THE BRICK INDUSTRY ASSOCIATION

TECHNICAL NOTES on Brick Construction

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Changing the Appearance of Brick Masonry

Abstract: This *Technical Note* discusses materials and techniques applied to brick masonry to change its appearance: exterior and interior applications of paints, coatings, aesthetically applied surface mortars and stains. It includes general recommendations including surface preparation, application, and removal, as well as the description, use, advantages and disadvantages of each treatment. Application of colorless coatings to brick masonry are included in *Technical Note* 6A.

Key Words: acrylic latex paint, coatings, limewash, masonry stain, mineral paint, mortar wash, paint, pigmented water repellents, silicone emulsion coatings, whitewash.

SUMMARY OF RECOMMENDATIONS:

Considerations/Selecting Treatment

- When contemplating whether to use a treatment, consider permanence and maintenance issues
- Avoid use of a treatment on glazed brick, pavers, floors and functioning fireboxes in fireplaces or residential brick ovens unless specifically designated otherwise by the treatment manufacturer
- When selecting a type of treatment, assess each of the following factors to determine the extent to which each should influence the treatment selected for the particular assembly (see Factors Affecting Selection of Treatment):
  - Water vapor permeance
  - Type of wall assembly
  - Relation of assembly to exterior
  - Mineral based vs. non-mineral-based
- Select a type of treatment that is appropriate for the particular assembly and provides the desired appearance (see Types of Treatments)
- Be advised that using treatments inappropriate for a particular assembly could result in damage to the brickwork
- Use mock-ups or sample panels to approve appearance

Types of Treatment

- Because conditions and construction of assemblies vary, not all treatments will be appropriate for the brickwork on every assembly.

Masonry Stains

- Use to permanently change the color of the masonry while maintaining its natural texture
- Provides semi-opaque to opaque coverage
- May be mineral-based or non-mineral-based, with mineral-based preferred

Limewash

- Use where a nonuniform appearance that weathers over time is desired
- Mineral-based, matte finish that can range from semi-opaque to opaque
- Used on many historical buildings
- Can be easily reapplied over existing limewash

Mineral Paints

- Used to soften the natural texture of brickwork
- Mineral-based with opaque, matte finish
- Durable and long-lasting

Mortar Wash (German Schmear)

- Used to obscure desired areas of brick
- Mineral-based, matte finish that can range from semi-opaque to opaque
- Can be applied during construction or to existing brickwork

Semi-Opaque Paint (Faux Limewash/Whitewash)

- Non-mineral-based treatment using diluted paint
- Semi-opaque finish with sheen that can range from matte to gloss based on paint selection
- Less durable than limewash

Acrylic Latex Paints

- Non-mineral-based, opaque finish in a wide variety of sheens
- Softens the natural texture of the brickwork
- Requires reapplication over time
- Avoid heavy application or too many coats

Pigmented Water Repellents

- Specialized product with opaque finish
- Prior to use, consult a qualified registered design professional for the specific system type and condition present

General Surface Preparation

- Prior to application of treatment, do the following:
  - Evaluate and repair all issues with brickwork, including but not limited to those in brick units, mortar, weeps, flashing and sealant joints
  - Identify and correct water penetration and excess moisture conditions of the brickwork as indicated by staining, soiling or efflorescence
  - If required, remove prior treatments by use of products and/or methods appropriate for existing brickwork (see Removal of Treatments on Existing Masonry)
  - Allow new or repaired masonry to cure and dry completely (at least 30 days)
  - Thoroughly clean existing or newly laid brickwork
  - Masonry must be dry before following instructions to apply treatment; extended drying times may be required
  - Where required, confirm moisture content, ability of brick to absorb water and pH level of brickwork

INTRODUCTION

The desire to change the appearance of brick masonry generally results from the appeal of a new look for existing brickwork, a requirement to match the appearance of existing brickwork for repairs or an addition, or the need to correct aesthetic issues. The desired effect often plays a role in the selection of the method and materials used.

CONSIDERATIONS

There are many aspects that should be considered when deciding whether to change the appearance of brick masonry by applying surface treatments. These include, but are not limited to, the existing condition of the brickwork, Grade of brick used, water vapor permeance of the treatment, environmental conditions, any required maintenance and the longevity of the treatment.

Choosing Whether to Apply Treatment to Brickwork

Each of the following should be thoroughly examined before making the choice to change the appearance of brick masonry.

Permanence. Many of the techniques described herein are irreversible, and some require ongoing maintenance or repeated application that would not be needed for untreated brick masonry. For example, paint can be very difficult to remove from brick masonry without causing damage, and painted exterior brickwork can require repainting on a regular basis depending on the type of paint.

Condition of Brickwork. Applying treatments to the brickwork is sometimes considered in an attempt to improve the appearance of deteriorating brickwork. However, one must proceed with caution in such cases. Altering the appearance of the brickwork without first addressing underlying issues may cause further problems. In most cases, deterioration of brick masonry is due to unaddressed moisture problems. Treatments can further compromise the brickwork if they trap moisture in the wall. Walls must be evaluated for sources of moisture penetration, such as lack of flashing or other deficiencies in construction, and must be repaired and cleaned properly prior to the application of a treatment.

