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# Felt Tips

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*In our March 1994 Felt-Tip we presented a paper by Clayford T. Grimm which was originally presented in the February 1992 edition of The Masonry Society Journal. As we noted in the introduction, Mr. Grimm's opinions are sometimes controversial. Following the appearance of Mr. Grimm's article, the Masonry Society Journal presented in August 1992 several letters with viewpoints which differed from those of Mr. Grimm. We would like to thank Brian Trimble, of the Brick Institute of America, for providing these letters to us. The letters are reprinted with the permission of The Masonry Society Journal. The Baltimore Chapter CSI makes no endorsement of the opinions contained within these letters.*

# What is Wrong with Brick Masonry Veneer Over Steel Studs? Part 2

Comment #1

I was very disappointed and disturbed by the extremely negative article "What is Wrong with Brick Masonry Veneer over Steel Studs?" by Mr. Clayford T. Grimm.

Mr. Grimm points out some of the deficiencies he has encountered in the use of Brick Masonry Veneer on Steel Studs (BMV/SS). However, he fails to recognize the numerous advantages of this system or even acknowledge its future potential as materials and design methods continue to improve. Here in the Southwest United States, we generally receive less than 10 inches of rain per year and we therefore do not have deterioration as Mr. Grimm describes. Instead we have found BMV/SS systems to be durable, economical and to have performed very well in earthquakes.

In his article, Mr. Grimm also implies that the Brick Institute of America (BIA) and the U.S. Army Corps of Engineers is against the use of BMV/SS. Having worked closely with BIA over twenty years, I would like to note that the BIA has increasingly supported BMV/SS based on improved materials and more rational design methods. Likewise, the U.S. Army Corps of Engineers has lifted its ban on the system after a cooperative effort of the brick and steel stud industries alleviated their major concerns with the system.

Although I do not discount some problems that this system has had in the past, I feel it is essential to also recognize the benefits and advantages of this system. As materials, design methods and construction techniques continue to improve, the use of this system is increasingly more attractive while the problems Mr. Grimm noted diminish.

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Comment #2

Mr. Grimm's paper on brick veneer over steel studs is not nearly an equitable means of treating the subject. He takes sentences and paragraphs out of context to support his viewpoint. He often overlooks further conclusion or alternate papers which do not support his conclusion. Many of the concerns raised are true of other wall systems, including those without masonry. Certainly interstitial condensation, cracking due to improper details or construction and corrosion occur in all wall types.

There are several omissions and errors in Mr. Grimm's paper which must be clarified:

1. Reference 1. BIA Technical Notes 28B is not our only publication which recommends a detailed, careful inspection at least once a year. We recommend seasonal, not yearly, inspection periods in Technical Notes 7F, "Moisture Resistance of Brick Masonry, Maintenance" for all brick masonry walls.
2. Reference 2. The compilation of Veneer/Steel Stud Problems by BIA was not exclusively brick veneer/steel stud projects, not all of the problems listed were related to the use of steel studs and not all of the projects listed had problems.
3. I know of connector failure in cavity wall buildings, one in Stillwater, Oklahoma and one in Houston, Texas, which I have discussed with Mr. Grimm. I am aware of more caused by corrosion of ties, but Mr. Grimm may not be aware of them.
4. Mr. Grimm's list of failures of brick masonry veneer/steel stud wall would have been much more valuable with date of construction, type of failure and cause of failure. The problem may not be related to the use of steel studs.

The combination of brick veneer over steel stud has evolved with its use and experience. Current design and detailing recommendations are a far cry from those used in the late 1960's when the use of this system began.

I too would prefer to see a different wall system used exclusively. Mr preference is an insulated brick and brick cavity wall. However, personal preferences are usually outweighed by engineering, architectural, economic and construction considerations. Steel studs will be used to provide backing for brick veneer in certain instances. Yes, there is "a duty to warn" and the Brick Institute of America has met that duty with updated versions of Technical Notes 28B.

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Comment #3

# BRICK MASONRY VENEER OVER STEEL STUDS - DESIGNING IS THE KEY

by Jeffrey L. Elder, P.E.r[1]

I would like to respond to the article found in the February [1992] issue of the T.M.S. Journal written by Clayford T. Grimm titled "What is Wrong with Brick Masonry over Steel Studs".

I would like to preface this article by stating that I agree with many of Mr. Grimm's comments. It is true when sufficiently high forces load a brick masonry veneer over steel stud (BMV/SS) wall beyond its flexural capacity, the rigidity and low flexural strength of brick masonry combined with the flexibility and high flexural strength of steel studs results in cracked masonry. It is true when these forces are caused from wind driven rain, the rain will enter the cracks and migrate into the cavity. If the cavity is not properly designed, moisture will migrate the interface of the stud and connector. If the stud or connector is improperly sized or protected, corrosion can occur.

I disagree with Mr. Grimm's statement, "Research has confirmed that the brick masonry veneer over steel stud wall system provides an unacceptable risk of performance and catastrophic structural collapse in the long term." This statement is a gross generalization. Research has proven and field experience has shown that certain methods of designing and constructing BMV/SS systems were inadequate and that better methods needed to be revealed and implemented. Unfortunately, this is the trial and error nature of all industry. Little energy is spent on evaluating the long term nature of a system until there is a problem with that system.

For instance, the original glue-laminated beams exposed to moisture would often check, crack and fail. It was not until these problems were observed that the glue was modified to retain its bond under the presence of moisture.

