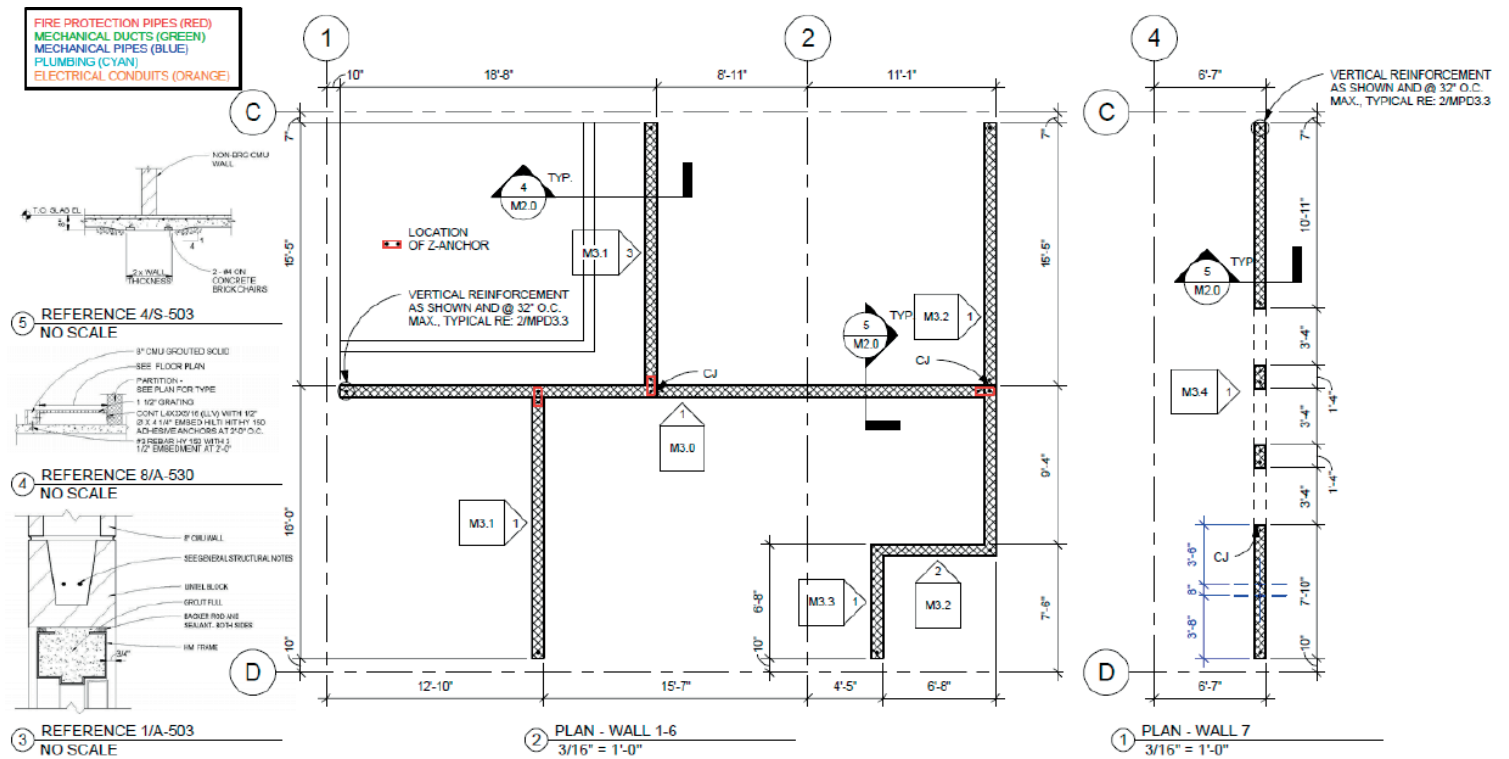


Figure 8

3D Views created from model (*Courtesy of Mortenson Construction*) Since Mortenson Construction was the CM as well as the mason contractor, they were able to incorporate all building components of the project into this model, making it an example of a federated model.



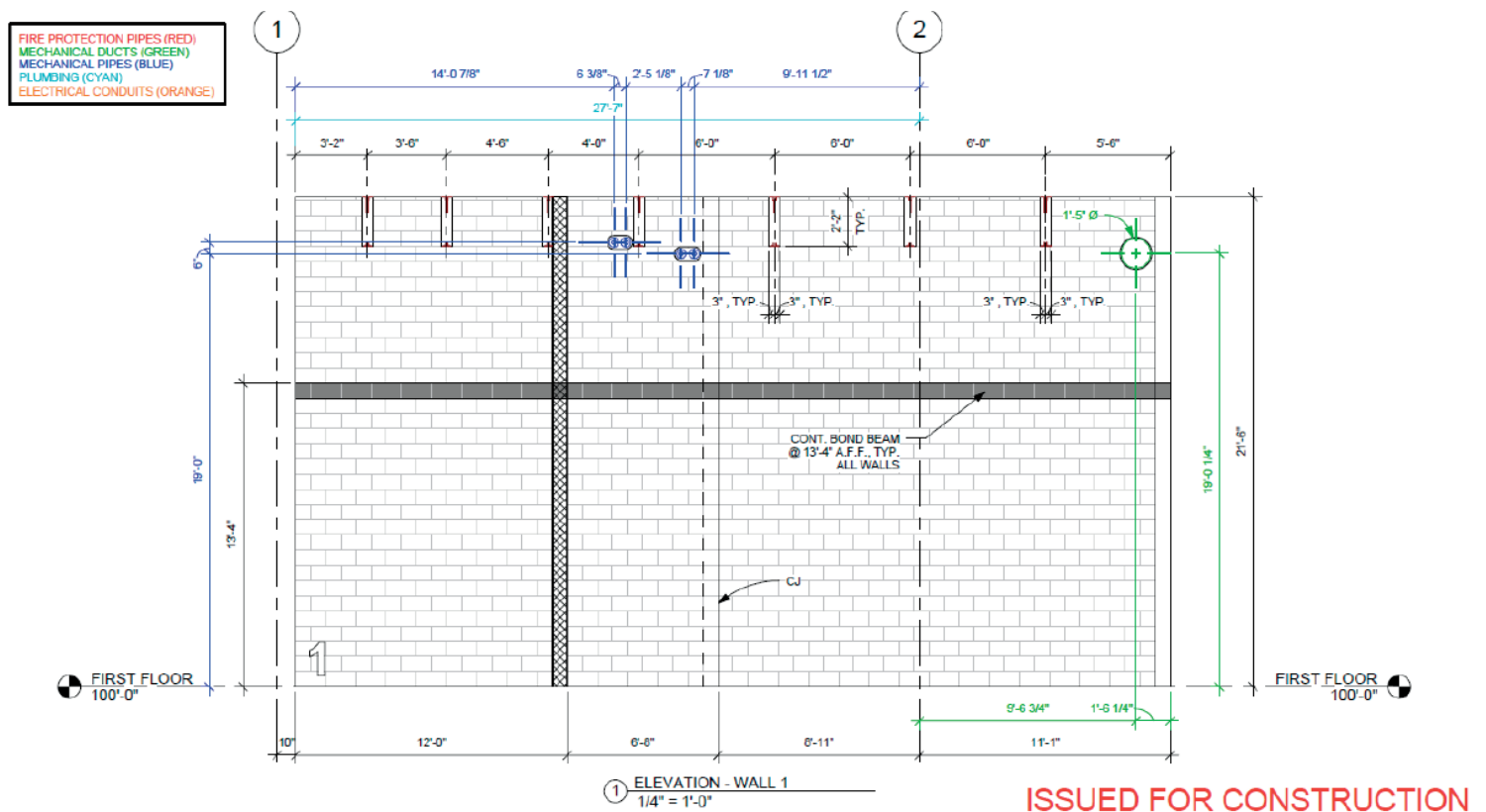
2D Floor Plan created from 3D model referencing wall elevations and rebar locations. (Courtesy of Mortenson Construction)



