Overcladding:

When Masonry Repairs Just Don't Make Sense

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Masonry has long been used as a construction material for buildings, and our use of this construction material has changed as new technologies have been invented. At the turn of the 20th century, masonry construction meant multi-wythe clay brick masonry, typically to a maximum of six or seven storeys. The best brick was used on the front of the building, with poorer quality brick used at the sides and back, and within the walls. Throughout the 20th century, however, many new methods of brick construction appeared—some successful, and others less so.

MAKING CONSTRUCTION MORE ECONOMICAL (AND PROBLEMATIC) WITH TTW BRICK

Pushes were made to make building construction more economical. One way of doing so was to make building walls thinner—using less material for construction, or reducing labour time by using larger brick.

Through-the-wall (TTW) brick was introduced as one new method to achieve these means. It typically consisted of a brick with a slightly larger face but a depth of up to eight inches. The brick's interior face was typically finished with parging, wood strapping, insulation, and plaster or gypsum board, creating a mass wall system designed to absorb some rainwater but that would dry out before saturation.

The use of TTW brick decreased construction time and the system's use became widespread in the late 1960s and '70s. However, it became apparent the system, as it was typically constructed, had flaws.

The building envelope was designed to act as a mass wall, but often, the single-wythe masonry system did not contain enough capacity to fully dry out between significant rain events. The thick, single wythe of brick also meant water was sometimes retained in the brick as cold weather approached, and freeze/thaw cycles would damage the masonry. Cracking in the masonry, either in the units themselves or at mortar joints, provided water with a direct path to the building interior, since only a single wythe separated the exterior environment from the moisture-sensitive interior building components, and the wall system typically lacked an effective means of draining water. Because of these issues, the use of TTW brick dropped dramatically and most manufacturers stopped producing the brick in that configuration.

An example of highly deteriorated glazed brick.

There are many TTW brick buildings in use today, and many—if not most—are experiencing issues related to brick deterioration and water entry. Effective long-term repairs are limited and expensive, as matching brick is hard to come by, and the wall's inherent weaknesses, particularly the lack of internal drainage and flashings, are not addressed. As a result, deterioration and water entry typically continues. Brick repairs, alone, cannot solve the problems associated with this wall construction.

THE DIFFICULTY WITH REPLACING GLAZED BRICK

Similar issues with brick availability and deterioration present themselves for buildings constructed with glazed brick. Using glazed brick gained popularity in the 1970s. New brick styles were made possible by adding a ceramic glaze to the exterior face of the masonry. This often took the form of a glossy white (or other colour) glaze.

This brick was used on many buildings, but it has issues in cold climates; water penetrating into the brickwork through the mortar is absorbed by the brick. Because of the ceramic glaze, which creates low permeability at the brick face, the moisture cannot dry out as easily. Freeze/thaw cycles then result in delamination and spalling of the brick faces, which weakens the brick and creates an unsightly mar on the building exterior.

As the problem became apparent, the use of the brick in colder markets declined, and its manufacture ceased. As a result, when the brick is replaced (the most simple repair to the issue), a suitable match is difficult or impossible to find.

DETERIORATION AS A RESULT OF CORROSION

Another common method of brick construction from the 1970s and '80s was building a high-rise residential building with a concrete structure of shearwalls and floor slabs with concrete block infill walls. The brick infill was then typically covered by a brick veneer, which was supported either by the protruding floor slabs or by steel shelf angles.

When brick is supported by the floor slabs, leakage is often an ongoing issue. Water penetrates past the veneer brick, either by high volume soaking through areas with high wetting, or more often, through deteriorating joints or cracks in the masonry. Once past the veneer, the water runs down the back (interior) face of the brick, and since there is often no through-wall flashing, the water can make its way to the building interior at floor level.

With brick that is supported by steel angles, through-wall flashings were not often installed, were poorly installed, or have deteriorated to the point that they are no longer effective. This exposes the steel shelf angles to water, creating ideal conditions for corrosion. As the shelf angles corrode, their strength decreases,

A steel shelf angle exhibiting moisture-related deterioration, resulting in a reduction in load-bearing capacity.


A brick veneer wall exhibiting repairs completed over many years.

sometimes to the point of becoming a structural concern.

Expansion due to corrosion also results in brick deterioration, and in some cases, bowing and failure of the brickwork. The steel ties that restrain the brick to the concrete block back-up wall are also exposed to water and are, therefore, subject to corrosion and failure.

On several occasions in recent history, entire sections of brick veneer have fallen from high-rise buildings, creating dangerous situations. Issues relating to the design and construction of these wall systems are difficult to correct, and in many cases, the deterioration is far too progressed for simple repairs.

IN SEARCH OF EFFECTIVE, LONG-TERM SOLUTIONS

The common thread among these brick masonry wall systems is that effective, long-term repairs are difficult to achieve. Typical repairs consist of partial brick replacement, mortar joint repointing, application of sealant at cracks, and/or the application of coatings to seal cracks and minimize water absorption.

In some cases, more aggressive repairs are performed, with attempts to provide flashings at window and floor slab levels. However, in most cases, brick deterioration and water penetration are seldom completely eliminated. Recurring cycles of repairs become costly, and owners begin to explore more effective solutions.

A long-term solution to ongoing repair of masonry walls is overcladding, which offers an opportunity to create a new wall assembly over top of the existing masonry, thereby addressing the issues relating to brick deterioration and water entry. The new wall assembly comes with drainage capabilities and increased insulative value.

Before overcladding, however, an engineering assessment must be completed to determine the condition of the existing brick, ties and shelf angles (if present), since the new cladding system is often attached directly to the existing masonry. Stabilization of the existing masonry can be completed as required, often using special techniques, such as the installation of helical masonry ties, which bind the exterior wythe of brick to the structural back-up without large-scale brick removal.

REPAIRING MASONRY WALLS WITH OVERCLADDING

Overcladding is most easily installed on non-cavity masonry walls, such as TTW and composite masonry walls. It can be a more complicated and costly process if attachment to the structural system is required. In any case, for many masonry walls, repairs often involve localized brick replacement, the use of helical ties (to secure the existing brick to the back-up wall), or in some cases, localized replacement of shelf angles.

Overcladding most often takes the form of prefinished metal panels or an exterior insulated finish system (EIFS). Both systems incorporate insulation (in EIFS, it is a constitutive component of the system), thereby improving the thermal performance of the building in addition to addressing masonry deterioration issues. Overcladding also improves the aesthetics of the building, giving it a more modern appearance. This can help reposition the building in the rental or condominium market, increasing the rent generated or resale value. Increased energy performance will also reduce on-going energy costs.

Overcladding is most often completed on buildings constructed between the late-1960s and the '80s, and many of these buildings have windows that are nearing the end of their useful service life. Overcladding projects and window replacement are, therefore, complementary, since detailing at window perimeters can be done in a collaborative manner.

Masonry is a very versatile material, and there are examples of masonry construction dating back hundreds—even thousands—of years. Some construction materials and techniques used during the 1960s through the 1980s, however, have proven to be much less durable. The masonry systems used to clad some of these buildings have reached a point where constant repair and maintenance is required to keep them in serviceable condition. In many instances, a strong case can be made for stabilization and overcladding. ■

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Pretium Anderson Building Engineers is a consulting firm specializing in building science and structural engineering. It has completed many projects involving the stabilization and overcladding of masonry buildings.

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