

Caring for the **Built Environment**

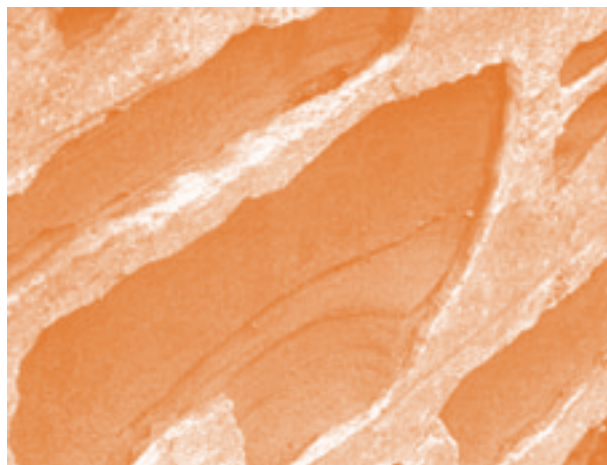


Traditional Lime Mortar

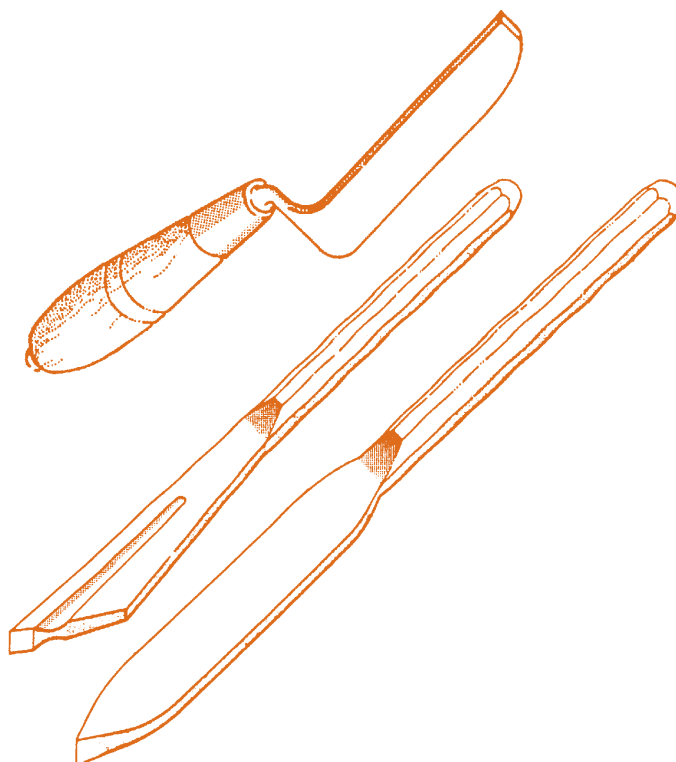
This leaflet is one of a group of leaflets which provide advice on materials and techniques relevant to the repair and conservation of traditional buildings. It provides advice on the make up and nature of lime mortars. Please refer also to the leaflet on the re-pointing of traditional buildings that deals with the techniques of re-pointing using lime mortar.

Only recently have we begun to realise that harder impervious cement mortars are not appropriate for older traditionally constructed buildings and can cause considerable damage. In contrast to lime mortar, cement mortar tries to act like a glue, does not flex or move with the building and prevents the evaporation of moisture from the joint. Because it is hard and brittle it cracks allowing water into the structure which then seeps to the interior. Cement mortar speeds stone decay by forcing water into the stone.

Traditional mortars were based on lime and have been in use for thousands of years. They have stood the test of time by being weaker than the surrounding stones yet being able to support the weight of the wall. Mortar is not the "glue" holding building stones together but is a bed to keep the stones apart. It has to move with the building. It must allow water to evaporate through the joints. This leaflet sets out to encourage the use of traditional lime mortar for all conservation work. We need to relearn the skills of previous generations. The use of lime requires a little more preparation and thought than cement mortar. If you are unsure about any aspect of the work then please seek appropriate specialist advice, which this introductory leaflet cannot give.



