



# Township of Cheltenham

## Board of Historical and Architectural Review

### GUIDELINES FOR MASONRY AND STUCCO



*Historically, stone was often used for stately homes such as this Colonial Revival example.*

#### PURPOSE

These guidelines were prepared to assist property owners with information when considering the maintenance, repair, replacement or installation of exterior masonry including stone, brick and stucco. They are not intended to replace consultation with qualified architects, contractors and the BHAR.

These guidelines were developed in conjunction with Cheltenham Township's Boards of Historical Architectural Review [BHARs]. The BHARs review Certificate of Appropriateness [COA] applications for proposed exterior alterations to properties within the historic districts that are visible from a public way. The applicant is responsible for complying with the provisions of the Zoning and Building Codes at the time of application. The applicant must obtain a Certificate of Appropriateness [COA] as well as all necessary permits prior to proceeding with any work. For more information, or to obtain permit applications, please call the COA Administrator at [215] 887-6200 ext. 213.

Please review this information during the early stages of planning your project. Familiarity with this material can assist in moving a project quickly through the approval process, saving applicants both time and money.

#### EXTERIOR MASONRY

Exterior masonry provides a strong, durable and attractive appearance with relatively low maintenance. Historically, a building's exterior masonry wall surface serves both visual and functional purposes. Visually, exterior masonry is an important design feature and includes stone, brick and in some instances, stucco. Functionally, historic exterior masonry typically acts as the principal load bearing system for the building as well as its skin, shedding water and deflecting sunlight and wind. Historic exterior masonry:

- Establishes a building's scale, mass and proportion
- Acts as an important design feature, helping to define a building's architectural style
- Adds visual interest to the streetscape
- Adds pattern and casts shadows on wall surfaces
- Acts as a principal element in a building's structural system
- Establishes a weather-tight enclosure, providing protection from rain, wind and sun
- Is affected by temperature variation and building movement

With proper maintenance, exterior masonry and stucco can last for centuries. Improper maintenance and repair can lead to problems and deterioration from water, inappropriate pointing and cleaning.



*Historically, many community buildings such as this school were built with masonry walls.*

## TYPICAL CAUSES OF MASONRY PROBLEMS

The principal components of most masonry walls are either stone or brick. Mortar, which is located between the bricks or stones, bonds the individual units together, transfers the load through the masonry and provides a weather-tight seal at the exterior surface. Many problems associated with historic masonry result from the failure to keep masonry mortar joints in good repair. Deteriorated mortar joints can allow water to penetrate the masonry and cause severe interior and exterior damage. There are five principal causes of mortar joint failures:

**Weathering** of mortar occurs when rain, wind and pollution eat away at softer historic mortar over time. (Historic mortar was purposely soft to allow the masonry wall to expand and contract with seasonal temperature changes.)

**Uneven Settling** of masonry walls may result in cracks along masonry joints or within masonry units.

**Temperature Cycles** can cause deterioration in this climate, which is subject to extreme heat in the summer and cold in the winter. Temperature cycles can cause masonry and mortar to expand and contract at different rates, breaking the masonry's bond with the mortar. This situation can be exacerbated if moisture enters an open joint, then freezes and expands, potentially popping out the surface of the mortar and the masonry, resulting in spalling.

**Poor Original Design and Materials** can cause ongoing problems if the masonry and mortar are incompatible or inappropriate for their installation location, or if the masonry does not properly shed water.

**Insufficient Exterior Maintenance** refers to potential areas that might cause water to enter a masonry wall and contribute to its accelerated deterioration. Potential areas of concern are poorly functioning gutters, downspouts and flashing; rising damp; standing water at foundations; water splashing back off hard surfaces onto walls; or water-entrapping vegetation such as ivy or shrubs on or near masonry walls, etc.

### DEFINITIONS:

**Efflorescence:** Water-soluble salts leached out of masonry or concrete by capillary action and deposited on a surface by evaporation, usually as a white, powdery surface

**Spalling:** Chipping or flaking of masonry



*Surface delamination of the bricks, several open joints and poor patching are visible. The delaminated areas and open joints can allow water penetration and accelerated deterioration.*

## WHAT TO LOOK FOR

It is important to identify masonry problems as early as possible to minimize potential ongoing damage. This is particularly true of masonry that is exposed to a water source. Once water is permitted to penetrate a masonry wall, the deterioration will accelerate very quickly, becoming more severe and costly. Some of the signs of problems in masonry walls include:

- Disintegration of mortar more than 1/4" deep from masonry surface
- Cracks in mortar, or mortar bonds broken or pulled away from masonry
- Open mortar joints
- Loose bricks or stones
- Delaminating or surface erosion of bricks or stones
- Pitted surfaces from sandblasting and abrasive cleaning
- Damp walls, sometimes evident through the growth of moss or algae, and more commonly evident through efflorescence, which is typically visible as a white powdery substance on the wall surface
- Damaged interior plaster or finishes
- Rot of wood framing along masonry walls

Prior to attempting to repair masonry problems, it is strongly recommended that the cause of the problem be addressed. This would include repairing any outstanding exterior maintenance and drainage issues.

