Checkup on Cavity Walls

IBC codes for seismic and wind loads

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Today's codes are forcing architects, engineers, and specifiers to look more closely at construction detailing than ever before. In many cases, to become code-compliant and present an error-free design, we must simply throw out the 'old' standard methods and look to the new ones.

In the past, there were several codes to which we had to comply—Southern Building Code Conference International (SBCCI), Building Officials and Code Administrators (BOCA), *Florida Building Code (FBC), National Building Code (NBC),* various state-sponsored and enforced codes, and the International Conference of Building Officials (ICBO).

Today, most jurisdictions have fully adopted the International Code Council's (ICC) *International Building Code (IBC),* with certain state-specific criteria. Masonry reinforcing has traditionally been placed in the bed joints at 0.6-m (2-ft) on center vertically or every third masonry course. For steel stud and sheathing back-up, the general rule was 406-mm (16-in.) on center horizontally and 0.6-m (2-ft) vertically for veneer ties or, in either case of back-up, 0.25 m^2 (2.67 sf) per anchor. The adoption of *IBC* further restricts construction with additional requirements for seismic and wind—or a combination of both.

Seismic considerations have been toughened—areas of the country that never had to contend with seismic controls are now forced to think more carefully due to the shifting and updating of zones. These controls are in effect for most building veneers, such as brick, architectural concrete masonry, calcium silicate masonry, stone panels, and other veneers 'pinned' to the back-up material.

Areas designated as seismic A and B zones remain generally unchanged from previous code issues and revisions, while zones C, D, E, and F have more stringent requirements for veneer anchorages. Through the structural engineering calculations, we now have to physically design more stringent requirements for pinning the veneer on the building. These new demands reduce the spacing of wall ties depending on the zone in which the project is located. (For more information, see Article 6.2.2.10 of American Concrete Institute [ACI] 530-05, *Building Code Requirements for Masonry Structures,* and ACI 530.1-05, *Specifications for Masonry Structures and Related Commentaries.*) Old methods are gone, old spacings are gone, and it has become time to rethink veneer construction.

Wind considerations have become more relevant, with wind pressures an important factor for veneer construction. This author was recently part of a team that designed a building in Savannah, Georgia, under the new code that had to take into account both seismic and wind loads. Its stud wall construction allowed the 406-mm (16-in.) on-center spacing with ties at every stud, but instead of placing them vertically every 0.6 m (2 ft), they had to be placed every fifth brick course (or about every 343 mm [13.5 in.]). Masonry back-up areas had reinforcing at every other block course with adjustable ties to accommodate this 343-mm spacing. It was, to put it delicately, a nightmare.

To make matters more complex, design professionals must also complicate the equation with the flashing details and mortar deflection devices. Certain evolutions in cavity venting have occurred in the last 20 years, with changes from the cotton rope wicks to open head joints, weep tubes, and plastic head joint ventilators with mesh to prohibit insects from entering the cavity. These devices, set in place in the cavity during veneer construction, bring up new challenges for wall tie placement. The mortar deflection devices are typically about 254 mm (10 in.) high and the through-wall flashing is required to terminate above these devices on the back-up wall as per Brick Industry Association (BIA) Tech Note 28B (August 2005), *Brick Veneer/Steel Stud Walls,* under the Flashing section:

Flashing should extend vertically up the backing a minimum of 203 mm (8 in.). If drainage materials that catch mortar are placed at the bottom of the air space, flashing at the base of the wall may need to extend further up the backing. This ensures that the flashing extends above the height of the drainage material and helps deter water that migrates across mortar on the drainage material from entering the backing. The water-resistant barrier on the backing should lap the top of the flashing a minimum of 102 mm (4 in.) ...Where flashing is discontinuous, such as over and under openings in the wall, the ends should be turned up at least 25 mm (1 in.) into the next head joint to form an end dam to channel water out of the wall. When possible, flashing should extend beyond the face of the brickwork to form a drip. When using a flashing that deteriorates with [ultraviolet] UV exposure, a metal or stainless steel drip edge can accomplish this. It is imperative that flashing be extended at least to the face of the brickwork.

This means one must set the flashing height above the highest point of any mortar droppings, which is assumed to be at least 102 mm (4 in.) above the top of the mortar deflection device or 350 mm (14 in.) above the base.

Veneer wall reinforcing typically used to be 0.6-m (2 ft.) on center for masonry back-up with the flashing tucked in the first masonry joint above the lintel, which was 200 mm (8 in.) up the backer wall. Once the 254-mm deflection device and the additional height for suspected

Photo courtesy Federal Emergency Management Agency. Photo © Kevin Galvin.

After a 2001 earthquake, a large van was crushed by brick debris in a Seattle, Washington, parking lot.

mortar droppings are added, we are up to the second bed joint of the block if the flashing is intended to be built in to the bed joint. (Another option is to use a termination bar and not build into the bed joint. These dimensions would also be true for steel stud/sheathing installation.) This adds 200 mm (8 in.) to the flashing height, significantly increasing flashing costs and eliminating the first mortar joint for installing the reinforcing. *IBC's* new zoning will not allow us to skip the mortar joint in the first block course with wall ties in every situation or seismic/wind zone combination.

This author's solution is to still use the time-tested dampproofing on masonry back-up or the #15-felt on steel stud/sheathing back-up, or to specify the 'new' trowel-on or spray-applied air barriers. By virtue of incorporating ACI 530-05 (Section CC-30, Paragraph 2.1.5), *IBC* also requires a 50-mm (2-in.) clear cavity space, rather than the historical 25-mm (1-in.) cavity. (This dimension also comes from the aforementioned BIA TN 28B.) This measurement is from the face of back-up or, if there is insulation in the cavity, a 25-mm clear space from insulation face is the minimum.

Now, one can delete the mortar deflection device and save the additional 254 mm of vertical height. Instead, a flashing/drainage system material that combines copper flashing with a non-woven drainage plane can be used. This system is surface-applied with a termination bar by the veneer mason at the same time he or she is building up the veneer. This avoids the risk of having to repair and replace flashing due to rips, tears, and missing flashing when the exterior veneer is started again. The increased code required wall tie criteria can thus be more easily accommodated.

End dams can be field-formed using the copper flashing/drainage system by any mason on the scaffold—usually in less than a minute—eliminating the cost of manufactured end dams as well as all of the unnecessary lap joints they create. The wicking fabric, which is mold resistant, acts as a continuous weep, carrying any cavity moisture behind and beneath the mortar droppings and right out through the mortar joint. Weep tubes can be installed as usual.

With all the flashing and drainage devices out of the way, there is clear access for installation of the masonry reinforcing (even with the strictest combination of *IBC* seismic and wind load zones). The good news is this has all been potentially accomplished at a lower cost through the reduction of the amount of flashing and the elimination of some of the accessory components.