ISSUED FOR CONSTRUCTION

Figure 10

2D Lift Drawings created from Floor Plan and used in the field for wall penetration locations, joist locations, and grout and bond beam locations. (Courtesy of Mortenson Construction)



3 IS A COLOR CODED DOCUMENT. IF THIS PRINT IS NOT IN COLOR, A COLOR COPY IS AVAILABLE FROM THE FOREMAN.

Figure 11

Additional Lift Drawings and Wall Section showing rebar and bond beam locations. (Courtesy of Mortenson Construction)

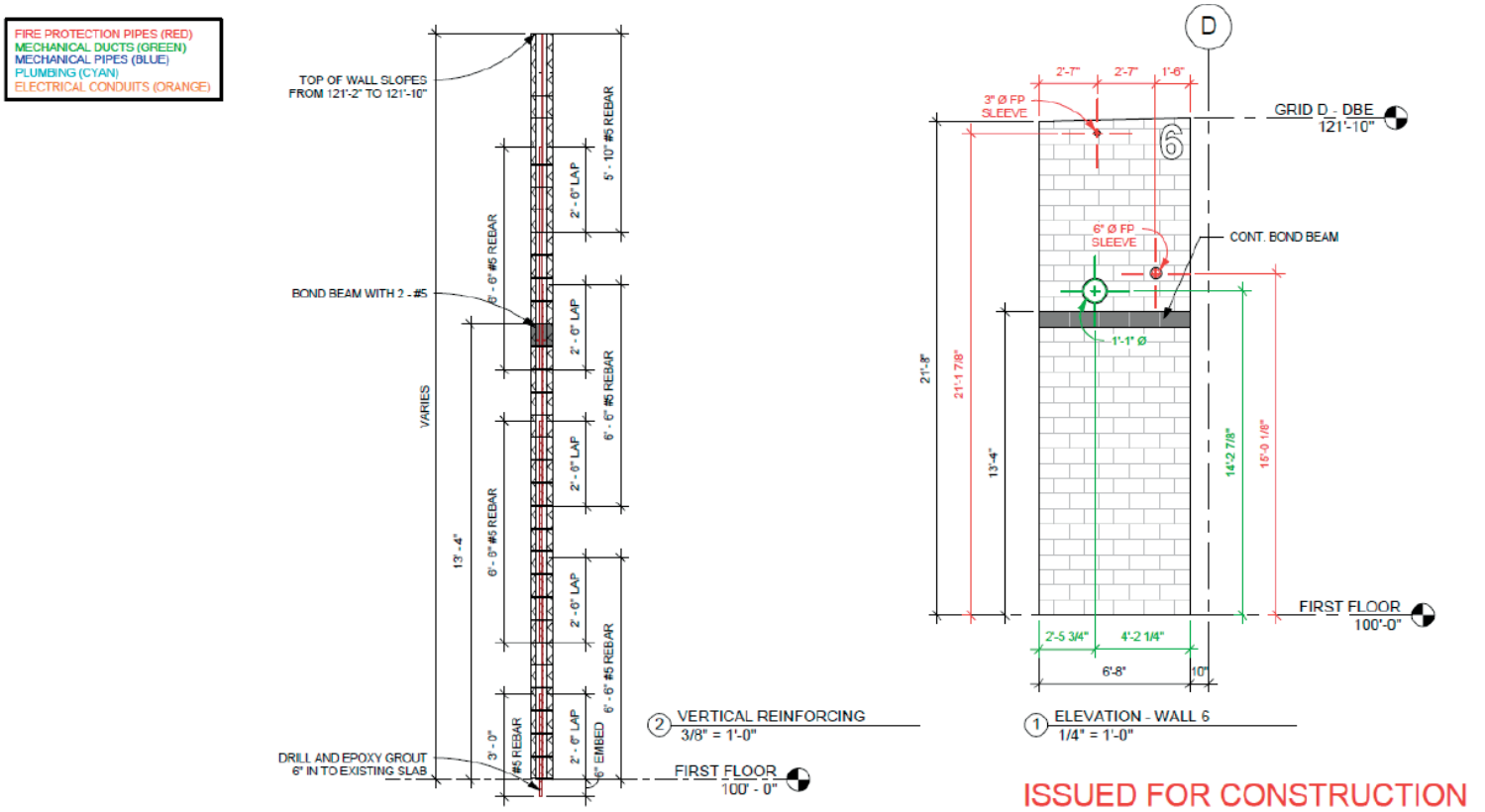


Figure 12

Brick Elevations showing brick types, bond patterns, and opening lay out model. *(Courtesy of R&D Masonry)*



Figure 13

Brick pattern and shapes created from the model in Figure 12. (Courtesy of R&D Masonry)

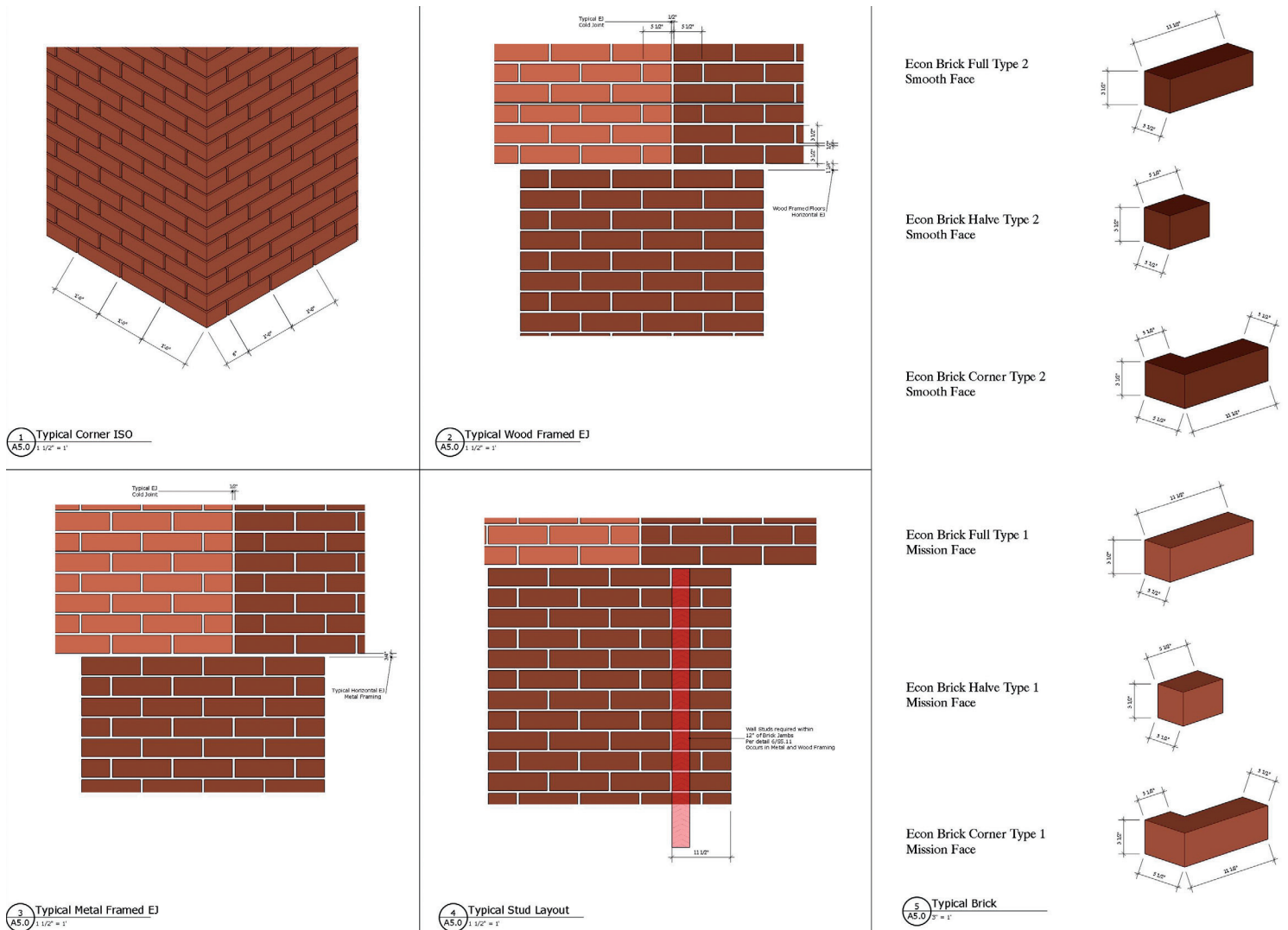


Figure 14

CMU and structural steel model that was created by pulling structural steel model into CMU model. (Courtesy of R & D Masonry)

