Stucco

History & Characteristics

Historical Overview

Stucco has been in use since ancient times in many applications. Stucco was primarily lime-based until the late 1800s; popularization of Portland cement changed the composition of stucco to a harder material. The terms “plaster” and “stucco” both continue to see rather interchangeable use, although the former tends to refer to the more historic lime-based coating, while the latter generally describes exterior applications. This is particularly true in the United States, where stucco is primarily used on residential buildings and relatively small-scale commercial structures. Some of the earliest examples herein include examples of the Federal,Greek and Gothic Revival styles of the 18th and 19th centuries, which tended to emulate influential European architectural fashions. Stucco gained popularity in the mid-nineteenth century as a result of widely circulated plan books published by authors such as Andrew Jackson Downing. It was believed to be superior in many respects to unfinished brick or stone because it was cheaper and could be tinted through the addition of pigments; additionally, it offered the added benefit of increased thermal insulation and moisture protection.

The introduction of many new revival styles of architecture around the turn of the 20th century, combined with the improvement and increased availability of Portland cement, resulted in a sharp increase in the demand for stucco in the United States. This subsequent popularity became increasingly associated with architectural styles including Prairie, Art Deco, Art Moderne, Spanish Colonial, Mission, Pueblo, Mediterranean, English Cottage and Tudor Revival.

Stucco continues to be today as an inexpensive material that can be "scored" or "lined" to simulate finely dressed stonework, or ashlar. A stucco coating over a less finished and less costly substrate such as rubblestone, fieldstone, or brick can lend the building an appearance of a more expensive and impressive structure. It is also considered a weather-repellent coating that not only protects the building from wind and rain penetration, but also offers a certain amount of fire protection when properly maintained.

Technical Overview

Stucco is a type of exterior plaster applied as a coating directly onto masonry, which exists in a wide variety of forms. Historic stucco is often incorrectly viewed as either a disguise or a sacrificial coating, and consequently removed to reveal stone or brick that, historically, was never intended to be exposed. The leading cause of stucco deterioration on historic buildings is simply sustained exposure to weather and climate, due to a lack of maintenance over time; additionally, stucco is particularly susceptible to water damage. It is important to understand that stucco repair requires the skill and experience of a professional plasterer. Realistically, each project is unique, presenting its own set of problems that requires individual solutions and qualified expertise.

Before the mid-to-late 19th century, stucco consisted primarily of hydrated (or "slaked") lime, water and sand, with straw or animal hair included as a binder. Natural cements were frequently used in stucco mixes after their discovery in the United States during the 1820s. Portland cement was first manufactured in the United States in 1871, which steadily replaced its natural predecessor. After the turn of the 20th century, most stucco was composed primarily of Portland cement, mixed with some lime. As a result of this development, stucco became even more versatile and durable.

The composition of stucco depends heavily on local customs and available materials. Common materials in stucco have covered a wide spectrum, including mud, clay, marble, brick dust, and even sawdust. A vast array of traditional additives have also be added to stuccos throughout history to increase their strength and durability, ranging from ingredients as strange as animal blood, urine, eggs, keratin or glue-size (animal hooves and horns), and varnish, to comparatively common wheat paste, sugar, salt, sodium silicate, alum, tallow, linseed oil, beeswax, wine, beer, and rye whiskey. Waxes, fats, and oils increase water-repellent properties, while sugary substances reduce the amount of water needed and slow down the setting time.

The appearance of stucco is determined by the color of the sand, or burnt clay, used in the mixture. Stucco can also be tinted with natural pigments, or painted with whitewash or house paint after stuccoing is complete. Until the early-20th century, when a variety of novelty finishes or textures were introduced, the last coat of stucco was commonly given a smooth, troweled finish and then scored or lined in imitation of ashlar. The illusion of masonry joints was sometimes enhanced by addition of a thin line of white lime putty, graphite, or some other pigment. Other novelty or textured finishes associated with the "period" or revival styles of this time period include pebble-dash, also known as dry-dash, and roughcast, also known as wet dash. Both variations involve the addition of small pebbles to alter surface texture. If the pebbles are added to the mix before being applied to the stucco before it sets it is called pebble-dash.

Problems & Causes

Historic stucco is not inherently a particularly permanent or long-lasting building material; regular maintenance is required to keep it in good aesthetic and working condition. Most stucco deterioration is either the result of water infiltration into the building structure or water splashing up from the foundation. Any necessary repairs to the building should be made before repairing the stucco. This includes removing previous incompatible repairs that may have caused additional deterioration. Before beginning any stucco repair, an assessment of the stucco should be undertaken by a qualified professional to determine the extent of the damage and how much must be replaced or repaired.

