Facade Rehabilitation:

Solving Problems Through Reanchoring

Reanchoring facades to existing buildings can be a major problem for specifiers. Here's some advice on how to approach a facade rehab project.

by S. H. Getz

Weather and other corrosive influences can take a toll on the original anchoring systems of primary building structures. To combat this problem, ITT Phillips Drill Division has devised ways to resupport the facades of projects in several states.

Each project required the reanchoring of a facade to concrete or masonry substructure. In one instance, the loss of support resulted in a marble panel falling several floors to a sub-roof area. No one was injured, but the owners were concerned for the safety of occupants and pedestrians.

Factors contributing to the eventual loss or weakening of anchoring systems included numerous freeze and thaw systems, the expansion and contraction behaviors of certain materials, and the omission of wall ties or installation of ties other than specified. In addition, corrosion preventative materials may have been limited at the time of construction or possibly the proper material or product specification was not made.

Certain repair considerations and techniques are vital to the designer involved in rehabilitation projects. Typically, the designer has three methods of repair he or she can consider:

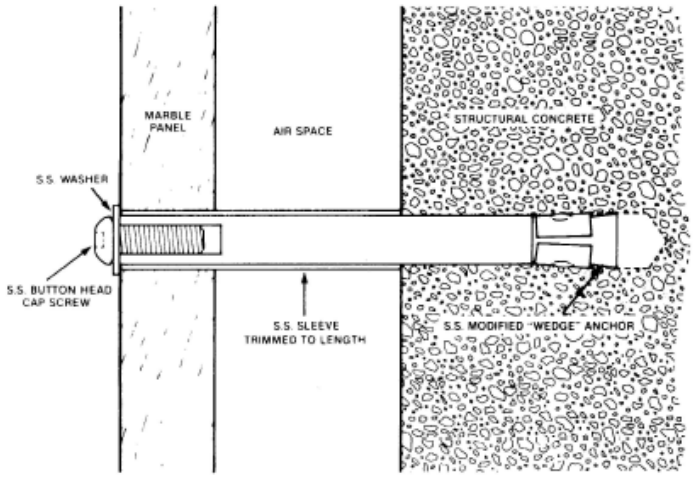
- Remove and replace the total facade.
- Remove and reanchor partial or selective facade sections.
- Reanchor facade with mechanical anchoring systems.

Complete removal of a facade and subsequent replacement must be considered both in terms of practicality and expense. The removal of several stories of marble or brick veneer raises questions of safety and cost effectiveness. Costs must be measured against projected building utilization.

Partial removal of sections of the brick veneer requires installing a new wall tie or anchoring system and replacing the brick sections.

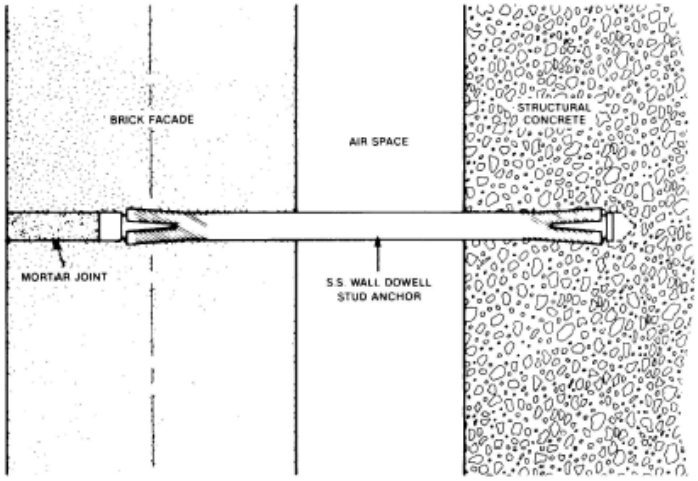
Mechanical anchoring is both the most practical and the most cost effective of the three methods and is considered the preferred repair technique. Installation procedures

Figure 1



MODIFIED "WEDGE" ANCHOR

Figure 2



MODIFIED STUD ANCHOR

may be unique for various facade repairs but do not require the removal of wall segments or panels.

Resupport Problems

The facade "resupport" problems that specifiers posed to the anchoring specialists at ITT Phillips Drill resulted in the design and manufacture of three separate mechanical type anchors.