Appropriate Brick in Brickwork. Application of paint or other treatments is not a substitute for using the appropriate brick in exterior applications. Any exterior brick to be painted should conform to the requirements of Grade SW (severe weathering) generally, or Grade MW (moderate weathering) where permitted, per ASTM C62, C216, C652 and C1088 [Ref. 1]. Care should be taken that the units have similar texture and absorption characteristics so the treatment will have an even application and uniform appearance. It may be acceptable to use brick units that have similar characteristics but differ in color, or brick meeting ASTM C62, which has no appearance requirements, on a wall to be painted.

Historical Masonry Structures. In some historical masonry structures (typically built prior to the 1870s), painting of the exterior was part of the moisture-control system. Typically, a limewash or similar mineral coating was used to protect the masonry substrate, which was less durable than modern brickwork. In these cases, the existing coating should not be removed but rather maintained with a product compatible with the historical coating. It is strongly recommended to engage a consultant experienced in historical masonry to assist in this process.

Factors Affecting Selection of Treatment

It should be understood that the conditions and construction associated with a particular assembly will vary. As a result, not all treatments will be appropriate for the brickwork on all assemblies. If an inappropriate treatment is applied, damage to the brickwork can result, including but not limited to cracking, spalling and other deterioration. After making the decision to proceed with changing the appearance of brickwork, several factors should be considered in order to select an appropriate treatment. First, it is recommended to consult the brick manufacturer, if known, about the appropriateness of a given treatment. Further, the individual selecting the treatment should exercise judgment in determining the extent to which each factor should be considered in the selection. If unsure of their qualifications to judge the appropriateness of a treatment for a particular assembly, the individual should consult the manufacturer of the treatment or a qualified registered design professional.

Water Vapor Permeance. The water vapor permeance (sometimes referred to as “permeability” or “breathability”) of the brickwork after the application of the treatment is an important consideration for successful performance. Water vapor permeance is the amount of water vapor that can pass through a given area of a material of a certain

thickness over time when subjected to a pressure differential (different pressure on each side of the material). Because exterior brick masonry is exposed to moisture, and in many cases freezing and thawing cycles, it is important that the treatment permits evaporation of moisture. Generally, treatments that result in brick masonry with a high water vapor permeance are recommended over those that could reduce the water vapor permeance. However, the location and substrate of a wall, and the layering of other materials and airspaces within a wall, may decrease or eliminate the need to maintain, at a minimum, the water vapor permeance of the brick masonry.

Water vapor permeance is measured in units of perms (inch-pounds) or metric perms and is calculated by dividing the water vapor transmission (WVT) of a material by the vapor pressure across the material under test. WVT is determined by a laboratory test conducted in accordance with either ASTM E96/E96M, *Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials* [Ref. 1], or ASTM D1653, *Standard Test Methods for Water Vapor Transmission of Organic Coating Films* [Ref. 1]. The two standards are not interchangeable. ASTM D1653 is limited to use on films and coatings, whereas E96/96M can be conducted on a wide range of materials [Ref. 7]. Within both ASTM standards there are two test methods: 1) the desiccant method (or dry-cup method), which is intended to simulate a heated dry building during a pouring rain and provides a measurement of water vapor moving from exterior to interior of the building; and 2) the water method (or wet-cup method), which is intended to measure water vapor moving in the opposite direction from the interior to the exterior of the building. The water method can produce higher water vapor transmission rates than the desiccant method for the same specimens tested under the same conditions.

Materials can be classified according to their permeance [Ref. 3] as follows:

- ≤ 0.1 perm: vapor impermeable
- Between 0.1 perm and 1.0 perm: vapor semi-impermeable
- Between 1.0 and 10 perms: vapor semi-permeable
- > 10 perms: vapor permeable

Treatments used for brick masonry commonly report a permeance of 20 to 85 perms depending on the type of treatment. Although a treatment may be vapor permeable by the above definition, it may still alter the permeability of the wall if the permeability of the treatment is drastically lower than that of the brick. When comparing the permeance of one or more treatments, it is important that the results reflect the same standards (ASTM E96/E96M or ASTM D1653), methods (desiccant method/water method), and test conditions. The thickness of the treatment also affects its permeance. Thus multiple layers of a treatment will decrease its permeance.

Type of Wall. The type of wall assembly affects the selection of treatments for brickwork. Drainage wall assemblies have an airspace and a water-resistive barrier between the brickwork and the interior wall substrate that provides a pathway for water to exit the wall via the flashing and weeps. Therefore, because moisture management is not solely dependent on evaporation through the surface of the brickwork, there is more flexibility in treatment selection for drainage walls. Barrier wall systems, which include mass masonry multi-wythe walls, manage moisture through absorption and storage during rain events and evaporation afterward. Therefore, for these walls, it is more critical to select a treatment that does not inhibit the water vapor permeance of the brick. Retaining walls and site walls that do not retain soil can be designed as either mass masonry walls or drainage walls. The type of wall must be verified before selecting a treatment and the recommendations for that wall type applied. Refer to *Technical Note* 7 for more information about types of wall assemblies and how they manage moisture.

