

Masonry Restoration Guidelines

1.0 Purpose

The intent of these Guidelines is to provide guidance in reviewing applications for alteration under the *Ontario Heritage Act* and provide guidance to heritage property owners, architects and contractors to carry out a successful masonry restoration.

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3.0 Application

The City of Hamilton is home to many historic buildings and structures that represent the City's diverse heritage and contribute to its unique identity. Many of the City of Hamilton's historic buildings are constructed with limestone, clay brick, stone, cast stone, and concrete materials.

The proper conservation of these historic structures is vital in order to preserve these heritage resources. The intent of this policy is to develop sensitivity to the particular needs of historic masonry by providing the best practices for masonry restoration. These guidelines offer helpful advice on the appropriate materials and methods to be used.

4.0 General Provisions

Brick, stone, and concrete are found on the majority of Hamilton's built heritage resources. The exposure to harsh weather conditions and building construction failure makes masonry susceptible to deterioration, especially at the mortar joints. Deterioration is identified by cracks or spalling and is often a result of:

- a) Water penetration from interior or exterior;
- b) Expansion and contraction of materials due to repeated wetting and drying (freezing and thawing);
- c) Stresses caused by the formation of salt crystals beneath the surface, especially common when cement is used as a quick fix to fill a masonry crack;
- d) Material impurities and incompatibility;
- e) Overgrowth of vegetation, (ivy, in particular), will cause severe damage to masonry;
- f) Poor craftsmanship during construction;
- g) Previous poor or incorrect repairs/restoration; and,
- h) Structural settlement shifts.

The decision to repair masonry is often related to some obvious sign of deterioration such as cracks in mortar joints, disintegrating mortar, loose bricks or stones, damp walls, or damaged plasterwork. However, it may be incorrect to assume that

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repointing the masonry will address the source of the deterioration. Therefore, it is recommended to investigate and understand the causes of deterioration before taking action in order to not only direct the repair of the masonry but also address the deficiencies that will potentially result from other problems.

5.0 Re-pointing

The most commonly required repair work undertaken on historic masonry is repointing, also known as “pointing”. It is the process of removing deteriorated mortar from the joints of a masonry wall and replacing it with new mortar.

It should be noted that while the mortar joints themselves are an important part of the building’s historical fabric, they are meant to be a sacrificial element of the wall assembly. In other words, mortar – unlike masonry units – is meant to deteriorate over time. Consequently, it is understood that historical masonry structures will require repointing periodically. It is important that repointing is correctly done since improper repointing can cause physical damage to the masonry units themselves, which are more difficult and expensive to repair.

5.1 Guidelines

The following guidelines provide advice on appropriate materials and methods for repointing historic masonry structures:

- a) *Limit repointing to areas of deterioration.* Only repoint in areas where mortar is loose or crumbling. If the bond is intact on both sides of a joint and the mortar is cohesive and firm, do not repoint as the joint is sound.
- b) *Cut out deteriorated mortar before repointing.* Cutting out must not damage masonry units or widen the joints. Loose and crumbling mortar should be removed prior to repointing to facilitate adhesion between the new and old mortar. All material is to be removed from the side of masonry units to the depth of sound mortar, and all dust and debris is to be removed. As a general rule, mortar removal is done to a depth of 2 to 2 ½ times the width of the joint. In brick buildings, this will usually mean removal to a minimum depth of 25mm when the joints are extremely narrow (3mm) the mortar should be removed to a minimum depth of 10mm. This process should be completed with hand tools rather than power tools. If the mortar deterioration extends deep within the walls, a low-pressure mortar injection may be necessary to reach the appropriate depth.

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- c) *Use a mortar mix that is equal, or lower in strength, to the historic mortar.* Do not use modern formulations with ordinary Portland cement. Acceptable mortar mixes vary, depending on the type of masonry used, (i.e. brick, stone, or cement), and on performance expectations. Ideally, a sample of mortar that has been identified as original material is extracted and analyzed in a laboratory to obtain the original composition and ratio of ingredients. In the absence of proper testing, an acceptable historical mortar mix should be used and matched closely as possible through visual and physical comparison onsite. **(Refer to 6.1 Recommended Mortar Specification)**
- d) *Point with a porous mortar.* Pointing with a porous mortar allows the wall to breathe by allowing moisture to migrate and evaporate through the mortar instead of the masonry unit. The mortar must match the original in material composition and method of construction and application.
- e) *The repointing should be carried out when the temperature is between 5 and 25 degrees C,* to avoid the possibility of frost or rapid drying of the mortar.

6.0 Mortar

6.1 Recommended Mortar Specification for Historic Masonry

Mortars for repointing historic buildings are typically custom mixed in order to ensure the proper physical and visual qualities. These materials can be combined in varying proportions to create a mortar with the desired performance and durability.

