



INFORM

RESTORATION MORTARS FOR MASONRY REPAIR

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Introduction

This INFORM provides information on the use of proprietary restoration mortars for repair of stone masonry. It identifies the types of products available for carrying out such repairs; the scenarios in which their use might be appropriate; the practical considerations for their use; and the associated visual implications. The use of restoration mortars is neither a long term or 'like-for-like' repair approach for traditional buildings, but situations can arise where it provides an acceptable solution for minor masonry repairs.

What are restoration mortars?

Proprietary restoration mortars are pre-mixed mortars designed for the repair of masonry units (usually natural stone). Such products fall into the broader category of 'plastic' repairs (i.e. repairs using workable materials that can be moulded into shape, will adhere to stone, and will harden after application) but are different from the site-blended mortars used by skilled masons. Restoration mortars are convenient to use, and appear to provide an 'off the shelf' solution to stone repair issues. This approach is favoured by some contractors as it removes the need for measuring out and matching materials on site. Some products claim to be suitable for use on several stone types, doing away with the traditional, skilled practice of specifying bespoke repair mixes. There are many products on the market with different compositions and properties, but most restoration mortars fall into one of the following categories:

Resin-based restoration mortars: a mixture of aggregate grains and liquid resin that is mixed with a 'hardener' just before use. Products based on resin are typically impermeable, potentially leading to the build up of moisture at the stone/repair boundary and the subsequent deterioration of the underlying and adjacent masonry.

Cement-based restoration mortars: these typically come as a dry mixture of cement powder, aggregate, grains and pigments. Such products can be liable to shrinkage during drying and the resultant cracks can form capillary pathways, drawing moisture into the structure. Due to their low permeability, the moisture becomes trapped behind the repair and can lead to degradation of underlying masonry.

Lime-based restoration mortars: these typically consist of a dry mixture of powdered lime and aggregate grains. The type of lime used can vary, and additives may be present to impart specific characteristics (e.g. improved workability). Lime is generally a permeable material, and can assist in dealing with moisture dissipation.

Hybrid-mix restoration mortars: a blend of lime, cement, aggregates, additives, fillers and pigments. These products are designed to have good workability, high permeability and frost resistance. Different products can vary in their compatibility with natural stone, and should be carefully selected based on the technical literature provided by the manufacturer.

Due to their low permeability, resin and cement-based products (Figs 1 and 2) are not normally considered suitable for repair of stone masonry. Lime-based products (Fig. 3) are better suited to most stone repair as they typically have high vapour-permeability and durability, whilst remaining sacrificial to the stone; some hybrid-mix restoration mortars also display these characteristics (Fig. 4).

When to use restoration mortars

Before carrying out stone repair, the need for repair should be established based on the degree to which the stone has deteriorated and whether its function is affected. Where deterioration is superficial, an option of minimal intervention (brushing or dressing masonry back to a sound surface), or no intervention, should be considered.

For significant deterioration, removal of the decayed stone and replacement with new stone is often the most appropriate option. However, there are times when stone replacement may not be possible or suitable. In such cases the use of a compatible restoration mortar, or traditionally prepared lime mortar, may be a suitable repair option for localised areas.

Compatibility of materials is a priority in building repairs. Ideally, repairs should extend the lifespan of masonry by slowing the rate of deterioration. Due to the variable nature of natural stone in historic buildings, combined with the limited range of available new stone, it is not always possible to source compatible stone for replacement. Where this is the case, a restoration mortar might be used on small areas of decay.

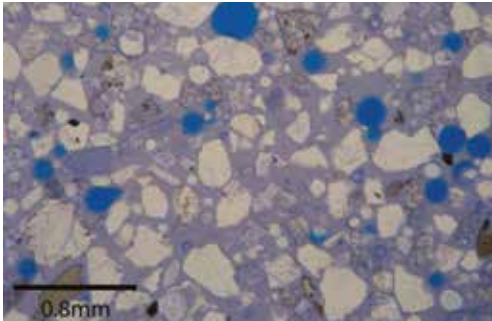


Fig.1: Resin based.

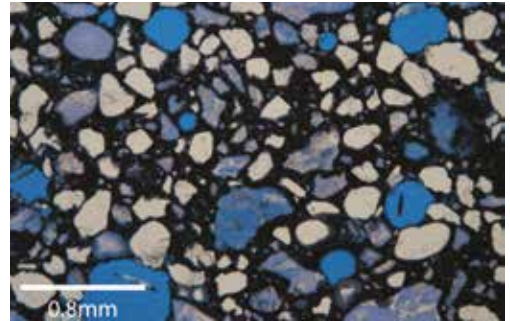


Fig.2: Cement based.

