UNUSUAL SUSPECTS

By E. Frank Kelm, RRC

Recently, a client contacted Howard R. Green Co. with concerns about his building addition. In a six-month period, employees had noticed a vertical wall crack increasing in width from 1/8-inch to 1-1/8-inches. A meeting was scheduled to have a structural engineer view the damage. The author, a roof and building envelope consultant, attended as an observer and to introduce the engineer to the client.

Upon arrival, it could clearly be seen that the existing control joint had separated. A large amount of staining, or what appeared to be efflorescence, occurred on the brick veneer of the addition.

Stained, cracked masonry units.

Following introductions, the client noted his concerns with a 1990 addition that connects to the original 1930 building. Construction of the addition consists of cavity walls with CMU backup and brick veneer, steel bar joists and decking, and a ballasted, single-ply roofing system.

While the client described to the engineer the control joint and how it was getting wider, the author took stock of the general condition of the room. Several ceiling tiles were stained and portions of the interior wall were water damaged. The client said they "couldn't keep the ceiling tiles replaced." Had they considered the possibility of a roof leak? the owner was asked. Indeed, three separate roofing contractors had been called and none of them could find a problem with the roof, according to the owner.

With the client's permission, the author went up onto the roof, confident of finding "the usual suspects" – deteriorated caulking joints in the copings, deteriorated flashings, open laps, etc. Once on the roof, however, it was easy to empathize with the roofing contractors. The caulking joints of the stone copings were in good condition, the base flashings were tightly adhered to the wall and were not deteriorated, the laps appeared to be well sealed, and the top edges of the flashings were sealed. Nothing seemed to stand out.

A quick recap of the situation was in order. Water damage was apparent along the (new) exterior walls of the addition, with no appreciable damage noted in the interior or where the addition abutted the original building. While walking along the surface, however, the roof felt solid underfoot up until 12 to 18 inches of the addition walls. It was also solid in the field of the roof and along the original building. However, the roofing assembly next to the exterior walls of the addition consistently felt soft underfoot.

Next came a quick trip down the ladder

Separated expansion joint.

Left: Interior wall and ceiling damage.

Below: Interior damage.

to retrieve a core bag, verify with the client that the roof was out of warranty, and to obtain permission to take a core. A core cut was then taken next to one of the addition walls. It revealed a layer of tapered perlite installed over a layer of polyisocyanurate insulation. The perlite was saturated and had no consistency, and the polyisocyanurate insulation was soaked. By lifting the membrane and peering underneath, it could be seen that the perlite insulation appeared to be dry away from the wall. Why was this occurring when the joints in the coping stones were good, the flashings were tight and sealed, and the laps were sealed?

The author noticed, however, a recently applied bead of caulking along the bed joint of the stone coping. When a section of caulking was peeled away, it was obvious that it had covered a small crack between the coping and the parapet wall. Looking along the interior and exterior bed joints of the coping stone, there was no evidence of a through-wall flashing or weeps.

Back downstairs, the engineer was lifting various ceiling tiles to view the steel decking and its joists. A tile was located near the core cut. When it was lifted, and the consultants could peer into the plenum and see that the addition roof was structurally sloped, with the slope running toward the wall in question. The bar joists were installed parallel to the roof slope with the ribs of the steel decking installed perpendicular to the slope. This configuration eliminated the possibility that water could be reaching the wall by traveling down the structural slope by way of the deck flutes.

In addition, there was corrosion on the underside of the steel decking and bar joists. It was also apparent that the corrosion was more severe where these components contacted or penetrated the exterior wall. In fact, a portion of steel decking located next to the wall was perforated by corrosion. The steel joists bear upon the inner CMU wall and the joist pockets appeared to be reasonably sealed. Portions of the CMU wall showed evidence of efflorescence, staining, and dampness.

A set of building plans was located and studied. The engineer was trying to determine the cause for the cracking, and the roof consultant looked for sources of leaks. When they came across the section view for the addition walls, three things caught their attention.