## DETERIORATED MASONRY

Although historic mortar will generally deteriorate before stones or bricks, individual stones or bricks can suffer damage from a variety of causes including moisture infiltration, harsh chemicals, abrasive treatments, hard pointing mortar, differential settlement, biological growth and heavy pollution.

After a stone or brick has been installed and exposed to the elements for a length of time, it develops a protective layer or crust on its outer surface. This layer provides additional protection for the interior of the masonry unit from outside elements such as moisture and pollution. If the protective layer is compromised, damaged, or spalled, the unprotected and softer inner core is then exposed and the deterioration can accelerate, causing the surface to become powdery and scale off. Spalling generally results from the build-up of internal pressure in a wall and can be caused by:

- Freeze-thaw action of moisture that penetrates a masonry surface, freezes and expands
- Expansion of metal components within a wall such as window lintels and tie backs that become wet, rust and expand
- Efflorescence of salts or minerals on the wall surface or build-up of salts within the wall that crystallize and expand
- Differential settlement

The principal cause of most instances of spalling is the infiltration of water or moisture inside the masonry construction.



*The visible cracking emanating from the left column of windows is probably the result of differential settlement. The pointing at the joints does not match the historic mortar.*

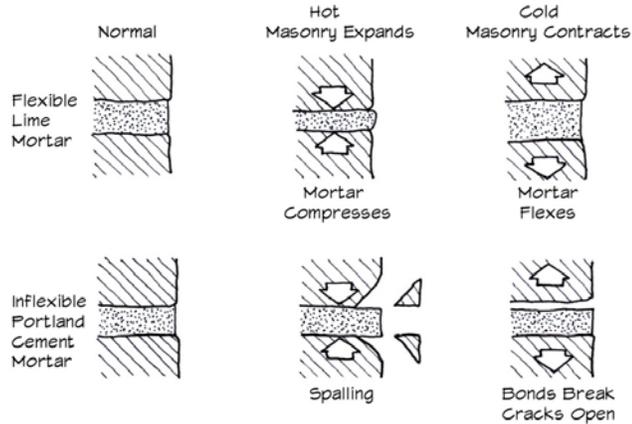
*The BHAR encourages:*

- Matching replacement masonry units to historic units in regard to colors, textures, sizes, shapes, bonding pattern and compressive strength.
- Replacement areas that are toothed or keyed into existing masonry.
- Reusing historic bricks or stones whenever possible (However, use caution when installing recycled historic bricks since they might not have been intended for exterior exposure - they might have been low-fired, softer, interior bricks.)
- Retaining and repairing historic masonry details including cornices, window and door surrounds and chimneys.
- Photographing and measuring existing conditions prior to beginning work to facilitate accurate duplication.
- Careful removal of moss, ivy and other vegetation from masonry walls.
- Cleaning using the gentlest means possible. (Prolonged saturation with low pressure water followed by brushing with a bristle brush is often sufficient.)
- Installing sloped mortar wash surfaces at the top of chimneys to protect chimney walls.
- Installing stone or terra cotta chimney caps in lieu of modern metal chimney caps, which were a mid-20<sup>th</sup> century development.

*The BHAR discourages:*

- Replacement masonry or mortar that is harder than the original historic masonry.
- Covering or removing decorative masonry.
- Covering masonry with artificial siding.
- Painting masonry surfaces or applying water repellent or waterproof coatings that can trap moisture and prevent the wall from “breathing.”
- Installing modern “antiqued” brick for patching historic masonry, since they are generally much harder and probably would not match the historic appearance.
- Cleaning with harsh chemicals, sand blasting, power washing, metal brushes or grinders that can damage the protective exposed surface.

## MORTAR HARDNESS AND MASONRY

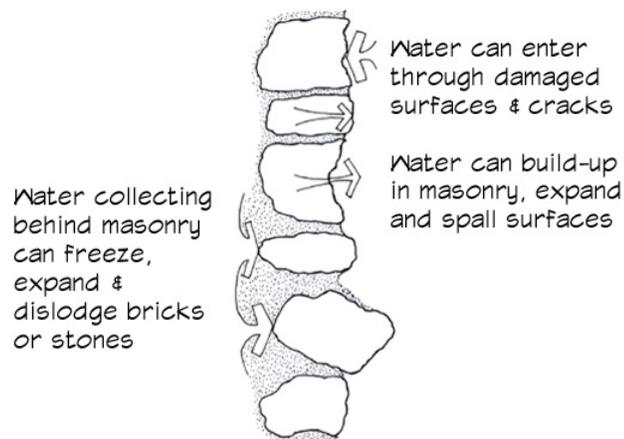


Temperature changes cause masonry units to expand when heated and contract when cold. The expansion and contraction of the masonry units results in compression and flexing of the adjoining mortar joints.