The marble panels on a 14-story concrete office building in Chicago, Illinois, required a corrosion-resistant anchor for resupport that could be installed with ease and would provide an aesthetic finish. Avoiding stress on the marble panels during actual installation and attaining structural stability with work loads of 600 to 700 pounds were other considerations.

The system developed combined an austenitic stainless steel "wedge" type anchor with internal threads, necessary for the expansion into concrete and final cosmetic appearance on the marble panel; a 303 stainless steel sleeve, which absorbs compression forces of expansion and pre-load; and an 18-8 stainless steel button head cap screw and washer for a cosmetically appealing finish (see *Figure 1*).

The facade resupport system structurally provided ultimate loads at about 7,000 pounds when applied at 90 degrees to the anchors' centerline and five inches from the building's concrete surface. The system allowed a "dowel" support for the panel in the event of a failure in its primary support system. The existing primary support system was a ledger and adhesive with copper tie backs.

The newly designed facade-resupport anchor supported the panel and gave it room to "breathe" without adding stress while providing a mechanism so the facade would stop "falling away" from the building.

The second project, an 18-story concrete dormitory in Lowell, Massachusetts, had a brick facade and required a different resupport system. The fastener designed for this application was adapted from a stud anchor (see *Figure 2).* This dowel stud provided load support in two directions; away from and toward the main structure. The modified stud anchor end expanded in the concrete wall and the other in the brick facade.

The anchor, made from stainless steel material, was ⅜ inch in diameter and fit in the mortar joints of the brick facade. The dowel stud end that expanded into the concrete was modified for the application. The part of the dowel stud that expanded in the brick also is a modification of the stud anchor's expansion, and a specially designed stainless plug was used in the brick facade.

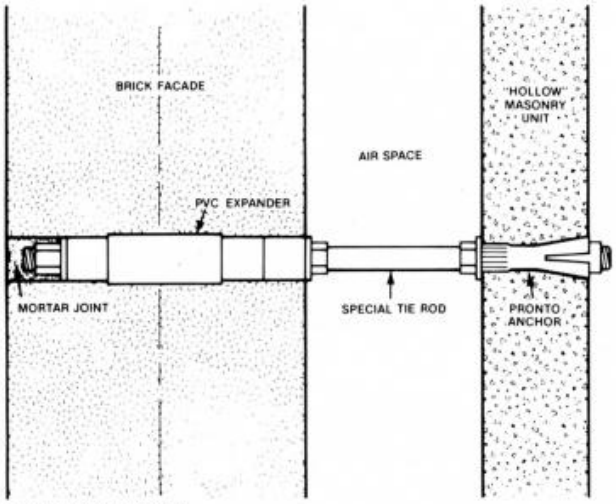
This facade anchoring system could support approximately 3,000 pounds while rigidly reconnecting the brick facade wall to the concrete dormitory structure. An added benefit to the contractor was an installation time of 90 seconds per stud.

The third project involved two 15-story brick apartment buildings in Newark, New Jersey, requiring resupport of brick facades to a primary structure of both concrete and masonry block units.

The method of fastening utilizes the Pronto Anchor® and an expandable, proprietary, PVC element. This combination system anchors to a hollow masonry wall (sub-surface material) and ties back a brick wall facade (see *Figure 3).*

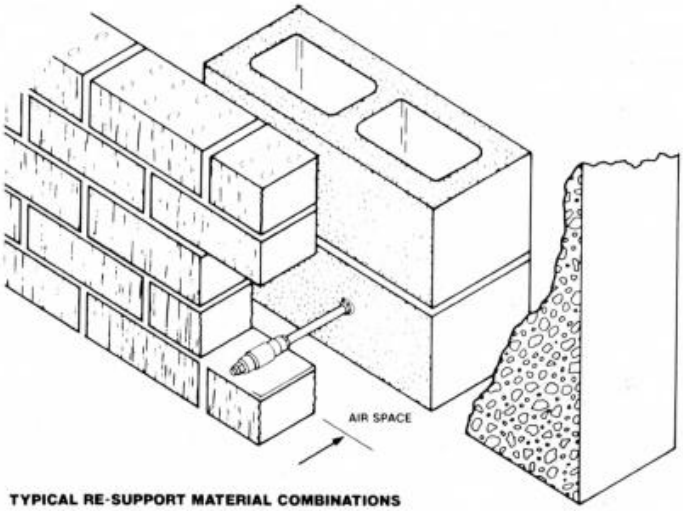
The Pronto Anchor was designed for use in masonry units. A specially designed rod both activates the anchor and attaches the outer wall to the rear masonry structure. The PVC, when expanded, swells the drilled hole in the brick facade. It is attached to the special activation rod used with the anchor.

