

BEST PRACTICE

Demonstrate It First!

**Job Site
Mock-Up
Panel
Qualifies
the Bidders**

by Alan Esche and Charles W Ostrander, PE



LEARNING OBJECTIVES

Upon reading the article you will be able to:

- 1 Identify elements of a masonry wall that should be identified in a mock-up panel
- 2 Describe how mock-up panels can improve the outcome of a project
- 3 Consider criteria of ASTM C216 and their impacts on a project



Photos courtesy of Esche & Lee

A mock-up panel, complete with openings and sills, represents what the owner and architect expect in the final building. It will also allow the design and construction teams to identify and allow for the resolution of issues before construction begins.

Masonry job site mock-up panels can range from a sample strap of brick to a fully designed, drawn and constructed panel, including all wall and enclosure systems.

In today's market place, the one way to ensure the low bidder is planning on using the specified and designed materials and is qualified to produce the quality expected is for the architect to design and require a job site mock-up panel in the scope of the bidding documents.

The same cleaning procedure that will be performed on the building should be performed on the sample panel

It does not matter what role you play in the construction building process, the job site masonry mock-up panel is the best way to demonstrate that all parties will be able to fulfill their responsibilities to the

construction of a project and are providing the specified design.

This simple, but too often overlooked, process ensures that the masons construct a masonry wall system that meets design requirements, achieves expected quality and demonstrates how other wall components work with the masonry design.

This allows contractors and designers to review actual construction prior to the start of building and demonstrates early on issues that may need to be addressed, such as a final design detail, approval of a specified special order masonry unit or compatibility with other systems.

Approval of the entire masonry wall system including flashing, weeps, end dams, anchoring, air and vapor barriers, closed cell, rigid cavity insulation and how they work with the backup wall system and other envelope components will also

provide the project team with a clear understanding of the design, along with giving insight into potential construction and sequencing issues.

Primary Objectives

Building and analyzing a mock-up panel determines that specified materials, sizes and colors satisfy the architect's and owner's expectations and can be approved for constructability. This requires looking at and including several factors:

- Use industry standards and specifications that allow tolerances of unit sizes, level and plumb workmanship and the quantity and size of chips that may be in the field.
- All masonry materials and colors should be represented in the mock-up including brick, precast sills, bands, stone, concrete masonry units (CMU) and accent banding, as well as brick

expansion joint and sealant and control joint in the backup CMU.

- Approve mortar color, tooling and workmanship of the mock-up panel according to the job requirements and industry specifications.
- If design calls for brick veneer on steel studs, build the steel stud wall with exterior sheathing and air barrier, exterior rigid insulation and flashing. Use the specified hot dipped adjustable anchors properly spaced for the brick.
- The size of the panel should be at least 6' X 6', in the specified bond pattern, with exposed inside and outside corners. Transition areas should be built with an isometric step back to expose cavity details and construction methods.
- After panel is built, the same cleaning procedure that will be performed on the building should be performed on the sample panel. It is sometimes recommended to leave a portion of the panel uncleaned to demonstrate mortar smears as built that can be compared to the cleaned final panel and to the actual walls being built on the building.

By keeping the mock-up onsite, it can be used as a measure of comparison and as a check for accuracy

Who Builds and Who Approves

The project team should predetermine who is authorized to approve the mock-up panel prior to its construction. Industry standards and procedures for viewing and approval should be reviewed by the team prior to building the mock-up.

The mock-up is built as a representative sample of what the owner and architect expect to see in the final building. Standard materials with their normal deviations in size, color and/or blemishes should be used to build the mock-up. An average tradesman with average quality construction that meets the specifications should be used to build the mock-up under close supervision. The mason should not use culled materials nor should the best tradesman construct the panel or else the mock-up will not represent a realistic sample of the finish project or average quality of the crew.

What does a mock-up panel do for the project team and owner? If constructed properly, it will identify and allow for the resolution of problems and expectations before the building is actually built. It could save project time, money and lots of meetings if an issue is addressed prior to the actual construction.

Do not use the mock-up panel as the first time material colors and samples are reviewed or approved. The mock-up panel should be constructed of already approved materials and methods. Who picked the brick color? The design architect? The architect of record? The owner and/or his representative? Once you know this, you are close to knowing who is going to approve the color in the mock-up panel.