Erosion of Sandstone caused by hard cement mortar pointing.





Traditional lime mortar can be either Non-Hydraulic or Hydraulic:

Non-Hydraulic lime

This is made by burning limestone or other sources of calcium carbonate such as shells and slaking the resulting quick or lump-lime in water. The lime putty this makes can be stored for long periods, under water, in the absence of air. Lime putty is the basis of traditional mortars. It is used for very fine ashlar joints. It is also used for the manufacture of lime wash, seen in many parts of the area, especially along the Solway coast and in the west.

Traditional non-hydraulic lime putty can be bought in ready for use from specialist producers. Lime putty should normally be left to age for several weeks before being “knocked up” with the aggregate to form the coarse stuff.

Even when mixed, if stored with the air excluded, it will keep in good condition yet will continue to improve in workability. Well made lime mortar will cling to an inverted trowel.

Non-hydraulic lime mortar does not “set” as does cement. Crushed shells, brick dust, volcanic dust and ash, etc. were sometimes added to give a set. Such lime mortar hardens over time by absorbing CO₂ from the atmosphere, a process known as carbonation. Do not add cement powder to achieve a set in non-hydraulic lime mortars, or use bagged builders’ lime. The addition of cement can make the mortar impervious and too hard while the properties of bagged lime are not consistent and inferior.



Non-Hydraulic lime mortar should be used internally, for plastering or where exposure is not a problem.

Hydraulic Lime

This comes from limestone that has natural impurities of clay and other minerals and will achieve a chemical set even in the presence of moisture. It must be stored dry and used within a short period after mixing.

Hydraulic lime can be bought in ready for use from specialist producers either as a dry hydrate or ready mixed with dry aggregate. (See below.) It should not be confused with bagged lime from builders’ merchants which is usually hydrated non-hydraulic lime.

The grade of lime used depends on the type of stone, its position and the degree of exposure. The three principal grades or setting qualities of hydraulic lime are; feebly hydraulic, giving a weak set and relying mainly on carbonation; moderately hydraulic and eminently hydraulic giving the fastest and most durable set. (These are referred to as NHL2, NHL3.5 AND NHL5 respectively in European and British Standards for specification).

For most general pointing, repair and building conservation work moderately hydraulic lime is likely to be appropriate. It should be mixed, as required, to a light buttery consistency with the minimum amount of water. Hydraulic lime mortar should be used soon after being knocked-up with the aggregate.

Mix moderately hydraulic lime mortar in the following proportions unless circumstances dictate otherwise:



*Moderately Hydraulic Lime : Sand. - 1:3
The mix ratio of 1:3 may need to be adjusted
for the particular needs of the job.*

*If a quicker set is required or where exposure
might be a problem or where a higher strength
mortar is needed then use:*

*Eminently Hydraulic Lime : Non Hydraulic
Lime : Sand. - 1:1:5*

*(Note: eminently hydraulic limes may cause
problems if used with the red Dumfriesshire
sandstones.)*

**DO NOT MAKE THE MORTAR DENSER
THAN THE SURROUNDING STONE.**

***Because local conditions result in higher
exposure to wet weather it is
recommended that hydraulic lime is used
in external, exposed conservation work in
Dumfries and Galloway.***

Aggregates

The choice of aggregates, like the choice of lime, will depend on the job to be done and the existing mortar being matched. Bedding mortar, mortar for pointing rubble wall construction and mortar for pointing fine ashlar will all have different characteristics and will need to be made up to suit the purpose.

Choose aggregates to provide a match for the old mortar within the structure. The colour and size of the sand particles determine the appearance of the mortar. Artificial colouring



Well made lime mortar will cling to an inverted trowel.

in an attempt to tone down new work should be avoided. New mortar discolours naturally over a short period. Matching should be with the mortar as found at depth in the old work and not the weathered and discoloured surface mortar.

