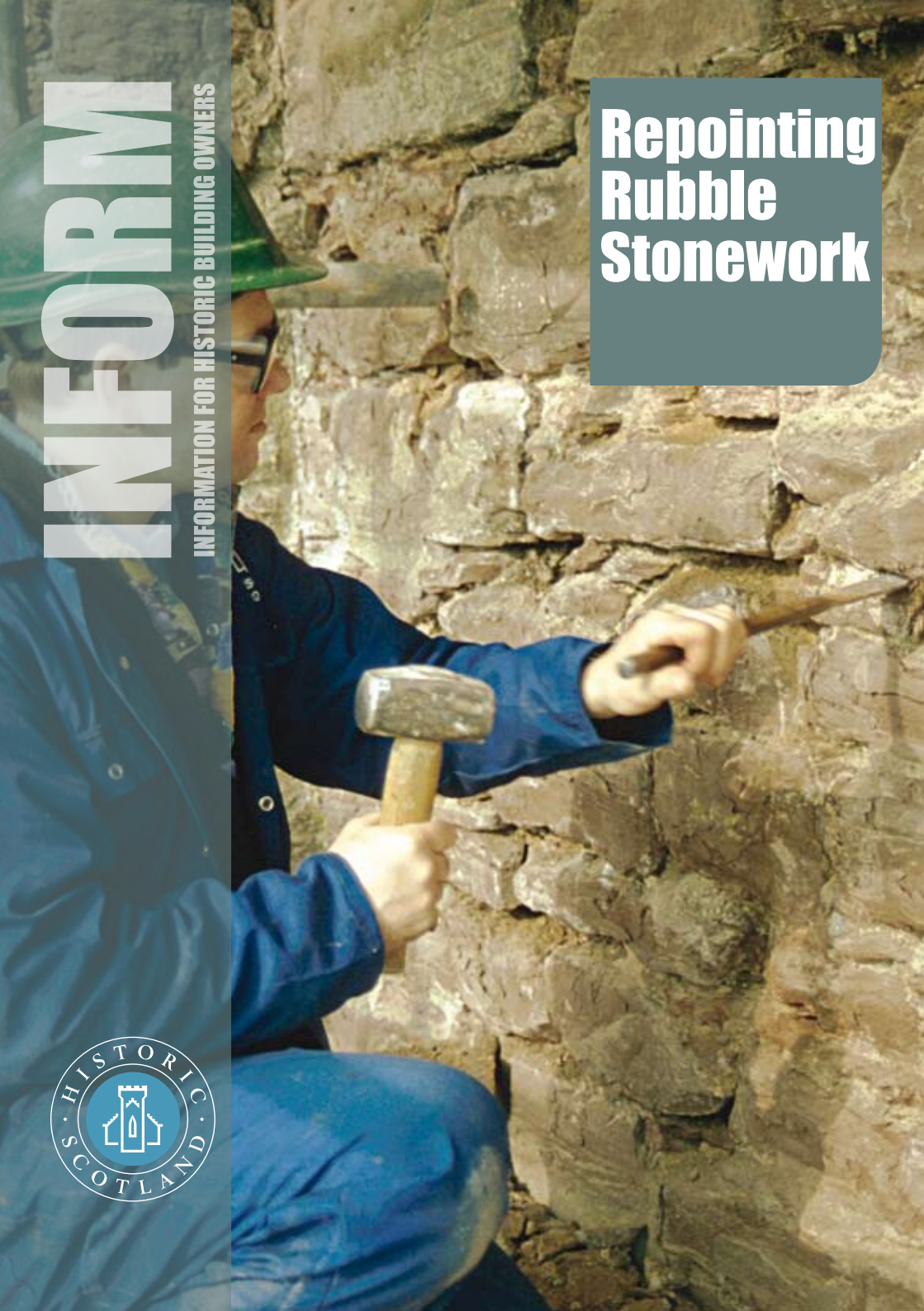
INFORM

INFORMATION FOR HISTORIC BUILDING OWNERS

Repointing Rubble Stonework



HISTORIC SCOTLAND

In traditionally built rubble stone walling it should be expected that the mortar that was used in its original construction will deteriorate over time and a need for repointing will eventually occur. If the wall was correctly built in the first place this is only liable to be required some time after the first 100 years. If repointed properly a further century of life can readily be expected from the wall without much additional maintenance. Over the last few decades the processes involved in doing this work effectively have not been fully understood. As a result, much superficial and inappropriate work has been carried out that will not last as long and will soon have to be redone. This INFORM aims to guide building owners through the steps that are required for contractors to carry out repointing work properly.

