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Using an Exterior Masonry Pre-Installation Meeting Through Construction Observation to Lower Rework Costs

Corey S Zussman^{a*}

^a Pepper Construction Company, Chicago, IL, USA

Abstract: Exterior masonry installation can be complex. Not only does the process affect other trades, but it can also cause quality issues that often result in expensive rework. Therefore, allowing the project team and masonry foreman to set clear expectations for installation at the beginning of a project is a critical first step to ensure success. This paper will cover typical masonry details and provide an understanding of what to examine during construction document constructability reviews and the pre-installation meeting, as well as what to look for during the construction observation phase. Strategies include reviewing best practices and lessons learned from previous masonry installations and what other trades affect or are affected by the masonry installation, including air/vapor barrier, windows and structure, and construction tolerances for masonry and other trades. Finally, it's important to review conditions and issues typically seen and documented in the field by quality personnel. By using QAQC tools and applying knowledge learned from other construction projects, a plan can be created and implemented to reduce design and construction errors and move the construction profession to the next level of quality, ultimately reducing rework costs. **Keywords:** QAQC, Pre-installation meetings, Construction observation, Rework

1 Introduction – Setting up the project for success

The mason has been chosen for a project and sent in their submittal package for review. The building envelope coordination meeting has occurred, and installation will begin in a few weeks. This is the ideal time for the masonry pre-installation meeting, where the installation of the specified products is discussed with all contractors associated with the work. Masonry specifications, specific masonry details, and coordination details are reviewed from the architectural and structural documents. The pre-installation meeting provides the team the opportunity for open discussion about the masonry scope of work, adjacent and subsequent construction, and all its complexities to ensure a comprehensive understanding of what will be built. The meeting will also cover specification requirements for the project, specific code requirements, and lessons learned from previous projects.

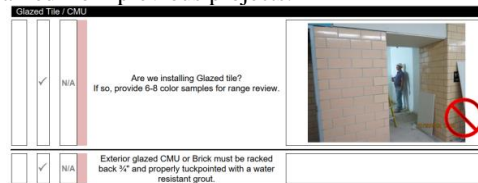


Figure 1. Excerpt from a masonry pre-installation meeting minutes guide

After the pre-installation meeting and during the construction observation phase, the installation expectations will be reviewed and confirmed, and construction compliance with the details will be verified. In this phase, potential constructability concerns or "lessons learned" may be identified for inclusion in the pre-construction meeting minutes, for reference on future projects as well as the running list of items compiled during the constructability review, which can take place either before the drawings are complete or after the General Contractor is awarded the project.

*Corresponding author email address: czussman@pepperconstruction.com

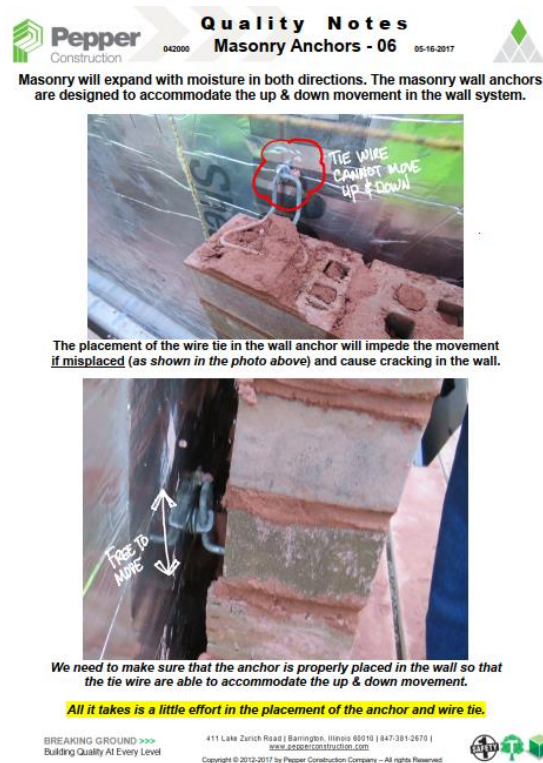


Figure 2. Lesson Learned Bulletin on masonry tie installation

1.1 Crucial moments for cross-contractor communication

During the pre-installation meeting, the project team confirms construction procedures and installation timing with all adjacent trades. Failure to do so can lead to significant quality issues and rework costs.

