Masonry and steel parapet details

For these exposed areas, take extra care to prevent water penetration and accommodate differential movement

By Walter Laska

A parapet is the portion of a wall that extends above the roofline. Parapets sometimes serve purely aesthetic purposes, such as hiding mechanical equipment. Or they may be primarily functional, to keep fires from spreading from roof to roof.

Because parapets have both sides exposed to the environment, they are particularly vulnerable to problems. Parapets are subjected to extremes of weather, from high winds to rain and snow to temperature variations that can cause numerous freeze-thaw cycles. As a result, parapet walls are susceptible to displacement, cracking, efflorescence, and spalling. When buildings combine masonry walls and parapets with structural steel frames, differential movements and varying construction tolerances between the two materials also can cause problems. Avoiding these problems requires careful detailing and vigilant maintenance.

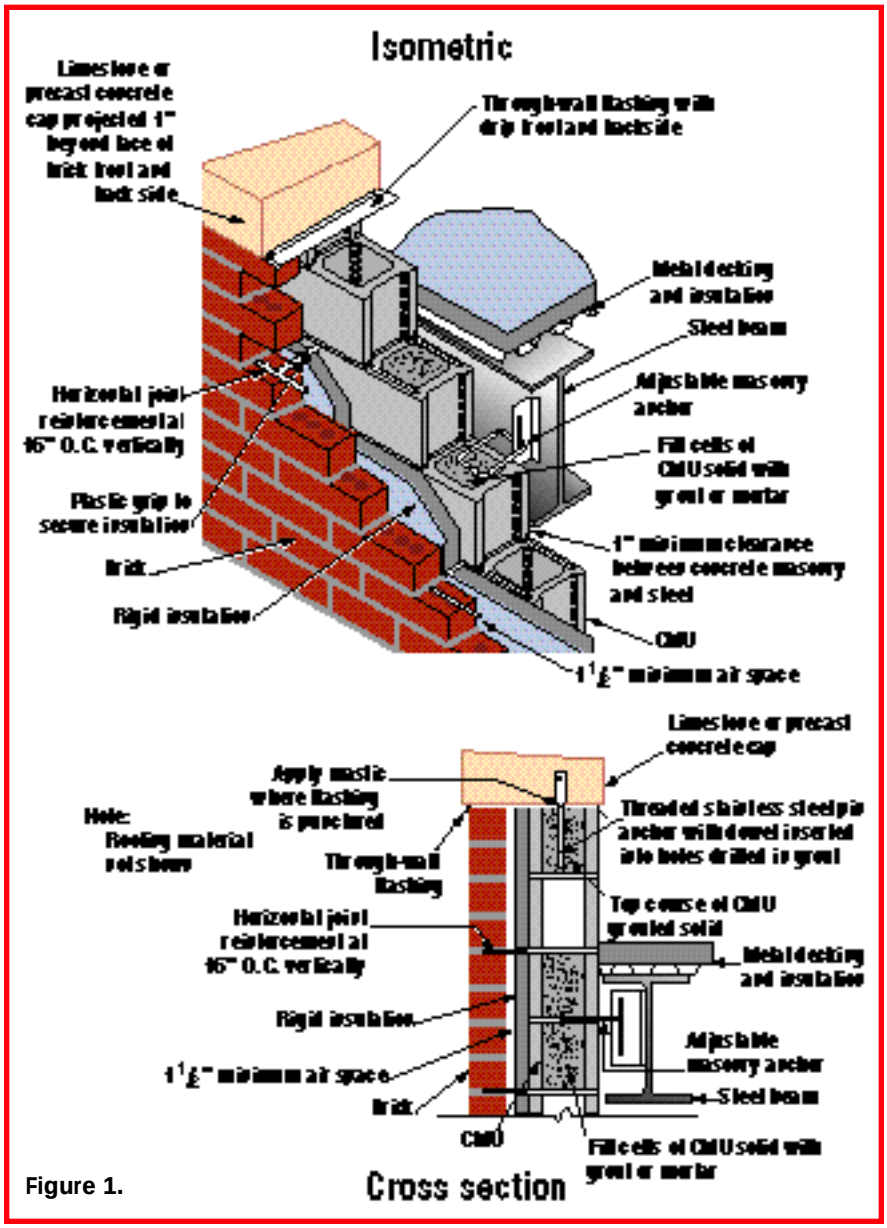

Figure 1.

Copings or caps

The top of the parapet wall is the area most vulnerable to moisture-related problems. Choosing the appropriate cap is an effective way of preventing such problems. Although a variety of copings are available, it's best to use a coping

material with thermal properties similar to those of brick and concrete masonry, such as limestone, terra cotta, hard-fired clay, or precast concrete. Metal caps have a coefficient of expansion nearly three times greater than that of masonry, which leads to a significant amount of differential movement between the parapet cap and the wall below. If you use a metal cap, be sure to provide tightly sealed slippage joints where the cap sections lap.