Figure 3



COMBINATION ANCHOR

Figure 4



TYPICAL RE-SUPPORT MATERIAL COMBINATIONS

Each of the three facade resupport problems required a careful evaluation of the anchoring application. The effect of load direction on the original structure had to be considered so the new facade resupport anchoring would hold.

Criteria

In solving each problem of retrofitting a building with a facade that had a decaying anchoring system, the engineers used the following criteria:

Identify the cause. The problem may be absence of a portion or all required wall ties, or the wall ties originally used may be eroded to 50 percent of their capacity. This information will assist in material selection, and in determining the number of anchor support ties required. Proper selection of anchor type, material, and quantity is necessary to avoid a recurrence of the problem.

Examine existing structural integrity. Can the exterior wall, or facade, be repaired safely without further destroying the integrity of the building? Determine the degree of facade rigidity and the capabilities of the anchor materials. Be sure that the expansion stresses developed with the mechanical anchoring devices do not exceed working limits of the material. Consider stress for both the facade and the substructure, or cracking and further building support material degradation may occur. On-site testing can verify working limits of the materials.

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Budget. There are usually constraints on money budgeted for building repairs. When developing a budget for a specific problem consider that the problem will not occur again for another 15 years using proper materials and installation procedures. The rehabilitation shouldn't cost more than the original building.

Working environment. Determine whether repair work done from a floating scaffold is necessary, and whether it will endanger occupants or pedestrians. These factors will influence the complexity of installation procedures and anchor selections.

Aesthetics. A cosmetic appearance may be required from the finished anchoring system; or it may be concealed from view.

Anchorage sub-strata. The proper anchor design will depend upon the type of material in which it is to be installed; for example, brick to block, panel to concrete, or brick to brick (see *Figure 4).* The sub-strata is also important when considering how to tie back veneer.

Loading descriptions. Consider the amount of force (wind load and weight) the anchor will have to support, and the direction the loading will be applied (tension, compression, shear or bending). This important element involves the mechanical anchor's design. The method of expansion, activation, and the ultimate performance of the anchor is a function of the manufacturing material used and expansion element mechanics.

Contractor expertise. Contractors installing these facade support systems must be familiar with standard anchoring techniques. Special installation instructions are required for these unique anchors, and no deviations or short cuts should be allowed on the job. Improper installation of anchors or installing fewer anchors than specified may result in eventual failure of the renovation project. Manufacturers should work closely with the installing contractors to answer questions and steer the project towards a successful completion.

Anchor material type. If corrosive elements played a large part in failure of the initial facade anchorage, stainless steel or other corrosive fasteners should be investigated. Materials, such as stainless steel, have a direct impact on the unit price of the anchor and, therefore, on the budget considerations for the project.

Material to be reanchored. Facade and building materials should be tested to see if they can take expansion stress, or whether stress should be isolated from the material. For example, marble, slate, brick or stone facades may require different anchoring techniques because of their ability to accept the stress of an expansion anchor.

Repair urgency. Material acquisition and lead times should be considered when developing a repair calendar. Exotic materials and intricate anchor design may affect the project's overall completion date if supply is limited.

Extent of air gap. A void space usually exists behind the facade. The width of the gap, and the variations of its plus and minus tolerances, must be considered when selecting the anchor length.

The selection of a mechanical anchoring system for facade renovation is not as simple as specifying an anchor from a catalog. The numerous variations in building materials and installation techniques dictate to a great extent that each application requires special consideration. Consult experts in the field of expansion anchoring systems to assure that the problem of facades which need resupporting to their existing structures be solved in the best way possible. □

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