First Published in Great Britain 1994

Black Dog Press

ISBN 0 9524341 2 1

Revised 3rd edition 1997, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008

(ISBN 0 9524341 0 5 1st edition 1994)

(ISBN 0 9524341 1 3 Revised 2nd edition 1995)

British library cataloging in publication data.

A catalogue record for this book is available from the British Library

Introduction

This booklet is aimed at people who want to know how to use lime, whether they are homeowners, builders, or even architects or surveyors working with old buildings. It is primarily a practical guide intended to give enough information for basic building and decorating work using non-hydraulic lime to be carried out by anyone, with or without previous experience.

All the information contained here has been based on personal experience, trial and error and also on the kind of questions I am most commonly asked by people using this unfamiliar material for the first time.

There is little mystery involved : a grasp of the basic principles combined with common sense and perseverance is all that is required. After using lime, most people realise just what a marvellous and invaluable material it is, become converts to 'the cause' and start to encourage others to try it for themselves.

This booklet is intended to make it easier.

TRADITIONAL BUILDINGS

Virtually all old buildings were constructed using lime. It was used in conjunction with many materials according to regional differences. Brick, stone, earth and timber-framed buildings all relied on lime as a vital ingredient in mortar, render, plaster and decoration before the widespread use of cement and gypsum became more common from the mid 19th century onwards. Lime was slower to build with and required skill and patience from the builder, but produced durable, attractive and healthy results. Damp was allowed to evaporate away harmlessly, and the 'soft but tough' materials worked in harmony with seasonal changes in humidity and temperature.

Cement and gypsum made it possible to build much faster and the demand for mass housing meant that the whole technology of building changed as the materials became readily available. Cement and gypsum set very hard and are impervious to damp. However, their success relies upon rigidity, and once movement occurs they are likely to crack. Any moisture finding itself drawn in through even tiny cracks will be trapped, unable to evaporate, and may cause problems. This is most likely to happen where hard and brittle modern materials are applied to a building whose underlying structure is of the softer, more flexible lime construction. Mixing these two entirely different building technologies almost invariably leads to problems sooner or later.

MODERN MATERIALS

Cement, gypsum plaster and plastic paints are universally available and there are very few old buildings which have not had some modern materials applied to them - likewise there are very few old buildings without some problems in the form of damp, peeling paint, crumbling plaster or flaking render. Repairing lime-based buildings with lime-based materials can often solve many of these problems, and will invariably prevent more from developing. Sometimes simply removing impervious plastic paint and replacing it with limewash can alleviate problem damp and condensation providing the original lime plaster is in reasonable condition.

Introduction

ENVIRONMENT AND HEALTH

Apart from the fact that most standard new materials are unsuitable for using on old buildings, there are other very valid reasons that traditional materials should be considered, even for use in new buildings. Cement, gypsum and plastics (and the stronger of the hydraulic limes) are generally 'one way' materials. Once used they cannot be converted back into their basic raw ingredients, and many are not readily biodegradable. Cement, although it is processed in a similar way to lime, produces carbon dioxide during its manufacture, but does not reabsorb it when setting, thus contributing to the problem of greenhouse gases

A building made of timber, earth and lime has caused less pollution to build and will eventually degrade in an environmentally less damaging way. Stone, timber and earth are also reusable, as is old lime mortar rubble which can become an ingredient in a new mix. Non-hydraulic lime in a building eventually reverts to the same chemical as when it was quarried, though obviously in a different location. In the long term, the elements of a traditional building can reproduce themselves. Emulsion, vinyl, gloss and other paints are plastics, produced from petrochemicals of which there is a finite amount. Most masonry paints are plastic- or cement-based.

In addition to the degree of pollution generated by their manufacture, many people find themselves increasingly affected by the vapours given off by modern paints as they dry and even by the low levels which continue afterwards. Sick building syndrome has been recognised as the result of modern materials in combination with poor ventilation, and can actually damage the health and performance of people living and working in them. Limewash has been used for generations and has been appreciated for its hygienic and mildly antiseptic properties. Lime plasters, washes etc. usually prevent both condensation and mould problems and an overdry atmosphere. Their use is ideal both inside and outside old buildings and can improve the living environment considerably.

THE FUTURE

Although there are many large buildings constructed with lime (cathedrals, stately homes) it does have its limitations today in some areas - e.g. highrise blocks of flats or offices. But the majority of buildings going up these days are no more than two or three storeys, where the only drawback in using lime would be the time taken. The actual cost of materials could well be considerably cheaper. However, speed is not always the main consideration, for instance in self-build schemes or D.I.Y. projects. In fact lime products can often be easier for the amateur to use, provided certain basic rules are followed. Modern materials can sometimes be too fast for comfort - going off rock hard before the desired finish has been achieved. Working with lime can provide time for adjustment, alterations and even changes of mind!

Buildings constructed with traditional materials last a very long time with regular, sensible maintenance. There are thousands of such buildings to prove this. Modern houses are not usually built to last, and although they may need less regular maintenance initially, are actually much harder to repair once failures develop. Whilst there will always be a demand for large and exciting structures necessarily made with steel, concrete and plastics, is it the appropriate way to put together the bulk of our housing stock? Traditional materials age and mellow far more attractively than cement and plastic which merely become tatty.