Improve Schedule by Eliminating Problems Upfront

Because of lead times, special order materials may have to be ordered long before the mock-up is built. Procedures should be in place to approve these colors on an expedited basis so the project is not delayed waiting for these special order materials. In one case, an Esche & Lee project required construction of two mock-up panels. The second panel was actually built out of state in order to test the wall system for hurricane force winds and rain. While not always common, requests like this do happen and must be accounted for in both the schedule and mason contractor's estimates.

Issues To Be Verified

- Material color to match samples provided.
- Masonry material used meets specification as well as design intended.
- Column width between the windows works with the actual brick size.
- Correct types of anchors and ties are used and placed.
- Correct type of flashing is used.

Top photo This mock-up panel shows the exterior wall with an opening and corner in the foreground. The glazed CMU in the background demonstrates the interior partition walls. It also illustrates how the masonry walls will intersect with roofing elements.

Bottom photo This mock-up panel leaves all of the wall components visible, including insulation and drainage material, as well as the transition from brick to stone and a corner.

- Correct type of insulation, air and/or vapor barrier, drainage material and other cavity elements are used and properly sequenced.
- Flashing end dams and other details are what the architect expects.
- Weeps properly placed.
- Window jamb and sill detail works in current window frame width.
- Workmanship meets industry standard and specifications.
- Structural steel or shelf angles allow for differential movement and adequate adjustment for the masonry system with the steel or concrete frame.



►► Demonstrate It First!



Images courtesy of Charles W Ostrander



Per ASTM C216 specifications, brick face(s) shall be free from cracks or imperfections when viewed from 15' for FBX/HBX and 20' for FBS/HBS and FBA/HBA. This implies that even if there are surface cracks, the brick are acceptable if the cracks are not visible from a certain distance.

Ensure Expectations Are Met

- Clear and updated job specifications indicate actual material types to be purchased.
- Complete flashing details included in contract design documents.
- Design and draw a mock-up panel with an isometric cutaway in the contract documents to be included in the scope of work and bid documents for each trade.

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All members of the project team can use a job site mock-up panel to their advantage to ensure the owner is provided the intended

design, performance and a return on investment he deserves with a sound investment in a masonry constructed building.

While the mock-up panel should be built and approved before construction begins, it should be built on an adequate foundation so that it can remain onsite throughout the construction. The mock-up process from design to construction provides an opportunity to resolve both design and constructability issues before building construction begins and may prevent delays in the project schedule and actual construction by identifying these issues early. By keeping the mock-up panel onsite, it can be used as a measure of comparison and as a check for accuracy.

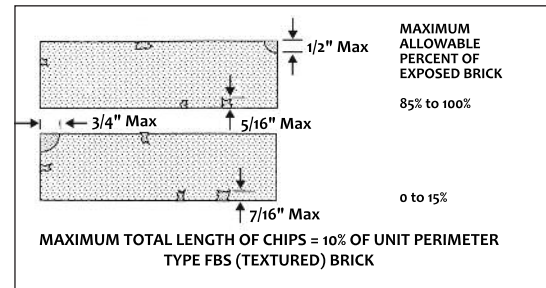


Diagram 2

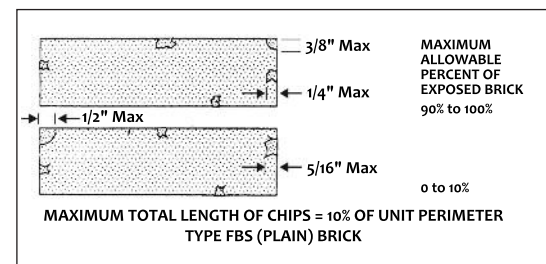


Diagram 3

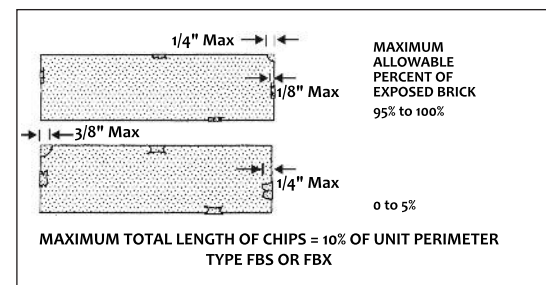


Diagram 4 Maximum total length of chips for: modular brick (7³/₈" x 2¹/₄" ~ 1.97"), utility brick (11¹/₈" x 3³/₈" ~ 3.05")