The need for pinning stones

When traditional rubble stone masonry walls were originally constructed it was common practice to use a variety of small stones, called pinnings, to make the larger stones secure in the wall. Both the large and small stones were bedded, or set, in lime mortar (although, occasionally, clay was used as a mortar). Throughout the country a variety of materials were used in constructing walls, and to make them as structurally sound and weather-tight as possible. This gave rubble walls distinctively varied appearances across the country depending upon what local practices and materials were used.

Depending upon the region, the lime mortar finish around the stones could be flush or slightly recessed so that all of the stone faces could be obviously seen. Elsewhere the mortar can be found to be progressively smeared over the faces of the rough stones until the final finish almost emerges as a full lime render. In other areas additional lines of small stones were pushed into the wet mortar or joint lines were drawn onto the wall face before it set to give the impression of squared stonework.

Irrespective of the finish, the underlying rubble stones were generally originally built so that the stones and smaller pinnings touched each other. In that way the structural load of the wall could be satisfactorily carried to its foundation whilst the mortar still had to set. This building process is an important point to bear in mind when carrying out repointing work because, if it is ignored, the visual appearance of the wall can be significantly altered.

When repointing is required

Repointing will be necessary when the bedding or jointing mortar becomes washed out from the wall and the stones start to become loose and risk falling out of place. If left unattended to rainwater can readily penetrate the heart of the wall and encourage further deterioration. If this is not repaired the wall can ultimately collapse.

In recent times cement mortars have been commonly used for repointing work but this is not recommended as it can also damage the stonework and interior finishes through keeping water trapped inside the wall. Lime based mortars are much more appropriate and effective for masonry repointing work as they let the walls breathe.

The successful use of lime mortars depends to a great degree on good site practice.

Provision should be made at an early stage for appropriate scaffolding to be built so that the work can progress in an appropriate manner. Before work starts it is always advisable to take some detailed photographs of the area to be repointed. This will give a visual reference of what the wall looked like before any changes are made to it, and the photographs can be regularly used to check the quality of the work against the original appearance as it progresses.

Site preparation

Lime mortar repointing work should not be carried out during periods of heavy rainfall or in frosty conditions. Adequate protection will need to be considered and this could require a fully protected scaffold. It is also necessary to ensure that appropriate access, mortar mixing areas, site protection, the correct equipment and all health and safety requirements are in place at all times.

Raking out

To provide a sound base for the replacement mortar it is necessary to remove any decayed mortar from the face of the wall and from around the stones. If, at some time in the building's past cement mortars have been used to patch the wall it may be necessary to use a hammer and chisel to carefully break away the cement and re-expose the underlying lime mortar. This needs to be done with care to avoid damaging the edges of the underlying stones. Otherwise, raking out should be done with a variety of thin metal tools which can easily penetrate between the stones to remove the loose or deteriorated old mortar.

The aim of this approach is to reach the position where sound mortar remains in the depth of the wall. In the process it is inevitable that some of the small pinning stones will become displaced and fall out of the wall. Occasionally some of the larger stones might also become displaced, especially if the wall is in a poor state before work starts. Any displaced stones should be carefully set aside for re-use in their original position when the repointing work takes place.

To ensure all of the loose and decayed mortar is removed the raked out areas should be carefully flushed out with water, taking care to also flush the loose debris down the entire wall face rather than let it accumulate on the faces of lower stonework. The resulting depth of the space into which new mortar needs to be placed should be in the region of two to three times the width of the original joint. Anything less will not give the new mortar sufficient space to set and perform appropriately. In the raking out process, power tools should not be used as they can be difficult to control and can badly damage or mark the remaining stonework. During the raking out work it is also important to ensure that all vegetation and any penetrating roots are completely removed from the wall structure. This is necessary to avoid the risk of future damage to the repointed work should the growth re-establish itself.