Types of Lime

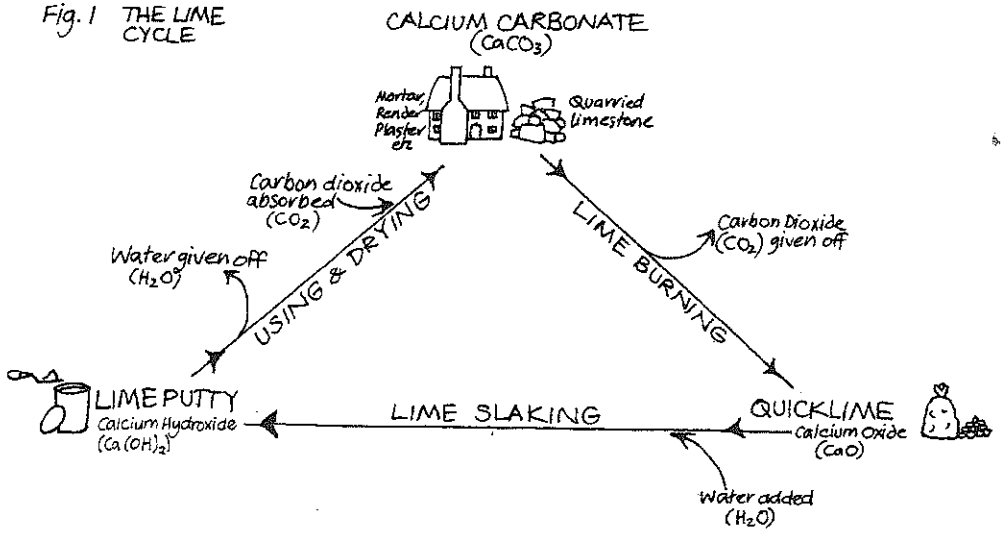
LIME PRODUCTION

Non-hydraulic lime is produced by burning limestone (Calcium Carbonate $CaCO_3$) during which process Carbon Dioxide (CO_2) is driven off. The resulting 'super-dry' material is quicklime (Calcium Oxide CaO). When mixed with water (H_2O), this reacts violently and boils. This is called slaking. The resulting slurry is lime putty (Calcium Hydroxide $Ca(OH)_2$) which is stored in a moist state until used. The longer the lime putty is stored, the better it will be as any unslaked particles will eventually slake themselves during storage. When exposed to the air it makes its set (technically, carbonating) by re-absorbing the carbon dioxide present, and becomes calcium carbonate again. The lime processes effectively transfer lime from rock to building in a neat cycle (fig.I).

This *non-hydraulic* lime is so called because it requires exposure to air to carbonate, and will not set under water. This is the most permeable of all the building limes, and the most appropriate lime to use in the conservation of old buildings where maximum permeability is required.

Small scale lime slaking is quite feasible (see Materials) but for the majority of jobs (and especially for novice lime users) commercially produced putty lime is the best material, particularly if it can be bought in advance and stored for a few months before use.

Fig. I THE LIME CYCLE



Types Of Lime

Hydrated lime or 'bag lime', a non-hydraulic lime available from most builders merchants, is produced by slaking with a precise amount of water which is driven off during the reaction, resulting in a dry powder. Although this has some uses, and is better than no lime at all, it is inferior to properly made lime putty for various reasons ranging from its particle size (lime putty is much finer) to its fast degradation in less than ideal storage conditions, where it can actually have carbonated in the bag. Just as you wouldn't grind up an old bag of cement and expect it to set, it is unreasonable to expect lime mortar to work effectively if its setting properties are exhausted before it is used.

Hydrated lime has regularly been used as an extender or filler in cement mixes, but its use as the principal binder is limited. (See under **Cement** below). If hydrated lime is the only option, it should be obtained as fresh as possible, and soaked in clean water for a couple of days - or longer - to form a putty. Even with this preparation, it will not be as good as proper lime putty, and will be unsatisfactory for limewash.

Hydraulic lime is produced from limestone containing clay and makes its set partly by a chemical reaction with water, without exposure to air, but also by carbonation. It can set under water, hence its name. In the ten years since this guide was first published, the availability of, and interest in, hydraulic lime has increased enormously in the U.K. There is also a great diversity of opinion on the benefits (or otherwise) of using hydraulic lime and urgently-needed research is only now being undertaken.

Hydraulic lime is a blanket term for a range of materials with widely ranging properties, which are usually referred to as follows:
Feebly hydraulic lime is defined by having less than 12% clay, which will make a set under water after about 20 days. It is usually an off-white colour, and makes a fatty (fairly sticky) mix which is easy to use. Feebly hydraulic lime is produced in the U.K., frequently from blue lias or some chalks.
Moderately hydraulic limes contain 12% to 18% of active clay and sets in water within about 15 to 20 days. Some U.K. produced limes fall into this category; they are generally pale grey of buff-coloured. The mortar is less easy to use as it is not so sticky.
Eminently hydraulic limes have up to 25% active clay content, make an initial set in a matter of hours, and is hard in a couple of days. It is a darker colour than other limes, and makes a mortar which is rather crumbly and difficult to handle when wet. All eminently hydraulic limes presently for sale in the U.K. have been imported, usually from France or Italy. Some contain cement (see page 5) or pozzolanic additives (see page 10) to keep their performance consistent.

French hydraulic limes are classified with a NHL number (NHL stands for natural hydraulic lime). Commonly available are NHL2 which is moderately hydraulic, NHL 3.5 which could be described as almost eminently hydraulic and NHL 5 which *is* eminently hydraulic.

In the light of the current arguments about the merits of hydraulic limes, and in view of the paucity of hard facts about their performance under present conditions and in the long term, it would be very difficult to give dogmatic advice about their use. However, there is no denying that hydraulic limes could and should be substituted for cement in many new building projects, both for ease of construction (e.g. avoiding the need for expansion joints) and because they would reduce the greenhouse gasses produced by the cement industry, (although this is rather contradicted if they have had to be transported all over Europe first!). There is also a sensible argument for using them in areas of old building repair where extra weather resistance is needed (e.g. wall copings, chimneys) or in permanently wet situations (mill races, water defences etc.) where non-hydraulic lime simply would not cope, and cement is not ideal.