Lime based mortar is pliable and is more likely to compress and flex through temperature cycles. If properly installed, it should also be softer than the adjoining masonry allowing it to deteriorate prior to the adjacent masonry.

Portland cement based mortars are significantly harder than lime based mortars and far less elastic. In addition, cement mortars tend to be substantially harder than historic masonry. When masonry units expand in warm temperatures, they press against the harder cement mortar and tend to spall at the edges. During colder temperatures, masonry units tend to pull away from mortar resulting in open cracks that can allow moisture penetration.

## MASONRY DETERIORATION



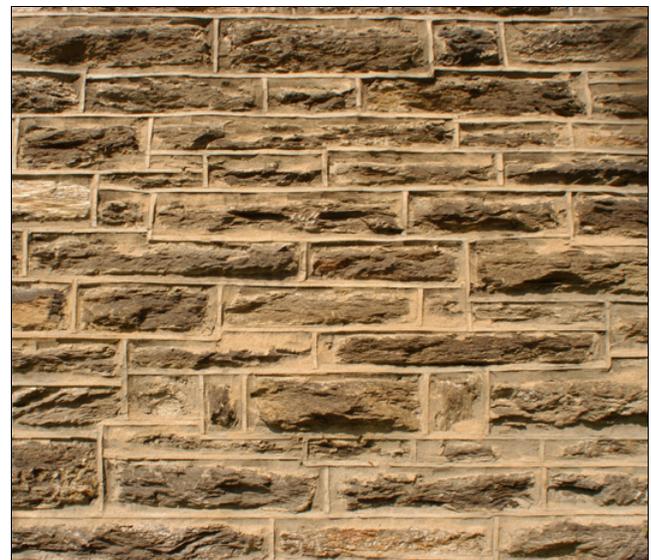
Moisture can enter walls through various ways including mortar cracks, spalled surfaces, groundwater and interior conditions. Moisture and impurities in masonry walls can cause outward pressure and result in spalling, dislodging of masonry units and deterioration of mortar joints.

## DETERIORATED MORTAR

Historically, mortar was mixed to be softer, or have less compressive strength, than the adjacent stone or brick. Because it is softer, the mortar acts as a cushion or sacrificial portion of the masonry surface as it expands and contracts through changes in temperature, moisture and differential settlement. If mortar is harder than the adjacent masonry, the stresses could be relieved through the individual stones and bricks. Cracking and spalling of the individual masonry units could occur, areas for potential moisture infiltration and potentially unstable or structurally compromised walls.

Because of its softness, mortar will typically deteriorate faster than stone or brick, requiring more frequent replacement, while the masonry remains relatively intact. Repointing is the process of removing deteriorated mortar from joints in a masonry wall and replacing it with new mortar. With the installation of the new joints, the visual and physical integrity of the masonry can be restored.

Repointing work can last 50 to 100 years when completed properly. However, it can be time consuming and expensive. Repointing requires a great deal of hand labor by knowledgeable craftsmen to remove the existing mortar, achieve the appropriate mortar mix and hardness, apply the mortar, and tool it to match the historic joint style and appearance. It is generally recommended that repointing projects be limited to areas of deterioration rather than an entire building.



Squared-off pronounced ribbon joints are typical joint style for stone walls in Cheltenham Township.

## MORTAR PROPERTIES

Historic mortar is generally composed of a few simple ingredients, sand, lime and/or cement, water, and possibly additives such as animal hair or oyster shells. Pre-mixed mortar available from hardware stores is generally inappropriate for use on historic masonry walls because it is too hard and contains too much Portland cement.

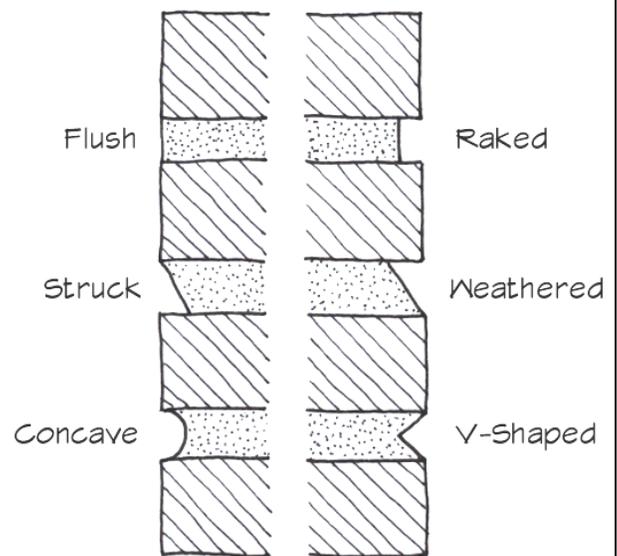
**Sand** is by far the largest component of mortar and defines its color, character and texture. Since masons would use products that were readily available, sand from historic mortars tended to have weathered, rounded edges and was available in a great variety of grain sizes and shades of white, grey and yellow. Most sand available today has sharper edges from being broken or mechanically pulverized and is sieved into standard grain sizes. Mixing sand colors and sizes might be needed to match historic mortar.