Only clean sharp sand should be used. Select aggregates from other sources such as crushed shells if necessary after careful examination of the original mortar. Builders' sand also known as soft sand should be avoided as this will generally not provide the necessary strength and workability.

***Use washed sharp gritty sand carefully
selected to provide the colour and texture
of the existing older mortar.***

***Do not use colours or pigments to tone
down mortar.***

Water

Only enough water should be added to provide a workable mix. Too much causes shrinkage and cracking on drying. Knocking-up a ready mixed non-hydraulic lime mortar will not normally require any additional water. Mixing/knocking-up should preferably be done using roller pan or paddle mixers.

The mortar should be sticky but not wet and will cling to an inverted trowel.

***Knock up the coarse stuff using the
minimum amount of water to obtain a
workable buttery textured mortar.***

Working practices and aftercare

Non-hydraulic lime must be stored with air excluded and will improve with age. Hydraulic lime mortar will begin to "set" once water is added and therefore needs to be used soon after preparation.

All new work should be protected from adverse weather conditions. Non-hydraulic lime mortars will be susceptible to rain washing and frost damage for several weeks. Do not work when temperatures are expected



to fall below 5° Centigrade within 72 hours of undertaking the work.

The mortar must not dry out too quickly. In hot, dry weather the work should be dampened down occasionally with a fine water mist and covered with damp hessian.

Ensure good working practices consistent with the materials being used.

In The History of Galloway (pub. 1841) is the following account of shell burning in Wigtownshire:

A Large Description of Galloway
by Rev A Symson (1625-1712)

“On the bank of this park, that lyes opposit to the sea, if there be in the winter time any high tides and storms from the south-east, the sea casts in innumerable and incredible quantities of cockle-shells, which the whole shire makes use of for lime, and it is the only lime which this countrey affords. the way of making it is thus: upon an even area, (the circumference they make less or more, according to the quantity of shells they intend to burne,) they set erected piets, upon which they put a layer of shells, a foot thick or more, and upon them again lay piets, though not erected as at first, and then another layer of shells, and so, stratum super stratum, till they bring it to a head like a pyramid;”

Symson then describes the form of the kiln with a hollow central chimney and the firing process lasting around 24 hours followed by slaking in situ;

“...and then with an iron spade they beat it down by degrees, and sprinkling water thereon, with a beater they beat it (or berry it ...) then put it so beaten into little heaps, which they press together with the broad side of their spade, after which, in a short time, it will dissolve (they call it melting) into a small white powder, and it is excellent lime. I have heard good masons say. that, as it is whiter, so also it binds stones together surer and better than stone lime itself.”

The Scottish Lime Centre Trust offers training, practical experience and specialist advice in the use of lime-based materials. Contact at: The Schoolhouse, Rocks Road, Charlestown, Fife, KY11 3EN (Tel. 01383 872722).

A valuable source of advice and information is the Technical Advice Note 1, **Preparation and Use of Lime Mortars**, published by Historic Scotland, 1995.

Other references include:

The Repair of Historic Buildings in Scotland, Historic Scotland, 1995

The Care and Conservation of Georgian Houses, Edinburgh New Town Trust 3rd Ed. 1986

Practical Building Conservation John & Nicola Ashurst, Gower Technical Press 1988.

Lime products can be obtained from the following suppliers:

The Scottish Lime Centre Trust
(see above)

Leonard Grandison & Son, Innerleithen Rd, Peebles EH45 8BA
Tel: 01721 720212

Masons Mortars, 77 Salamander Street, Leith, Edinburgh, EH6 7JZ
Tel: 0131 555 0503

Telling Lime Products Ltd, Primrose Avenue, Fordhouses, Wolverhampton, WV10 8AW
Tel: 01902 789777

NHL Products
St Astia Hydraulic Limes,
The Lime Line – 0800 7839014

Somerset Stonework Ltd, Tout Quarry, Chessels Lane, Charlton Adam, Somerset, TA11 7AN