A rowlock brick course is another type of coping. Although rowlock brick is attractive, it should be used only in moderate climates. Rowlock copings contain many long, exposed mortar joints that can provide a path for water to enter the wall. Avoid using them in areas where frequent freeze-thaw cycles occur.

Copings can be manufactured in a variety of shapes, but they all must possess adequate pitch, project at least 1 inch beyond the wall surfaces, and include continuous drips. These elements protect the top of the parapet from ponding water and prevent water from running down the outer wall surfaces.

Flashing parapets

Copings are susceptible to moisture penetration where the individual sections butt at head joints. To prevent moisture from entering the wall from the top, install a continuous through-wall flashing membrane beneath the mortar bed directly under the coping. This flashing membrane can be made from stainless steel, copper, asphaltic glass fiber, rubberized asphalt, neoprene, or a combination of these materials. Placed completely through the wall, flashing creates a slip plane between the coping and the parapet. To prevent the coping from sliding or blowing off, it must be anchored to the wall below.

Anchoring copings to the wall

Any of a number of stainless steel anchorage systems can be used to anchor the coping to the wall. Provide a vertically adjustable system so the mason can align the anchor properly with dowel rods or predrilled holes in the cap. Use a generous amount of mastic wherever anchors penetrate the flashing.

Movement joints

Because parapet walls are completely exposed to extremes of temperature and moisture, they can move at different rates than the walls below. Furthermore, parapets lack the dead load of masonry above to help contain movement. Unless this differential movement is compensated, displacement of the parapet will occur.

To accommodate movement due to thermal expansion, provide vertical expansion joints that pass completely through the parapet wall. Specify twice as many expansion joints in the parapet wall as you specify for the wall below. Provide one soft head joint (totally devoid of mortar) for every section of coping stone. These joints should align with any other expansion joints in the roof and wall below.

Whenever it's feasible, construct all wythes of a parapet with the same material. This enables