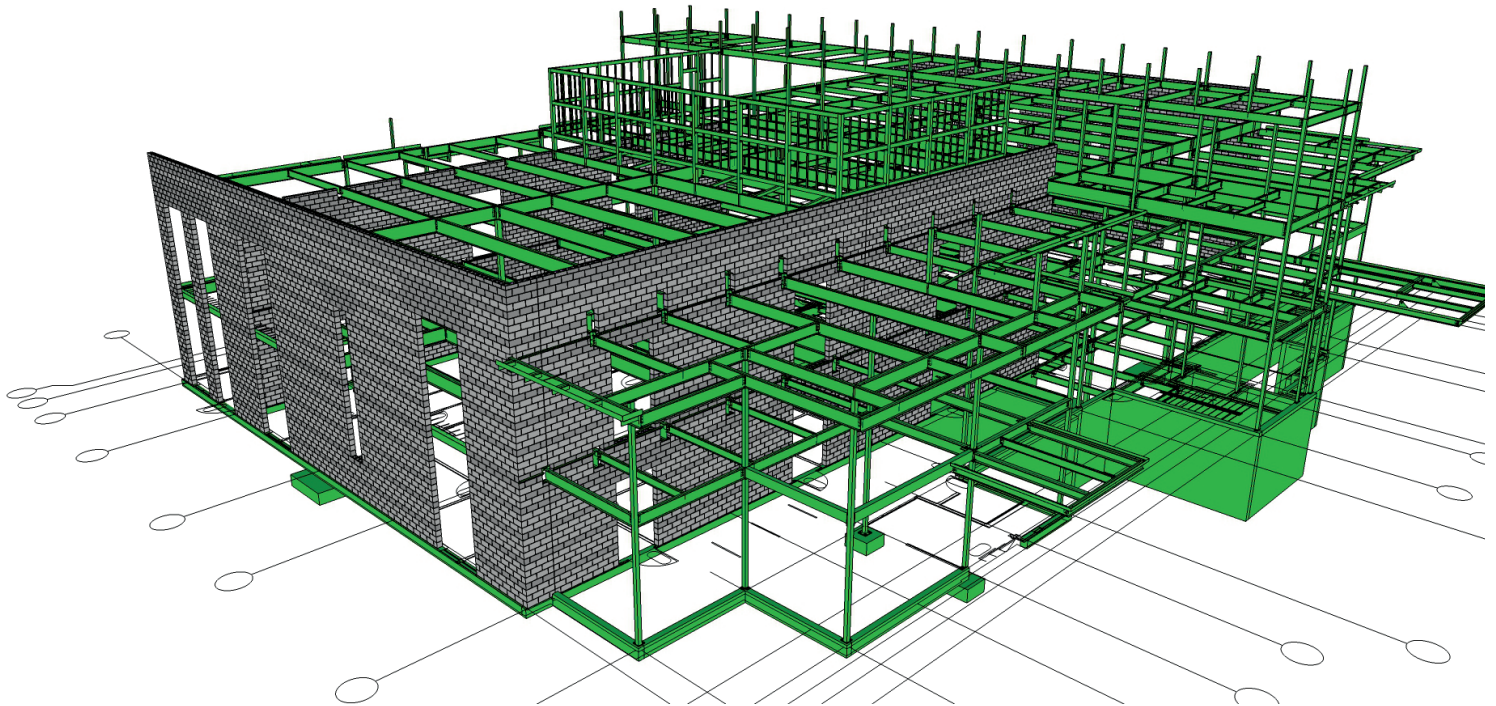


Figure 15

2D Lift Drawing showing bond beam locations and bearing plate location on elevations created from model. *(Courtesy of R&D Masonry)*