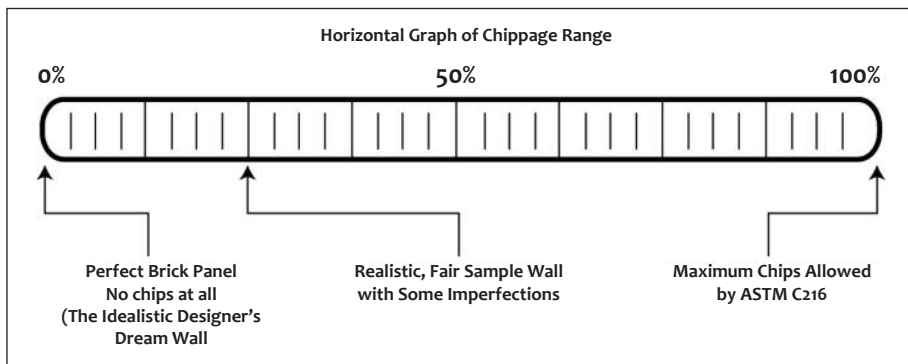


Diagram 1

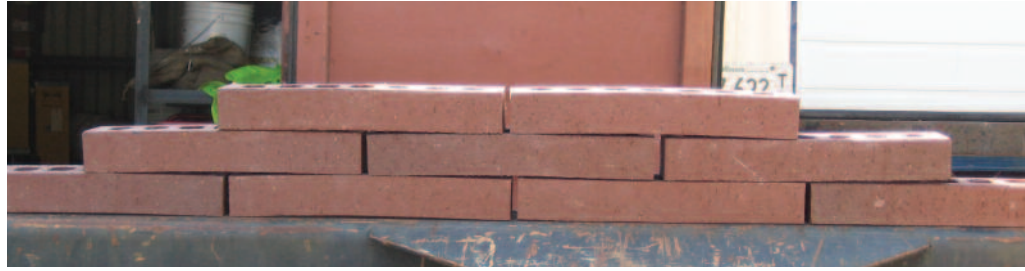
Case Study

A particular brick was submitted to an architect for approval. A sample panel was built and approved, but the only criterion checked was color.

Approximately eight weeks later, a delivery of cracked and distorted brick was made to the job site. (See photos to left). Upon major protest by the mason contractor to the architect and construction manager and an additional four week production delay and work stoppage, the brick manufacturer agreed to replace the delivered brick with another batch of uncracked and undistorted brick.

The brick manufacturer, in this case, must take some responsibility for the quality of product it is shipping. It is likely that manufacturers would take such brick and grind it for use as grog in future brick production. In most cases, it would never make it to the brick yards. That is not a guarantee, as evidenced by this particular project, so it is the responsibility of all parties to inspect the brick and see how it would respond to actual built conditions, as in a mock-up panel. In theory, if the brick samples are only being assessed for color, the cracks and distortion are non-issues. In practice, however, there is always more to consider.

While ASTM C216 states the level, or tolerance on distortion, for 15 $\frac{3}{8}$ " long brick, type FBS, is $\frac{1}{32}$ ", it may be difficult



Example 1 A mock-up panel would have brought the distortion of these brick to light long before the entire brick order was filled.

to see with the naked eye in inspecting a single brick or even a strap of brick. Once they are laid in a running bond pattern (See Example 1), it becomes very obvious. Had a mock-up panel been constructed, it would have been seen long before the brick order was fulfilled.

Conversely, more chips and cracks are allowed by C216 than what one usually sees in actuality. (See diagrams 1-4 for allowable levels of cracks and chips.).

ASTM C216 is conspicuously silent on the subject of efflorescence. No owner or architect wants his brick building to effloresce. To eliminate clay brick as a source for efflorescence, the brick should be labeled "non efflorescence" on the test reports. For more information on efflorescence, refer to the Brick Industry Association's technical note 23A on www.gobrick.com.

Therefore, in addition to using ASTM C216 for specifying brick, the Masonry Advisory

Council also recommends adding the following to specifications:

1. Clay brick shall not have continuous cracks on the bed face from the header face to the core or from core to core.
2. The exposed and unexposed exterior face brick shall also be free of cracks that extend to a core.
3. Brick chosen should be labeled "non efflorescence" on test reports.

Mock-up Specification

From preplanning throughout construction, a mock-up panel can demonstrate final results to the architect and owner, demonstrate the quality of materials and workmanship expected, eliminate problems of compatibility and constructability and improve schedule. Architects should write this process into contract documents and mason contractors should plan for the time and cost of erecting it. It will ensure a better product from beginning to end. ■■■



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