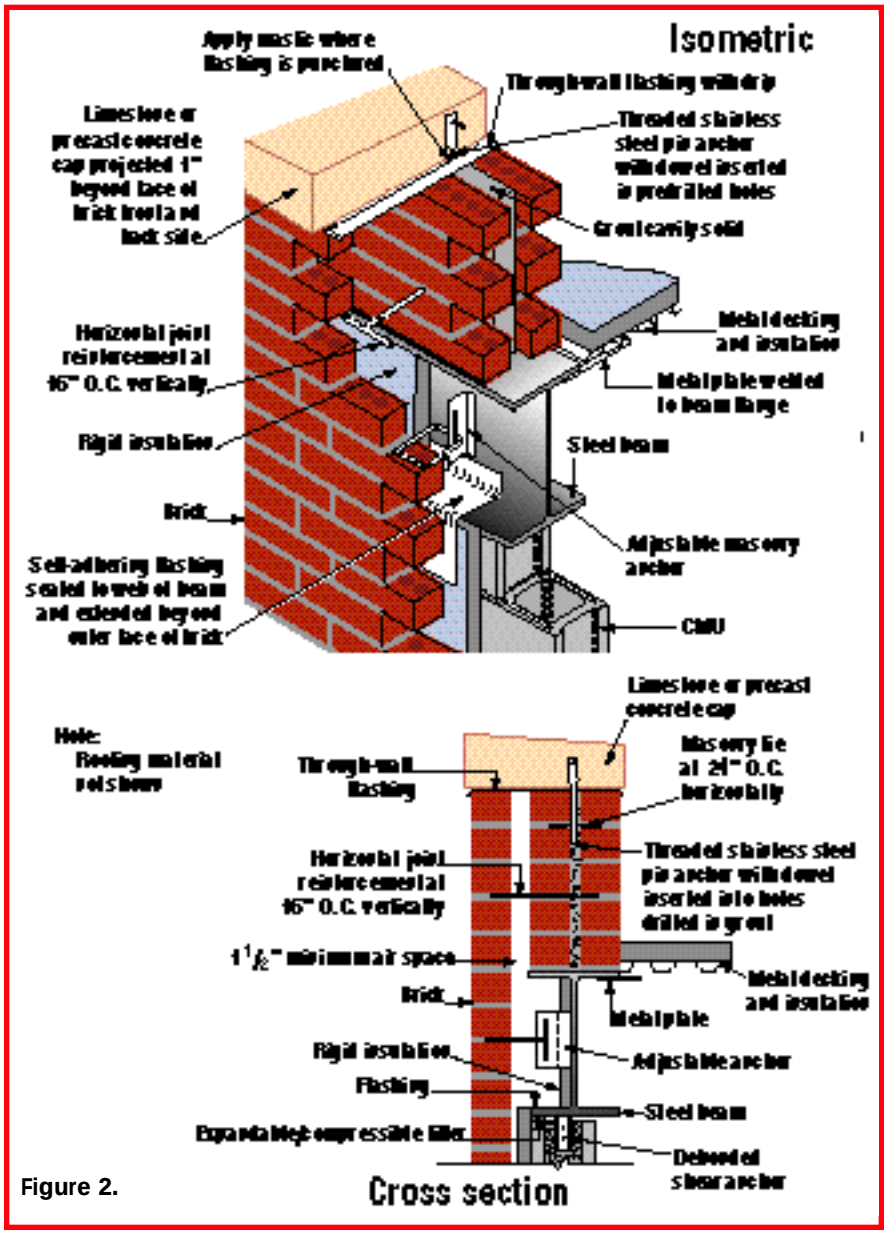

Figure 2.

all the individual wythes to react uniformly to temperature changes.

Height limitations

Keep the height of the parapet to a minimum. The Masonry Standards Joint Committee *Building Code Requirements for Masonry Structures* requires parapet walls to be a minimum of 8 inches thick, with their height no more than three times their thickness.

For taller parapets, the wall thickness must be increased or additional lateral support must be provided. Vertical reinforcing bars can be grouted solid within the wall for this purpose. Piers or pilasters also can be used as a means of structural support.

Protecting the back side against water permeance

A suitable cap and through-wall flashing protect the parapet from moisture penetration at the top of the wall, but the exposed inner surface of the parapet remains vulnerable, especially in areas where rain and snowfall are common. Coat the inner wall surface with a breathable water repellent to protect it.

Notes on Figure 1

Figure 1 shows a parapet for a cavity wall that is independent of the steel structure. In such walls, the masonry will react to changes in moisture content and temperature, while the steel frame will experience movement due to structural loads. The masonry wall should be anchored to the steel frame at the spandrel beam, using an anchor with the flexibility to accommodate these differential movements.

- For this type of wall, continuing the block backup and brick facing wythe for the parapet is more practical than switching to multiple brick wythes at the roofline. This design can perform acceptably, as long as the parapet is low (no more than two block courses above the roof) and the roof flashing extends up the interior face of the parapet to the cap.
- When masonry walls are designed to bypass the structural system completely, anchor adjustability is critical. It's rare for the anchor to align exactly with the bed joint of the concrete masonry, due to construction tolerances. So to provide proper anchorage of the masonry wall to the steel beam, specify an anchor with enough adjustability to allow the mason some flexibility in installation.
- When specifying the type of anchor and connectors, consider pullout strengths and resistance to expected loads on the building. Note that this connection will not resist in-plane shear forces.
- When the anchor must be attached to the beam web, specify an anchor that engages a receptor angle. This will provide the additional rigidity needed to prevent the anchor from buckling. The anchor span is the distance between the receptor angle and the point at which the anchor engages the masonry. Generally, the anchor span should not be more than 4 inches. If the anchor span exceeds this distance, a detailed anchor analysis must be performed.
- Terminate the insulation directly below the through-wall flashing. Adhere this top section of insulation to the concrete masonry backup with mastic. This will prevent water from migrating behind the insulation and into the building.

Notes on Figure 2

Figure 2 shows a cavity wall with the block backup supported on the floor slabs in the plane of the structural frame. The facing brick is used to construct all wythes of the parapet.

- When the back side of the parapet is exposed completely, specify that it be coated with a breathable water repellent.
- Connect concrete masonry to the bottom flange of the steel beam with a debonded shear anchor. The anchor should be mechanically fastened to the bottom flange of the beam at designated intervals that align with head joints of the concrete masonry.
- A debonded shear anchor will resist out-of-plane (but not in-plane) shear forces and permit structural movement (deflection) of the steel beam. The anchor must be embedded fully in mortar, within the head joint of the concrete masonry, for this connection to be effective.
- Where the brick must be anchored to the spandrel beam, specify an adjustable anchor that will permit differential movement between the brick and spandrel beam.
- Discontinue insulation at the bottom flange of the beam. Continuously bond self-adhering flashing tape to the insulation and beam web. This will secure the insulation to the concrete masonry backup, and prevent the migration of water behind the insulation and into the building. It also will create an airtight seal at this location.

Pay strict attention to the design of parapet walls and emphasize equal care in their construction, to help ensure good performance from these sometimes troublesome features.

Walter Laska is the senior consultant and president of Masonry Technologies Inc., Downers Grove, Ill. The information in this article is excerpted from his Masonry and Steel Detailing Handbook, *published by The Aberdeen Group.*

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