**Lime and Portland Cement** act as binders for the mortar. High lime mortar is soft, porous and varies little in volume with seasonal temperature fluctuations. Because lime is slightly water-soluble, high-lime mortars can be self-healing and reseal hairline cracks. By contrast, Portland cement can be extremely hard, resistant to water movement, shrinks significantly upon setting and undergoes relatively large thermal movements. Portland cement is available in white or grey, and the two colors can be mixed to achieve the desired coloration. In general, high lime mortars are recommended for nearly all historic repointing projects to ensure a good bond with original mortar and masonry. It is possible to add a small percentage of Portland cement to a high lime mixture to improve workability and plasticity.

**Water** needs to be clean and free of salts, detrimental minerals and acid. If not, it can break-down the mortar and adjacent masonry and discolor finished surfaces.

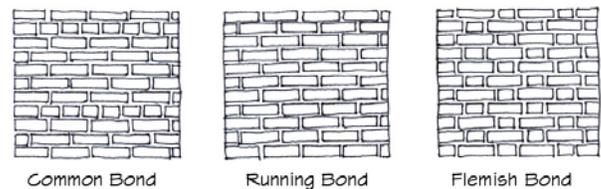
**Historic Additives** can include oyster shells, animal hair, clay particles, etc. To duplicate the character of historic mortar it might be necessary to include additives to match the original. It should be noted that there are several types of chemical additives available today including those that increase or reduce the setting time, expand the recommended temperature installation ranges, pigments, etc. The use of newer chemical additives is strongly discouraged unless they have been specifically tested over an extended period of time with similar materials as the proposed installation conditions.

## JOINT PROFILES



*There are numerous joint profile types, with each producing different shadow lines and highlights. When repointing an area of masonry, it is important to tool mortar to match the existing joint profile for a consistent appearance.*

## BRICK BONDING PATTERNS



*The most frequently constructed brick bonding pattern is common bond, which features stretcher courses with a header course every 6<sup>th</sup> row. Other familiar brick bonding patterns include running bond, comprised of only stretcher courses, and Flemish bond, alternating single stretchers and headers.*

## STONE BONDING PATTERNS



*Uncoursed and coursed Wissabickon schist are common building and landscape wall materials in Cheltenham Township. There are fewer cases of cut stone walls. Quoins are large rectangular stones located at a building's outside corners. Historically, quoins were used in a variety of bonding patterns including fieldstone.*



*Stone walls with crenellated tops are an important historic feature in Cheltenham Township. Large areas of missing mortar allow water to penetrate the wall and support plant growth. The plant roots can further deteriorate the wall by popping-out pointing mortar.*

## **MATCHING HISTORIC MORTAR**

Although the most exact method of matching historic mortar is to have it analyzed by a professional, below is a less costly testing method that approximates the original:

1. Remove 5-6 samples of historic mortar from different areas of the building. The building might have been repointed several times, so care should be used in selecting the earliest possible samples.
2. Set the largest sample aside for comparison with the pointing mortar.
3. Break the remaining samples with a wood mallet until they are separated into their constituent parts. There should be approximately ¼ cup.
4. Carefully blow away the powdery material, which is the lime and/or cement matrix which bond the sands and additives together.
5. Examine the remaining sand and historic additives with a magnifying glass, noting the color range and various sizes.
6. Mix several mortar samples based upon the components of the historic mortar noting the composition of each sample including sands, historic additives, lime, Portland cement and water. Place samples in channels or on a board and tool to match historic mortar profiles.
7. Allow samples to dry thoroughly and compare to historic mortar. Adjust mortar mix and create new samples until a visual match is achieved.



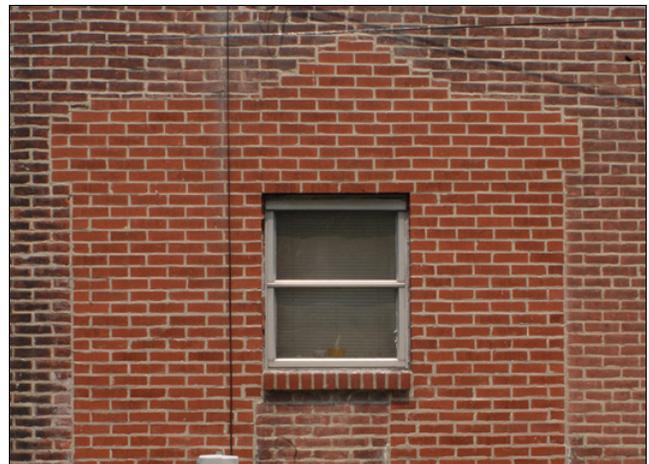
*The replacement mortar to the right does not match the color, texture or hardness of the historic mortar to the left. Cracking and plant growth are visible within the area of historic mortar, both of which can promote moisture infiltration and deterioration of the masonry.*

