

## Repointing historical masonry structures

### Introduction

Whether it is stone, brick, concrete block or terra cotta maintaining the mortar joints on a masonry or masonry-clad building is important to esthetically and physically preserving a structure. Mortar joints ensure that the building envelope continues to perform as a barrier to the elements. Much research has been done to analyze the destruction caused by the use of inappropriate mortars and pointing methods on historical structures. The purpose of this technical information sheet is to assist heritage easement property owners and their contractors with carrying out a successful repointing project.



Inappropriate repointing has damaged these masonry units. The harder, cement-based mortar has caused the bricks to spall. The mortar has also been carelessly applied, thereby compromising the architectural character of the building.

Mortar serves many purposes in masonry construction, but its main function is to make the wall assembly watertight. Mortar must be softer and more porous than the surrounding masonry units, thereby allowing it to accommodate contraction and expansion and providing a route for moisture to escape. The colour, texture and profile of the mortar joints also contribute to the appearance of a historical structure.

Repointing is the process of removing the outer deteriorated layer of mortar from the joints and replacing it with new mortar. Repointing deteriorated mortar joints, however, is more complicated than it may seem. If done incorrectly, it can lead to an unsightly mess, deterioration of the historical fabric, serious loss and water infiltration into the building.

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.

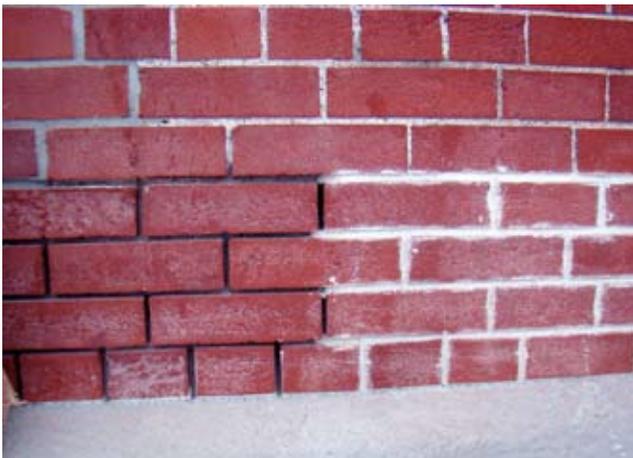
### General guidelines

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

- **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.
- **Cut out deteriorated mortar before repointing.** Cutting out must not damage

masonry units or widen the joints. Loose and crumbled 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. This process should be completed with hand tools rather than power tools. If the mortar deterioration extends deep within the walls, a low-pressure grout injection may be necessary to reach the appropriate depth to consolidate the walls.

- **Use a mortar mix that is equal, or lower in strength, to the historical mortar.** Do not use modern formulations with ordinary Portland cement. Acceptable mortar mixes vary, depending on the type of masonry used (i.e., stone or brick), and on performance expectations.
- **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.



This mock-up reveals that the cutting-out methods employed by the contractor widened the joints and damaged the brick. The mortar mix does not match the original pointing in composition, colour or profile and the mortar itself was inappropriately applied.

- **Be aware of the mortar specification.** Ideally, a sample of mortar that has been identified as original material is extracted and analyzed in a laboratory to obtain the



These bricks were repointed with a cement-based mortar. The high, compressive strength of the mortar, compared to the masonry units, has caused the bricks to spall, leading to irreparable damage.

original composition and ratio of ingredients. This process, however, may be costly and beyond the scope of small projects. In the absence of proper testing, an acceptable historical mortar mix should be used and matched as closely as possible through visual and physical comparison onsite. Type N mortar (1:1:6) is acceptable, in most instances. This mortar is one part lime (type N – normal hydrated lime), one part white cement and six parts aggregate (well-graded masonry sand). Air entrainment (agents used to help mortar resist freeze-thaw damage) can be added to the mortar, but it should ideally be within 8-10 per cent and should not exceed 12 per cent or it will reduce bond strength and porosity. No additives are permitted to the mortar – such as plasticizers or antifreeze. Cement must be white (e.g., Federal White). Aggregate should match the original mortar (i.e., grading, shape and colour, and the proportion of cement and lime). The mortar colour must match the period mortar found onsite. Colour should be obtained from the aggregate. If pigments are required to achieve a satisfactory colour match, the proportion should not exceed 5 per cent of the mix as this will weaken the mortar and cause shrinkage cracks. The mortar mix must be approved by the Trust

prior to commencement of work. Please provide details of the existing mortar and the proposed mix and mixing method.