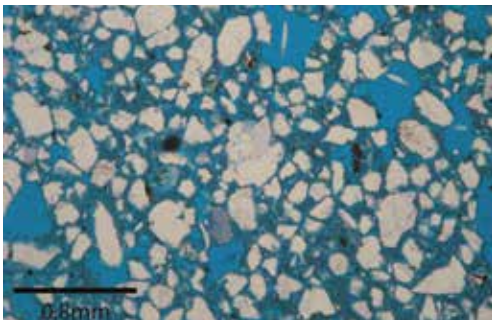


Fig.3: Lime based.

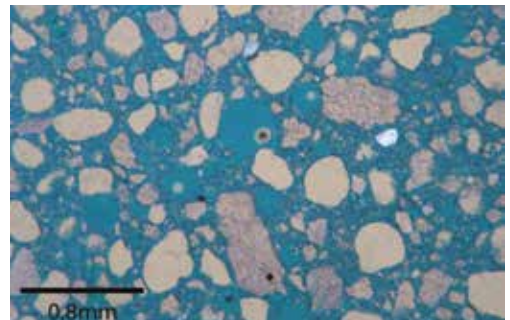


Fig.4: Hybrid mix.

Figs 1 to 4 Restoration mortars under the microscope. Blue areas indicate pore space.



Fig. 5 Over mixing or addition of excess water can create a 'foamy' texture in restoration mortars.

Repairs should be carried out in such a way as to preserve as much historic building fabric as is possible. However, where stone replacement is specified, areas of sound stone may need to be removed to provide a base for attaching the new stone. Where small areas of deterioration are affecting the way a building functions, for example on drip detailing or cills, it can sometimes be appropriate to repair these areas with a compatible mortar, rather than cutting out larger areas of original masonry to enable stone replacement.

Restoration mortar repairs are generally cheaper than stone replacement, so may be favoured on projects where there are financial constraints. However, the funds spent on temporary repairs might be better used addressing the fundamental problems causing stone deterioration (e.g. repointing joints or maintenance of gutters). Temporary repairs can end up costing more than stone replacement in the longer term.

Restoration mortars are not a 'like-for-like' repair option for listed buildings. Depending on the extent of the work, such repairs may constitute an alteration, and therefore may be subject to listed building consent. The local planning authority should be consulted in advance of carrying out such works, as they can provide



Fig. 6 Surface preparation for application of restoration mortar requires chiselling to a sound surface.

guidance, and clarify whether listed building consent is needed. Large-scale use of restoration mortars is rarely appropriate for listed buildings.

Practical considerations

Restoration mortars must be prepared and applied in accordance with manufacturers' guidelines. Materials, particularly those containing additives, can behave in different ways when subjected to different mixing and/or application methods. Deviation from guidelines can impact on the workability of the fresh material and how it performs when hardened, causing variation in properties such as permeability and durability, as well as affecting its appearance (Fig. 5).

Weak areas of stone with disaggregating grains should be removed before mortar is applied. Chiselling back to sound stone will ensure a better bonded repair (Fig. 6). Some manufacturers recommend using corrosion-resistant anchors/pins for repairs over a certain depth, however where the stability of a repair is a concern, stone replacement is usually a better option. Stone replacement will also be necessary if the existing masonry is very soft or if chiselling to a sound surface requires removal of a significant depth of stone.

Mortar repairs need to be protected from harsh weather conditions for a period of time after completion. Guidance on appropriate post-application treatments and aftercare of proprietary restoration mortars should be sought from manufacturers.

Visual implications of using restoration mortars

Restoration mortars are usually coloured to match adjacent or underlying stone. This is achieved by adding pigments, or by using aggregates of different colours. Products colour matched using pigments, often have a homogeneous appearance that contrasts poorly with natural stone (Fig. 7). Very skilled contractors can combine differently pigmented materials to mimic the variation present in natural stone (Fig. 8). Experience has shown that restoration mortars coloured with pigment can fade over time. Using UV-resistant pigments can reduce the degree of fading, although colour variation can still occur if repairs are not adequately protected as they cure.