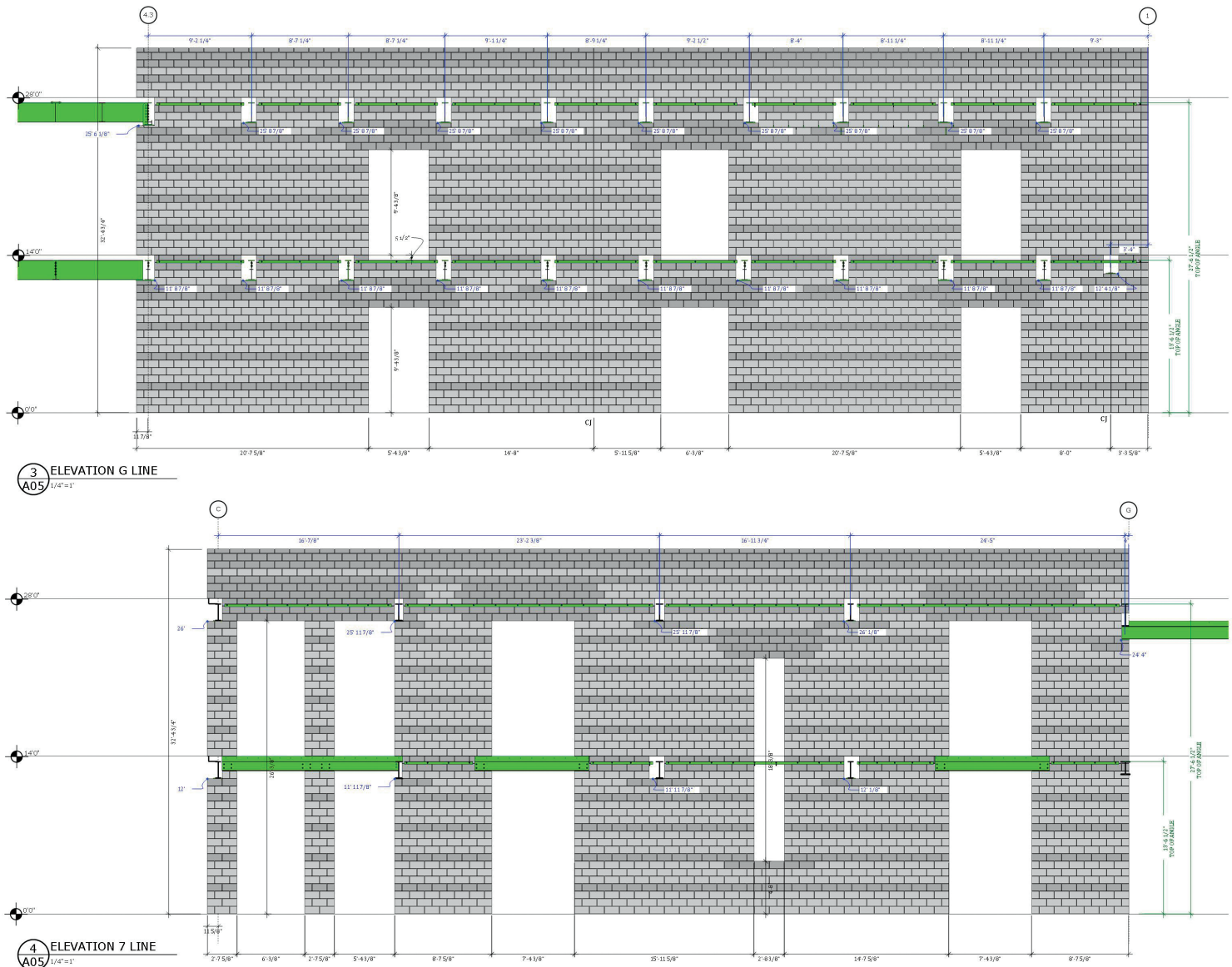


Figure 16

Scaffold Lay Out and Phasing shown on site plan. *(Courtesy of Ollier Masonry)*

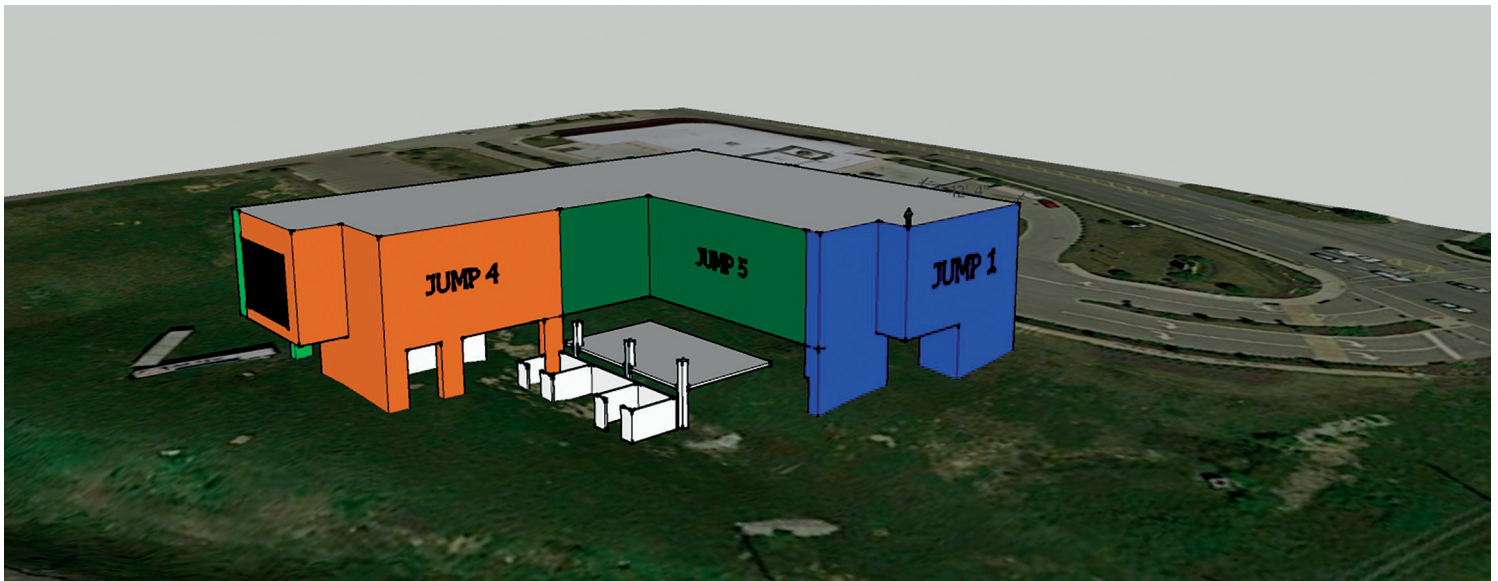


Figure 17

Portion of 2D Construction Drawing created from model and used for lay out of bond pattern and including work instructions. *(Courtesy of Ollier Masonry)*

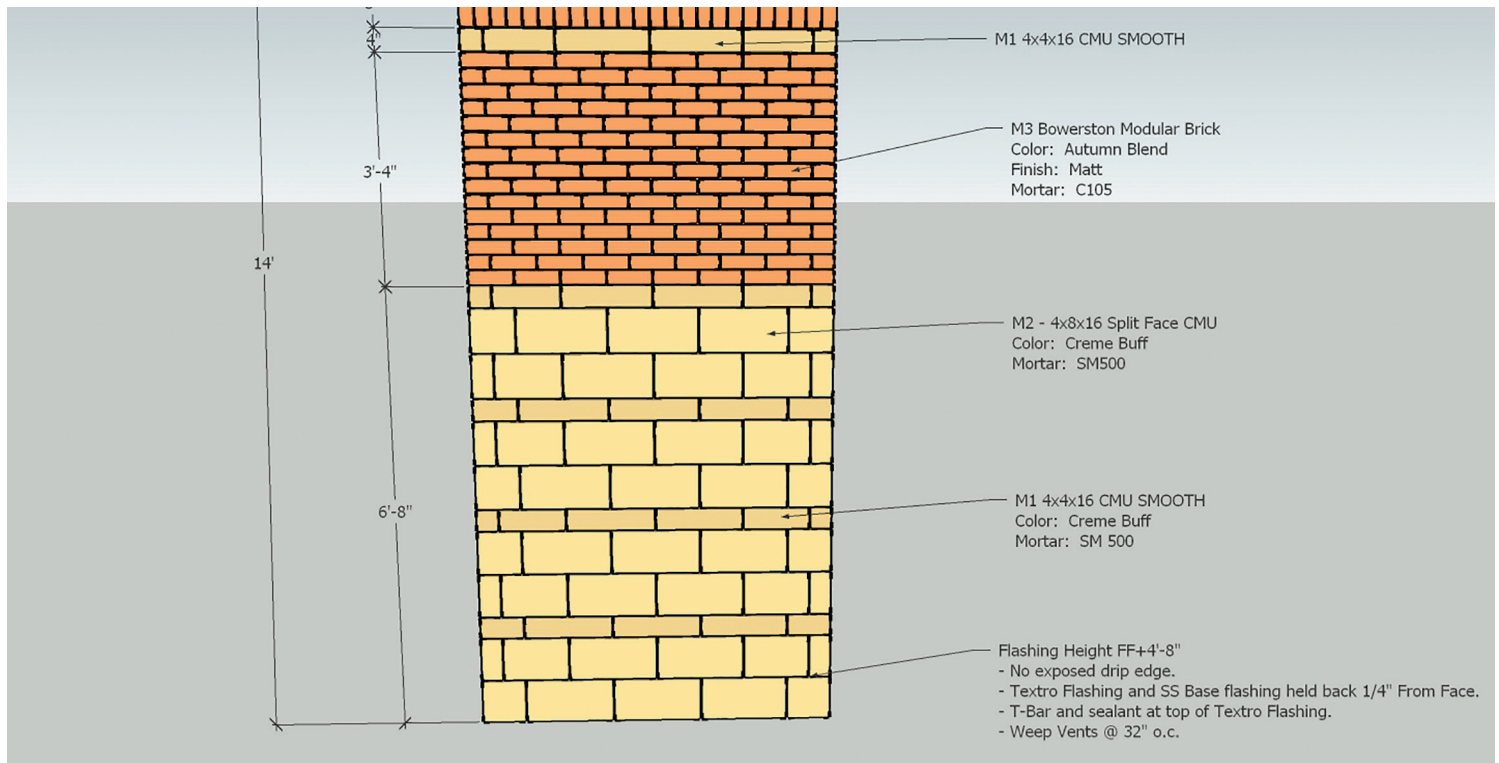


Figure 18

3D CMU model showing bond patterns, openings, block type, and sills. *(Courtesy of KMI Construction)*