*The BHAR encourages:*

- Repointing mortar of the same hardness or softer than the original mortar and always softer than the original masonry, typically high lime content mortar with limited Portland cement

*The BHAR discourages:*

- Installing hard, Portland cement based mortar
- Utilizing pre-mixed mortar that contains a high degree of Portland cement and does not match the appearance of the historic mortar

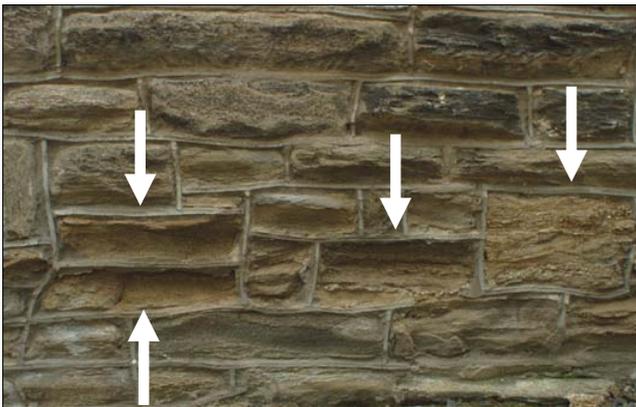


*The area of brick in-fill area is very visible and outlined by a thicker mortar joint. The replacement bricks are not keyed or toothed into adjacent brickwork and a different size and color than the historic bricks.*

## REPOINTING HISTORIC MASONRY

To achieve the best possible results, repointing work is best completed during fair weather. Generally, it is recommended that repointing be completed when the temperature is expected to remain between 40°F and 90°F for at least 2 days after the installation of the mortar. This will help to properly bond the mortar to the masonry and minimize the possibility of freezing and excessive evaporation. A good repointing job can last 50 to 100 years, while a poor job can damage historic masonry and mortar resulting in more costly future repairs. To repoint joints:

1. Remove existing mortar in areas of repointing to a minimum of 2½ times the width of the joint or until deteriorated mortar is removed. (For brick, approximately ½" to 1" deep.)
2. Before filling, particles from joints should be removed with a stream of water. Joints should be damp and without standing water at the time of repointing.
3. Mortar should be thoroughly mixed and used within 30 minutes of mixing.
4. Apply mortar in ¼" layers, packing it well back into the corners. Apply additional layers when installed mortar has reached thumb-print hardness.
5. Tool final layer to match historic joint profile when mortar is thumb-print hard. Proper timing is important to match color and appearance.
6. Carefully clean excess mortar from masonry surface with a stiff bristle brush avoiding brushing and damaging new mortar joints. Cleaning should occur approximately 1 to 2 hours after tooling of the final layer and before mortar has fully hardened.



*The stones towards the center are delaminating and are now concave. The porous surface is more susceptible to moisture infiltration. Delamination is often the result of spalling due to repointing mortar that is harder than the adjacent masonry.*



*There is a stark difference between the recent repointing and the adjoining historic mortar.*

*The BHLAR encourages:*

- Consulting with a professional to achieve the best possible results
- Repointing in fair weather for the best possible results
- Removal of mortar with hand tools
- Using a high-lime mortar mix
- Repointing of joints prior to cleaning to prevent moisture from migrating into walls
- Repointing mortar that matches the appearance, color, texture, joint size and tooling of the historic mortar

*The BHLAR discourages:*

- Using power tools to remove existing mortar from joints since many power tools can damage historic masonry by over-cutting joints and breaking edges, resulting in wider joints
- The use of modern chemical additives
- Installing the mortar in a single layer
- Widening the existing mortar joints or overlapping the new mortar over the masonry surface
- Cleaning mortar from masonry with metal brushes or chemicals that can damage the surface of the masonry

## MASONRY CLEANING

Appropriate masonry cleaning can enhance the character and overall appearance of a building. However, improper cleaning of historic masonry can cause damage to the historic surfaces and cause more harm than good both physically and aesthetically. There are three principal reasons for cleaning historic masonry:

- Improve the appearance by removing dirt, pollen, stains, graffiti or paint
- Retard deterioration by removing deposits, salts, efflorescence, acids, ivy, algae, moss, mildew and pollutants that can damage masonry surfaces
- Clean select areas to match historic masonry or mortar or to assess surface condition

Masonry cleaning methods fall within three general categories:

- Low pressure water, with the possible use of gentle detergent and brushing
- Mechanical cleaning including sand blasting, power washing, grinding, sanding, wire brushing
- Chemical cleaning

Because of the potential damage to historic surfaces, cleaning should be completed using the gentlest means possible. In many cases, soaking the masonry with low pressure water can remove much of the surface dirt and deposits. If the soaking method is not successful, it might be necessary to add a non-ionic detergent or brush the wall surface with a natural bristle brush.