For example, on a new, three-story masonry building, the mason was unfamiliar with the air barrier product, the associated requirements, and specifically the recommended cure time for the product. The mason proceeded to install the masonry flashing primer and membrane on the air barrier soon after installation. The air barrier did not fully cure, and the air barrier material liquified behind the masonry flashing as the chemicals were still gassing-off from the air barrier product. Because the air barrier products were not reviewed at the pre-installation meeting, the mason and the general contractor were unfamiliar with the air barrier requirements. The failure was caught at the beginning of the installation during the first work-in-place review performed by the general contractor's quality team. This example became a documented lesson-learned event. It also resulted in a new agenda item in the pre-installation meeting, requiring the product and air barrier cure times to be reviewed and the compatibility confirmed. Additionally, a marker was placed in the project schedule hold points, thereby preventing this item from becoming a job site concern that could cause possible construction delays on future jobs.

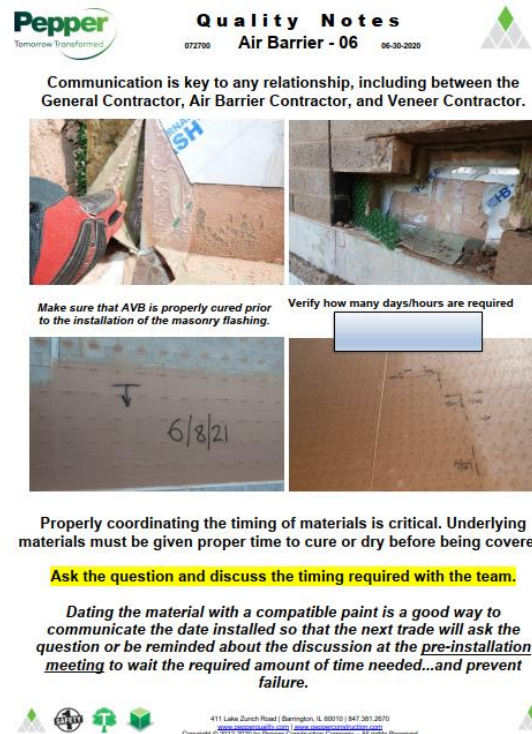


Figure 3. Lessons learn bulletin and worksheet for AVB cure times

2 Elements of a Pre-Installation Meeting

The pre-installation meeting is one of the most significant meetings on any project. The process should reflect the importance of the system, its intricate installation and integration of masonry, and the itemized coordination of the different components, such as structural detailing, waterproofing, air and vapor barriers, windows, applied cladding, and roofing systems.

The pre-installation meeting should be separate from the safety meeting so as not to subordinate or dilute the importance of job site safety. Both meetings are important and offer critical yet different messages to different audiences.

Typical scope of work items to be included in the pre-installation meeting.

Table 1. Typical project scope of work items

<i>Structural CMU</i>	<i>Interior / Exterior non-load bearing CMU</i>	<i>Masonry Veneer</i>
<i>Natural Stone / Limestone</i>	<i>Precast Concrete</i>	<i>Tuckpointing</i>
<i>Stone Patching</i>	<i>Adhered Veneer</i>	<i>Other</i>

The masonry pre-installation meeting is typically designed to accomplish the following:

- Review the mason contractor's Job Specific Quality Plan (JSQP)
- Review and confirm job-specific product data, shop drawings, and written installation procedures.
- Review building envelope meeting minutes and contract document details and specifications.
- Review past projects with the mason and any lessons learned.
- Develop a detailed database that collects installation discrepancies per mason to learn from and review typical trade concerns to improve the pre-installation and job site review processes.

- Discuss each stakeholder's primary project concerns early in the meeting and ensure that all concerns are addressed.
- Review and confirm project and product warranty requirements.
- Confirm testing requirements and protocols.
 - Confirm Quality Assurance Level and Risk Category prescribed on the Structural Drawings per TMS 402, section 3.1.
- Review cold and hot weather requirements and procedures, including all the installed products' temperature limitations.
- Provide a clear understanding of expectations from the installer and adjacent trades.
- Review the project for any archaic assemblies that require special documentation and report
- Review the project specifications to confirm the information has been updated.
- Confirm knowledge of all components in the installation.
- Discuss any lessons learned from previous projects that can be leveraged on the project. Often several stakeholders have a recent story about utilizing the product that will benefit the team and will mitigate the possibility of a repeat concern.
- Review and verify installation sequencing, equipment to be used/logistics.
- Confirm compatibility of adjacent materials, such as waterproofing, air and vapor barrier, sealants used for masonry and other trades, etc.
- Discuss weather concerns, exposure limits, and installation constraints.
- Discuss lessons learned from previous projects and experiences with the installation details and products being used.
- Confirm requirements and schedule with other building envelope trades. For more information on this topic, refer to Zussman C. S. (2019). "Constructability Mock-ups Sets Expectations," Smart Dynamics July 2019.