BUT, there are few situations where an old structure cannot be repaired effectively with non-hydraulic lime provided that the work is carried out thoroughly, and risks are not taken by working at the wrong time of year. Non-hydraulic lime generally makes a softer material - of utmost importance in maintaining a permeable, flexible old building.

Hybrid mixes of non-hydraulic and hydraulic lime have proved problematic in some circumstances, and although some practitioners are happy with the results, English Heritage advised against their use until more information was available. Many people have seen hydraulic lime as an 'easy option' - a way of making lime mortar that behaves more like a cement mix - believing that it will solve all the inconveniences of non-hydraulic mortar, and will enable them to continue working over the winter months with a much faster-acting material. This is not the case, however, and the proper use of hydraulic lime is more involved than working with modern cement mixes. Suppliers of hydraulic lime should provide sufficient technical information with their product to enable the user to work effectively with it.

Hydraulic lime is normally supplied in hydrated form (dry powder) although some feebly hydraulic lime is available as quicklime or short life putty.

This guide concentrates on the use of non-hydraulic lime as it has a proven track record in the repair and maintenance of old buildings, and in many ways it is easier to use effectively to the benefit of the building.

Cement is made by burning a mixture of chalk and clay in a series of firings, with some types having various other additives. When those responsible for the maintenance of our older buildings became aware of the damage done by hard cement mortars, the use of lime was revived and has been appreciated more and more in recent years. However, common practice has been to gauge lime mortars with a small amount of cement 'just in case' particularly on very exposed buildings. In the 1980's a typical specification would have been for, say, 1 part cement to 3 parts lime to 10 parts aggregate. This was certainly less damaging to the building than the hard cement mixes of the '50s and '60s but recent research by English Heritage and others (The Smeaton Project - see Further Reading) seems to indicate that a small amount of cement actually weakens a lime mortar considerably, and its durability is reduced. Where conditions are less than ideal (e.g. very exposed or inaccessible) it seems that a lime mortar containing brick dust as a pozzolanic additive (See page 8/9) is a far better option.

TOOLS AND EQUIPMENT

The equipment needed for making and using lime-based materials is relatively simple and can often be improvised.

Buckets and plastic containers with lids will be useful for mixing, sieving and storage. Undamaged plastic **sacks** (sand or fertiliser bags) can also be used.

A gauging trowel (not too large) **& spatulas** for building, plastering and pointing, and a thin flexible, fish-tailed **palette knife** (which can be sharpened and used to remove emulsion paint) are all invaluable. A **pointing iron** can be improvised, and a **coal shovel** which is useful for gauging sand and lime can also (with the end cut off) be used for casting on render.

A hawk can be bought in plastic or metal or simply home-made from a square of ply and a piece of dowel. **A spot** for mixing mortars and plasters can be any old sheet of plywood about 4'x4' as long as it is smooth and flat.

A lump hammer and various **cold chisels** may be needed for removing old render or pointing. **A hoof pick** makes a very cheap and handy tool for raking out joints.

A churn brush with stiff natural bristles has a multitude of uses, particularly for brushing green-hard pointing. A **soft brush** is needed to remove dust prior to limewashing. **Paint brushes** for limewashing are largely a matter of personal preference, but both small and broad are needed. A **paint kettle** to decant small quantities into (or an old ice cream box) will be easier to hold than a bucket.

An **egg beater** or **potato masher** help when making limewash and various **sieves** (the larger the better) are essential.

A pump-action garden sprayer is needed for steady, even damping down.

A cement mixer (drum mixer) saves a great deal of hard work, and is essential for larger quantities. These can be hired everywhere.

