INFORM

INFORMATION FOR HISTORIC BUILDING OWNERS

Flat Plastering in Traditional Buildings

HISTORIC ENVIRONMENT SCOTLAND | ÀRAINNEACHD EACHDRAIDHEIL ALBA

Introduction

Plaster has a long history of use as a finishing material for internal walls in Scotland. Traditional plasterwork is usually either earth or lime based. The two main methods of using lime plaster as an internal finish are either to apply it directly onto masonry, commonly referred to as plaster on the hard, or onto a backing of timber laths.

This INFORM provides information on the material make-up and preparation methods of lime plaster, as well as how to apply it. It also considers how to repair plaster, including re-plastering and patch repairs works.

Materials for traditional plasterwork

Lime

The main component of the majority of plaster in traditional buildings is lime. Traditionally, most lime used for internal plastering would have been non-hydraulic or fat lime. This was formed by burning limestone in a kiln to drive off its carbon dioxide and water content to leave a white powder known as *quicklime*. This was then *slaked* (immersed in water) to produce lime putty (Fig. 1) and left in a pit or tank to mature for around three months before use.

Today lime for plastering mainly comes in the form of bagged hydrated lime. Best practice would still be to mature this in water for around three months prior to use in order to bring about the benefits of traditionally

Fig. 1 *Quick lime being slaked using traditional methods.*

Fig. 2 *Matured lime putty for use in traditional plastering can be bought from suppliers.*

slaked and matured putty (Fig. 2). Matured lime for plastering can also be bought from specialist suppliers of lime and traditional building materials. It is important to note the difference between *hydrated lime*, lime which sets in the air, and *hydraulic lime* which sets in the presence of moisture and would rarely be used for plastering traditional buildings.

Gypsum

Another material found in traditional plastering is gypsum (calcium sulphate,

or Plaster of Paris) which became popular from the late 18th century. Like lime, it is burnt to form a powder which when immersed in water creates a gypsum putty. However, this creates a putty which is harder and sets more rapidly than lime putty. Most available modern plasters are gypsum based. Lime and gypsum are, however, materials with different properties and where repairs are being carried out to traditional flat lime plasterwork the use of gypsum is likely to be inappropriate. Lime plasters were sometimes gauged with gypsum, where a small amount of gypsum was added to the mix, and where this is found to be the case its addition may be appropriate in repair work although this should not be carried out simply as a matter of course. Material used for the repair of flat plaster work should match that found used originally on a "like for like" basis.

Aggregates

To form lime plaster, lime putty is mixed with sand aggregate, to form either *coarse stuff* or *fine stuff*, coarse stuff being formed of aggregate with a larger grain size than fine stuff. Where possible repairs should be like for like, ideally analysing the original plaster to provide information on the type and grading of aggregate, binder to aggregate ratios, the presence of gypsum gauging and other additions. Sand for plastering should match that used in original work. Generally sand with a grain size of 1-6mm would have been used for the first coat, 1-3mm grain size for the second and 0.5-1.5mm for the finishing coat. Sand used in plaster mixes should be sharp, well graded (having a good mixture of grain sizes) and should be well washed to remove contaminants. In some cases lime plaster, especially the first coat, often contained hair as a reinforcement material. Where this is being added it should always be broken up and well distributed throughout a plaster mix. Hair reinforcement should never be added to a mix prior to maturing, as this will degrade over time and will be unable to provide the strength required.

The decay of plasterwork

The main cause of decay in plasterwork is water ingress which can be caused by defective roofs or plumbing and excess internal moisture (Fig. 3). Water penetration into plasterwork will cause staining and ultimately will lead to the plaster becoming

Fig. 3 *Water ingress and excess moisture is the most common cause of damage and decay to plasterwork.*

detached from its background and collapsing. Where water ingress is the cause of the deterioration of plasterwork the building defect which has led to the problem should be rectified before any repair work takes place. The decay of plasterwork can also be caused by problems with the background to which it is applied such as timber decay in laths or structural movement within masonry. Vibration can also cause mechanical damage to plasterwork. Where these causes are present the fault leading to problems within the plasterwork should be rectified before the plaster itself is repaired.

Re-plastering work

Wherever possible, repair work should be like for like in material properties and methods as these are likely to provide a repair which is durable and compatible with surviving original work. Most traditional plasterwork was applied in three coats. In some cases where masonry was plastered directly on the hard, without laths, only two or even a single coat may have been used. This was dictated by the standard of finishing required. In repair work the number and thickness of coats used should match that used originally. When plastering, each coat of plaster should be allowed to dry until firm to the touch but not completely dried prior to the next coat being applied. This will normally take between 1 to 3 weeks depending on temperature and humidity.