Hairline Cracks - Class I

Small hairline cracks are generally not considered to be a serious issue. They may be sealed with a thin slurry coat of the finish coat, paint or whitewash. However, commercial caulking compounds are not suitable materials for patching hairline cracks. Although gently washing the surface with water may clean some stucco, the relative success of this procedure depends on the surface texture of the stucco and the type of dirt to be removed. As with any masonry treatment, cleaning should begin with the gentlest means possible to avoid all irreparable damage to existing materials.

Recommendations

Patching - Class II

In the interest of saving and preserving as much as possible of the historic stucco, patching rather than wholesale replacement is preferable. When repairing lime-based stucco applied directly to masonry, the new stucco should be applied in the same manner (directly onto the stone or brick). It is vital that this new stucco be compatible with its historic counterpart, which should be carefully analyzed to inform the selection of a mix for repair. When patching or repairing a tinted historic stucco, it may be possible to determine through visual or microscopic analysis whether the source of the coloring is sand, cement or pigment. Many stucco building have been painted over the years and will require repainting after the stucco repairs have been made.

Total Replacement - Class III

Complete replacement of historic stucco with new stucco of either a traditional or modern mix will probably be necessary only in cases of extreme deterioration (a loss of bond on over 40-50 percent of the stucco surface. Incompatible and ill-conceived repairs may comprise another basis for total removal, in their presence may so thoroughly compromise the physical and visual integrity of the historic stucco that continued patching offers little chance for success. When stucco no longer exists on a building there exists more inherent flexibility in choosing a suitable mix for replacement, yet this should still be conducted with care by a qualified professional. The most important factors to consider for replacement are material durability, color, texture and finish.

Conclusion

Historic stucco is a character-defining feature and should be considered an important historic building material, significant in its own right. When repairing historic stucco, the new stucco should duplicate the old as closely as possible in strength, composition, color and texture to maintain vital historic integrity.

Paint

History & Characteristics

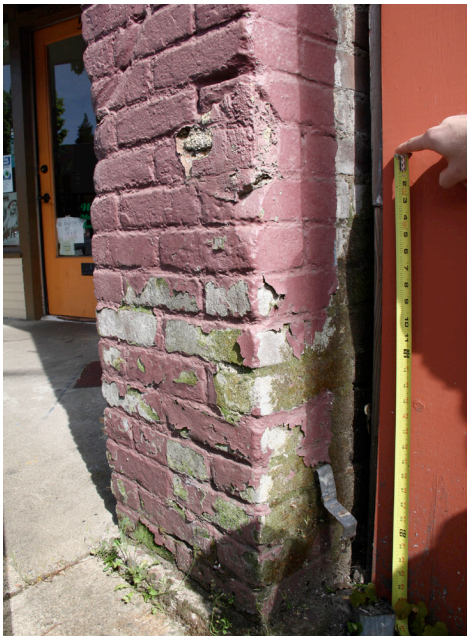
Historical Overview

Even though it has coated and colored the walls of America's past buildings, exterior paint has undergone a series of transformations. Due to their puritanical beliefs, the early colonists of Massachusetts Bay strongly opposed the generous usage of paint. This did not, however, stop others from experimenting with different paint recipes. By this time, the "Dutch method" was already a popular process that consisted of combining lime and ground oyster shells to create a white wash. As paint evolved, both in North America and around the world, the general trend of development was away from the use of natural ingredients like milk, egg whites, clay and ground stone towards the use of synthetic ingredients like alcohol, epoxy and petroleum. Through the 18th century grinding pigment had to be done by hand, which exposed painters to regular contact with white-lead powder and its little-understood health hazards. Yet its color remained a valued and popular product well into the 20th century. Also, lead paint maintained good durability and color retention, and for this reason was not prohibited in house paint sold or used in the United States until 1978. During the mid-19th century, increased access to linseed oil and mass-produced industrial pigments led the tran-

sition from costly small batches of paint to its comparatively inexpensive industrial production. After the Second World War linseed oil became relatively scarce, resulting in the increased production of chemical-, solvent-, and petroleum-based paints. Today most exterior paints are either latex (water-based) or oil- (or alkyd-) based.