Fig. 2 TOOLS

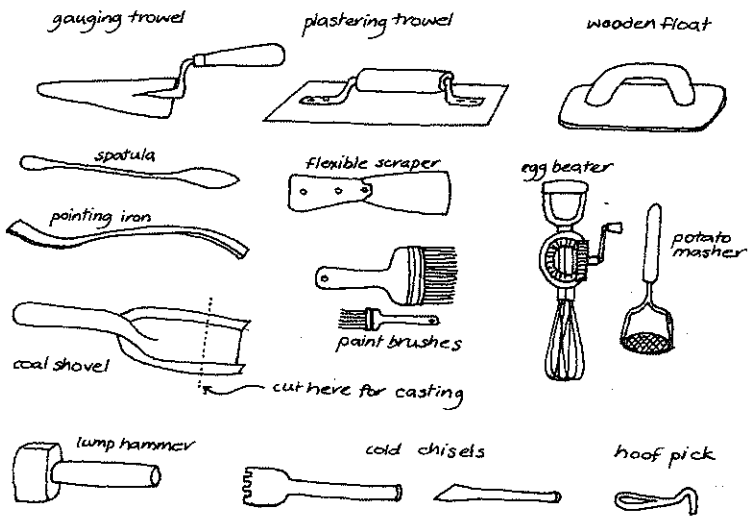
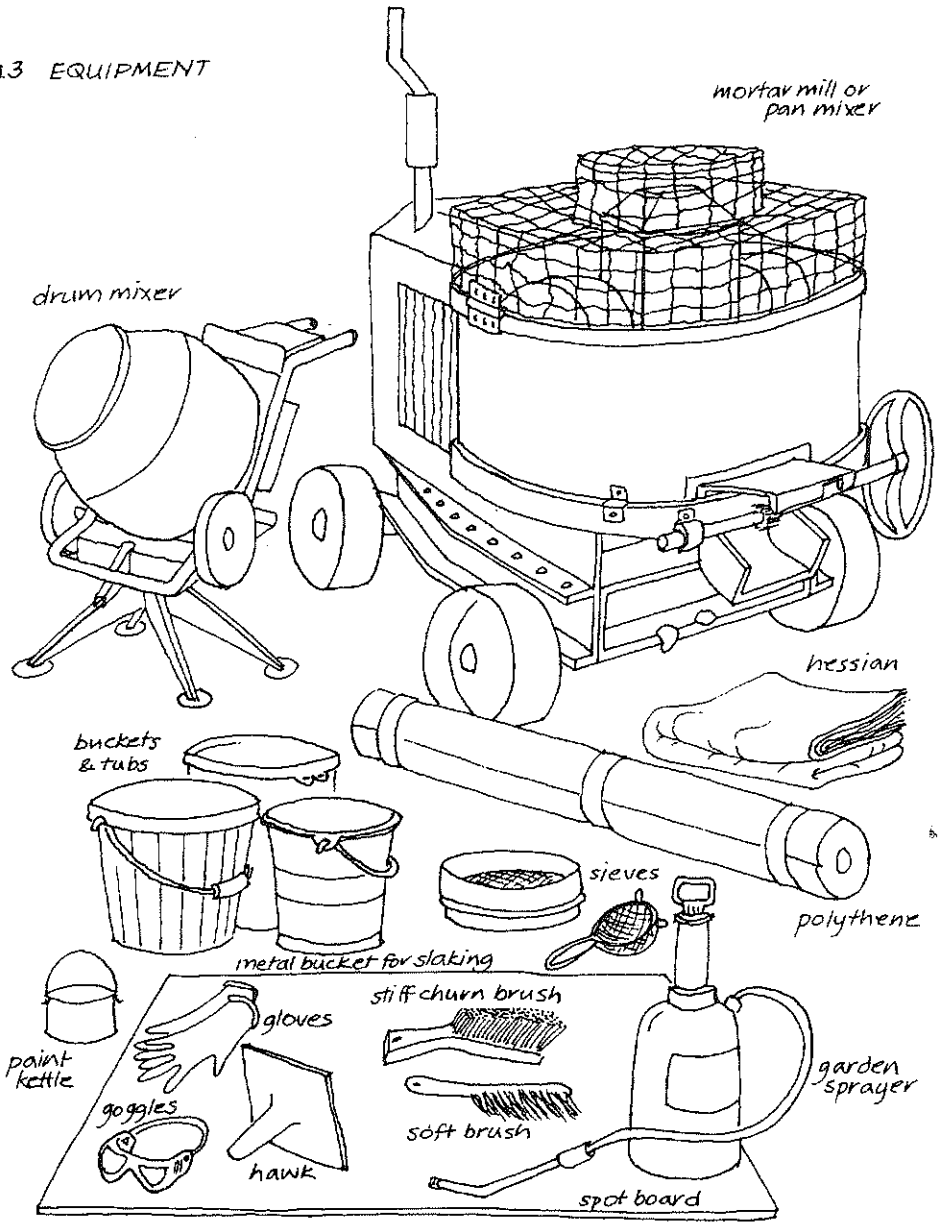


Fig.3 EQUIPMENT



MATERIALS

LIME

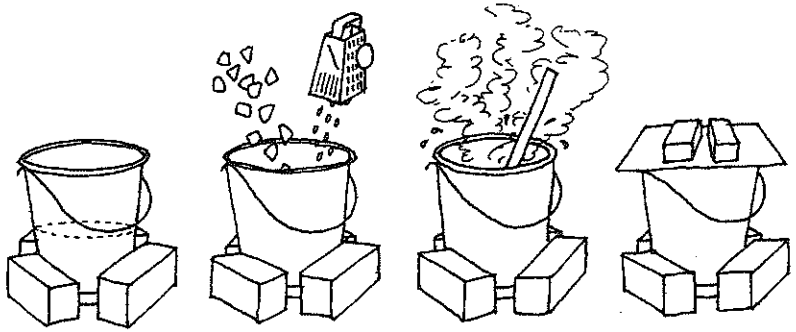
Non-hydraulic, high-calcium lime may be bought as quicklime which will have to be slaked and stored before use, or, more easily, as lime putty (already slaked). Ask how long the lime putty has been stored since slaking. The older it is, the better, but be prepared to pay a premium for old lime. Try to buy your lime well in advance so that you can mature it yourself for nothing. Two months really is the **absolute** minimum. Lime putty usually comes in plastic tubs with lids which are fine for storage if protected from frost.

D.I.Y. Slaking

Slaking should take place out of doors, well away from children, animals etc. Quicklime should be slaked as soon as possible after delivery as it is a dangerous material to store because it reacts so violently with moisture, even damp in the atmosphere. Small quantities of lime may be slaked in a metal bucket, larger amounts in a suitable metal container e.g. a galvanised water tank or trough. You will need protective clothing, gloves, barrier cream for exposed skin and, most importantly, goggles: and so will any onlookers. Remember that quicklime **boils** in water - get a bit in your eye and it will boil there instead. WEAR GOGGLES. You will also need a strong wooden stick for stirring (a simple paddle and a rake are useful in a tank). The quicklime will be in either irregular-sized lumps or, more probably, "kibbled" (like large gravel). Kibble tends to react much faster, and either type used really fresh will slake satisfactorily starting with cold water. A small amount may be tested in a bucket to see how reactive it is. A sluggish, large-lumped quicklime may need hot water to get going.

