TITLE: Issues with Code-Compliant Brick Veneer in Residential Construction

DESIGNATION: RCI-TA-001-2011

OBJECTIVE: To provide commentary on issues associated with brick veneer construction that is code-compliant but differs from long-accepted trade practices.

A. BACKGROUND

- Modern residential brick construction includes brick veneer installation in front of wood wall framing covered with a wood sheathing product.
- Water that penetrates the brick veneer migrates down through the drainage cavity to exiting weep holes and flashing located at the base of the wall or at interruptions in the drainage cavity.
- Brick veneer details published by the Brick Industry Association–some dating as far back as July 1950–have provided many years of successful performance when properly constructed.

B. THE PROBLEMS

- Investigations of many brick-veneer-clad buildings have revealed construction details that were found to meet code requirements but were not consistent with long-accepted trade practices.
- The International Residential Code (comprised of parts and pieces of previous building codes) includes provisions that differ from established details that have been found to be more functional.

C. MORTAR-FILLED AIR SPACE

- Code:
  i. 2009 IRC, Section 703.7.4.3: "As an alternate to the air space required by Section 703.7.4.2, mortar or grout shall be permitted to fill the air space. When the air space is filled with mortar, a water-resistive barrier is required over studs or sheathing. When filling the air space, replacing the sheathing and water-resistive barrier with a wire mesh and approved water-resistive barrier or an approved water-resistive, barrier-backed reinforcement attached directly to the studs is permitted."
- Positions:
  i. Water vapor can readily migrate through the masonry wall assembly, even with the presence of the code-approved, highly permeable water-resistive barriers described above. Approved water-resistive barriers have typical perm ratings ranging from 9 (#15 asphalt-saturated felt) to approximately 60 (spun-bond polyolefin) and are marketed as vapor- and liquid-water-impermeable. However, investigations have revealed opposing results in certain assemblies.

ii. Liquid water can easily pass through unprotected areas of the wall assembly by capillary continuity when saturated mortar is in direct contact with a high-perm, water-resistive barrier. When this occurs, components and materials within the wall assembly are likely to deteriorate and/or exhibit mold growth. When mortar is in direct contact with high-perm, water-resistive barriers, moisture migration can occur and result in significant damage.

iii. These problems can become exacerbated in hot-humid climates due to the inward direction of moisture/vapor drive during the cooling (summer) months. Moisture/vapor moves from the hot-humid exterior environment, through the wall assembly, toward the cool, air-conditioned interior environment. To further intensify the problem, summer rain showers can saturate the brick veneer, and the moisture can migrate through to wet excess mortar accumulations within the cavity that are in contact with the high-perm, water-resistive barrier. Some of the moisture evaporates on the wall surface, while much of the moisture can be driven towards the cool, conditioned interior. The wall assembly, when built in accordance with the referenced building code requirements, can experience possible damage.

D. CODE-REFERENCED STANDARD

- The building code references ACI 530/ASCE 5/TMS 402, *Building Code Requirements for Masonry Structure,* which is a joint document prepared by the American Concrete Institute (ACI), the American Society of Civil Engineers (ASCE), and The Masonry Society (TMS). The reference is primarily structural in nature; it does address general design requirements for masonry veneer (i.e., brick).

- The ACI/ASCE/TMS standard referenced by the building code does not allow for the cavity to be filled with mortar in the presence of an approved water-resistive barrier.

- There are no specific exceptions to providing a water-resistive barrier when a 1-inch air space is provided.

- This reference standard is inconsistent with the requirements of the very building codes to which it is incorporated (IRC and IBC).

E. INDUSTRY STANDARDS

- Brick Industry Association

  i. BIA Technical Note 28: “It is essential, when constructing brick veneer, to keep the 1-in. (25.4-mm) minimum air space between the veneer and the backing clean and free of all mortar drippings, so that the wall assembly will perform as a drainage wall.”

     1. This technical note does not address the filling of the air space with mortar in the presence of an approved water-resistive barrier, and there is no mention of omitting the water-resistive barrier when a 1-inch air space is provided.

     2. The current provisions in the IRC contradict the long-standing (successful) details recommended by the BIA.

- Architectural Graphic Standards

  i. The brick veneer cross section from the first edition of the AGS (published in 1932) includes the installation of building paper over the exterior wood wall sheathing and the presence of a 1-inch air space between the brick veneer and the protected wall sheathing.

ii. The recommended design practices, as early as 1932, incorporate design details that provided protection of the wall assembly and effective drainage provisions.

iii. The current provisions of the IRC can allow for the construction of possible suspect wall assemblies by the use of details that differ from the time-tested details that have been proven successful for many decades.

F. CONCLUSIONS

- Portions of the current IRC building code reflect details that are substandard and have resulted in damages.
- Structures located in mixed or hot/humid climates are particularly vulnerable to possible damage.
- Current building codes need to be carefully reviewed and revised to reflect the construction details that incorporate the time-tested best practices of the industry.

G. RECOMMENDATIONS

- Modify existing IRC building codes to prohibit the filling of wall cavities with mortar.

H. REFERENCES

- International Code Council, Inc., 2009 International Residential Code for One-and Two-Family Dwellings, March 2009.
- International Code Council, Inc., 2009 International Building Code, February 2009.
- ACI 530-08/ASCE 5-08/TMS 402-08, Building Code Requirements for Masonry Structures.
- Brick Industry Association, *Technical Notes on Brick Construction, Anchored Brick Veneer Wood-Frame Construction, Technical Note 28 Revised*, August 2002.
- Charles George Ramsey and Harold Reeve Sleeper, *Architectural Graphic Standards for Architects, Engineers, Decorators, Builders and Draftsmen*, 1st edition, 1932.