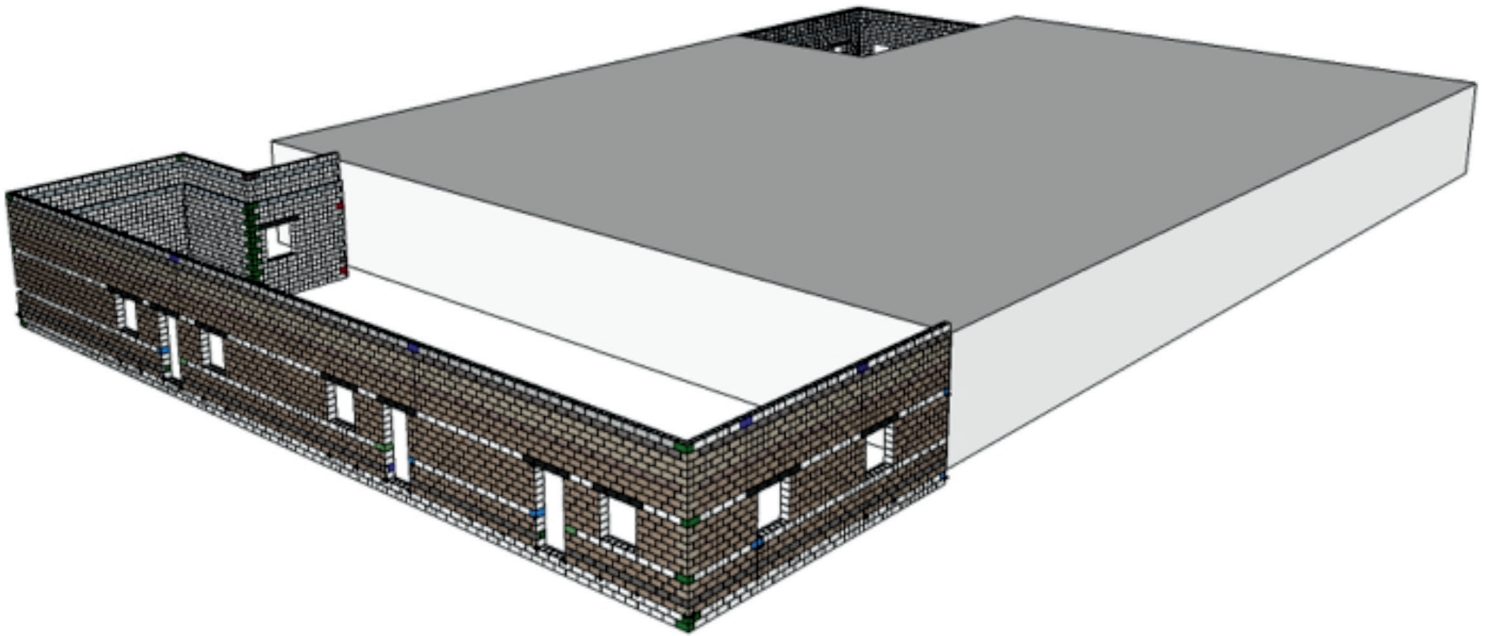


Figure 19

Block Shapes and Purchase Order quantities obtained from model. (Courtesy of KMI Construction)

SOUTH ADDITION PIECE COUNT BY ELEVATION

Block ID	Description	North Elevation
12R-S	12" Regular Stretcher	37
12FFS	12" Rockface Stretcher	108
12FFS-BB	12" Rockface Bondbeam	9
8R-S	8" Regular Stretcher	18
8R-FE	8" Regular Flush End	20
8R-3 Q	8" Regular 3 Quarter	1
8FFS	8" Rockface Stretcher	26
8FS-FE	8" Rockface FE	8
8FFS-BB	8" Rockface Bondbeam	8
8FS-3Q	8" Rockface 3 Quarter	6
4R-1Q	Concrete Brick	10
4FFS	4" Rockface Stretcher	9
4FS-LC	4" Rockface "L" Block	1
4FS-1Q	4" Rockface Quarter	7

Block ID	Description	South Elevation
12R-S	12" Regular Stretcher	253
12R-BB	12" Regular Bondbeam	29
12R-2Q	12" Regular 2 Quarter	3
12R-FE	12" Regular Flush End	3
12FFS	12" Rockface Stretcher	712
12FFS-BB	12" Rockface Bondbeam	74
12FS-2Q	12" Rockface 2 Quarter	59
8R-S	8" Regular Stretcher	131
8R-FE	8" Regular Flush End	8
8R-2 Q	8" Regular 2 Quarter	7
8R-3 Q	8" Regular 3 Quarter	2
8FFS	8" Rockface Stretcher	216
8FS-FE	8" Rockface FE	18
8FFS-BB	8" Rockface Bondbeam	74
8FS-2Q	8" Rockface 2 Quarter	8
4R-1Q	Concrete Brick	18
4FFS	4" Rockface Stretcher	65
4FS-2Q	4" Rockface 2 Quarter	3

Block ID	Description	West Elevation
12R-S	12" Regular Stretcher	89
12R-3Q	12" Regular 3 Quarter	2
12R-BB	12" Regular Bondbeam	4
12R-1Q	12" Regular Quarter	2
12FFS	12" Rockface Stretcher	262
12FFS-BB	12" Rockface Bondbeam	23
12FS-1Q	12" Rockface Quarter	7
12FS-2Q	12" Rockface 2 Quarter	6
12FS-3Q	12" Rockface 3 Quarter	6
8R-S	8" Regular Stretcher	45
8R-FE	8" Regular Flush End	5
8R-1Q	8" Regular Quarter	1
8R-3 Q	8" Regular 3 Quarter	5
8FFS	8" Rockface Stretcher	69
8FS-FE	8" Rockface FE	17
8FFS-BB	8" Rockface Bondbeam	23
8FS-1Q	8" Rockface Quarter	2
8FS-3Q	8" Rockface 3 Quarter	4
4R-1Q	Concrete Brick	19
4FFS	4" Rockface Stretcher	23
4FS-LC	4" Rockface "L" Block	1
4FS-1Q	4" Rockface Quarter	7
4FS-3Q	4" Rockface 3 Quarter	1