Bucket method Prop the bucket with stones or blocks so that it can't fall over, and fill about half full with cold water. Add about one pint volume of quicklime in small pieces and stand back. The mixture should start to boil. Use the stick to loosen up any lime which cakes at the bottom so it is all evenly slaked. If the mixture becomes too thick to stir then a little more water may be added. When the activity subsides, cover the bucket securely and leave to cool. (If limewash with tallow is required (see Mixing:Limewash) then an egg sized lump should be shredded in during slaking.)

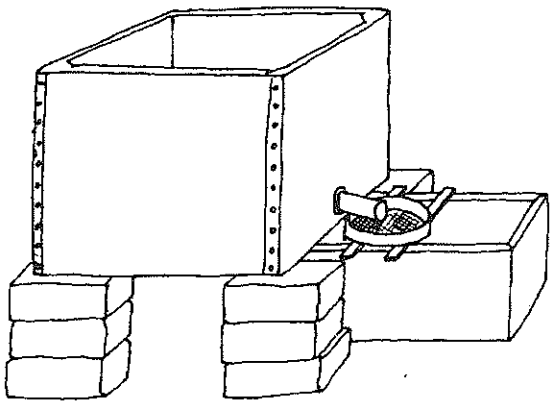
Fig. 4 LIME SLAKING : BUCKET



Tank method. Lime is best slaked in a galvanised water tank or drinking trough, or an old bath (not plastic!). A strong water-tight wooden container can also be used. Make sure the tank is level, and run cold water no more than half way up the sides. Unless your tank is very big it will be better to use half a bag of quicklime at a time. Gently tip the quicklime into the water (be careful water does not splash back into the remainder in the bag). The reaction should start very soon and the lime will need to be stirred continuously to prevent caking and sticking. If it becomes too stiff more water may be added. There may be a lot of steam as the lime boils. Stir until the reaction is over and there are no lumps left (10 minutes or so). The lime may be run out through a sieve into a storage vessel, though if baling out by hand it should be left to cool first. Sieving removes particles of unburnt limestone (grey) and odd bits of duff lime (white), but is not strictly necessary for well-kept lime destined for mortar (rather than plaster) or, at this stage, limewash (which will be sieved when making). Cover the tank securely to prevent debris, animals etc. falling in.

Lime water will form on top of this putty as it settles, and this should be prevented from evaporating completely. Plastic dustbins with lids make good, if heavy, storage containers. Lidded 10 litre tubs (from bakeries and restaurants) may be stacked up when full and are easy to move. Although lime putty *can* be used after it has frozen, it tends to become granular and harder to mix, so lime stored over the winter should be kept frost-free. Large quantities can be stored in a polythene-lined pit in the ground where freezing is less likely, but it must be securely covered with rigid boards. Putty should be stored for as long as possible before use: 2 months is the absolute minimum; 6 month lime will be easier to use 1 year old lime is better still. Well stored it will last indefinitely.

Fig. 5. LIME SLAKING : TANK



1. Upper tank half filled with water.
2. Add quicklime and tallow(if using)
3. Stir and rake to prevent caking at the bottom
4. When bubbling stops, remove bung and run into storage tank through sieve
5. Cover storage tank tightly

WARNING: DURING LIME SLAKING BY EITHER METHOD GOGGLES, GLOVES & PROTECTIVE CLOTHING MUST BE WORN BY ALL INVOLVED.

SAND / AGGREGATE

The ideal sand has particles of all sizes as this will mix best with the lime, and because the irregular spaces between the grains will hold more air in the mix and promote better setting. Even quite smooth plaster can be made with coarse sand which will provide a good base for subsequent limewashing. It may not be possible to match modern sand to existing mortar and render, but it is possible to buy more than one type or colour of sand and aggregate and combine them as appropriate. Avoid highly coloured sands which contain a lot of silt and make your hands stained when you rub them. This will need washing (and time for drying) before use. The ideal sand will make a crunchy crackly noise when squeezed. When sampling sand do not take it from the top of the heap where the rain may have washed it clean - burrow down to get a realistic sample. Avoid all sea sand whether it claims to be washed or not.

EARTH

Use only subsoil and avoid sticky clays which will shrink dramatically. Obviously a very stoney soil will be inappropriate unless sieving is possible. Old cob may be reconstituted for use as earth for mortar, or reused in new cob or cob blocks.

HAIR

Hair needs to be rough, long ($^3/_4$" or more)and teased out to avoid lumps. Cow, goat, horse (body, not mane or tail), llama and even some types of dog would all be usable. Human hair is often too glossy. Avoid horsehair (mane & tail) and wool which are too springy and lustrous. Hair from animal clipping is usually too short to be of use, but groomed out hair is often long enough.

POZZOLANIC ADDITIVES

Because lime needs contact with carbon dioxide (i.e. in air) to make its set, there are limitations to the depth at which it can be used. (In fact, ancient buildings have been found to contain lime mortar deep in the walls which remained unset until archaeological investigation exposed it to the air, whereupon it started to go off!) The temptation has been to use cement to overcome this problem, but this merely creates another one by inhibiting the breathing qualities of the mortar, and also reducing its durability.

It is, however, possible to add 'pozzolanic' material (the name derives from the volcanic ash in Pozzuoli in Italy which was used by the Romans to encourage better setting of lime mortars). Adding a pozzolanic material helps the mortar to set deep inside a wall. There are various types, some of which can be home-made.