Figure 4. Masonry constructability mock-up review report

- Provide first work-in-place review guidelines (note that this is not an in-place mock-up).
- Review and confirm ongoing job site quality control (QC) procedures, including the installation reviews, any hold-point requirements, and documentation required.

Typically, the comprehensive pre-installation meeting should take two to four hours, depending on the project's complexity. Planning adequate time to review all necessary information and adequately set expectations are critical steps to ensure that all parties can plan accordingly.

When attending the masonry pre-installation meeting, team members must be open to hearing the requirements of the installation, which are sometimes new to the installer, for the exact product and procedure that is being installed or installed adjacent to the masonry. Having an open mind is imperative for a successful meeting. Treat each meeting like it is the first time these products and adjacent components are being installed. Adopt the mindset that materials change over time; the manufacturer periodically modifies installation instructions to include updated concerns and information from the field on other projects. As well, adjacent materials are typically different on every project. Even if this is a second-phase installation, conducting a pre-installation meeting with the same intense scrutiny as the first meeting will allow the team to benefit from the first-phase lessons learned and ensure the manufacturer, architect, and other subcontractors have not changed materials or procedures because of product availability and that the designer has not modified the specified products.

On a recent project, the air barrier contractor decided to modify the installation procedure of their material in the second phase to benefit the schedule and save installation time. The new installation procedure changed the substrate preparation requirements, which were discussed in the masonry pre-installation meeting. This allowed the mason to understand the new requirements for their installation and adjust the masonry installation procedures to accommodate the air barrier requirements.

2.1 Who should attend the pre-installation meeting?

Because of the complexity and interaction of many different trades, the team members that should attend this meeting include the following:

- Architect and/or architect's onsite observer
- Structural engineer and/or structural engineer's onsite observer
- General contractor's project manager and superintendent/foreman
- General contractor's quality team member
- Subcontractor foreman (a must!), project manager, and QA/QC personnel
- Manufacturer(s) representative (as necessary)
 - Masonry manufacturer
 - Masonry specialty manufacturer(s)
 - Waterproofing and Air/Vapor barrier
 - Applied cladding manufacturer
 - Fire stopping manufacturer
- Owner/Owner's Representative
- Owner's testing team

2.2 Shop drawings and submittal information and review

It is essential to review shop drawings and other relevant submittals at this meeting, ensuring all the product data is submitted and the details are coordinated with the final building plans. It is recommended project specifications include a note that before the pre-installation meeting, the designer verifies that necessary project submittals have been submitted. Participants should also consider any modifications that might have arisen in the building envelope coordination meeting and final shop drawings of the adjacent areas.

It is best practice for the masonry contractor to provide a list of all components that are being installed, regardless of their inclusion in the project specifications. A complete review of all items being installed is essential to confirm the correct application of the materials, adjacent compatibilities, and completeness of installation understanding.

Even though some architects do not require the contractor to provide documentation on all masonry components, submitting all installed items to review the system adequately is good practice. Not having each component with updated installation instructions, the latest manufacturer technical bulletins, and weather procedures could lead to the masonry scope of work being installed incorrectly or compatibility issues with adjacent materials.

Items to review typically include those shown in Table 2.

Table 2. Typical items to be submitted for review

Job-Specific Quality Plan	CMU product information, including fire rating(s)	Brick veneer(s) product information	Brick veneer efflorescence tests
Grout(s) product data	Mortar(s) product data	Lateral CMU reinforcing(s)	Masonry anchors
Post-installed masonry anchors	Vertical reinforcement product information	Vertical and bond beam reinforcement shop drawings	CMU CJ materials
Masonry joint filler	Weeps/Vents	Flashing / Primer	SS Drip
Bridging material (SS)	T/Wall Anchor	Sealant/Backer rod	Drainage Cavity
CMU insulation and/or insulation & clips	Cleaning Product & Masonry Mfr letter of Acceptance	Epoxy and installation instructions	Roof Protection Plan
CMU vertical bar positioner	Cast Stone Anchor Calculations	Stone anchor calculations	Samples
Cast stone product data, shop drawings, and anchors	Stone Product Data, Shop Drawings, and Anchors	Fasteners	Damp proofing
Bridging materials	Adjacent Trade Shop Drawings	Existing masonry testing information	*Air/vapor barrier products being used on the project