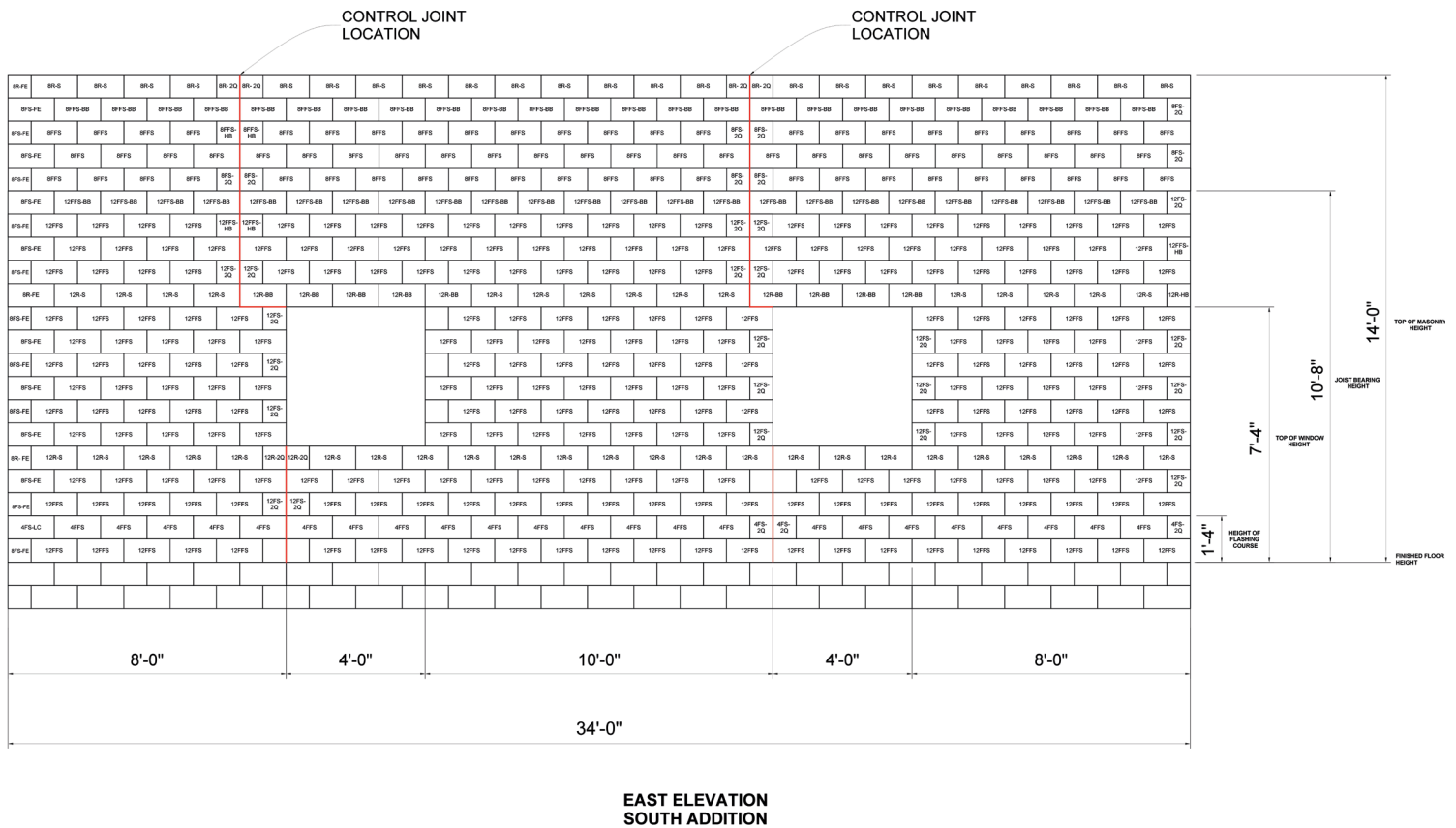
Block ID	Description	East Elevation
12R-S	12" Regular Stretcher	88
12R-BB	12" Regular Bondbeam	9
12R-2Q	12" Regular 2 Quarter	4
12FFS	12" Rockface Stretcher	246
12FFS-BB	12" Rockface Bondbeam	24
12FS-2Q	12" Rockface 2 Quarter	32
8R-S	8" Regular Stretcher	46
8R-FE	8" Regular Flush End	2
8R-2 Q	8" Regular 2 Quarter	7
8R-3 Q	8" Regular 3 Quarter	1
8FFS	8" Rockface Stretcher	70
8FS-FE	8" Rockface FE	8
8FFS-BB	8" Rockface Bondbeam	24
8FS-2Q	8" Rockface 2 Quarter	10
4R-1Q	Concrete Brick	8
4FFS	4" Rockface Stretcher	23
4FS-LC	4" Rockface "L" Block	1
4FS-2Q	4" Rockface 2 Quarter	3

NORTH ADDITION PIECE COUNT BY ELEVATION

Block ID	Description	North Elevation
12R-S	12" Regular Stretcher	73
12R-BB	12" Regular Bondbeam	13
12R-2Q	12" Regular 2 Quarter	7
12FFS	12" Rockface Stretcher	197
12FFS-BB	12" Rockface Bondbeam	31
12FS-2Q	12" Rockface 2 Quarter	50
8R-S	8" Regular Stretcher	18
8R-S-HH	8" Regular Half High	23
8R-FE	8" Regular Flush End	3
8R-2 Q	8" Regular 2 Quarter	1
8R-3 Q	8" Regular 3 Quarter	1
8FFS	8" Rockface Stretcher	71
8FS-FE	8" Rockface FE	9
8FS-2Q	8" Rockface 2 Quarter	13
8FS-2Q-HH	8" Rockface 2 Quarter Half High	1
4R-1Q	Concrete Brick	9
4FFS	4" Rockface Stretcher	20
4FS-2Q	4" Rockface 2 Quarter	1

Block ID	Description	West Elevation
12R-S	12" Regular Stretcher	57
12R-3Q	12" Regular 3 Quarter	2
12R-BB	12" Regular Bondbeam	13
12R-1Q	12" Regular Quarter	2
12FFS	12" Rockface Stretcher	153
12FFS-BB	12" Rockface Bondbeam	17
12FS-1Q	12" Rockface Quarter	8
12FS-2Q	12" Rockface 2 Quarter	44
12FS-3Q	12" Rockface 3 Quarter	6
8R-S	8" Regular Stretcher	15
8R-S-HH	8" Regular Half High	17
8R-FE	8" Regular Flush End	2
8R-2 Q	8" Regular 2 Quarter	4
8R-3 Q	8" Regular 3 Quarter	2
8FFS	8" Rockface Stretcher	32
8FS-FE	8" Rockface FE	7
8FS-FE-HH	8" Rockface FE Half High	1
8FS-1Q	8" Rockface Quarter	1
8FS-2Q	8" Rockface 2 Quarter	6
8FS-3Q	8" Rockface 3 Quarter	1
8FS-3Q-HH	8" Rockface 3 Quarter Half High	1
4R-1Q	Concrete Brick	8
4FFS	4" Rockface Stretcher	15
4FS-LC	4" Rockface "L" Block	1
4FS-2Q	4" Rockface 2 Quarter	4
4FS-3Q	4" Rockface 3 Quarter	1

CMU 2D Shapes and Lay Out Drawing from model. (Courtesy of KMI Construction)



**EAST ELEVATION
SOUTH ADDITION**

[illegible]

**EAST ELEVATION
SOUTH ADDITION
FLASHING COURSE
8" BACKUP BLOCK**

Figure 21

3D model showing shapes, block types and layout created in AutoCAD. (Courtesy of CAD BLOX)