Relation to Exterior. When applying treatments to brick walls, consideration must be made for the relation of that wall surface to the exterior walls. Interior brick masonry is typically not exposed to moisture or freezing conditions. As a result, a wider range of treatments may be used in the interior of a building. A wall in which both sides are interior to a building would have no restrictions on the type of treatment that can be applied. However, applying some treatments to the inside face of a mass masonry wall can inhibit evaporation, which could cause problems if the wall previously functioned by drying to both the interior and exterior. In this situation, it is recommended to treat interior brick like exterior brick to maintain the water vapor permeability of the original construction. There is more flexibility in treatment type when applying treatments to the inside face of a drainage wall, because the primary drying direction is from the air space behind the brick toward the exterior.

Mineral-Based vs. Non-Mineral-Based Treatments. Mineral-based treatments are made from inorganic materials derived from geological sources. Non-mineral-based treatments use pigments suspended in an organic polymer

that binds itself to the substrate. In general, there are fewer caveats and restrictions when using mineral-based treatments because these treatments penetrate the pores of the brickwork while maintaining the water vapor permeance. They are highly compatible with brickwork, form a chemical bond and naturally have no volatile organic compounds (VOCs). Non-mineral-based treatments typically form a film on the surface of brickwork, which can adversely affect the water vapor permeance of the brickwork. In this case, the bond is limited to the adhesion of the treatment. Non-mineral-based treatments can be obtained in low- or no-VOC formulations.

Areas Not Recommended for Treatment. While many locations are suitable for at least one type of treatment, there are several general cases in which application of a treatment is not recommended unless specifically designated by the treatment manufacturer. These are cases either where the treatment will not perform well or where it will adversely affect the functionality of the substrate other than its permeability:

- *Glazed brick:* The glazed surface of brick is hard, glossy and generally impermeable to moisture. This impermeability means that treatments relying on access to the pore structure of the brick—such as mineral paints, stains and limewash—will not bond to glazed brick. In some cases, film-forming treatments can be applied, provided that the glaze is roughened and specialty products are used; however, such a treatment would have very limited durability and is therefore not recommended.
- *Pavers and floors:* In general, it is not recommended to apply treatments to brick pavers and floors, except for distinct traffic markings. In the case of pavers, they experience a more severe moisture environment than exterior walls due to their horizontal orientation and have the ability to dry only upward, so the risk of failure of the treatment is higher. Further, the abrasion created by foot traffic on the pavers or floor would result in limited durability of the treatment and a nonuniform appearance. Treatments can also reduce the slip resistance of the walking surface.
- *Fireboxes:* The firebox is the recessed portion of a fireplace or interior surface of an oven in which the fire occurs. Typically, this includes the bottom, tapered sides and back. If the fireplace or oven remains functional and will be exposed to open flames, treatments should not be applied to the firebox or oven surfaces.

TYPES OF TREATMENTS

There are many types of treatments for brick masonry. Selection of the appropriate type of treatment should consider the environment as well as the desired effect. Treatments are available that provide opaque and semi-opaque coverage that conceal or show the brick texture, and that are durable or intentionally fade and weather over time. Some treatments also provide water resistance, mold resistance or reflective properties. The following sections provide information on the properties, suitability and aesthetic characteristics of various treatments. Note that many treatments provide semi-opaque to opaque coverage depending on the number of coats applied or the dilution rate of the product.

Masonry Stains

Masonry stains are used to change the color of the masonry while maintaining its natural texture. As such they are sometimes considered semi-opaque but can also provide opaque coverage.

Staining has been a widely accepted industry practice for more than 50 years. It has been used by nearly all brick manufacturers in the United States for color correction of brickwork located in climatic conditions throughout North America, including hot, humid, high precipitation and freezing weather. Masonry stains can be mineral-based or non-mineral-based. Generally mineral-based stains are preferred due to their high water vapor permeability. Stains can be used to lighten or darken the appearance of individual brick units, mortar joints, a field of brickwork or any combination thereof. Masonry stains are often used to blend new or repaired masonry with existing brick masonry (see the BIA Brick Brief “Modifying the Color of Brickwork with Brick Stain”) but are also used to change the appearance of the entire structure fully covering the brick and mortar for a matte finish that maintains the natural texture of untreated brickwork. See Photo 1 and Photo 2 for an example of a home where all brick units were stained to change the overall color of the brickwork.

Masonry stain can be applied as needed to the individual brick units, allowing the existing mortar surrounding the brick units to remain in place. In cases where brick color correction is desired, this is often preferable to removal and replacement of individual brick units or small areas of brickwork. This option eliminates the possibility of the

Photo 1
Before Staining Applied

Photo 2
After Staining Applied

replacement mortar not matching the existing mortar color. Mortar color can be changed as well if desired. Staining brick masonry does not affect the structural integrity of the brick or mortar.