Crushed Brick or Tile Brick dust fired at a low temperature may be bought, or old broken bricks or clay tiles (not cement tiles) or even broken flower pots can be smashed up (laboriously but cheaply) with a lump hammer to make what is probably the best pozzolanic additive of all. Grinding them in a mortar mill or stone crusher could be easier if access is available. Obviously, it is usually brick coloured.

H.T.I. High Temperature Insulation is fired china clay and a cheap source is the white bricks in old fashioned nightstore heaters. This needs to be ground down. Although fairly expensive to buy ready-to-use, its white colour can be an advantage in certain situations, although it apparently requires higher temperatures to work well.

P.F.A. Pulverised Fly Ash is a waste product from coal-fired power stations and, provided it can be supplied uncontaminated by sulphates, is a useful artificial pozzolan. However, its dark grey colour is not always appropriate where mortar will show.

Pumice A natural pozzolan imported from volcanic areas. Expensive.

PIGMENTS

Artists pigment are the best quality, but often too expensive for use in limewash. Lime-fast mortar-colouring pigments or dyes are cheaper and a quite acceptable alternative. Sheep-raddle may be used and comes in an interesting, if variable, range of colours.

General Principles

PRACTICAL CONSIDERATIONS

There are some basic rules which apply to all lime products.

SPEED

The slower the lime dries out and makes its set, the better and stronger the end result. In practice, this means that the surface the lime is being applied to should be dampened to prevent the water being drawn out of the lime too quickly. It also means that lime should not be used on a south-facing wall on a hot sunny day unless some temporary covering (say wet sacking and plastic sheet) can be provided to reduce the effects of the sun. Likewise, a stiff, drying breeze should be protected against.

WET AND DRY

The more mixing, turning and 'knocking up', the softer and wetter the lime becomes. Coarse stuff (the sand & lime which has been premixed and stored) often seems dry and impossible to use, but mixing and turning will make it workable again. If water is added to this dry coarse stuff, then the end result will be far too wet. As water cannot be extracted, great care should be taken if adding any. Too much water increases the natural shrinkage to the extent that cracking occurs. All lime mortars, plasters and renders should be used as dry as possible, and pressed firmly into place. Thus using lime is physically harder work than using the squashy mixes of gypsum and cement. However, as there is considerably more time available, smaller amounts may be lifted and this problem is counteracted.

FROST

As with all building work, frost can be very damaging. As lime takes longer to go off, the threat from frost is greater and protection may be needed several days or even weeks after the lime has been used if frost is likely. The ideal time for lime work, especially renders, is the late spring when frost danger has passed but the hot weather has not begun. Using lime externally in the late autumn is very risky. Using lime internally should not present any problems. The use of any form of anti-freeze should be avoided completely.

PREPARATION.

There is little point applying lime products over impermeable modern cement or plastic surfaces. As most buildings have had modern materials applied to them, the major part of any job will be preparation. Before any stripping is undertaken, a careful check should be made for any evidence of mural paintings which can be found in almost any buildings. If there is any sign of them, specialist advice should be sought immediately via the local Conservation Officer. Grants are often available for conservation work.

LIMEWASH

New lime plaster or render needs no preparation other than a light spraying with water to dampen the surface. Newly built walls or those repointed with lime-mortar will need vigorous brushing with a stiff bristle brush to remove all dust and debris. It may be appropriate to use a fungicide to kill off moulds and lichen, though a wall with considerable lichen growth is probably best left unpainted.

The removal of unsuitable paint may sometimes be achieved by physical means: chipping, scraping or with the careful use of a high pressure water lance or wallpaper steamer (particularly good on emulsion paint). Heat strippers have their uses, but care should be taken to ensure that oils and stains are not driven into the plaster as these will subsequently stain the new limewash. Where the modern paint to be removed has been applied over thick layers of old limewash and distemper it is often possible to score through the paint surface (taking care not to cut into the old plaster) and spray with water a few times. The water is drawn under the impermeable layer making it possible to slip the thin, flexible blade of a palette knife or spatula underneath. Mechanical stripping, aided only by water or steam will avoid the danger of residues left by other methods.

Occasionally, chemical strippers have to be used. These must always be of a water soluble type, i.e.neutralised with water. Generally speaking, a slower-acting poultice type is preferable to a faster-acting liquid as the poultice tends to draw the old paint residues out of the plaster. The poultice type can also be used quite successfully on soot stains.

When a wall which has been sealed up for many years is eventually allowed to breathe, it is quite likely that salting (a fluffy deposit appearing on the surface) will occur. This should be brushed off and, ideally, the wall should be left unpainted until salting has ceased, although small amounts may be brushed off the limewashed surface without damaging it. Salting is a sign that the wall was in desperate need of 'a breather'.

LIME PLASTER - INTERIOR SOLID WALLS

Stone, cob, brick and other solid walls need to be in a reasonable state of repair before lime plaster is applied, and preferably pointed with a lime mix. Any old nails, cramps or items which might rust should be completely removed or they risk rust-staining the new plaster. Walls thickly encrusted with soot or smoke staining require special attention. All sooty debris should be scraped away and the wall scrubbed. In extreme cases, a poultice-type paint stripper can be used to remove deep stains. The traditional method of 'parging' over sooty walls with fresh cow dung is surprisingly effective! It can also be mixed generously into the first coat of plaster.

Any loose material or dust should be removed with a churn brush. Fungicide should not be necessary unless there has been considerable mould growth e.g. from a leaking roof. The wall surface should be well sprayed with water, until more or less saturated. Absorbent areas may need more than others.

Old plaster should be retained wherever possible, and carefully patched around. When patching, the edges of the old plaster should be trimmed roughly at right angles to the surface. This will help the new patches to support the perhaps rather wobbly old plaster.