- **Prepare the mortar correctly.** Use clean potable water. Mortar must not be mixed with an excess of water. If the mortar is used too wet, it will leave smears on the surface of the masonry and will cause shrinkage cracks, which will in turn lead to premature deterioration and loss of strength. Once the mortar is mixed, do not retemper it (i.e., add more water).
- **Always repoint in moderate weather conditions.** Never apply mortar in temperatures near or below freezing, or in hot, direct sunlight. In either case, the mortar will not attain its intended structural strength. Repointing should never be done when the temperature is below 5° C (41° F). Newly laid mortar must be protected against freezing until it is set and cured. Mortar takes a minimum of approximately 28 days to reach initial cure. The temperature must not drop below 5° C (41° F) during this period. 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. Polyethylene tarps should be used to control rapid evaporation.
- **Be aware of the various methods of pointing.** The new pointing profile must match the original. Masonry should be saturated with clean, potable water prior to application of mortar to allow for a good bond. Saturate masonry but do not proceed with pointing if the water is pooled on the surface. Wait for it to be absorbed. Pack mortar into the joints in built-up layers that do not exceed 15 mm (0.6 inches). Ensure that the mortar fills all voids and is firmly packed into the joint. Do not smear mortar on the surface of masonry or feather the joint on the edge of irregular masonry. The width of the mortar joint should remain constant. Fill the joint so that the mortar is slightly proud of the intended profile. Once the mortar has reached initial set (i.e., resists pressure from your finger), scratch back the surface of the newly pointed joints to the desired profile



These steps were repointed during the onset of cold weather. The mortar was not able to achieve its intended structural strength because of the temperature. Consequently, the mortar prematurely failed during the same winter season.

and stipple with a stiff natural-bristle brush to expose the aggregate. Do not leave a film or skin of lime on the surface (caused by dragging metal pointing tools over the damp surface of the mortar) as this will not allow the mortar to breathe, and will lead to the premature deterioration of the masonry. Newly pointed joints should be kept damp for a minimum of three days following pointing. Mist frequently and cover over with damp hessian and polythene sheeting to allow for a proper cure.

- **Protect your worksite and building.** Protect adjacent materials. Clean up dropped mortar when it dries. Do not use harsh chemicals to remove mortar stains from the surface of surrounding masonry

and/or other architectural features. Muriatic acid (i.e., hydrochloric acid) or other similar corrosive agents should never be used to clean masonry.

## Conclusion

When properly executed, repointing masonry joints conserves the historical character of a building while preserving its physical integrity. These guidelines, along with proper maintenance, should ensure that any new repointing work has a long service life.

The Trust recommends retaining a consultant and/or tradesperson with expertise in historical conservation. These professionals should be able to help identify the cause of mortar failure and to assist in the preparation of specifications for the work. Where the project is large or complex, consider the services of a conservation architect

as well to design and supervise the project. When correctly done, repointing will contribute to the architectural character and long-term preservation of your historical masonry structure.

## Additional reading

Mack, R.C. & Speweik, J.P., 1998. Repointing Mortar Joints in Historic Masonry Buildings. Preservation Brief No. 2. Washington, DC: National Park Service. Available at: [www.nps.gov/history/hps/tps/briefs/brief02.htm](http://www.nps.gov/history/hps/tps/briefs/brief02.htm).

Maurenbrecher, A.H.P. Trischuk, K. Rousseau, M.Z. and Subercaseaux, M.I., 2007. Key Considerations for Repointing Mortars for the Conservation of Older Masonry. National Research Council Canada. Available at: <http://archive.nrc-cnrc.gc.ca/obj/irc/doc/pubs/rr/rr225/rr225.pdf>.

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This new repointing work was based on historical research and site evidence. The white, raised rule profile of the joint was based on existing period mortar found elsewhere on the building and in other nearby structures of similar age. These joints are an integral part of the architectural character of this structure.