Masonry stains do not alter the surface texture of the brick masonry and do not require maintenance. They have a long history of successful performance on brick masonry, with projects where the stain has lasted 20 years or more. Because masonry stains rely on absorption into the pores of the brick, a water test must be performed prior to staining to qualitatively evaluate the surface absorption behavior of the brick. Glazed brick cannot be stained due to the impermeability of the exposed surfaces. There are also some unglazed brick with dense surfaces that will not successfully receive masonry stains.

All stain products are proprietary, and they do not necessarily provide equal levels of performance and durability. It is recommended to use contractors and products that have a history of demonstrated performance on wall assemblies and in climates similar to the intended application. In some cases, a colorless coating is applied over a non-mineral-based masonry stain and the surrounding brickwork in order to prevent a difference in appearance when wet.

Qualified contractors or applicators should have a minimum of three years of experience applying masonry stains to brick masonry surfaces of the type and scale for the project and should offer a warranty of 15 years or more. Mock-ups or sample panels should be used for color selection prior to completing the work. In the case of blended brick walls, where multiple colors or shades of brick are combined, it is important that mock-ups and sample panels incorporate the full range of colors and that they are of an adequate size to ensure that the desired effect is achieved.

Limewash

Limewash, sometimes referred to historically as “whitewash,” is a centuries-old method of protecting buildings and modifying their appearance. In the United States, it was used on many historical buildings, often in cellars or outbuildings, and was recommended for use on the exterior of lighthouses during the early 1900s [Ref. 5]. It is still commonly used today as a treatment suitable for exterior and interior brick surfaces of both historical and contemporary masonry.

Limewash is a mineral- and water-based treatment made from a paste or putty of slaked or hydrated lime (calcium hydroxide), or quicklime (calcium oxide) that is then diluted with water prior to application and brushed onto the desired surface [Refs. 2, 6]. Limewash provides a naturally nonuniform matte finish that varies in opacity based on the amount of water used and the number of coats. With a sufficient number of coats, an opaque finish can be achieved. Limewashes can also be colored with natural pigments, though the available color range may be limited compared with other products. A limewash can typically be used on interior or exterior brick. In interior applications, limewash on brick masonry creates a subtle, suede-like appearance. See Photo 3 showing an opaque finish and Photo 4 showing a semi-opaque finish.

Photo 3
Opaque Finish of Limewash

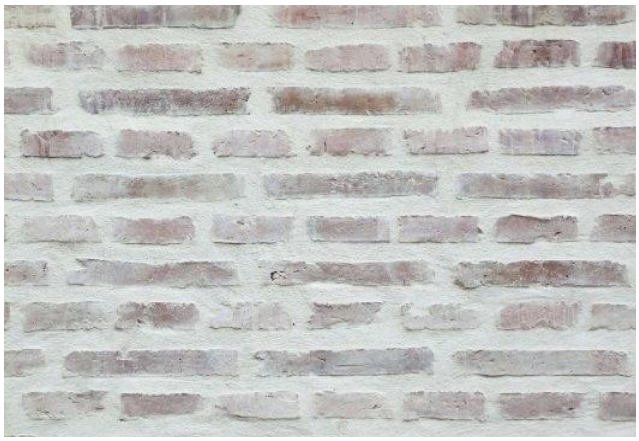

Photo 4
Semi-Opaque Finish of Limewash

Lime is naturally alkaline and is commonly used as a component of masonry mortar, so it is fully compatible with brick masonry and will not change its vapor permeability. In exterior applications, the treatment will weather, often forming streaks, for an “Old World” appearance. Because of its high pH, limewash is naturally mold-resistant and is typically very durable, as it forms calcite crystals bonded to the masonry by absorbing carbon dioxide from the air. The life span of limewash is dependent on the environment and the number of coats applied. It can last five to 10 years or more depending upon the level of weathering desired. Recoating is not difficult, as prior coats do not have to be removed. Some limewashes can be removed using water within the first few days of application if the appearance is not as desired. Because moisture will remove limewash over time, interior limewashed surfaces are not typically washable. Sealing of limewash to protect the finish is not recommended in locations where the permeability should not be reduced.

Mineral Paints

Like limewash, mineral paint (Photo 5) is also a product that was developed centuries ago to change the appearance of masonry and similar materials. Mineral paints were patented in Germany in the late 1800s, although the raw materials had been known since the Middle Ages. They were developed to replicate the appearance of the lime-based paints used in Italian frescoes while being durable enough to withstand the more severe climate farther north. Mineral paints provide a fully opaque matte appearance that softens the natural texture of brickwork, smoothing the variations between the brick and mortar profiles.

Mineral paints combine pigment with potassium silicate (waterglass) or sodium silicate as the binder. Modern versions can include additional ingredients. Through the process of silicification, a chemical bond forms between the paint and the substrate where the silica and pigment are deposited into the substrate. Because of this, mineral paint can be applied only to brickwork that is clean and unsealed, so the pore structure of the brick can be accessed. If there is an existing coating on the brick, it must be removed before applying mineral paints. Neutralizing the surfaces following the application of paint strippers or acid-based cleaners is strongly recommended because this type of paint is sensitive to acid.