2.3 Coordination with adjacent trades

Masonry design and installation is affected by or affects other trades and subsequent installation of materials. The pre-installation meeting allows the team to understand the requirements of other trades that are affected by masonry or that affect the masonry. There are several items that are important for the mason to know to reduce the rework of both trades, such as:

CMU type and the effects on other trades – Review the type of CMU (lightweight, medium weight, or normal weight) and determine how the CMU affects other trades, for example, the air/vapor barrier or painting contractor should be aware that a lightweight CMU has a higher water absorption rate than the other two CMU types, per ASTM C90-22 "Standard Specifications for Loadbearing Concrete Masonry Units," table 2. So, lightweight CMU will absorb more paint or air/vapor barrier membrane. Therefore, more material may be required to adequately coat the CMU depending on the type of CMU used. Another concern is how the masonry joints are finished. Typically, the joints might not be compressed slightly concave if the masonry is not exposed. However, the joints must be compressed to install the air/vapor barrier or waterproofing. If the joint is not compressed, the air/vapor barrier or waterproofing will require more material, or the joint will need to be ground and/or re-pointed, depending on the type of coating.

Weight Classification	Density (Ave of 3) (lb/ft ³)	Maximum Water Absorption (lb/ft ²)		Minimum Compressive Strength (lb/ft ²)
		Average of 3 Units	Individual Units	
Lightweight	Less than 105	18	20	1,900
Medium Weight	105 - 125	15	17	1,900
Normal Weight	Greater than 125	13	15	1,900

* Standard Specification for Loadbearing Concrete Masonry Units, ASTM C90-11b, ASTM International

Figure 5. Excerpt from ASTM C90-22 Table 2 on CMU classification comparisons

Coordination with other trades will also include protection of other trades' work, such as roofing, finished floor or wall surfaces, window systems when cleaning the masonry, etc. Discussing and having the plan reviewed by the adjacent trade so work in place is not inadvertently damaged is important. This will also ensure that any protection does not create issues for the mason's sequence of work.

2.4 The devil in the details

During the pre-installation meeting, it is critical to review and verify contract documents and building envelope notes with the job-specific shop drawing details provided by the mason. Reviewing these details with adjacent contractors will confirm installation and sequencing. In addition, keeping a guide sheet of typical details to review and how connections of the air barrier are made will be an excellent resource for the meeting.

Typical job-specific details that should be reviewed include the following:

- Base of wall(s)
- Parapet or top of wall(s)
- Openings (head, sill, and jamb) for each opening system
- Penetrations
- Special detailing and coursing, prefabrication components, and anchor design/placement
- Building and wall movement joints, including horizontal floor movement joints
- Transitions to other building components

Once all drawings and other applicable submittals have been reviewed, the project complexities, building component clearances, and tolerances should be confirmed. Discussions on what will happen before and after masonry installation and what, if any, additional instructions are needed for those installations are critical. Examples include top-of-wall clips and head-of-wall firestopping. Shelf angle installation will need to be coordinated with the steel erector to coordinate with the masonry coursing and proper pitch.

The superintendent and/or the foreman typically attends the pre-installation meeting, not the entire crew, which poses a knowledge transfer concern in the field. The foreman must adequately convey the information discussed to the daily crew and any new tradespeople onsite. For this reason, it is imperative that the pre-installation meeting include clear photos of the expected detailing, as well as detailing that will not be accepted. Photos transcend language barriers that might exist in the field or in the meeting. The foreman should give each tradesperson a chance to review and ask questions about the meeting minutes and have them sign the document. Signing the document will signal to the crew its importance to the project.

3 Job Site Observation

Completing the pre-installation meeting is just the beginning of the process. Onsite review and verification of the systems' details and typical installation requirements are critical. Reviewing the work in place confirms an understanding of what was discussed in the pre-installation meeting.

Photos are taken during the review showing both non-compliant and compliant items. Any photos taken of non-compliant items must be responded to with a corresponding compliant photo as proof of correction. We use these photos in the job site report we prepare and for inclusion in future pre-installation meetings and quality bulletins that we distribute to our team, other general contractors, architects, and contractors on our distribution list.

