INSULATED MASONRY VENEER SYSTEM

TEST STUDY ON SHORT-TERM DEFLECTION AND PERFORMANCE

BUILDING TRUST

INTRODUCTION

Sika Facades manufactures a variety of construction products and systems including Exterior Insulation and Finish Systems (EIFS) which are exterior wall claddings for above grade walls of commercial and residential buildings. EIFS with drainage are multi-layer systems comprised of an air/water-resistive barrier, mechanically or adhesively attached thermal rigid insulation board (ci), glass fiber mesh embedded in base coat and a finish coat which provides the final appearance. EIFS are a popular cladding because of recognized benefits such as high thermal properties provided by the external continuous insulation, cost effectiveness and design flexibility.

Throughout the years the sole option for the outermost layer was a relatively thin textured finish with a wide variety of colors and textures which enabled numerous design options. Over the years ongoing product innovations resulted in new, but still relatively thin finish coat options that provide additional choices including the appearance of other cladding materials such as brick, wood, stone, and metal panels.

More recently, actual veneer materials such as ceramic tile, masonry stone veneer, thin brick and natural stone became design interest for the exterior finish layer. These veneers are used in conjunction with EIFS to create a look of a multi-clad building. Unlike the original thin finish layer used with EIFS, these veneers are relatively thick and often weigh up to 15 lbs. per sq. ft. which results in additional considerations for attachment and overall performance when used as a finish layer for EIFS and other applications.

Sika Facades has introduced the Insulated Masonry Veneer System which enables tile, manufactured stone veneer, thin brick and natural stone veneer materials to be substituted for the typical finish coat in what is otherwise a traditional EIFS application. This innovation, which has undergone rigorous fire and other performance-based testing, helps satisfy recent design interests while maintaining the recognized benefits of EIFS.

TEST AND STUDY OBJECTIVES

An objective of the third-party laboratory testing and study was to understand the short-term deflection performance of Sika Facades' Insulated Masonry Veneer System when subjected to gravity only loads imposed from a typical veneer material with an assumed unit weight of 15 lbs. per sq. ft. (PSF). A secondary objective was to obtain qualitative information of shear strength performance of the components within the Insulated Masonry Veneer System and between the various layers within the assembly.

As a baseline and means of comparison, the study also included short-term deflection testing of a code compliant (2021 IBC Section 1404.10.1.4) base wall consisting of framing and sheathing and an adhered masonry veneer assembly comprised of an air/water-resistive barrier, lath, mortar scratch coat and masonry veneer. This testing was for short-term deflection only and not intended to address other performance aspects such as attachment for wind load or long-term deflection testing.

TEST ASSEMBLY DESCRIPTIONS

Figures 1 and 2 show the Insulated Masonry Veneer System and base wall and describe the assembly components. The supporting framing and sheathing are identical for both assemblies, the only variable is the cladding component which supports relative comparison of short-term deflection performance. The specimen in Figure 1 is an EIFS assembly with 4” of EPS foam insulation. The specimen in Figure 2 is the more traditional assembly for masonry veneer including metal lathe and scratch coat with no continuous insulation. For the finish or outermost layer, both assemblies incorporated a 20-gauge perforated steel sheet embedded in SikaWall-1000 MaxGrip Veneer Adhesive in lieu of a traditional finish coat.

As shown and further described in the Test Methodology, the steel sheet is able to be ‘vertically downward loaded’ via a hydraulic ram with a connected load cell to record simulated veneer weights. The assembly was constructed as such, in lieu of using actual veneer materials as the finish layer, to have a verifiable weight (load) plus it eases uniform loading of the assembly. It also provides an opportunity to obtain additional results by varying the load (veneer weight) to simulate other veneers without the need to construct and test additional panels.