Fig. 7 Restoration mortar colour matched to one area of masonry can be a poor match to another.

Restoration mortars can be tooled to match the adjacent or original stone (Fig. 9). This requires skill, as poorly finished repairs can be conspicuous (Fig. 10). Ideally, repairs should be allowed to stiffen before being hand-tooled to produce as close a match as possible to the original stone finish. Using metal tools immediately after application of the mortar, or overworking during application, can promote the movement of fine particles to the outer surface of the repair, resulting in a lighter or patchy appearance (Fig. 11). Overworking can also create a 'skin' on the surface that can affect moisture distribution.

Tooling to mimic weathered stone (Fig. 12) helps maintain visual integrity but can be deceptive to observers. Skilled repairs such as this tend to be time-consuming and costly. Good quality, colour-matched repairs can be difficult to identify and may be overlooked during inspections. Repairs should be documented so that affected areas can be easily identified and considered in any future repair plans.



Fig. 8 Colour matching mimicking the natural variation of stone.



Fig. 9 Tooling of repairs should match the original stonework.



Fig. 10 Surface detailing in the repair (arrowed) does not match the adjacent stone.



Fig. 11 Overworking the repair surface (highlighted by dashed lines) results in a light, patchy appearance.



Fig. 12 Skilled contractors can achieve textures close to those in natural stone.

Responsible use of restoration mortars

Restoration mortars are generally used for shallow repairs, typically no more than a centimetre or two deep. The use of other materials for base coats (faced with restoration mortar) should be avoided unless specifically recommended by the manufacturer, as incompatible materials may result in failure of the repair and accelerated deterioration of the underlying stone masonry. Where extensive deterioration means that the repairs will be deep, stone replacement is preferable to a mortar repair, as the stone can be securely fixed in place. The use of restoration mortars for high level works and in exposed conditions is best avoided as exposure to harsh conditions is likely to reduce the lifespan of the material.

Use of restoration mortars on large areas can affect how a building looks and the way it disperses moisture. Although re-facing with restoration mortars can be visually effective at



Fig. 13 The extensive use of restoration mortars for an entire building façade is not recommended.

first (Fig. 13), it results in an artificially ‘renewed’ appearance, which can often weather poorly, and may lead to degradation of the façade and the underlying masonry in the longer term. Such extensive use is not recommended.

Where repairs are carried out to adjacent masonry blocks, the existing mortar joints should be retained and repointed with a suitably specified repointing mortar. This reduces the impact of the repairs on moisture diffusion within the building. Some restoration mortars (particularly those containing cement) have insufficient flexibility to accommodate movement across masonry blocks and may crack if they bridge joints.

Where extensive repair of masonry is required across an elevation, stone replacement is normally the best option. In some cases brushing or dressing back the deteriorated stone to a sound surface may be sufficient and possibly, for rubble stonework, applying a lime harl. Rendering or harling of other types of masonry such as ashlar work is not normally appropriate.

Conclusion

Restoration mortars have a limited but useful role in masonry repair and conservation. Materials should be selected for both their technical and aesthetic qualities, and used on the basis of minimal intervention. Careful preparation and application of materials is essential, and an experienced contractor should always carry out the work.

Restoration mortars have a limited lifespan. Their use does not remove the need to identify and treat the causes of masonry deterioration, or to carry out regular building maintenance. The judicious use of restoration mortars provide a short term solution to prolong the life of small areas of deteriorated masonry, allowing retention of the wider historic fabric, with the acknowledgment that stone replacement may eventually be required.

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Further Reading

English Heritage. *Practical Building Conservation: Stone*. London: Ashgate, 2012.

English Heritage. *Practical Building Conservation: Mortars, Renders & Plasters*. London: Ashgate, 2011.

Historic Scotland. *Inform: The Use of Lime and Cement in Traditional Buildings*. Edinburgh: Historic Scotland, 2007.

Historic Scotland. *Short Guide 6: Lime Mortars in Traditional Buildings*. Edinburgh: Historic Scotland, 2014.

Historic Scotland. *TAN 1: Preparation and Use of Lime Mortars*. Edinburgh: Historic Scotland, 2005.

Historic Environment Scotland's INFORM Guide and Short Guide series contain further information on the conservation and maintenance of traditional buildings. These publications are free and available from our technical conservation website, address above. Alternatively, you can contact us on technicaleducation@hes.scot for these or any other publication enquiries.

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