The recommended mortar for historic masonry is the mixture of lime and white non-staining cement, which is different from Portland cement mortar normally used in modern construction.

Mortars for repointing should be softer or more permeable than the masonry units and no harder or more impermeable than the historic mortar to prevent damage to the masonry units. It is a common error to assume that hardness or high strength is a measure of suitability, particularly for lime-based historic mortars. A mortar that is stronger in compressive strength than the masonry units will result in permanent damage to the masonry, such as cracking and spalling.

Permeability of the mortar is very important—if the mortar does not permit moisture to migrate out of the wall and evaporate, it will cause permanent damage to the

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masonry units. Depending on the application, the mix must be adjusted to suit the masonry material type and exposure.

6.2 Recommended Approach to Colour Matching Masonry

For aesthetic reasons, it is recommended that the texture and colour of the mortars should match the original historic masonry, which is primarily a result of the type of sand used. Pigments can be used to achieve the desired colour; however, pigments often result in short or long-term spots. A small test patch is recommended to achieve desired mortar outcome.

6.3 Recommended Curing Approach to New Mortar

Repointing should not take place in temperatures near or below freezing (below 5°C), or in hot or direct sunlight. Both cases would not allow the mortar to achieve its desired strength. When the temperature is above 25° C (77° F), newly laid mortar must be protected against rapid drying with damp burlap protection and frequent misting to control drying and shrinkage.

7.0 Masonry Cleaning Guidelines

First, it is important to determine if cleaning the masonry is appropriate. The objective of cleaning a historic masonry building must be considered carefully before arriving at a decision to clean. There are several major reasons for cleaning a historic masonry building: improve the appearance of the building by removing unattractive dirt or soiling materials, or non-historic paint from the masonry; delay deterioration by removing soiling materials that may be damaging the masonry; or provide a clean surface to accurately match repointing mortars or patching compounds, or to conduct a condition survey of the masonry.

It is recommended that cleaning of historic masonry be done with the gentlest means possible. Generally, a gentle pressure wash with water is all historic masonry requires.

The use of abrasive cleaning methods is not recommended on heritage buildings as they operate by wearing down dirt or paint from a masonry surface, which can simultaneously erode the surface of the building material. It is recommended that methods be tested on a small inconspicuous area of the masonry before applying to the larger surface area.

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The following cleaning methods are discussed below for different applications:

1. *Water Cleaning*

Water cleaning is the gentlest means of cleaning to remove dirt from historic masonry. However, it may be detrimental to badly deteriorated masonry or on gypsum. There are four kinds of water-based methods: soaking, pressure water washing, water washing with mild detergents, and steam cleaning. Even water used with high enough pressure can be detrimental, so, high-pressure water washing is strongly discouraged.

2. *Chemical Cleaning*

Chemical cleaners can be used on historic masonry to remove persistent dirt or paint, including graffiti. The chemical cleaning is followed by water cleaning to rinse the chemical off the surface. Acidic cleaners, alkaline cleaners and the organic compound are used to remove dirt on the masonry, while organic solvent and alkaline paint removers are used to remove graffiti. However, **not all chemical cleaners are appropriate for historic masonry**, so, care should be taken to choose an appropriate product.

3. *Poultice*

Poultice cleaning can be an effective way to remove graffiti and stains that already penetrated on the wall. Poultice cleaning is often used for smaller applications often consisting of more delicate and detailed architectural features. Poultice consists of water and a medium to create a paste that is applied to the surface with the intent of drawing out the dirt and stains. The most common medium is clay; however, chemical mediums are at times appropriate. Care should be taken to thoroughly rinse and neutralize the masonry when chemical mediums are used.

4. *Sandblasting*

Sandblasting is not recommended. Bricks develop a protective skin from the firing process. This skin protects the brick from the elements. Without this protective layer, bricks will deteriorate.

Sandblasting historic brick will not only remove paint, dirt and graffiti, but it also removes the protective skin; leaving the brick exposed to the elements and subject to some of the following problems:

Spalling: Sandblasting leaves the brick exposed and weakened. Spalling occurs when the brick begins to deteriorate, turning into a powder and breaking apart. Spalling can also occur from repointing with a mortar that

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is too hard which causes the face of the brick to break off to expose the softer interior.

Weakened Structure: Often people sandblast and then apply a sealer to the face to prevent spalling or other damage. Heritage brick and lime mortar are very breathable building materials. Sealing one side of the material, prevents that natural breathability, causing moisture to build up within the brick on the underside of the sealer. With moisture build-up, minerals will be deposited just below the surface of the sealer; eventually weakening the structure of the masonry unit, causing it to break apart.

Cosmetic Damage: Sandblasted brick will leave the surface uniformly rough, and it will not have the same appearance as the original surface. The brick will lose some of its character and charm.