3.1 What is typically reviewed?

The typical construction items and the job-specific details documented in the meeting minutes become the basis and checklist for the construction observation phase. Some typical details include the following (based on TMS 402, TMS 602, and BIA tech notes, and/or job-specific manufacturer installation requirements):

- a. Confirming job site storage procedures
- b. Reviewing end-of-day work-in-place protection as well as the protection of materials stored onsite (Figure 6)



Figure 6. Photo of end of day protection

- c. Unacceptable CMU damage per ASTM C90
- d. CMU vertical reinforcement placement, edge clearance, and overlaps
- e. Looking for grout protrusions extending ½" or more into cells to be grouted per TMS 602-3.3B-2c(Figure 7)



Figure 7. Photo of mortar encroaching into the grouted cell more than ½"

There is a lot to review during the entire installation process. Having a system to review and document the conforming and non-conforming items is key to a successful quality program.

3.1.1 Key data points and data tracking

Keeping track of the compliant and non-compliant items is important to identify trends that need to be addressed in different ways to prevent the non-compliant items from being repeated. Taking photos of the installation will provide a better understanding of the detailing needed. For example, internal bulletins could be written and distributed to the tradespeople, design teams, estimators, etc. Correctly identifying problems quickly will lower future project rework time and cost. When the design team changes the details, it helps provide a more complete and accurate bid.

Observations	Action Required	Non-Compliance Photo	Action Taken	Compliance Photo	Closed/Reopened
<p>Date of Obs: 10/20/22</p> <p>Contractor: Red Stone Masonry</p> <p>Obs-Description: The precast coping is being installed back about 1/2" deep. The joint should be 3/4" in order to install a basket rod and anchor. The rebar needs to be 4ft along an 8ft long linear type anchor creates an incorrect embed depth. However, embed depth will create failure of the rebar.</p>	<p>Action Required: Red Stone Pre-Installation Meeting</p> <p>The correct needs to be installed back at least 3/4" where there is no embedment of rebar.</p>		<p>Action Taken: Rebar has been re-set back of least 3/4" where there is no embedment - 10/13/22</p>	<p>Date of Compliance: 10/20/22</p>	<p>Closed/Reopened: Yes</p>

Figure 8. Excerpt from a job site quality report

4 Conclusions

Masonry installation is complex and hard work. An aging workforce and lack of newly trained workers entering the market are leading to fewer skilled masons on our jobs and raising concerns about quality. The foremen frequently do not read the contract documents, including both the specifications and the installation instructions for various masonry components, and the materials are being installed incorrectly. Because of this trend, the industry is already seeing a slight decline in masonry quality with newer masonry contractors. For this reason, a thorough, well-defined pre-installation meeting is necessary to keep rework costs down and ensure that the masonry team fully understands the project's expectations and requirements.

Developing clear, quality pre-installation meeting minutes that can transcend language barriers by utilizing actual field photos will benefit the project and future projects, no matter how experienced the designer, or the mason is on the project.

Keeping track of data and following through with an observation report after each visit is critical to keep the job in line with the contract documents and other requirements. In addition, submitting follow-up photos for each non-compliant item identified, along with the time it takes to correct the issue, will keep your program in check. Constantly learning the concerns in the field and creating lessons learned from your observations will improve the design process and take our industry to the next level.

6. References

The Masonry Society (2022), TMS 402/602-22, *Building Code Requirements and Specifications for Masonry Structures*, The Masonry Society (TMS), Longmont, CO.

Zussman C. S. (2019). Life Safety Digest Fall 2019, "*Proper MEP-FP Coordination with Non-Bearing Fire-Rated Walls*," Hillside, IL.

Zussman C. S. (2019). "*Constructability Mock-ups Sets Expectations*," *Smart Dynamics* July 2019

ASTM International (2022), ASTM C90-22 "*Standard Specifications for Loadbearing Concrete Masonry Units*," ASTM International, 2022.

ASTM International (2022), ASTM C216-22 "*Standard Specifications for Facing Brick (Solid Masonry Units Made from Clay or Shale)*," ASTM International, 2022.

Brick Industry Association 1995, BIA Technical Note 31- Brick Masonry Arches, Brick Industry Association (BIA), Reston VA.

Brick Industry Association 2002, BIA Technical Note 21B- Brick Masonry Cavity Walls Detailing, Brick Industry Association (BIA), Reston VA.