Scratch coat

The first coat of plaster is known as the scratch or base coat (Fig. 4). The mix for a scratch coat is usually one part of lime putty to between 1 to 3 of coarse, well graded sharp sand although this can vary depending on the properties of the sand and lime being used. The scratch coat will often have hair added to the mix to give added strength. Masonry or lath backgrounds should be

Fig. 4 *Scratch coat of plaster applied on the hard directly to a rubble masonry wall. (Photo credit: Eden Hot Lime Mortars)*

dampened down prior to application. A scratch coat will normally be around 9-10mm thick. Whilst still wet the plaster should be scratched using a lath scratcher or other wood toothed tool in diagonal lines to form a diamond pattern.

Floating coat

The second coat of plaster is referred to as the floating or straightening coat. The mix is again likely to be 1 parts of lime putty to 2-3 of coarse, well graded sharp sand. A thickness of around 9-10mm is again used. A long floating rule or straight edge is used to obtain a flat level surface on the plaster whilst still wet. When the floating coat has begun to harden it is dampened and rubbed or "scoured" with a wooden float to reduce the likelihood of shrinkage and produce an open grained finish to help the top coat adhere.

Finishing coat

The final coat is the finishing or top coat. It is generally thinner than the scratch and floating coats, between 2-5mm and uses a finer aggregate. The mix can vary depending on the finish required. More lime will give a softer finish but one which can be polished to a smoother surface. More sand will give a harder finish. Often a simple one part lime to one part sand ratio will be employed. The finishing coat can be applied in two or three thin layers in some instances to help achieve a very fine surface finish. The floating coat is always lightly dampened before application of the finishing coat to reduce the suction of moisture from one to the other. Once the finishing coat is applied a float is used to scour the surface to give a smooth finish. This final coat of plaster can be worked in a number of ways to achieve a desired finish. A trowel can be used to give a fine closed finish to the plaster. Wooden or sponge floats will give a more open and textured finish.

Plaster on the hard

When repairing lime plaster which is applied directly to masonry all existing, loose materials such as old plaster or paint should be cleared away. Masonry joints should be raked out only enough to give a key for plaster to adhere to the wall. Masonry should always be dampened prior to application of plaster to avoid too rapid drying which can lead to cracks in plaster. Where a masonry surface is uneven "dubbing out" may be required. This involves indentations in the wall being filled with plaster of the same composition as the scratch coat to give a more even surface.

Where plaster is being applied to laths (Figs. 5 and 6) it should be applied diagonally across the laths with sufficient pressure to force it through the gaps allowing the hardened plaster behind to form a "plug" or "rivet" to anchor the plasterwork. There is no reason why new plaster cannot be applied to existing laths as long as these are in good condition, free of old plaster and other debris and are dampened before new plaster is applied.

Fig. 5 *Replacement timber laths ready for application of base coat.*

Fig. 6 *Plaster applied to laths in large scale repair.*

Patch repair of flat plasterwork

Where small areas of plasterwork have failed or cracks have developed it is possible to carry out patch repairs. The first stage in any repair strategy is to identify the cause of failure and rectify this prior to any work to plaster taking place.

It is important when considering repairs to plasterwork to remember hairline cracks can open and close through the seasons with changes in moisture levels and temperature. This type of crack is common in old buildings and does not necessarily require repair. Larger cracks or missing sections of plaster should be checked for any associated structural faults. If a large crack has existed unchanged for many years, it is probably stable and repairable. Quick-setting finish plaster or proprietary modern fillers should be avoided, as they will differ from the surrounding plaster in strength and density and therefore may cause further damage. If only a patch repair is being carried out, where the new work meets the original plaster this should be dampened down to avoid moisture being sucked from the new work into the old. Repairs should also be carried out using the same number and thicknesses of coats as the original work. (Figs. 7, 8 and 9).

Fig. 7 *Loose plaster removed from cracked section of plasterwork - note no requirement to strip out the entire wall lining, patch repair is both achievable and economic.*

Fig. 8 *First coat of coarse plaster used in a patch repair.*

*(**Figs. 7, 8 and 9** Photo credit: Darren McLean)*

Fig. 9 *Finishing coat applied to patch repairs ready for decoration when the plaster has set.*

Conclusion

This guide considers the materials and methods used in traditional flat plastering and its repair. If executed correctly, plaster can be repaired economically and in a way which will last long into the future. There is much about plastering which has not been described here and every building will be slightly different in terms of materials used, number and thickness of coats etc. More information can be found in the sources listed below.

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Further reading

Historic Scotland. *Short Guide 6: The Use of Lime Mortar in Traditional Buildings.* Edinburgh: Historic Scotland, 2014.

Historic Scotland. *Technical Advice Note 2: Conservation of Plasterwork.* Edinburgh: Historic Scotland, 2002.

Millar W. & Bankart G. *Plastering Plain and Decorative (4th Ed.).* London: Donhead Publishing, 2009.

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

Building Conservation Directory. Available online at http:/www.buildingconservation.com/articles/articles.htm#plasterwork

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 avail-able 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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