Similarly, reinforcing steel in bridges and roadways was installed untreated for many years until the concrete began to spall and it was determined that electrolysis was occurring due to free salts in the concrete and causing the steel to rust.

Today, new epoxy coated reinforcing is available to aid in protecting the reinforcing steel against corrosion.

Although these changes have eliminated many of the problems, these products may still have problems unless properly detailed, designed and constructed. More research needs to be conducted on all exterior wall systems, i.e., glass curtain walls, steel wall panels, concrete walls, and brick walls to protect them from rain and condensation. Unless properly designed, each of these systems is prone to corrosion and possible failure.

Currently there exists thousands of buildings constructed using BMV/SS systems. Many of these have been in place for over twenty years without any indication of distress.[1]

Possible the number 1 problem with BMV/SS system is that it does not require a design analysis. In general little attention is given to the system. If proper attention is given, brick masonry veneer over steel studs systems can be properly designed and constructed. Upon further research, the Army Corp of Engineers has rescinded their position on the BMV/SS systems. The Corp of Engineers and the B.I.A.[4] have both issued design guides which will give direction to the proper construction of BMV/SS wall.

The first recommendation in designing a brick veneer wall, regardless of the back-up system, is to assume that the brick veneer will leak. Water will enter into the cavity. Most researchers conclude that for typical floor to floor spans, the brick veneer backup system cannot economically be constructed which will have sufficient stiffness to eliminate cracking of the veneer. Studies show that a deflection less than L/2000 will crack the veneer.[5,6] Currently the brick industry recommends that a deflection criteria of L/720 be used to design the backup.[4] If this is true, the designer should anticipate cracking of the veneer. Under wind driven rains, these cracks will allow moisture to migrate into the wall cavity.

Even though it is assumed that the brick veneer will leak, special attention should be given to the quality of the materials and workmanship in order to control the quantity of moisture that might enter the wall. Selecting the proper mortar is essential. "Type S mortar is recommended" and portland cement-lime mortars are recommended over masonry cement mortars."[3]

If the use of Type S portland cement-lime mortars can reduce the crack probability to 10%,[7] this will have a major impact on reducing the water permeance into the wall.

The designer must detail the wall to insure that any moisture entering into cavity is directed away from the backup to the exterior. This type of wall system is classified as a drainage wall system. It requires that a water resistant membrane be place against the backup wall which will direct water down the cavity toward flashing and weep holes and finally to the exterior of the wall. Although this may seem like a simple task, items such as the type and size of weeps holes can be a big consideration.

Different regions of the country receive varying amounts of annual rainfall. This should be considered as an indicator of the amount of water which might be expected to enter the cavity.

The use of cotton wicks or plastic tubes may not be sufficient to remove the quantities of water that might be expected along the Gulf Coast but may be adequate in dry arid climates such as Utah. It may be more appropriate for brick veneer constructed along the Gulf Coast to omit mortar from the full head joint.

Brick veneer should be attached with wire anchors. "The use of wire anchors reduces the likelihood of corrosion action forming and increases the life of the anchor."[3] "Corrugated metal veneer ties should not be used."[4]

Water sensitive sheathings are not recommended on the exterior side of the steel studs. Water sensitive sheathing helps promote water migration through the sheathing to the interface of the steel stud and the connector.[8]

Next, the designer should assume that moisture will find its way to the connection between the wall tie and the steel stud. It is at this interface that corrosion becomes a major concern. The potential for galvanic action is increased when two dissimilar metals are in contact. Therefore, it is important that the anchors and the fasteners be of similar materials.[3,4] Stainless steel anchors should be attached with stainless steel fasteners. In addition, fasteners should be designed to impede moisture transfer. This can be done by inserting EPDM synthetic rubber washers between brick ties and the waterproofing covering.[8]

In Mr. Grimm's article he discussed the fastener as follows: "the only structural element holding the masonry on the building is the fine, thin arris of a single thread of an abraded screw, which is periodically bathed in a salt solution".

There are several different ways to attach anchors to steel studs. One way is to rely on the tension capacity of a screw, another is to use the shear and bearing capacity. Not all screw connectors fit into the category of fine, thin arris of a single thread.

In areas where the corrosion level is expected to be high, it is important to insure that a single thread is not the only attachment connecting the anchor to the steel stud. In these regions a device should be used which does not rely on screws for connection and support.[9]

The steel stud has been a major participant in the failure of the BMV/SS system. Past designs included light gage studs with a base metal thickness of less than 22 gage. Many

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[1] Mr. Elder is the present Technical Committee Chairman for Western States Clay Products Association.

of these were plain, nongalvanized studs. These studs promote corrosion. In many instances, the light gage material did not allow more than a single thread of an abraded screw.

The Army Corp of Engineers requires a minimum base metal thickness of 18 gage in their 1992 Engineering Technical Letter 1110.[3] The Corp also requires the stud and framing to be hot-dip galvanized with a minimum ASTM A525 G60 coating. Requiring studs to be galvanized with a base metal thickness greater than 18 gage increases the corrosion resistance and the load carrying capacity of the fastener.

Water condensation can be another source of moisture which enhances corrosion of the stud and the fastener. A vapor barrier should be placed along the warm side of the insulation. More information on the proper placement of vapor barriers can be obtained from Kluge and Drysdale.[10]

In conclusion, if sufficient attention is given to the design, details and construction of the brick masonry veneer over steel stud system and "if one can avoid design errors of the past, this system promises to provide one possible solution"[6] to the economic construction of brick veneer walls.

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