Similar to limewash, the water vapor permeability of the substrate is not affected when mineral paints are applied. The paints are

Photo 5
Mineral Paint Finish on Brickwork with Raked Joints

UV-resistant, contain zero VOCs and due to their high pH resist biological growth. These paints, though similar in appearance to the matte and opaque applications of limewash, differ in their durability and length of service. Because of these factors, mineral paints typically have warranties of 15 years or more, and there have been projects in which recoating was not required for 30 years or more.

Mortar Wash (German Schmear)

Mortar wash, also called German Schmear, is a mineral-based matte treatment that can be applied to interior or exterior brickwork either during installation or post-construction. The appearance of the treatment can vary widely, from a semi-opaque finish, similar to limewash, to a thick layer of mortar that obscures large areas of the brickwork, similar to deteriorated plaster exposing the underlying brick. Another option applies a consistent layer of mortar over the entire surface of the brickwork to create a fully opaque finish rather than an uneven one, as described above. Unlike cement plaster (stucco) or parging, the mortar wash in this case is thin enough that the texture of the brick and mortar joints is still visible when this variation of the surface treatment is used. Photo 6 and Photo 7 show examples of opaque and semi-opaque mortar washes.

Photo 6
Mortar Wash Obscuring Areas of Brick

Photo 7
Semi-Opaque Application of Mortar Wash

When performed on new walls, typically the excess mortar from the mortar joints is smeared artfully across the surface of the wall. Depending on the desired opacity and thickness of the treatment, additional mortar may be supplemented. The appearance of the mortar wash is often dependent on the material used to spread the mortar. For example, the term “sacking” is used to describe smearing the mortar using burlap [Ref. 4]. In the thicker applications of mortar wash, a trowel is used.

When applying mortar wash, it is recommended to use pre-bagged, pre-blended mortar conforming to ASTM C1714 and C270 [Ref. 1] for best results. Pre-bagged, pre-blended mortar includes all necessary material components, so only the addition of water is needed. Typically, Type N mortar should be used, but Type S mortar can be used as well. Standard colors for mortar include gray and white; however, colored mortars are available if desired. Mortar itself solidifies through a chemical reaction, making it a durable treatment. Binding with brick through fines entering into the pore structure of the brick, mortar wash creates a durable bond that can last for many years.

Semi-Opaque Paint (Faux Limewash/Whitewash)

This non-mineral-based treatment uses diluted acrylic latex paint to create a semi-opaque effect that allows some portion of the underlying brick color to be visible through the finish. The opacity of the finish depends on the water-to-paint ratio and the number of coats, with a more intense result achieved when the dilution is low or when several coats are applied. Multiple paint colors may be needed to create the desired effect. The sheen of the paint (flat, satin, semi-gloss, etc.) should also be considered. When light-colored paint is used, this treatment may be

referred to as “whitewash” because it creates a similar appearance to limewash, but it is a faux finish with very different performance characteristics.

Because this treatment uses acrylic latex paint, it only changes the appearance of the brickwork and does not provide the advantages of authentic limewash. Acrylic latex paint forms a film on the surface of the brick, unlike treatments like limewash that penetrate the pore structure of the brick. Although the paint is diluted, multiple heavy coats or reapplications of the treatment could adversely affect the permeance of the brick, unlike limewash. Semi-opaque paint should not be expected to be as durable as limewash in exterior applications, as the acrylic latex paint is generally more susceptible to peeling or flaking and will require reapplication over time.

Acrylic Latex Paints

Acrylic latex paint is one of the most common types of non-mineral-based treatments and is readily available in a wide variety of colors and sheens. Painting provides a fully opaque appearance that softens the natural texture of brickwork, smoothing the variations on the surface of the brick and between the brick and mortar profiles. Due to the uniform color of paint, it can also highlight any differences in the surface texture of the brickwork, which may or may not be desirable. Acrylic latex paints form a film on the surface of the brick. Most manufacturers do not provide information on permeance, but acrylic latex paint is typically identified as vapor semi-permeable rather than fully vapor permeable. It is recommended to use products with a history of successful performance on brick masonry assemblies and in environments that are similar to the intended application. In all cases, avoid too many coats or heavy applications of paint, which will further lower the permeability of the walls. Applying acrylic latex paint to brick creates a recurring exterior maintenance task, requiring multiple reapplications over the life of the brickwork.

The alkalinity of the brickwork can reduce paint durability and performance. Brick are normally pH neutral but are set in mortars that are chemically basic (high pH). As a result, an alkaline-resistant primer or a paint specifically designated for use on masonry is recommended.

Pigmented Water Repellents

Pigmented water repellents are made from silicone emulsion formulations. These coatings combine the look of paint with a waterproof or water-repellent coating. Most are intended for exterior use above grade on brick and other masonry walls, although some are suitable for interior applications. Properties vary by manufacturer; however, most have a water vapor permeance of 20 perms or more. Pigmented water repellents create an opaque, flexible membrane that allows for water vapor passage. Use of these coatings is recommended only for applications where water-repellent properties are required or necessary. It is strongly recommended that use of these coatings be reviewed by a qualified registered design professional to determine suitability for the brick masonry application, as changing the water vapor permeability of a wall could trap moisture, potentially resulting in damage to the brickwork.