The use of mechanical methods, including abrasive blasting, power washing, sanding or grinding, can potentially remove decorative details and the protective surface of the masonry resulting in an eroded surface and permanent damage. Abrasively cleaned masonry usually has a rougher surface that can hold additional dirt and be more difficult to clean in the future. Chemical based cleaners can etch, stain, bleach or erode masonry surfaces. Both mechanical and chemical cleaning method can also make the masonry surfaces more porous and deteriorate mortar joints allowing for increased moisture penetration.

*The BHLAR encourages:*

- Cleaning using the gentlest means possible
- Making sure mortar joints are sound and building is water-tight prior to water cleaning
- Using water without traces of iron or copper that can discolor masonry

- Conducting water cleaning a minimum of one month prior to freezing temperatures to minimize the potential for spalling
- Minimizing water pressure to reduce potential etching of masonry surfaces (generally no more than 100 psi)
- Using clean water without excessive salts, acids or minerals that can deposit on masonry surfaces
- Using non-ionic detergent and natural bristle brushes when water soaking is not successful

*The BHLAR discourages:*

- Using mechanical cleaning methods including sand blasting, power washing, grinding, sanding, wire brushing
- Using chemical cleaning

In instances where a severe stain or graffiti is present, it might be necessary to use a chemical based cleaner in specific areas. Caution should be taken to test the effects of the proposed cleaner on a discrete area of the building prior to using it on a principal elevation. It is recommended that the most diluted possible concentration be used to minimize potential damage of the masonry surface. It should be noted that many chemical cleaners are hazardous and require special handling, collecting and appropriate disposal of the chemicals and rinse water.

*The BHLAR encourages:*

- Hiring a contractor with specialized knowledge of masonry cleaning when gentler cleaning methods are not successful



*The peeling paint might be the result of improper paint type, preparation or moisture infiltration. The loose and flaking paint should be removed and cause for peeling determined prior to repainting.*

## MASONRY COATING

Water repellent and waterproof coatings are generally applied to prevent water from entering a masonry wall, but tend to be unnecessary on weather-tight historic buildings. Water infiltration through masonry buildings is generally caused by other moisture related problems including open mortar joints and poor or deferred maintenance. In instances where the surface of the masonry has been severely compromised, such as following sandblasting, the use of water repellent coatings might be appropriate.

**Water Repellent Coatings**, also referred to as “breathable” coatings, keep liquid from penetrating a surface but allow water vapor to escape. Many water repellent coatings are transparent or clear when applied, but might darken or discolor over time.

**Waterproof Coatings** seal surfaces and prevent liquid water and water vapor from permeating the surface. Generally, waterproof coatings are opaque or pigmented and include bituminous coatings and some elastomeric coatings and paint. Waterproof coatings can trap moisture inside of a wall and can intensify damage. Trapped moisture can freeze, expand and spall masonry surfaces.

*The BHLAR discourages:*

- Applying water repellent or waterproof coatings to weather-tight historic masonry
- Applying waterproof coatings on masonry above the surface grade level

## MASONRY PAINTING

If the exterior of the masonry surface has been compromised through previous sandblasting, moisture infiltration or the use of harsh chemicals, appropriate painting can provide a degree of protection. Proper application of a water repellent paint can prevent water from penetrating while allowing water vapor to escape. Waterproof or inappropriate paint can trap moisture within a masonry wall. Proper preparation is critical to a successful masonry painting project.

1. Remove loose or flaking paint, mortar and masonry as well as ivy, algae, moss and mildew.
2. Complete items of deferred maintenance including repair of deteriorated gutters and downspouts.
3. Complete repointing and re-caulking as needed.
4. Select a paint color appropriate for the building style. Apply undercoat and paint appropriate for masonry application type. Follow manufacturer’s recommendations for application.

## REMOVING PAINT FROM MASONRY

When considering whether to remove paint from a masonry surface, it is important to assess whether stripping is appropriate. In some instances:

- The building might have meant to be painted, less attractive, softer or more porous bricks or stones might have been painted to provide a water repellent protective layer
- Paint could mask later changes or additions

Reason to consider stripping paint:

- To reduce the long term maintenance requirements associated with repainting
- Paint might have been originally applied to mask other problems such as a dirty building
- If existing paint has failed, it might be necessary to strip it prior to repainting

Caution should be used since some paints include lead, requiring proper collection and disposal techniques. Signs of failed paint include:

- Paint is badly chalking, flaking or peeling, possibly due to moisture penetration. It is important to find the cause of moisture and repair prior to repainting.
- If masonry has been “sealed” by excessive layers of paint or by waterproof coatings, the underlying masonry might not be able to “breathe” and dispel the internal moisture and salts. Eventually, pressure from moisture and salts can build-up under paint layers and possibly cause the paint to peel and masonry to spall.