5. *Other Methods of Cleaning such as Soda Blasting, Bead Blasting and Dry Ice Blasting*

These cleaning methods are not recommended. Similar to sandblasting; these methods are used to remove dirt, paint and graffiti on masonry. However, these methods are often promoted as being more environmentally friendly, less abrasive and less damaging to masonry surfaces.

It is recommended that property owners do their due diligence to investigate the pros and cons of any new methods of cleaning masonry and always test on a small inconspicuous area of the masonry before applying to the larger surface area to ensure the masonry surface is not damaged.

8.0 Special Masonry Features

Beyond the masonry cladding of a building, special masonry features such as stone walls, chimneys, rubble stone foundations, stone buttresses, stone stairs and masonry garden features are all types of building elements a heritage property owner may need to repair over the lifetime of a building.

Wall-capping

Do not use mortar mix to finish the top of a masonry structure, for example, a wall or a chimney. This is not the correct method for finishing these structures. Specific capping stones or capping bricks should be used to finish the top of these assemblies. This will ensure that the water can run off, which will prevent the

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moisture from entering the structure's core. Allowing water to enter the core of the structure will eventually lead to degradation and failure of the masonry assembly.

A professional should always be consulted where significant deterioration is evident, to ensure the structural integrity of the element has not been compromised and ensure the method of repair is correct.

9.0 Historic Exterior Stucco

Stucco or roughcast cladding is a material that covers the exterior of some historic buildings. It is traditionally placed on lath or directly on masonry producing a uniform finish that is resistant to rain. This process adds a decorative effect to the building surface with its texture, detailing and colour. Early stucco was generally applied in two or three coats for strength and durability. Stucco is a type of external plastering or rendering of lime, or lime and cement mortar with a sharp sand aggregate. Early stucco used animal hair, straw, or other binders. In the late 19th and early 20th century, stucco was made with a small portion of Portland cement and lime. Sand and fine gravel were used to create surface texture.

9.1 *Inspection and Maintenance*

Simple tapping for a hollow sound will sometimes distinguish whether the stucco is applied to a wood frame or masonry. Areas of thin or failing stucco may also reveal the underlying structural system. Stucco is a rigid material and susceptible to cracking and crumbling. Water may enter cracks and rot the underlying lath; structural settlement may cause cracking, and poor original composition may result in poor adhesion to the lath causing cracking and the loss of pieces of stucco. Common failures of stucco include bulging, cracking, and deterioration at the ground line and at the roofline. These areas should be monitored. Maintain eavestroughs and downspouts to eliminate water penetration and damage to the coating and structural damage to the frame. The soil in planting beds should not be banked against a stucco wall.

9.2 *Repairs and Replacement*

Traditionally, stucco was not painted. Its colour was derived from the aggregate, often sand, and any permanent pigment mixed in the finish coat. Normally applied in three coats, the finish coat received different surface treatments depending on the technique that was fashionable at the time. Repairs to stucco should seek to replicate these traditional techniques, avoiding contemporary processes such as

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blown applications. General guidelines to the repair of stucco cladding are as follows:

1. Accurately record textured or decorated stucco surfaces before repairs begin. Note the thickness of the stucco relative to the wood trim and maintain the dimension in order not to hide or destroy the function of detailing (i.e. sill drips, corner boards, window frames).
2. New stucco should never be applied over an existing surface since this can hide damaged surfaces and destroy architectural detailing.
3. Remove unsound stucco to lath or a sound base and duplicate original formulation in strength, composition, and texture.
4. Patching and new stucco surfaces should match the historic finish, colour, texture and any special markings found on original stucco surface. Consider repairing an entire wall surface, particularly if a principal elevation, to maintain consistent colour and texture if most of the surface is failing.
5. Duplicate original method of application (i.e. build up repairs in layers or coats to ensure good bonding and curing). Dampen patches and surrounding area for a couple of days after repair for successful adhesion of patched section to original stucco.
6. Do not paint the stucco surface if it is not already painted.
7. To date, no effective method of cleaning stucco has been developed. Dirt and dust should be rinsed off with water on a yearly basis.

10.0 Regulatory Requirements and Financial Incentive Programs

Consulting with the City's Planning and Economic Development Department is required before proceeding with any work on a structure that is designated under the Ontario Heritage Act or located within one of the seven Heritage Conservation Districts. The proposed work may require a building permit and/or Heritage Permit.

The proposed work may also qualify for funding by the City of Hamilton Financial Incentive Programs. For applicable projects, the City offers the Heritage Property Grant Program as well as the Hamilton Community Heritage Fund (HCHF)

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Heritage Property Owners are encouraged to contact the City's Heritage Planning Staff for helpful advice, guidance and assistance with any questions they may have.

Who to contact:

Cultural Heritage Planner in the Planning and Economic Development Department

Tel: 905-546-2424 ext. 1202 or ext. 1214

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