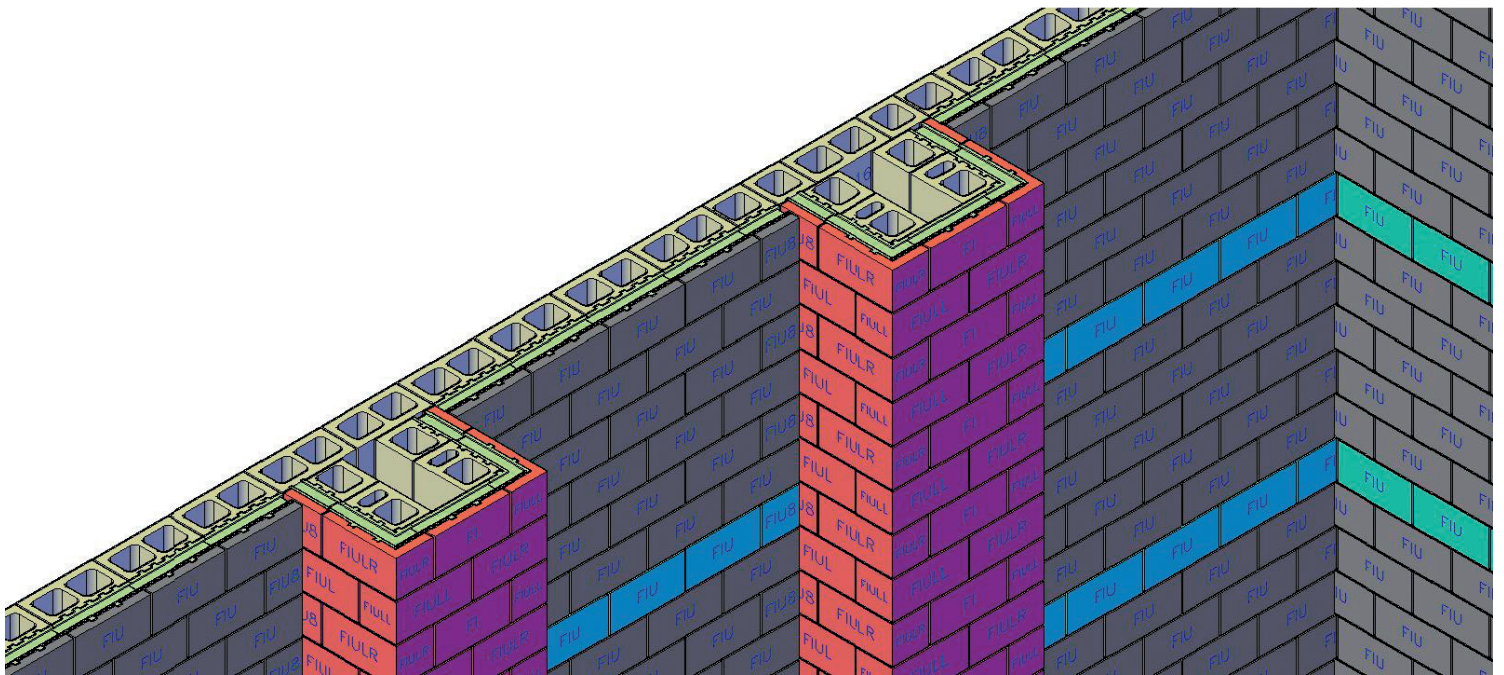
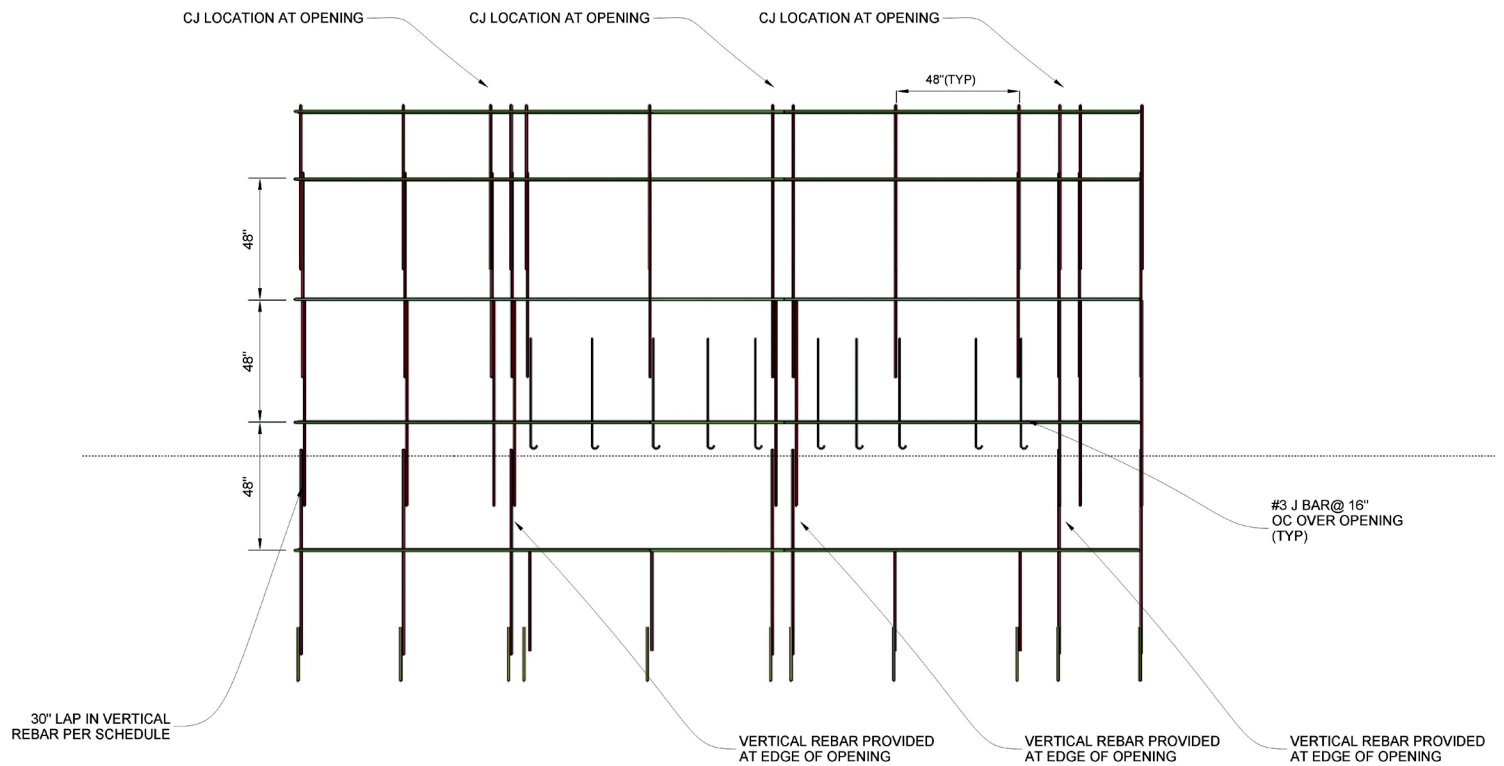


Figure 22

Example of rebar shop drawing. (Courtesy of KMI Construction)



TYPICAL WALL ELEVATION - TWO OPENINGS

Figure 23

Integrated Project Work Plan example. (Courtesy of KMI/Mortenson)

SAFETY

- 1) 100% PPE required at all times
- 2) Inspect Equipment and Tools Daily
- 3) Inspect Scaffold System Daily
- 4) Proper Ladder Use
- 5) 6-0" Tie off
- 6) No Smoking onsite

QUALITY

- 1) Proper Installation of Vertical Reinforcing
- 2) Proper Installation of Horizontal Reinforcing
- 3) Proper Installation/Location of all grouted cells for steel attachment
- 4) Maintain proper rough opening size for all doors and windows
- 5) Coordinate all MEP Sleeves and Wall Rough-ins with the applicable contractor
- 6) Sand Fill at East CMU Fire Wall
- 7) Proper Control Joint Spacing (See Note 11 on S-001)

LABOR/PRODUCTIVITY

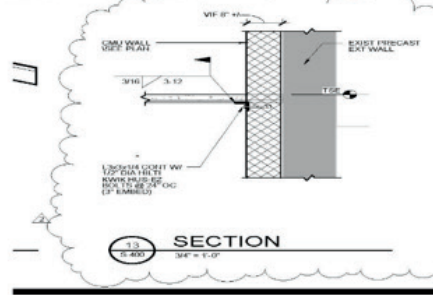
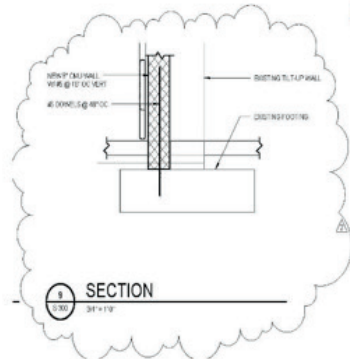
- 1) NO Bulldoze CMU at all Jambes and Corners
- 2) Maintain a clean mixing station
- 3) Sand Fill at East CMU Fire Wall

PREDECESSOR ACTIVITIES

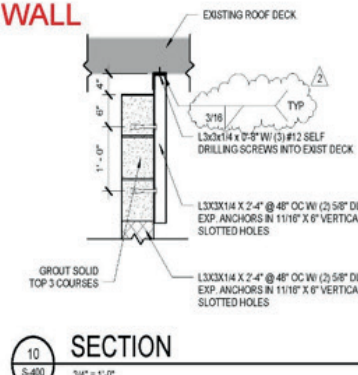
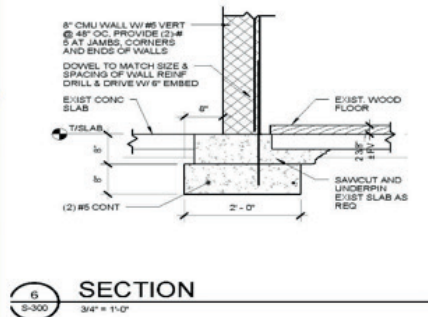
- 1) Concrete Footing and Foundations
- 2) Floor Cutting
- 3) Underground Plumbing