Figure 1

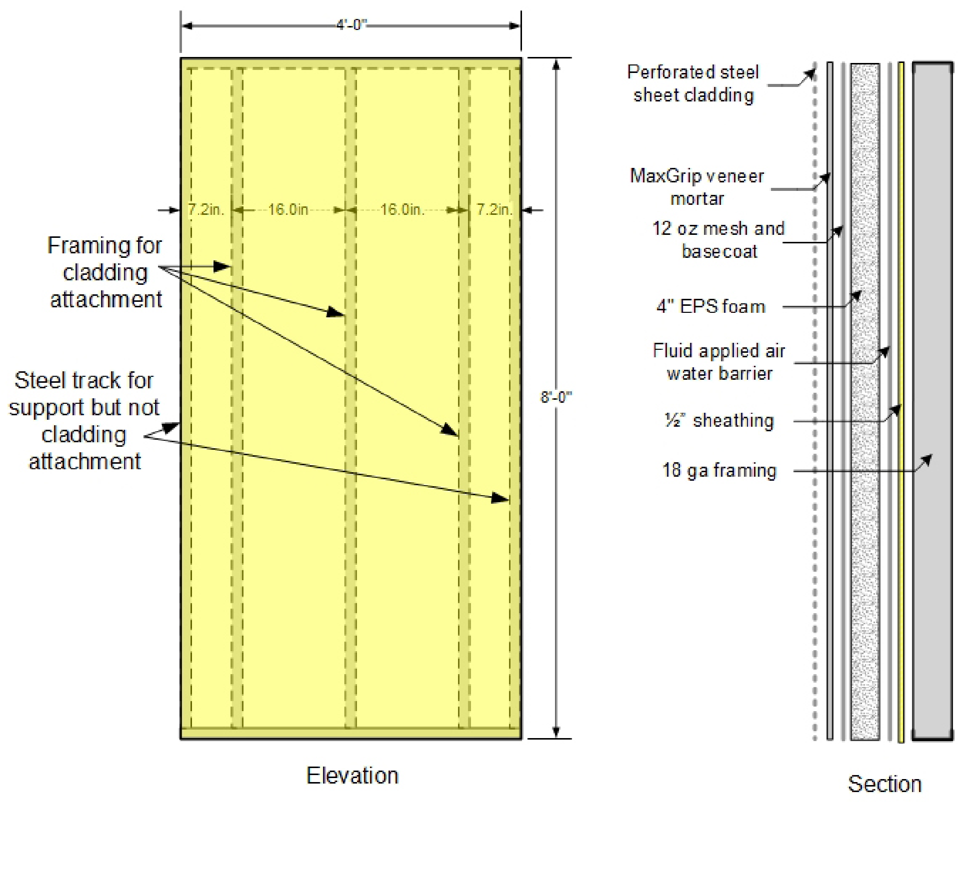
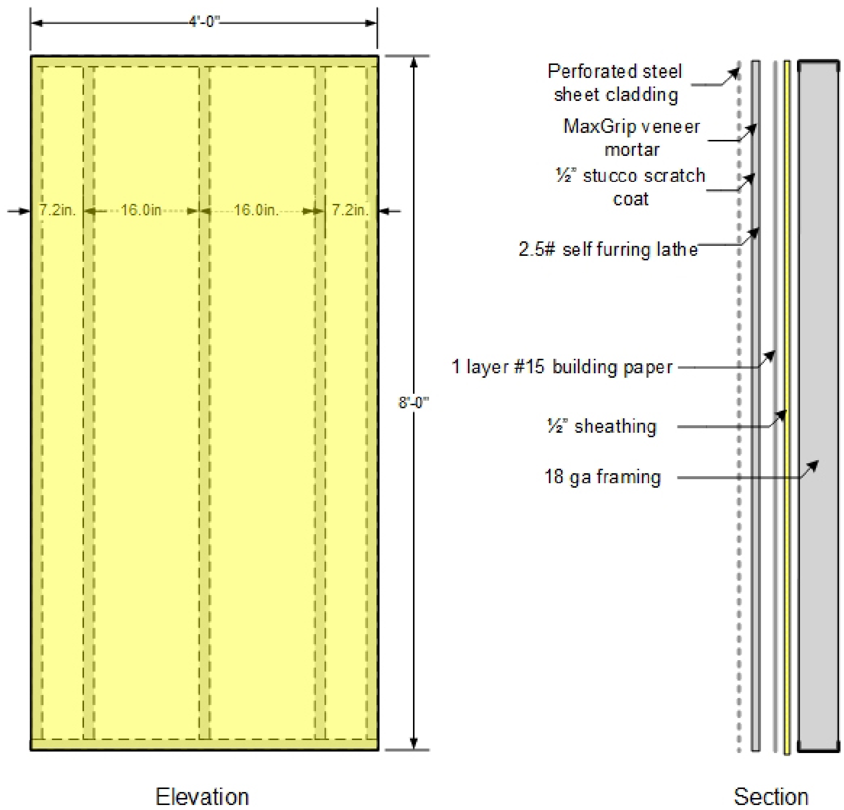


Figure 2



TEST METHODOLOGY

After construction of the test specimens, the assemblies were allowed to cure in ambient indoor conditions approximately 45 days prior to the start of testing. To facilitate testing, the test specimens were mounted vertically to a concrete block wall in the test facility (Figure 3). Three deflection gauges (+/- 0.01-inch accuracy) were installed as shown in Figure 5 to measure movement in the steel framing, sheathing, and cladding as the load was applied, however the main objective was to measure the movement of the cladding relative to the sheathing.