In some cases it may be necessary to dismantle a particularly loose section of wall so that it can be rebuilt during the repointing work. Where this is required it is appropriate to paint a square grid onto the face of the stones before dismantling work starts. Using water-soluble emulsion paint, the loose stonework should be marked with a square grid and this area should be specifically photographed for future reference before work starts. Dismantling should occur so that the stones are carefully laid out beside each other in the manner by which they were taken apart from the wall. That way, using the painted grid lines and pre-work photographs as a reference, they can be readily identified when the time comes to rebuild them back into the original position - carefully removing the painted grid after rebuilding.

Preparation of mortar

In preparing the repointing mortar it is important to "batch" the volume of the lime and sand materials accurately so that successive mixes can follow the same proportions. It is also necessary to understand the behaviour of lime mortar and how it sets to use it appropriately. In gaining this understanding it is important to recognise that regional variations in the mortar mix can exist and that these should be copied so that the appearance of the finished work matches the original. To do this properly it may be necessary to obtain some specialist support to analyse what the original mix consisted of to ensure that the replacement material will look right and perform equally well.

Tamping

The process of repointing starts with the need to push new mortar back into the heart, or core, of the wall in a process called tamping. Using appropriate tools the mortar should be pressed well into the spaces created by raking out so that it comes into direct contact with the original mortar thereby eliminating any voids. The mortar mix used for tamping should be the same as that used for the final repointing.

Pointing

During this process it is important to replace any missing pinnings or loose stones back into their original position and to ensure that all the replaced stones make physical contact once more. In doing so, this gives the wall back its full structural strength and original appearance. Any missing pinning stones will generally be revealed by the remaining wide joints, and these should also be replaced as work proceeds. To ensure that the pinnings

are correctly positioned in the wall the mason will probably have to drive them into the spaces between the large stones using the wooden shaft of the hammer. This is preferable to using the metal hammer head as there is a real risk that the metal could shatter the small stones and render them useless.

As work progresses care also needs to be exercised to finish off the appearance of the wall in such a way as to match the original. The surface finish and texture of the lime mortar is also important to the final appearance. When the mortar has started to set, dabbing the surface with a wet sponge, or gentle stroking with a bristle brush, can be effective in avoiding an overly smooth finish. Reference to the pre-work photographs can assist in creating the right appearance, the final joint size and finish on the rough stonework. This can be difficult to control as sometimes only a few extra millimetres of mortar thickness can lead to the creation of a wider surface finish as the mortar smears on to the face of the rough rubble stonework so particular care is required at this stage of the work to get the finish right.

Lost pinning stones

The appearance of the wall can be dramatically altered if pinning stones are missed out during the tamping stage of the work. This can often happen as recent repointing practices have tended to ignore the "time consuming" effort that is required to replace the small stones. Consequently, the volume of stone that was originally used in the wall is much reduced, only to be replaced by a similar volume of mortar.

This can give the false impression that only large stones were used to build the wall in the first place, and that they were surrounded by wide mortar joints. This approach not only creates the wrong appearance but it is also a false economy. Because of the increased amount of mortar that has to be used and will be exposed to the weather, there is a greater risk that it will decay faster and the expected life of the repointed work will be much reduced.

Weather conditions

As noted , tamping and repointing work should not be carried out in extreme weather conditions, and particular care needs to be exercised if work is being carried out when there is a risk of frost. In such cases, some form of insulation should to be provided to protect the wall face that has been worked on. Usually this is provided by hessian sheets. Equally, care needs to be exercised during repointing works when heavy rain is expected. This is to avoid the fresh mortar from being washed out of the wall face and appropriate protection may need to be put in place to prevent that from happening. In extremely hot weather intermittent gentle spaying with clean water, or covering the work with dampened hessian, will help prevent too rapid drying.

Performance

Many lime mortared original rubble walls have stood in good condition for over a hundred years and in numerous cases for much longer, whilst only requiring minimal maintenance. By recognising how these walls have performed in the past, and understanding the original techniques that were used in building them, appropriate repointing work should ensure their continued survival for another century or more.

Useful contacts

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Further reading

TAN 1 *Preparation and Use of Lime Mortars*
Historic Scotland, Reprint 2005,
ISBN 1 903570 42 5
Mortars in Historic Buildings – Literature Review
Historic Scotland, 2003, ISBN 1 903570 82 4
The Repair of Historic Buildings in Scotland
Historic Scotland, 1995, ISBN 0 9517989 2 8
The Conservation of Architectural Ancient Monuments in Scotland – Guidance on Principles
Historic Scotland, 2001, ISBN 1 903570 32 8

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