If paint is stable, complete paint stripping might not be necessary. However, new paint should be compatible with previously paint layers for best adhesion.

*The BHLAR encourages:*

- Consideration about paint removal appropriateness
- Paint removal using the gentlest means possible

## HIRING A CONTRACTOR

- Repair, maintenance, installation and cleaning of masonry and stucco can be potentially dangerous work and should be left to professionals
- All masons are not necessarily experienced in all materials, choose a contractor with demonstrated experience in working with historic masonry
- Verify extents of warranty for materials and labor
- Check references especially from 5 years prior to understand how well work has held-up

## STUCCO

Stucco is a relatively inexpensive material that can provide a more finished appearance to rubble stone, brick, or wood framed buildings. It acts as a weather repellent coating, protecting the building from the elements including rain, snow, sunlight and wind, and can moderately increase fire resistance. In most cases, stucco was applied at the time of construction over rubble stone walls or as a design element around the beginning of the twentieth century in revival architecture. It was also applied years after construction to vary to original appearance or as a remodeling material for deteriorating buildings.

## STUCCO PROBLEMS

Similar to masonry walls, many stucco failures are caused by water infiltration, and a lack of maintenance can hasten deterioration. Some typical moisture-related deterioration include:

- Rain and precipitation
- Moisture vapor migration from the interior
- Rising damp from the ground
- Leaking plumbing

In addition, stucco failures can be caused by:

- Improper mixture of mortar
- Improper installation including inadequate keying to substrate
- Rotted, warped or inadequately fastened lath to substrate
- Building settlement
- Exposure to the elements

Typically, stucco failures are evident in cracks or bulges in the wall surfaces. The bulges can indicate that the stucco is pulling away from the underlying wall substrate.

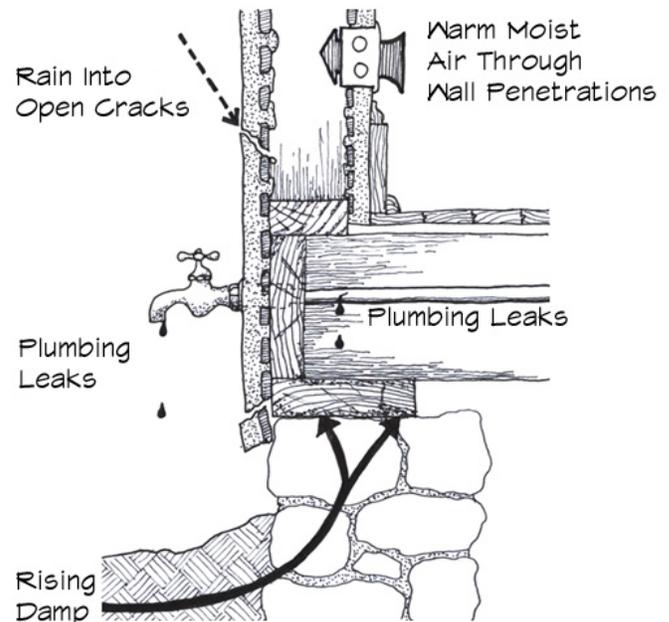
*The BHLAR encourages:*

- Repair of deterioration cause prior to completion of stucco work such as gutter and downspout repair
- Proper use and maintenance of flashing, drip edges and exterior drainage systems
- Installation of a vapor barrier between interior and exterior stucco
- Ventilation of moisture intensive space including bathrooms, kitchens and laundry rooms
- Installation of proper stucco termination above ground level

## STUCCO COMPOSITION

The components of stucco are similar to pointing mortar and include lime, Portland cement, sand, water, and possibly animal hair or straw as a binder. Stucco can be applied to either a masonry wall or a wood framed wall, with Portland cement based stucco more common on wood framed wall installations.

Similar to mortar, lime based stucco is more “flexible” while Portland based stucco is harder. When repairing existing stucco, it is important to test each situation to determine and match the historic stucco composition. Similar to pointing mortar, if stucco patches are too hard, they could cause additional damage to the adjacent historic stucco surfaces or encourage the formation of cracks that can be an avenue for water migration into the wall surface.



*Stucco walls are affected by similar sources of moisture infiltration as stone and brick walls. Trapped moisture within a wall or floor framing system can lead to wood rot, mold and insect damage.*

**Rain and Precipitation** can enter stucco walls through damaged surfaces, small cracks in the stucco surfaces and crevices with adjacent materials including window and door frames.

**Rising Damp** is the migration of moisture from the soil into the building structure through capillary action. The soil adjacent to the foundation can become saturated through improper drainage from gutters and downspouts and vegetation planted adjacent to the foundation.

**Plumbing Leaks** include piping as well as bathroom fixtures, kitchen and laundry appliances.

**Condensation** occurs when warm moist air from bathrooms, kitchens and laundry facilities comes in contact with cold surfaces and changes to water droplets.



