Testing Brick Veneer/Steel

Two Construction Associations Announce Results of Test Using Brick Veneer-Steel Stud Exterior Walls

Brick veneer-steel stud exterior wall systems have been used successfully on numerous buildings nationwide. The pleasing appearance and durability of brick veneer combined with the cost efficiency and structural integrity of steel framing make the system very attractive to designers.

While this system has met the test of experience on many buildings, its performance on others has been questioned. There has not been a unified effort to collect and publish information on the proper design and installation of the system.

Responding to this need, the Metal Lath/Steel Framing Association (ML/SFA) and the Brick Institute of America (BIA) have jointly sponsored research on the brick veneer-steel stud wall system. This research was conducted in 1981 at Clemson University, Clemson, South Carolina under the direction of Dr. Russell H. Brown, P.E.

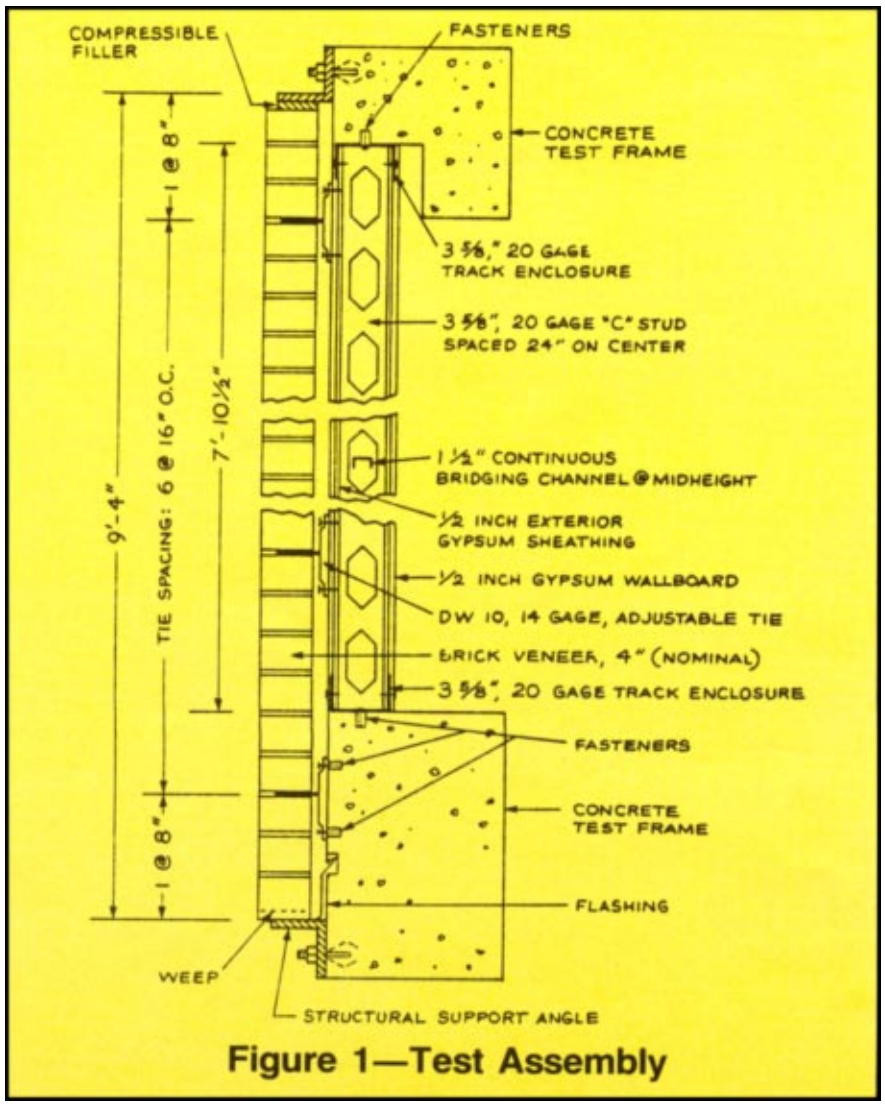

Figure 1—Test Assembly

Research Goals . . .

Brick veneer-steel stud systems have been questioned by some due to the differences in the relative stiffness of the two materials. It has been the recommendation of the steel framing industry to design the stud backup for a deflection limit not to exceed L/360 of stud span. There was not, in the opinion of some, sufficient test data to support this practice for the stud design when used with brick veneer walls subjected to lateral loads. The primary goals of the research program were to investigate the integrity of the L/360 deflection limit, the metal tie systems and the susceptibility to water permeance.

Test Procedures

The research investigation consisted of two phases. The first phase involved the testing of corrugated and adjustable wire ties. Based on performance, DW 10, 14-gage, two-piece adjustable wire ties were used in the construction of the test assemblies which were constructed by commercial contractors to simulate field conditions (see Figure 1). Three were subjected to positive pressure, and three to negative pressure.

These same specimens were also subjected to water permeance tests, before loading and after removal of the loading. Construction of the test wall assemblies followed the current recommended practices as set forth by both the BIA and ML/SFA. Standard size (nominal 4 x 2-2/3 x 8), Grade SW brick and Type S portland cement-lime mortar were used in the construction and were tested for com-

Continued on page 10

pliance with the applicable ASTM standards.

The steel studbackup was designed so that the stud alone would theoretically experience a maximum lateral deflection of L/360 when subjected to full design load. A galvanized 3-5/8%" 20-page "Cee" stud was selected for the tests. based on a 7' 10-1/2" stud height, 24" o.c. spacing and L/360 deflection limitation, the lateral design load was 24.16 psf.

When tested at the design load, all six walls behaved elastically. Cracks did not occur in the brick veneer at design load level.

In the three specimens subjected to positive air pressure, hairline cracks in the mortar occurred at an average of twice the design load. Hairline cracks occurred at 2.36 times design load in two of the specimens and in one specimen at 1.29 times design load.

When tested at three times design load, none of the specimens experienced structural failure of the wall system.

When subjected to negative pressures, two of the three specimens did not crack when tested to triple the design load. The remaining wall experienced a mortar crack when loaded to approximately 2-1/2 times the design load. Again, none of the wall assemblies experienced structural failure.

During both positive and negative loading, sufficient lateral movement occurred at the top of the brick veneer to relieve stresses in the brickwork, thus enabling the system to resist more load.

The water permeance tests were inconclusive insofar as demonstrating any relationship between water penetration and loading.

Conclusions

All wall samples withstood their design lateral load without flexural cracking of the brick veneer, while five of the six walls withstood double design load without cracking. These results demonstrated that limiting lateral load deflection of the backup steel stud alone to L/360 of stud span is acceptable to prevent structural failure of the brick facing.

This conclusion is limited to the parameters of the test assembly. The critical parameters for this test program include: provision for lateral movement at the top of the brick veneer, the use of a suitable type of portland cement-lime mortar, standard size brick, and a proper adjustable wire tie system.

Further, the use of the L/360 deflection limit for applications other than that tested is left to the judgment of the designer.

For additional information regarding the construction of brick veneer-steel stud wall systems, contact the respective sponsoring organizations—the ML/SFA and BIA. Each has reports and publications about the products of their members. Individual member companies will also be pleased to help you with information about the design and use of specific products. Also, a copy of the Clemson University research report is available from either ML/SFA or BIA for a nominal charge.