COA-Early Childhood Center INTEGRATED WORK PLAN KMI Construction CMU Installation

SOUTH FIRE WALL



EAST FIRE WALL



PICTURES/ATTACHMENTS

TOOLS/EQUIPMENT

- 1) Forklift
- 2) Saw
- 3) Grout and Mortar Mixer
- 4) Scaffold System

OWNER/ARCH/ENG CONCERNS

MAIN PROJECT CONTACTS

KMI Task Foreman:
Dale Labeck 414-581-0016
Berghammer Superintendent:
Kevin Bartoshevich 414-588-9144
Berghammer Project Manager:
Tom Schneider 262-790-8110
Berghammer Project Coordinator:
Tammy Krenz 262-790-8107

Revision Date:
Prepared By: Fred Kinatader, Jr.
Project Number: 15108

Distributing the Information (the ‘I’ in BIM)

With the deliverables established, what is done with the information? The following is an example of a breakdown of who might benefit from the receipt of each deliverable. This breakdown could be incorporated into the work flow diagram as part of the BIM Execution Plan.

- 1.** Material Quantities
 - a.)** Material Suppliers
 - b.)** Foreman
 - c.)** Labor Foreman
- 2.** Shop Drawings
 - a.)** CM/GC
 - b.)** Foreman
 - c.)** Labor Foreman
 - d.)** Material Suppliers
- 3.** Virtual Mock Ups
 - a.)** CM/GC
 - b.)** Foreman
 - c.)** Architect/Engineer/Owner
 - d.)** Material Supplier
- 4.** Clash Detection
 - a.)** CM/GC
 - b.)** Architect/Engineer
 - c.)** Foreman
- 5.** Find Unworkable Details
 - a.)** CM/GC
 - b.)** Architect/Engineer
 - c.)** Foreman
- 6.** Layout
 - a.)** Foreman
 - b.)** CM/GC
 - c.)** Equipment Manager/Yard Foreman
- 7.** Rebar Sizes & Placement
 - a.)** Foreman
 - b.)** Material Supplier
- 8.** Heights & Coursing
 - a.)** Foreman
 - b.)** Labor Foreman
- 9.** RFIs
 - a.)** CM/GC
 - b.)** Architect/Engineer
 - c.)** Foreman
- 10.** Lift Drawings – Work Instructions
 - a.)** Foreman
 - b.)** Crew Leaders/ Sub Foreman
 - c.)** Labor Foreman
- 11.** Equipment & Scaffold Requirement
 - a.)** Equipment Manager/Yard Foreman
 - b.)** Foreman

Just like everything else within the BIM process, these are suggestions based on how other contractors are using and dispensing the information. It is up to each contractor to decide how the information is best used within the structure of their company.

Return on Investment Realized through the Use of BIM

The return on investment for each company is going to depend on the level of participation. How many of the BIM deliverables are you able to incorporate into your work flows/ processes? It will depend on the buy-in and the culture of your company.

There are mason contractors that have reported gains in their production in the 10% range. They are making use of all of the deliverables outlined previously. However, the increase in efficiency is an estimate because there is no way to know their level of proficiency before they were modeling. It is a certainty that ***“Building it Before You Build It”*** will eliminate downtime waiting for answers and RFIs. Many questions will be answered before you are on the job, thereby eliminating delays and improving productivity. You can also have your layout complete and have your pieces and shapes ordered.

BIM can also provide supply chain improvements. Not only can you fine tune your ordering and reduce overages, but you can also make sure you don't have shortages that would cause costly delays. The contractors that are participating estimate that they're saving 3%-7% by using BIM.

In an attempt to try and show the economic potential or ROI, let's make some simple assumptions.

Let's begin with a project with a value of one million dollars. Assume that the labor costs are 60% or \$600,000. A conservative assumption, based upon reported results, is that there could be 5% savings on the labor, or approximately \$30,000.

Now, assume that the material cost is \$400,000. Again, using reported results from various projects, there could be a savings through supply-chain management of 3%. That would produce a savings of \$12,000.

If it took 40 hours @ \$90.00/hour to create the model, that would be a cost of \$3,600. If you have an investment of \$1,000 in software, the total investment, excluding staff training on this project, is \$4,600.

The potential savings of \$42,000 against the investment of \$4,600 gives a potential ROI of \$37,400 or \$8.13 for each dollar invested.

This theoretical example demonstrates that the potential savings could be significant and worth the investment in training and software. However, there are too many variables involved in each project, and each company's individual work processes and costs to say these savings can be realized unequivocally.

Educational Resources

There are many education opportunities available to the mason contractor. The following is a sampling.

BIM-M and its sponsors offer seminars, webinars and online assistance. Refer to bimformasonry.org for more information.

There is also plenty of information online from the software vendors. If you search the Internet for SketchUp or Formit 360, they will direct you to tutorials and YouTube videos. Trimble and Autodesk, the parent companies of SketchUp and Formit 360 respectively, also offer information through help desks and tutorials.

For each software program, there is also more information once you download the program. Many vendors offer free trial

versions that you should try before purchasing any software. Make sure it is going to work in your circumstance.

There are some third party providers also available that have in-depth tutorials. One example is Lynda.com. They have tutorials for SketchUp, Formit 360, and Revit.

Another learning resource is Pluralsight.com. They have an online library of over 4,500 courses including an abundance of Autodesk courses.

Global e-training globletraining.ca has a large Autodesk Library of tutorials and will soon have a SketchUp course.

Finally, check out the BIMForum at bimforum.org where there is an extensive list of resources available.

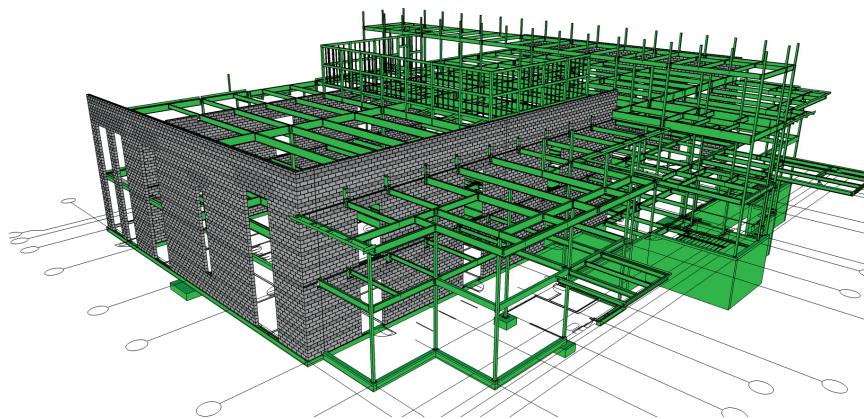
Summary

Based on the adoption of BIM by many contractors in other trades, Companies using materials that compete with masonry are using BIM to increase their productivity and profitability. It is common for the concrete, structural steel, steel studs, drywall, and curtain wall trades to be involved in the BIM process.

The goal of this document is to encourage mason contractors to participate in the BIM process. Participation is the key to growth in the masonry industry. Participation will make mason contractors more productive and competitive. Participation will show our customers, the CM/GC community, that mason contractors can work with today's technology and be part of the team.

Many of the industries using materials that masonry competes with are involved in the BIM process. If the masonry industry chooses not to participate in BIM, it will continue to lose market share to these industries.

This document offers critical information and resources on how to get started in BIM and gives contractors a list of deliverables they can get from modeling. Those deliverables will improve productivity and profitability. Please watch for upcoming webinars and seminars that will give more information related to BIM for mason contractors.

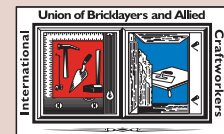




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Program Coordinator: **David Biggs** | Industry Consultant: **Art Theusch**

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