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Fire-Resistance-Rated Brick Veneer Exterior Walls

By Rick Thornberry, P.E., President The Code Consortium, Inc.

At ground level, the structural brick seen here contained the fire within the building. Brick fire walls are effective nearly 100 percent of the time.

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Part One of a Two Part Series

The 2009 ICC International Building Code (IBC) now contains four new exterior nonbearing wall design entries in *Table 720.1(2) Rated Fire-Resistance Periods for Various Walls and Partitions.* The IBC designates these designs as Items 15-2.1 through 15-2.4 for one-hour and two-hour fire-resistance-rated exterior walls finished with brick veneer. Items 15-2.1 and 15-2.2 describe one-hour and two-hour exterior walls constructed using thin brick veneer units attached as adhered masonry veneer. Items 15-2.3 and 15-2.4 provide details for one-hour and two-hour exterior walls finished with masonry veneer attached as anchored brick units.

These new exterior wall designs with brick veneers will provide architects/engineers/ building designers with user friendly prescriptive designs for those applications where a brick veneer is desired but the exterior wall is required to have a one-hour or two-hour fire-resistance rating by the IBC. 2009 IBC *Section 720, Prescriptive Fire-Resistance* references Table 720.1(2) and states that the materials of construction listed in that table shall be assumed to have the fire-resistance ratings prescribed therein. So a design professional need only consult the table to get the information necessary to design such a one-hour or two-hour fire-resistance-rated brick veneer exterior wall using steel or wood studs without having to consult a directory or listing provided by an independent third-party testing laboratory.

These new item entries in Table 720.1(2) are the result of the approval of Code Change Proposal FS151-06/07, which was submitted by the author on behalf of the Western States Clay Products Association (WSCPA). The WSCPA retained the author to develop and submit the Code Change Proposal during the first 18-month cycle (2006/07) for the development of the 2009 IBC. It did this to incorporate the brick veneer exterior wall designs into the code and preserve those designs previously contained in the International Conference of Building Officials (ICBO) Evaluation Service Report ER-5058 titled, “Brick Veneer Fire Endurance Ratings of Wall Assemblies” issued to the WSCPA. ICBO is one of the legacy organizations of the

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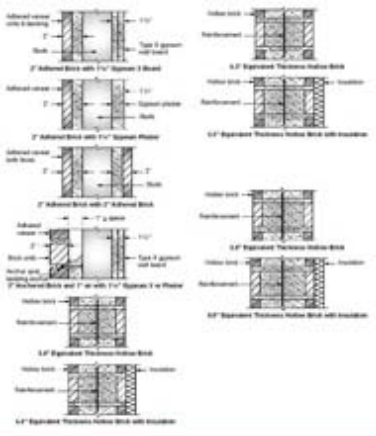
International Code Council (ICC).

II. History

In the early 1990s, the WSCPA retained Walter Dickey, Consulting Engineer, Los Angeles, to conduct a series of reduced-scale and large-scale ASTM E119 fire endurance tests of brick veneer walls at Warnock Hersey in Pittsburg, Calif. The testing was conducted in 1993 to develop data that resulted in the approval and publication of the ICBO Evaluation Service Report ER-5058 containing generic fire-resistance-rated wall designs for one-hour and two-hour ratings for both adhered and anchored brick veneers, as well as for hollow brick walls. The first publication of ER-5058 occurred in 1993 (See Figure 1 – Fire Ratings of Brick Veneer Walls taken from the last edition of that report which ICBO reissued on Sept. 1, 2002).

With the merging of the ICBO Uniform Building Code (UBC) into the IBC and the impending adoption of the IBC by the State of California, the WSCPA decided to preserve the fire-resistance ratings for the one-hour and two-hour fire-resistance-rated brick veneer walls documented in ER-5058 by including them in Table 720.1(2) of the IBC. The WSCPA retained the author to develop the appropriate code change submittal with supporting documentation and submit it to the ICC in March 2006 for the 2006/07 code development cycle. The ICBO Evaluation Service Report ER-5058, as well as the 1997 UBC and the 2006 IBC, were thoroughly reviewed to assure that a technically correct translation of ER-5058 was made for inclusion in Table 720.1(2) with the appropriate referenced standards and specific design criteria.