The edges of the old plaster should be well dampened.

LIME PLASTER - INTERIOR TIMBER WALLS.

Traditional supports for lime plaster include split (riven) or sawn timber laths, woven wattle panels and bundles of reed. Today expanded stainless steel lath may also be used, although great care must be taken that the sharp edges of the mesh do not cut off the key of the plaster. On wattle panels an earthy daub mix is used to dub out to a reasonably smooth surface which is then lightly keyed and wetted to take the lime plaster finishing coats.

LIME RENDERING - EXTERIOR SOLID WALLS.

Walls must be in a reasonable condition, preferably pointed with a lime mix before render is applied. Removing unsuitable hard render can be an extremely frustrating procedure, as it can be hollow or even dropping off in one area, and rock-hard and 'welded' to the wall in another. Systematic patching, although producing an irregular finish, is the traditional approach, and many attractive old buildings show evidence of generations of patch repairs. In some cases it may be the only feasible option. If the edges of the remaining render are cut square (i.e. at 90° to the surface) then later replacement remains a possibility.

Wall surfaces must be free of any ferrous items and vigorously brushed with a stiff bristle brush to remove dust and debris. In certain circumstances (hot sun, drying winds) some form of protection should be rigged up. Render should not be applied when there is any risk of frost. Where render is to be cast on, it is sensible to protect doors, windows, drainpipes etc.. by masking with polythene, and covering drains. All surfaces should be well dampened before the render is applied, with particular attention paid to more absorbent areas which may need re-spraying as work proceeds. Expanded metal lath or chicken wire is both unsuitable and unnecessary as a support.

LIME RENDERING - EXTERIOR TIMBER-FRAMED WALLS.

Laths and wattle panels must be in sound condition and firmly fixed. Non-ferrous fixings are preferable. Any earthy daub should be allowed to dry and harden, and then well wetted before render is applied. Weather protection should be arranged as above. New riven laths or fresh hazel twigs may be pieced in as necessary.

Preparation

LIME MORTAR - FOR BUILDING

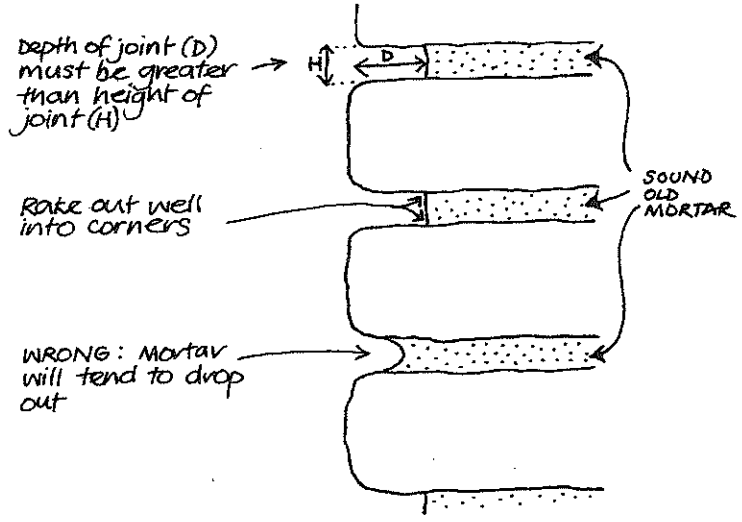
Stones or bricks should be free of old mortar, lichen, moss etc.. Very absorbent stones or bricks should be dampened before use to prevent water being drawn out of the mortar too quickly. Old sacking / hessian and sheets of polythene should be at hand to cover new work.

LIME MORTAR - FOR POINTING

Preparations for pointing must be made with great care. Removing old mortar may be easy if it is soft and crumbly, or even if an inappropriate hard mortar has been applied previously without proper preparation - it will probably be falling off by itself. However, deep, hard cement pointing can be incredibly difficult to remove without damaging the surrounding softer stones or bricks. As with render, a patching operation may be the only sensible option. Although the wall will look irregular, at least moisture will be able to escape in some areas. Using a hammer and cold chisel on hard pointing is infinitely preferable to a disc cutter which will almost always cause damage. A compromise would be to use a power drill to make a series of holes in the offending joints, and then chip out the interstices by hand. For softer joints, an ordinary hoofpick or even a piece of wood with a nail banged through it may be useful. As it is so often in old building repairs, success usually depends on the patience of the operative rather than any particular tool or device. Very narrow joints may be cleared out with a hacksaw blade or scraper used sideways.

The joint must be cleaned out square, and should be considerably deeper than it is high (see Fig. 6) Any loose debris should be brushed or flushed out (by hand sprayer, not hose) and the joint well wetted before pointing.

Fig. 6 PREPARATION FOR POINTING



Mixing

MIXING.

In general, lime products are better to use the longer they have been stored. Because of this, it is often convenient to make up, or buy in, all the material necessary and use it gradually. The recipes given below are intended as a basic guide. As there are few really hard and fast rules about quantities and proportions, do experiment with different mixes, and find out what suits your particular situation the best.

LIMEWASH.