SURFACE PREPARATION

Proper surface preparation prior to application is essential for the successful performance of any treatment. For paint or other coating treatments, ASTM D6237 [Ref. 1] includes information regarding surface preparation; however, note that not all methods described in that document are appropriate for brickwork. Surface preparation includes the evaluation of the masonry substrate to determine its suitability to receive the treatment and whether any repairs are necessary.

Evaluation and Repair

The masonry must be in good condition prior to application of a treatment. Assessment of the condition of brickwork is part of the process of determining whether to apply a treatment. Refer to *Technical Note* 46 for more information about visual evaluations of existing brickwork, potential causes of observed distress and how to repair brick masonry. The evaluation is intended to identify conditions that require correction or repair, such as the following:

- Discoloration or surface soiling
- Biological growth
- Cracks in brick units or mortar wider than the thickness of a business card

- Loose or damaged brick units
- Loose, missing or deteriorated mortar
- Damaged or missing flashing
- Missing or clogged weeps, for drainage walls
- Visible evidence of active or previous water penetration on interior or exterior surfaces
- Damaged or missing sealant joints

If any of the conditions above are identified, they should be corrected prior to applying a treatment. The corrections, if required, vary in complexity. Surface soiling and most types of biological growth can be removed by cleaning. Units that have hairline cracks (those that are not visible from a distance of 15 to 20 ft) can remain in place if securely set in the brickwork. Otherwise, units that are cracked, loose or deteriorated should be removed and replaced. Damaged or missing sealant joints should be replaced using backer rod and elastomeric sealant conforming to ASTM C920. Mortar that is deteriorated, loose or missing, or contains cracks wider than the thickness of a business card, should be removed and repointed. Repointing, particularly on the exterior, is recommended to be performed by a mason experienced with repair and restoration. Refer to *Technical Note* 46 for more considerations regarding repointing. Correction of any issues with flashing or weeps is also recommended to be performed by a mason experienced with repair and restoration.

Excess Water and Moisture. Moisture may enter masonry walls in any of several ways: through the pores of the material; through incompletely bonded or only partially filled mortar joints, copings, sills and projections; through incomplete or failed sealant joints and improperly installed or failed flashing; or in locations where flashing is omitted. When excess moisture enters the wall assembly behind the outer face of the brick, or moisture generally is not properly managed, the resulting conditions in a masonry system can hamper the satisfactory performance of the surface treatment. During the visual evaluation, look for evidence of water penetration, which may include liquid water observed at the interior or staining that suggests that liquid water was previously present. Soiling or efflorescence on the exterior are also signs that excess moisture is present. Conditions resulting in excess moisture in the brickwork should be addressed before proceeding with treatments.

Removal of Treatments on Existing Masonry

In most cases, treatments previously applied to existing masonry, including sealers or water repellents, must be removed prior to application of a new treatment, including brick color correction. However, be aware that some treatments may be difficult or impossible to remove without damaging the brickwork due to the bond formed between the treatment and the brick masonry. Abrasive methods such as sandblasting are not recommended, as the process will damage the brickwork. Although pressurized water can be used for cleaning, it is not recommended for removal of treatments because the pressures needed would be excessive. Generally, a proprietary chemical solution specifically formulated for brickwork is required to remove most existing treatments.

To determine the viability of removing a specific treatment from existing masonry and the proper chemical solution to do so, it is recommended to obtain the advice of the original manufacturer of the treatment, if known, and a reputable manufacturer of masonry cleaning products. A trial application of the proposed chemical solution on an inconspicuous area will help determine the efficacy of the removal process and whether the proposed removal process will result in damage to the underlying brick before being implemented on the entire surface. Refer to *Technical Note* 20 for more information about cleaning trials and removal of existing treatments.

Cleaning Brick Masonry Prior to Treatment

Both existing masonry and newly laid masonry must be cleaned prior to applying treatments. Exterior brick masonry may have biological growth, atmospheric dirt, efflorescence, mortar smears or other soiling that must be removed for proper adhesion or penetration of the treatment. Follow the brick manufacturer's recommendations for cleaning. When the brick manufacturer is unknown or does not provide guidance, it is recommended to use the least aggressive technique necessary to achieve the desired cleaning. In many cases scrubbing with a stiff-bristled, non-metallic brush and soapy water or low-pressure washing is sufficient. In other cases, stronger cleaning methods may be necessary. *Technical Note* 20 provides detailed information on cleaning brick masonry, as well as removing many common masonry stains.

When chemical cleaning solutions are needed, consult a manufacturer of specialty cleaning products for masonry and the brick manufacturer, if known, for cleaning recommendations. In dealing with difficult soiling and stains, care

must be taken to not damage the brick masonry through improper cleaning agents or methods. Do not use diluted or undiluted muriatic (hydrochloric) acid. The use of unbuffered acids for cleaning is not recommended in general, as they can cause damage and staining that cannot be removed or repaired.

