

Focus: Historic Stucco

Stucco adorns religious buildings of all denominations and architectural styles throughout New York State. This incredibly versatile material is more complex than meets the eye, though, and requires careful planning and execution to preserve. Well maintained, stucco is very durable and long-lived. James Renwick's Gothic Revival Saugerties Reformed Church in Saugerties, New York, still has its original 1852 stucco.

Applied as the original surface finish, it was either left smooth, textured, or scored to imitate stone. Sometimes, stucco was applied later as a means of transforming the look of a building, in order to reflect changing use and demographics.

What is it?

In the United States, stucco typically refers to a two-or three-coat system applied directly to exterior masonry or onto a supporting framework of lath (such as wood strips or metal mesh). To complicate matters, the term stucco may also refer to highly decorative interior plaster work. This article focuses on the exterior version. Stucco is not one of the synthetic "protective" coatings being applied to brick these days -- those are potentially problematic.

Stuccos have been in use worldwide for thousands of years. Their composition varies by region and epoch and reflects locally available materials and traditions.

Applied to the exterior of a building, stucco acts as a "sacrificial" skin which is intended to absorb the brunt of the weather thus protecting the structure underneath. It is actually meant to deteriorate preferentially over time, preserving the material beneath. Stucco can be applied to wood, common brick, or fieldstone, and historically was often used to imitate more noble (and costly) materials such as smooth blocks of masonry.

Stucco maintenance traditionally involved patching damaged areas as required. Keeping water from infiltrating the protective stucco layer is key. Unfortunately in more recent times, stuccos have been mistakenly removed to expose what was thought to be the originally visible surface. This practice is especially unsound when the underlying material is fragile and does not weather well, ultimately compromising both structural integrity and the intended appearance of the building.

Because of their implicit sacrificiality, old stuccos are rare survivors which hold a wealth of information about original building practices, materials, finishes, and the appearance of the structure over time. The conservation of historic stuccos should therefore be considered when planning repairs or maintenance work.

What's in it?

Traditional stuccos were composed of a binder (traditionally slaked lime), aggregate (often a locally available sand), and sometimes additives which enhanced desirable characteristics. These lime-based stuccos provided a protective skin which was elastic, vapor permeable, and low in strength -- all admirable qualities for a stucco. Inorganic additives such as brick dust or natural cements gave a mix a hydraulic or quick set. Organic additives such as animal hair, blood, urine, linseed oil, eggs, and beer imparted qualities such as reduced shrinkage, increased strength and water repellency, and extended set time. Although pigments might be added, another source of integral color and texture came from the sand -- important to remember when formulating a replication mix. Some stuccos were lime-washed which could be pigmented to add color.

After the turn of the 20th century, Portland Cement began to replace lime as the binder of choice. Its fast set and high strength were mistakenly considered advantages over slaked lime. Simultaneously, revival styles of architecture gained momentum and the popularity of stucco increased dramatically due to its versatility in color, texture, and finish.

How it is Applied

True stucco is composed of a system of layers. The first and second coats, generally known as the scratch and brown coats respectively, are composed of relatively similar mixes. The scratch coat is applied directly to the substrate and is usually the thickest as it serves to even out the surface. After its initial set, the scratch coat is scored to provide a key for the second, or brown coat. The finish coat is usually much higher in lime content with a fine aggregate to produce a smooth surface finish (unless a rough texture is desired).

Deterioration of Stucco

Properly maintained, stucco can last many years. Although weathering varies depending on the unique environment and building materials involved, the basic conditions associated with the deterioration of stucco are:

- * Biological growth -- anything from molds to vines and plants
- * Blistering -- looks like bubbles beneath the stucco
- * Cracking -- hairline to wide-open
- * Delamination -- the finish, brown, and scratch coats detach from one another
- * Detachment -- the stucco actually detaches from the wall beneath
- * Disaggregation -- loss of binder
- * Flaking -- thin, small layers of the finish coat loosen and flake off
- * Loss -- sometimes sheets of stucco detach and fall exposing the substrate beneath