Click here to see Figure 1 – Fire Ratings of Brick Veneer Walls - taken from the last edition of that report which ICBO reissued on Sept. 1, 2002.

This Code Change Proposal was designated as FS151-06/07. The IBC Fire Safety Committee approved it as modified at the ICC Code Development Committee Hearings held in September 2006 in Lake Buena Vista, Fla. The Committee made modifications to the original Code Change Proposal to clarify the minimum air space width and the minimum thickness for the brick units required for the anchored masonry veneer in Items 15-2.3 and 15-2.4. It also provided a specific reference to ASTM C216 for the brick units. Subsequent to the publication of the Committee recommendations resulting from the public hearings in Florida, the City of Seattle, Wash., submitted a Public Comment to Code Change Proposal FS151-06/07 to request approval as further modified by adding Footnote (d) to each item. Footnote (d) to Table 720.1(2) states: “Shall be used for nonbearing purposes only.”

This oversight occurred when the Committee approved the Code Change as modified, since the ICBO Evaluation Service Report ER-5058 clearly stated that the wall assemblies were nonbearing. At the ICC Final Action Hearings held in May 2007 in Rochester, N.Y., the author, representing the WSCPA, spoke in support of the Public Comment, and ICC Class A voting members in attendance approved it. As a result, the ICC published Code Change Proposal FS151-06/07 in the 2007 Supplement to the International Codes and that is now a part of the 2009 IBC (see Figure 2, which reproduces page 136 of the 2009 IBC containing Items 15-2.1 through 15-2.4, along with the complete list of Footnotes to Table 720.1(2) found on page 137).

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The clay brick façade compartmentalizes damage to the interior without a major structural collapse, giving occupants ample time to evacuate safely.

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Description of Brick Veneer Wall Assemblies

B. Adhered Brick Veneers

The one-hour and two-hour fire-resistance-rated adhered brick veneer wall assemblies consist of steel or wood studs spaced at a maximum 24 inches on center with the outer face of the studs covered with a metal lath and a minimum ¾ inches of Portland cement plaster in which the thin veneer brick units of clay or shale are embedded along with mortar. The inside face of the studs is covered with 5/8-inch Type X gypsum wallboard.

The main difference in the design of these walls between the one-hour rating and the two-hour rating is that the one-hour wall requires a minimum combined thickness of 1 ¾ inches for the plaster/mortar/thin veneer brick units on the exterior face, whereas the two-hour rating requires a minimum 2 inches combined thickness. Also, the one-hour rating only requires one layer of 5/8-inch Type X gypsum wallboard on the inside face, whereas the two-hour rating requires two layers. Thus, the total minimum wall thickness for the one-hour rated brick veneer exterior wall assembly is 6 inches as compared to 6 7/8 inches for the two-hour rating.

B. Anchored Veneers

The one-hour and two-hour fire-resistance-rated anchored brick unit veneer exterior walls are constructed of steel or wood studs at a maximum 16 inches on center faced with clay or shale brick units not less than 2-5/8 inches thick which are offset from the exterior face of the studs with a minimum 1-inch air gap. The inside face of the studs is covered with 5/8 inch thick Type X gypsum wallboard.

The main difference in the design of these walls between the one-hour and two-hour fire-resistance ratings is that there is only one layer of 5/8-inch Type X gypsum

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wallboard applied for the one-hour rating, whereas the two-hour rating requires two layers. Thus, the total minimum wall thickness for the one-hour rated brick veneer exterior wall assembly is 7 1/8 inches as compared to 8 ½ inches for the two-hour rating.