- The coping stone had been set directly on top of the masonry without a through-wall flashing.
- The wall cavity is 2-3/8-inches wide with two inches of rigid insulation, leaving only a 3/8-inch clear space for drainage.
- The coping stone lacks a defined drip edge.

While this construction may have been appropriate in 1990 when the addition was constructed, it clearly would not meet today's requirements. *Technical Note No. 21* of the Brick Industry Association (dated August 1998) lists general requirements for the construction of masonry cavity walls. Three of those requirements are:

- Through-wall flashings should be installed under copings.
- Copings should have a minimum of one drip edge.
- Maintain a minimum 1-inch clear air space in the cavity.

The addition struck out on all three requirements. A through-wall flashing placed under the coping would have diverted water penetrating the coping and its joints to the exterior, preventing it from entering the wall cavity. A well-defined drip edge would have stopped most water drips from reaching the bed joint of the coping (and entering the wall through capillary action). Finally, a 1-inch cavity is deemed as the minimum clearance required for both proper construction and to allow the wall to drain.

Above: Roof perimeter showing coping stone.

Right: Overview of roof edge.

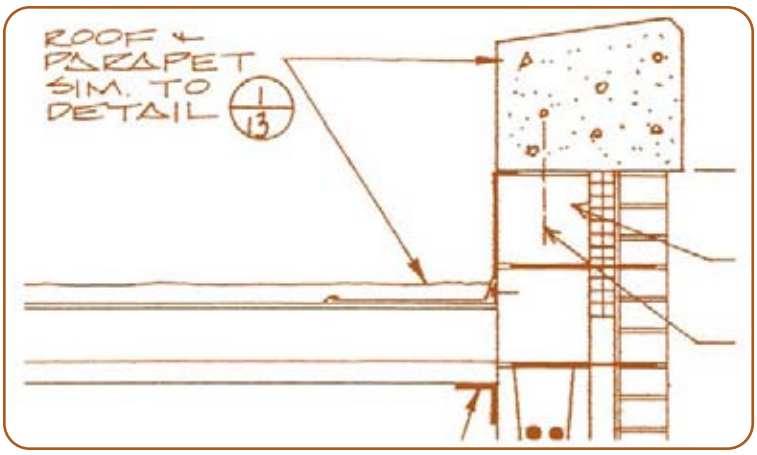
The small, 3/8-inch cavity compromised the capability of the wall to dry out and increased the likelihood of mortar tailings creating connections between the exterior veneer and interior CMU. Moisture that did not pass to the CMU back-up by these connections could be trapped between the outer brick veneer and the face of the insulation. Thus the brick veneer can become wetted for extended periods of time, with little opportunity for drying.

The engineer was fairly certain that the cracking was due to settlement caused by poor compaction and/or poor soils condition. A geotechnical investigation and soil report would be required to establish the structural repairs. Structural repairs were estimated at a construction cost of approximately $30,000.

A brief recap of the roof consultant's findings of the roof and exterior walls of the addition showed that at a minimum, the wet roof insulation and deteriorated metal decking should be removed and replaced for an estimated cost of approximately $5,000. This left the client with a 15-year-old ballasted roof, which might not be the best investment of $5,000. An estimated cost of $16,500 was given to replace the ballasted roof with a fully adhered one, and included the cost to replace deteriorated metal decking.

The masonry repairs will prove to be more extensive and costly. The existing coping stone could be removed and salvaged for re-use, with new through-wall flashings installed, deteriorated portions of the brick veneer demolished and replaced (approximately one-third of the wall), damaged and wet cavity insulation removed and replaced, and the remaining brick ties examined for corrosion and repaired as needed.

While it was felt that the installation of a through-



Exterior wall coping detail.

Deteriorated metal decking.

wall flashing would solve most of the problems, that left the problem of the narrow wall cavity.

One solution would be to install new brick vents throughout the surface of the wall. These would provide airflow and promote the wall's ability to dry out. The estimated cost for the masonry repairs was $74,000.

What started out as a routine "tag along" trip turned out to be a case of unusual suspects.

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