Most often, water causes these conditions. For example, traditional stuccos contain acid-soluble lime, making them susceptible to disaggregation when exposed to acid rain. If salts are present in the stucco itself, the material beneath, or the environment, cyclical wetting and drying can lead to damaging efflorescence -- the leaching of the salts which then crystallize, expand, and attract more moisture. Repeated freezing and thawing causes internal deterioration, detachment of stucco from the substrate, and delamination of the stucco's layers. Excessive water infiltration (through cracks or loss, for example) leads to a high moisture content which presents a hospitable environment for biological growth -- not only an eyesore, but root systems can also lead to deterioration.

Cracking in stucco can generally be attributed to building settlement or water damage. While annual lime-washing of historic stucco was a traditional maintenance method for filling in small fissures, larger cracks require other means of stabilization such as grouting and filling. It is imperative that roof and drainage systems (flashing, leaders, and gutters) are maintained to keep excessive water from running over the stucco surface. Joints around windows, doors, and chimneys are also points of entry and should be kept sealed. Rotting of wood or corrosion of metal lath as a result of excessive water infiltration can lead to detachment and loss of the stucco. The ground at the base of the building should be graded so that water runs away from the building in order to discourage rising damp which can cause deterioration of the stucco as well as the substrate. In addition, vegetation should be kept from the base of the building as it promotes moisture retention and biological growth.

Another plague inflicted on historic lime-based stuccos are well-meaning but damaging repairs which utilize cement-based materials. Difficulty inevitably arises when contemporary building materials are applied to traditional structures. Cement stuccos are harder than traditional lime stuccos, transmitting stress to the historic materials beneath rather than absorbing it. This means that cement doesn't protect the underlying materials as a more elastic lime stucco would. Cement stuccos also have a tendency to trap moisture causing rising damp, fungal attack, salt-and frost-related damage, and ultimately accelerated deterioration.

Repair

Congregations designing a repair or maintenance program for their building should consult an architectural conservator or preservation architect for assistance in developing the most appropriate methods and materials to salvage your historic stucco. These professionals, well-versed in the needs of historic buildings, can also be instrumental in documenting conditions and materials as reference for future generations.

The first step in developing repair treatments for historic stucco is to determine what is there. What is the substrate material? How many layers is the stucco? An analysis of the stucco's composition may be necessary to formulate an appropriate repair mix. The architectural conservator will determine what testing is needed. A testing program might include gravimetric analysis (using acid to digest the lime, the acid-soluble portion of the stucco, thus leaving the sand behind). Gravimetric analysis can roughly determine the ratio of binder to aggregate. This ratio is critical in formulating a replication mix because it directly affects properties such as strength and permeability of the stucco. Isolating the sand enables the conservator to determine the color, shape, and grain size distribution of the sand, information which helps to match the original as closely as possible.

The next step is to do an overall conditions survey. This survey should note conditions of the stucco and other building systems such as roofing, flashing, and drainage. Successful repairs address not only the condition, but the source of the problem in order to avoid further deterioration. A visual survey of the stucco may not be sufficient. It is always a good idea to sound the stucco by tapping with a rubber mallet or your knuckles in order to check for detached material. Detached stucco will produce a deep hollow sound when tapped; intact stucco sounds solid.

Following repairs to the associated building materials, repair of the stucco itself can begin. Since historic stucco is an important source of information, it is best to save as much as possible. Complete removal and replacement of historic stucco is only recommended when it has been determined by a preservation specialist to be unsalvageable due to its advanced state of deterioration. Repairs generally include a combination of approaches, including crack filling, patching, and sometimes injections and grouting.

In any repair or replacement project, it is critical to use compatible materials with respect to mechanical as well as aesthetic properties. The resulting finish should blend visually with the historic stucco in both texture and color. Most importantly, repair materials used should be weaker and more permeable than surrounding historic fabric. In the long run it is more cost effective to properly repair and maintain the stucco than to have to rebuild the wall beneath it.