It is interesting to note that the actual fire tests upon which the original ICBO Evaluation Service Report ER-5058 was based for anchored veneers utilized a 2-inch thick brick unit with a ½-inch air gap for the one-hour walls and a 1-inch air gap for the two-hour walls. However, both Table 1405.2 of the IBC and Section 6.2.2.4 Masonry Units of TMS 402/ACI 530/ASCE 5-08 specify a minimum thickness of 2.625 (2 5/8) inches for weathering purposes. Furthermore, Section 6.2.2.6.3 for wood studs, Section 6.2.2.7.4 for steel studs, and Section 6.2.2.8.2 for masonry or concrete backing of TMS 402/ACI 530/ASCE 5-08 require a 1-inch-minimum air space for installation purposes. Refer to WSCPA Fire Endurance Ratings of Clay Brick Masonry for additional information and details.

Main Differences Between ICBO Evaluation Service Report ER-5058 and Items 15-2.1 through 15-2.4 of Table 720.1(2) of the 2009 IBC

Those code officials and architects/engineers/designers who had previously used the ICBO UBC and referred to the ICBO Evaluation Service reports for code compliance guidance may notice, upon a detailed comparison between the ES Report ER-5058 and Items 15-2.1 through 15-2.4 added to Table 720.1(2), that they are in some respects significantly different. Of course, the code section references and the standards references are different, though technically equivalent. Otherwise, for the adhered brick unit veneers, as previously noted, the code change revised the minimum thickness for the brick units and the minimum width of the air gap to reflect the latest requirements in the IBC and the applicable standards TMS 402/ACI 530/ASCE 5-08.

Click here to see Figure 2, which reproduces page 136 of the 2009 IBC containing Items 15-2.1 through 15-2.4, along with the complete list of Footnotes to Table 720.1(2) found on page 137)

Also, the four items added to Table 720.1(2) do not include the adhered veneer designs where the veneer is installed on both faces of the studs in lieu of the 5/8-inch Type X gypsum wallboard installed on the inside face. It was not felt necessary to include that design in the table, because it is a symmetrical wall design that would find very little use in the real world. But it is comparable to one-hour and two-hour fire-resistance-rated walls constructed with 5/8-inch Type X gypsum wallboard on both sides of the studs.

The one-hour and two-hour fire-resistance-rated hollow brick walls with reinforcing steel in the grouted cells are also not included in Table 720.1(2) as new items since they can already be found in *Item 1 Brick of Clay or Shale*, specifically in Item 1-1.3, for one-hour through four-hour fire-resistance ratings.

Also, the adhered brick veneer designs added to Table 720.1(2) do not include the use of gypsum plaster in lieu of the gypsum wallboard of the same thicknesses. This was not felt necessary, since gypsum plaster is generally considered at least equivalent to Type X gypsum wallboard for the same thicknesses. In fact, this can be observed in Table 720.1(2) by comparing Item 12-1.1 to Item 14-1.3 for one-hour fire-resistance-rated wood stud walls and Item 11-1.1 to Item 13-1.1 for one-hour fire-resistance-rated steel stud walls.

However, it is interesting to note that *Section R703.4 Attachments* and *Table R703.4 Weather-Resistant Siding Attachment and Minimum Thickness* in the 2009 ICC

International Residential Code (IRC) only require a minimum 2-inch thickness for the anchored masonry veneer.

Summary

Part 1 of this two-part series provides the history behind the development of new Items 15-2.1 through 15.2.4 now found in Table 720.1(2) of the 2009 IBC. It has also described the two basic types of brick veneers specified in the four items in the table: adhered brick veneers and anchored veneers. Finally, it has documented the significant differences between the descriptions in Items 15-2.1 through 15.2.4 and the various brick exterior wall assemblies contained in ICBO Evaluation Service Report ER-5058.

Part 2 (to be published in the April issue of BSJ) will document the design details for the adhered thin brick veneers and the anchored brick unit veneers, as well as specific code requirements applicable to their installation on exterior walls. It will also discuss where the 2009 IBC requires exterior walls to have a one-hour or two-hour fire-resistance rating and how that is determined for a building project, including some specific examples. Click here for a list of documents referenced in this article.

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