ASTM D5703, *Standard Practice for Preparatory Surface Cleaning for Clay Brick Masonry* [Ref. 1], also provides information on cleaning that may be helpful. However, because it is focused on preparation for water-repellent application and allows for acid cleaning, which could potentially stain or damage certain colors of brick, its guidance shall not supersede that of the brick manufacturer, treatment manufacturer or *Technical Note* 20.

Efflorescence. The deposit of water-soluble salts on the surface of masonry, efflorescence, is another factor that can hamper the performance of treatments on masonry. Efflorescence present on the surface should be removed, and once removed the surface should be observed for reoccurrence prior to being treated. Methods of preventing and removing efflorescence are discussed in *Technical Note* 23A.

Fireplaces. Brick masonry fireplace surrounds often require supplemental cleaning prior to painting, to remove soot as well as for general cleaning. Dry brush the brickwork with a non-metallic stiff-bristled brush to remove surface debris, and then vacuum. Pre-wet the brick and use a sponge or rag to clean the fireplace surround with a grease-cutting detergent and water, or a stronger agent such as trisodium phosphate if needed. Carefully rinse and let dry. If soot or discoloration is not removed by these methods, then consult a manufacturer of specialty cleaning products for masonry.

After Cleaning and Prior to Applying Treatments

Prior to applying treatments, the brick masonry should be dry, although some treatments require dampening of the brick immediately prior to application. Consult the treatment manufacturer recommendations for requirements related to moisture content or other conditions, such as pH. Generally, the brick surface should be chemically neutral prior to applying treatments. Products applied to the brickwork as part of surface preparation can leave residue that is acidic or basic, so it is recommended to include neutralizing products in the regimen. In cases of new or repaired masonry, allow at least 30 days for the mortar to cure prior to treatment, although longer waiting periods may be necessary, especially in cooler weather. After cleaning, wait at least 24 hours for the masonry to dry before applying treatments. Extended drying times may be necessary in some circumstances, particularly when rain or high-humidity conditions occur. Be aware that brick masonry does not dry at a uniform rate or evenly across a building.

A simple qualitative test can be used to estimate whether the brickwork is dry enough to treat. The test involves applying a piece of 4 mil thick plastic sheet to the brick surface, tightly sealing the perimeter with adhesive tape, and maintaining it in place for a minimum of 16 hours. If moisture is present on the plastic sheet after the duration of the test, it indicates that additional drying time is needed. Although this method is primarily used for cast-in-place concrete, the principles also apply in the case of masonry, provided that a good seal can be established on both the brick and the mortar. More information about this test method is discussed in ASTM D4263, *Standard Practice for Indicating Moisture in Concrete by the Plastic Sheet Method*. Where a specific moisture percentage is required by a treatment manufacturer, an electrical moisture meter can be used to measure the moisture content of the brickwork. The moisture meter used should be intended for use on concrete and masonry substrates. In some cases, representatives from the treatment manufacturer may be able to assist in the calibration of equipment or confirmation of the results.

APPLICATION

After selecting a treatment and preparing the surface of the wall to receive the treatment, proper application is the next step for a successful end result. Refer to the individual sections below for application information specific to each treatment. When using proprietary products for any of the treatments, follow manufacturer's instructions.

General

Proper application begins with addressing environmental factors and performing trial runs on mock-ups or sample panels. ASTM D6237, *Standard Guide for Painting Inspectors (Concrete and Masonry Substrates)* [Ref. 1], provides additional guidance on painting application and techniques.

Mock-Ups and Sample Panels. The final appearance of the treatments depends on the selected color, the application tool and the technique used to apply the product. Even in cases where experienced personnel will be

applying the product, a mock-up or sample panel is recommended to show the final appearance of the treatment. Standalone mock-ups are preferred rather than designating an area of initial brickwork that will remain as part of the permanent installation. The mock-up should be approved by the end user as to its desired effect. For projects where practice of a technique is needed, create multiple samples until the desired effect is achieved. When performing a trial on a test area, allow the surface to dry completely before evaluating the results, as the treatment may appear different when wet. All mock-ups and sample panels should be kept until the end of the project.

Temperature and Humidity. Most treatments have limitations on the temperature and humidity at which they can be applied. The specific requirements vary widely depending on the product type and the manufacturer. Consult the product manufacturer for specific recommendations, as well as the brick manufacturer, if known. Per ASTM D6237, the typical minimum air, material and surface temperature to apply the treatments is 40 °F. Avoid painting surfaces that are less than 5 °F above the dew point.

Specific Treatments

Masonry Stain and Pigmented Water Repellent. Masonry stains and pigmented water repellents are proprietary products that vary by manufacturer. For these products, follow the manufacturer's application instructions.

Limewash. Limewash is made by mixing lime or lime putty with water. The lime-to-water ratio should be carefully noted so consistency can be achieved between batches. Limewash is typically applied with a bristle brush. Application using a roller or sponge is not recommended. The lime putty must be diluted with water to the desired consistency—either a 1:1 ratio or 1 part lime putty to 2 parts water—and thoroughly mixed. The brickwork should be dampened slightly by misting with water. When used on an exterior wall, it is best to apply limewash on an overcast day so it does not dry too quickly. Using random brushstrokes, apply the limewash with a 4 to 6 in. wide brush. Allow 24 hours of drying time between coats. The more coats, the more opaque the appearance.