Two stiff metal angles were installed on the bottom of the perforated steel sheet to distribute uniform load from the hydraulic ram to the perforated metal sheet that was previously attached to the assembly by SikaWall-1000 MaxGrip Veneer Adhesive (bottom of Figure 3). Loads were measured with a 3000 lbs. (with 0.2% linearity) load cell and applied in increments of 500 lbs. (15 PSF). Dial gauge readings were recorded at each load increment.

FIGURE 3
Test Set Up with Vertically Mounted Specimen

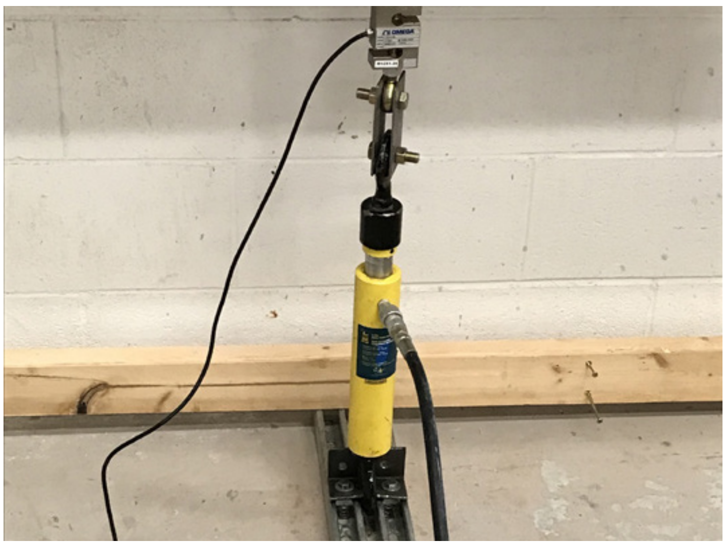


FIGURE 4
Hydraulic Ram with Load Cell at Base of Test Specimen

FIGURE 5
Dial Gauges to Measure Deflections

RESULTS AND CONCLUSIONS

Short-term deflection testing started with an applied vertical load of 15 PSF to represent the typical maximum allowable unit weight for an adhered veneer. After the initial 15 PSF load, both wall assemblies were tested again at 15 PSF increments up to a maximum vertical load of 90 PSF which would be a 6x safety factor in terms of short-term deflection. Table 1 summarizes the short-term deflection readings in terms of the differential movement between the veneer, which is represented by the steel mesh relative to the sheathing.

Deflection dial gauge readings show both wall assemblies performed very similarly in terms of having insignificant deflection (<1/64") at the 15 PSF veneer weight and only slightly higher deflection (<1/32") with an applied load up to 90 PSF. Additionally, neither assembly showed any outward sign of structural failure (adhesively between components or cohesively within the components) or excessive deflections. Systems were not taken to failure or test loads beyond 3000 lbs. (~94 PSF) due to limitations in the equipment and structure supporting the specimens. As described in Figure 1, the Insulated Masonry Veneer System achieved this loading based on adhesive attachment only, no mechanical fasteners were used in the system.

It was noted during testing that an apparatus bracket experienced unanticipated movement during the test of Insulated Masonry Veneer System because of the high load. Unfortunately, this movement resulted in slightly higher deflections recorded for the Insulated Masonry Veneer System and these could not be numerically corrected after testing. Even with the additional movement, the deflections recorded for the Insulated Masonry Veneer System with 6 times the design load (15 PSF x 6 = 90 PSF) are still very small, and the difference in deflections between the Insulated Masonry Veneer System and the base wall is very minimal. Additionally, there was some small movement in the steel stud wall as the load was applied however the dial gauges measuring the sheathing and the cladding movements were used to isolate the relative movement between the sheathing and the cladding.

TABLE 1

MEASURED DEFLECTION (INCHES) - VENEER RELATIVE TO SHEATHING						
WALL DESCRIPTION	**APPLIED VERTICAL LOAD**					
	15 PSF (typical maximum weight of adhered veneer)	30 PSF	45 PSF	60 PSF	75 PSF	90 PSF
Base Wall	.0014 (<1/64")	.0038	.0085	.0115	.0123	.0123 (<1/32")
Insulated Masonry Veneer System	.0042 (<1/64")	.0142	.0185	.0215	.0225	.0270 (<1/32")

In summary, the Insulated Masonry Veneer System was able to resist over 90-PSF applied load with deflections similar to more traditional masonry veneer assemblies.

REFERENCES

RDH Building Science Laboratories Project 12016.002 dated May 24, 2019 – Short Term Deflection Testing Report

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