Technical Overview

Paint is the product of four components: binders, solvents, pigments and additives. The binder, or vehicle, provides adhesion and forms a film over the substrate. The binder strongly influences properties such as gloss, durability, flexibility and toughness. It can include either synthetic or natural resins such as alkyds, acrylics, epoxy, oils, etc. The solvent, or dilutent, improves the working properties of the paint, but does not become part of the paint film and is an optional component. The pigment contributes properties such as color, opacity, weatherability and gloss, and is classified as either natural or synthetic. Additives modify the coating of the material, which include properties that may affect drying time, ease of application, and resistance to fading. There are two overarching categories for modern paint composition, water-based or solvent-based. The former are also known as latex paints, which employ water as their solvent. The latter coatings are also referred to as oil or alkyd paints, including solvents such as turpentine, alcohols and hydrocarbons. Paint as a whole is an extremely variable material. The type and ratio of binders, solvents, pigments and additives determines a wide range of properties for a given paint. For example, a “flat” paint contains high proportions of pigment and relatively low proportion of film-forming solvent. This results in a completely matte surface texture. Enamel paints, on the other hand, contain a low proportion of pigment and a high proportion of vehicle that results in a glossy surface. Stains are yet another variation of paint, which can be transparent, semi-transparent or solid. Transparent stains contain little or no vehicle or pigment, instead employing a high proportion of solvent and a dye additive. Such a composition is intended to alter the paint’s color and is commonly applied to concrete. Semi-transparent stains contain more pigment or vehicle. Solid stains are usually water based and contain much more pigment and vehicle. They resemble a diluted paint. Clear coatings are high in vehicle and solvent, containing little or no pigment and are used to protect the substrate. Clear coatings are commonly used on both bricks and stone, as a means of providing a protective coat without obscuring the visual character of the materials beneath. Two of the most commonly used



clear coatings are lacquers and varnishes.

Problems & Causes

Minor Blemishes - Class I

These issues concerning painted masonry generally do not require pain removal.

- The accumulation of dirt, soot or pollution on a paint surface can be easily removed by gently washing the surface.
- Staining or rust discoloration can be identified by the presence of orange-brown stains on the paint surface.
- Mildew on surfaces generally occurs when the environment remains moist or shady for an extended period of time. Grey, brown, green or black splotches will be apparent on the surface.
- Chalking is an issue that may arise for a number of reasons. Its leading causes include a previous application of low-quality, improper, or over-thinned paint on an inadequately-sealed or prepared porous surface. Chalking results in the appearance of an excessive amount of fine chalky powder on the surface of the paint.

Most Class I issues can be resolved by washing the masonry surface. There are different solutions for washing masonry. However, as a general rule, always begin with the least harmful method, water, then progress to using a mild detergent and water solution. For certain issues a more specific repair solution may be necessary. For example, rusting steel should be replaced if rust discoloration is present and a trisodium phosphate cleansing solution will remove mildew. Such issues may persist if underlying problems are not first treated with careful and informed maintenance.

Surface Coat Failure - Class II

Minor repairs are often necessary as a result of a failure of the top layer of paint; typically only limited paint removal is required

- ***Crazing*** occurs when incompatible paint types have been used, the surfaces were not properly cleaned before paint application and when an

intercoat is peeling. Crazed paint is frequently recognizable by its thick and brittle surface.

- ***Wrinkling*** occurs when the topcoat dries too quickly. If this occurs while the lower coat remains wet, it will continue to move and cause a wrinkled pattern easily seen at the surface.
- ***Sagging***, or running, may occur when too much paint is applied in a single coat; when a paint is excessively thinned and then applied; when paint is applied under improper conditions, such as high humidity; when the surface is not cleaned properly prior to painting; or when the surface is too glossy. Sagging paint appears to be dripping or drooping, even when dry. If the paint is still wet when this occurs, simply redistribute the paint to achieve a more even consistency.

The typical method of repair for Class II issues with painted masonry involves an abrasive treatment. Abrading, or wearing down the surface, can be carried out manually and/or mechanically. Sanding and scraping are two common examples. After the problem area of the paint has been carefully sanded or scraped down, it is important to properly clean, prime, and repaint it. Consult a qualified before attempting to repair a class two paint issue.

Total Paint Failure - Class III

If multiple layers of the paint are failing, total removal is necessary.

- ***Alligatoring*** occurs when a second, incompatible paint coat is applied to a previously painted surface, or when a second paint coat is applied too soon. A deep relief-cracking pattern, which resembles the texture of an alligator's skin, is the common symptom of this condition.
- ***Peeling*** occurs moisture becomes trapped beneath the surface of the paint; when the surface was improperly prepared for painting; when the paint has poor adhesion to the substrate; when the quality of the paint applied was low, or when blistering paint was allowed to progress. (Blistering paint is a class two problem that is less common in masonry buildings).

Recommendations

Paint Removal

Abrasive, thermal and chemical methods are used for class three paint removal. (Abrasive paint removal is discussed above within Class II treatments). Chemical removal involves using a paint or varnish remover. Such a treatment will soften the paint, so that it can then be scraped or washed away. This is typically the fastest and easiest method of removal, but should be conducted with care and precision. Thermal paint removal involves using a heat plate or gun to heat up the paint surface, breaking down its adhesion and making it easier to scrape. It is imperative to consult a qualified professional before dealing with Class III paint issues.