Mineral Paint. Mineral paints do not necessarily behave identically to modern conventional paints. In general, the formulation of mineral paint is thicker than other types of paints. While it can be applied by sprayer, this thicker formulation should be considered when selecting the sprayer tip size. Avoid diluting or otherwise modifying mineral paint unless additives and procedures are verified with the manufacturer, as mixing with water or other materials can adversely affect performance.

Mortar Wash. The appearance of mortar wash is inherently tied to how it is applied. To obscure large patches of the brickwork, it is recommended to use a trowel to apply the mortar. For less obscuring applications, the mortar can be applied with a trowel but is then partially removed with materials such as burlap or carpet, depending on the desired finish. It is especially important to perform a trial application on a sample panel or an inconspicuous area of the wall since the final appearance is dependent on the technique, which is more of an art form than a specific procedure.

Mix mortar for the treatment in small batches. After initial mixing begins, the mortar should be placed within 2½ hours. After placement, the mortar should be left undisturbed to cure. Retempering is not recommended for colored mortar, as it will dilute the intended color. For this same reason, the same volume of water must be used when mixing each batch to maintain color consistency and the desired opacity. For more information on mortar, refer to the *Technical Note* 8 series.

Semi-Opaque Paint (Faux Limewash/Whitewash). In order to obtain a semi-opaque finish, latex paint is diluted using water. A ratio of 1 part latex paint and 1 part water is typically recommended as a baseline. Adjustments to the proportion of water or paint can be made to achieve the desired effect. When applying to large areas, semi-opaque paint should be mixed in large batches and the paint-to-water ratio carefully noted so consistency can be achieved between batches. As a diluted coating, semi-opaque paint requires thorough mixing throughout its application. Because this treatment is made from diluted paint, it can be removed with a damp cloth prior to drying. To simulate a whitewash appearance, the paint can be applied with either a roller or brush and partly removed with a cloth by dabbing, or applied by dabbing the paint directly onto the surface. Similar to mortar wash, the final finish of the treatment is dependent on the material used to remove the paint and the amount removed. It is recommended to perform a trial application on a sample panel or an inconspicuous area of the wall to confirm that the technique achieves the desired result.

Acrylic Latex Paint. The methods and means used to apply acrylic latex paint are broad and expansive. Two overarching considerations include the use of a primer and the chosen application tool.

When using acrylic latex paint on brick masonry, many paint manufacturers recommend a primer. There are several acrylic latex paints described by manufacturers as being formulated for use on masonry. Consult with the manufacturer for the specific applications in which a primer is required.

Acrylic latex paint can be applied by brushing, rolling, spraying or dabbing with various media such as sponges or wadded cloths. Similar to mortar wash, the final appearance is tied to the application technique. Therefore practicing various application methods to determine the desired result is recommended.

SUMMARY

Brick masonry walls are known for their inherent character and attractive appearance. However, there are times when changing the appearance of the brickwork is desired. There are a variety of surface treatments available for brick masonry that can provide an opaque to semi-opaque finish. This *Technical Note* provides information on acrylic latex paints, masonry stains, mineral paints, limewash, mortar wash, pigmented water repellents and semi-opaque paint, as well as their suitability for use on brickwork in exterior and interior applications.

REFERENCES

1. Annual Book of ASTM Standards, ASTM International, West Conshohocken, Pennsylvania, 2024:

Volume 4.05

C62	Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
C216	Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
C270	Standard Specification for Mortar Unit Masonry
C652	Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
C1088	Standard Specification for Thin Brick Veneer Units Made from Clay or Shale
C1714/C1714M	Standard Specification for Preblended Dry Mortar Mix for Unit Masonry

Volume 4.06

E96/E96M	Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials

Volume 4.07

C920	Standard Specification for Elastomeric Joint Sealants

Volume 6.01

D1653	Standard Test Methods for Water Vapor Transmission of Organic Coating Films

Volume 6.02

D4263	Standard Practice for Indicating Moisture in Concrete by the Plastic Sheet Method
D5703	Standard Practice for Preparatory Surface Cleaning for Clay Brick Masonry
D6237	Standard Guide for Painting Inspectors (Concrete and Masonry Substrates)

2. Bock, Gordon, “Whitewash and Calcimine: Paints That Ain’t,” republished in *The Interiors Handbook for Historic Buildings*, Volume II, Historic Preservation Education Foundation, Washington, D.C., 1993.

3. Building Science Digest 106, “Understanding Vapor Barriers,” Building Science Corporation, Westford, Massachusetts, April 2011.

4. General Shale Brick, “Technical Bulletin – Mortar Wash,” August 2021.
5. National Bureau of Standards, “Preparation of Paints from Semipaste Paints, Thinning Ready-Mixed Paints, and Preparation of Water Paints,” September 1936.
6. National Lime Association, Bulletin No 304-G, “Whitewash & Cold Water Paints,” 1955.
7. Roberts, Cheryl, “The Significance of the Permeability of Paints,” KTA University, May 2017.