*This Tudor Revival style residence has a stone first floor with stucco and ornate applied half timbering above.*



*This Tudor Revival style residence has a brick first floor with stucco and simpler applied half timbering above.*

## PATCHING STUCCO

Successful patching of stucco surfaces generally requires the services of a skilled craftsman. Matching of uncoated or unpainted stucco is particularly challenging given the difficulty associated with matching mortar colors, textures and a weathered finish.

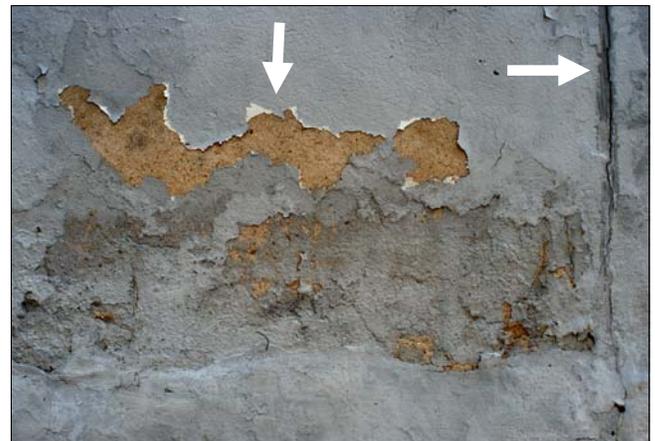
Prior to beginning any patching work, areas of deterioration should be tested to determine the extent, and a plan established to complete the work.

In general, hairline cracks can be filled with a thin slurry coat of the finish coat ingredients, while larger cracks need to be cut-out and prepared for a more extensive repair. Similarly, bulging wall surfaces need to be cut-out to sound surfaces. To test the extent of deterioration at bulging wall surfaces, press on the wall surface to identify the areas of movement or sponginess. Unsound or un-keyed stucco will also sound hollow when gently tapped with a wood mallet. For the best appearance, the area to be patched should be squared-off with a butt joint when possible, and terminated at a building joint or change in materials such as a window or door frame.

When applying stucco directly to a masonry wall, it is important to rake out the masonry joints to a sufficient depth to allow the stucco mortar to be bonded to the masonry and keyed into the joint. Historically, when stucco was applied to a wood framed building it was installed over spaced wood lath and more recently on metal lath. It is important to verify that lath is securely attached to the substrate. In addition, the use of metal lath at masonry buildings is discouraged since it can be prone to rust and eventually spalling of the stucco surface.

Similar to repointing mortar, stucco should be applied in fair weather conditions, avoiding extreme heat, sun and freezing temperatures. Historically, stucco was applied in three coats, scratch, brown and finish coats. Each coat is approximately ¼” thick, matching historic stucco. To ensure bonding between the various coats, the scratch and brown coats are hatched to provide a key to hold the subsequent coat. For the best adhesion, it is important to mix only as much stucco as can be installed in about one hour. Partially set mortar will not bond properly to wall surfaces and should be disposed of. The coats should also be permitted to dry between applications, generally 24 to 72 hours for each coat, prior to the application of subsequent coats. The final appearance should duplicate the old as closely as possible in strength, composition, color and texture.

Many stucco buildings have been painting and will require repainting after repairs have been made. When selecting paint, it is important that the new paint is compatible with earlier paint and stucco material and applied following the manufacturer’s recommendations.



*The peeling paint, surface delamination and cracking of the stucco surface can promote moisture infiltration.*

## PREVENTING MASONRY AND STUCCO DAMAGE

Exterior masonry and stucco provides a strong, durable and attractive appearance with relatively low maintenance. By following some simple steps, costly damage to exterior walls can be minimized.

*The BHLAR encourages:*

- Repointing of open, cracked or deteriorated mortar joints regularly with appropriately soft mortar
- Matching the composition and appearance of historic mortar and tooling
- Repair or replacement of deteriorated or missing masonry with similar units on an as-needed basis
- Matching the composition, color, texture and appearance of historic stucco
- Regular maintenance and cleaning of all gutters, downspouts, flashing and other water run-off systems
- Correcting problems where the masonry meets the ground including rising damp, splash-back and standing of water adjacent to the foundation
- Removal of water entrapping vegetation from or near masonry walls
- Cleaning using the gentlest means possible

*The BHLAR discourages:*

- Installing hard, Portland cement based mortar
- Using power tools to remove mortar that can damage historic masonry
- Ivy moss or other plants growing on masonry
- Salt to melt snow adjacent to masonry walls
- Cleaning masonry with harsh chemicals, sand blasting, power washing, grinders or metal brushes
- Installing waterproof or water repellent coatings except in extreme cases



*Efflorescence is visible on the right half of this pier. It is typically evident as a white powdery substance on a masonry surface.*

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