In its best and simplest form, limewash is made from a well-matured lime putty, diluted until very thin with water, and well sieved to remove any particles of unslaked lime or bits of debris which might have got into the putty. Mixing the putty and water can be done in a bucket with an egg beater, potato masher or paint mixing attachment on a power drill. As the water becomes cloudy with lime, pour it off into a large vessel through a sieve, add more water to the bucket and keep mixing. Water and putty may be added to the mixing bucket as necessary. If colour is required, lime fast pigment (usually in powder form, but not powder paints) should be shaken up with hot water in a jam jar and sieved in. The colour of the wet limewash must be much darker than the result required. As the lime is virtually transparent before it dries, really only the pigment can be seen. (A test can be made on a piece of paper, and dried quickly to see the final colour.) All the limewash for a single coat should be coloured in one go as matching is very difficult. When the right tint is achieved, sieve the limewash again, and use. It can be stored pretty well indefinitely in airtight plastic containers. (Gallon 'jerry cans' are useful as they are easy to shake up before opening.)

Traditional colours for limewash are cream (made with yellow ochre), yellow (more yellow ochre with a touch of red ochre), pink (more red ochre with a touch of yellow) and an apricot shade (made with red and yellow). Duller creams and fawns are made with umber or sienna, and a greyer shade of any of these comes from adding tiny quantities of lamp black. All pigments may be mixed together, although too many can result in muddy colours. Stone dusts may also be used.

If limewash is properly made from mature lime putty and applied thinly, no additives are necessary for all internal and most external work. However, in a very exposed position, it may be desirable to add small quantities of certain additives to help the limewash shed some of the direct rainwater. It should be remembered that all such materials inhibit the permeability of limewash in varying degrees, and they should not be used as an excuse for applying it more thickly.

Traditionally, almost anything seems to have been added to limewash for some reason or other (and some of them of a very dubious nature) but the three most reliable are tallow, raw linseed oil and casein. Tallow must be incorporated during the slaking process (lime putty with tallow is available), but linseed and casein (often in the form of skimmed milk) are added to the limewash itself. A maximum of about an egg-cup full of linseed or one pint of skimmed milk per large bucket (about 3 gallon) should not be exceeded. The oil will need beating back in frequently during application. Casein is a better choice as it has very little effect on permeability.

See also 'Hot Limewash' page 19.

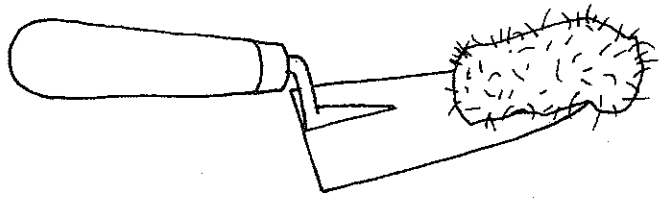
LIME PLASTER

Lime plaster is made from three or four basic ingredients in varying proportions. These are lime, sand and/or earth, and hair. The lime should be the best quality lime putty which has been sieved after slaking so no gritty unslaked bits remain. It should have been stored for as long as possible; ideally six months or more. The storage time allows any unslaked particles to slake before the lime is used. If unslaked particles remain they can slake themselves in situ in the plaster causing small craters or 'blows'. This can happen months after plastering.

Sand should be composed of particles of all sizes, including quite coarse grains as this will reduce shrinkage and cracking, and make a plaster that sets better. Sand should be kept as dry as possible. A smooth finish can be obtained with a coarse sand, although a finer sand is sometimes used in the final coat. Earth was used extensively in earlier plaster, especially for the backing coats. Most subsoil, except a very heavy clay, should be usable but test panels should be tried out to establish the most suitable mix. Stoney soil will obviously need sieving.

Hair acts as a tie in the plaster, and so needs to be fairly long - 3/4" or more - and of a soft rough texture. Shiny springy hair is not suitable, nor is wool. (see Materials - Hair). Although hair can often be seen in old plaster (especially backing coats) in great lumps, these cause weak spots and the hair should be well teased out. Carding combs may be used, but standing by the mixer (in goggles) with a lump of hair in one hand, teasing it straight into the plaster as it is mixing is a reasonably efficient method (except on a very windy day!). Quantity is largely a matter of preference, but as a guide, a trowelful of plaster pulled out of the mixer should have plenty of individual hairs sticking out of it all round. In top quality work, white hair was selected and saved for the final coat, especially in decorative plasterwork which was not intended to be painted.

Fig 7 "WELL-HAIRED" PLASTER



Lime plaster can be made perfectly well in an ordinary cement mixer, or small quantities mixed by hand. (A very earthy mix will tend to "ball" in a mixer - treading & turning on the ground is more effective. If available, a mortar mill is useful.) A good working mix would be (by volume):

1 part lime : 2 or 3 parts sand/earth : $^1/_4$ part very loosely teased hair

Set the mixer running, and add the sand and lime alternately, in whatever proportions you are using. When the mixer is full, then tease in your hair. Unless the sand is bone dry, it is unlikely that you will need to add any water as the lime will get more and more liquid as it mixes. As the lime putty makes quite a sticky mix, it sometimes helps to tilt the mixer up slightly to encourage the plaster to drop off the paddles: perhaps putting a brick under each back foot. (Obviously, care must be taken not to destabilize the whole thing to the extent that it tips over.) If after about 15 minutes mixing the plaster seems too dry (i. e. crumbly) then a small amount of water can be added, really no more than half a pint at a time. 20 to 30 minutes is ample overall mixing time. Ideally, this 'coarse stuff' should be set aside for a couple of weeks before using, stored in airtight bins, sacks or a heap tightly wrapped in polythene. Before use it can be 'knocked up' again by mixing, chopping and turning on a board, or another ten minutes in the mixer. If you are planning to store your coarse stuff for more than a few weeks (and it will improve with keeping) then it is better to mix in the hair just before use, as hair kept wet for a long time might start to rot.

LIME RENDER

Lime render is mixed in much the same way as plaster although it does not usually contain hair. Occasionally hair is included in the backing coat.

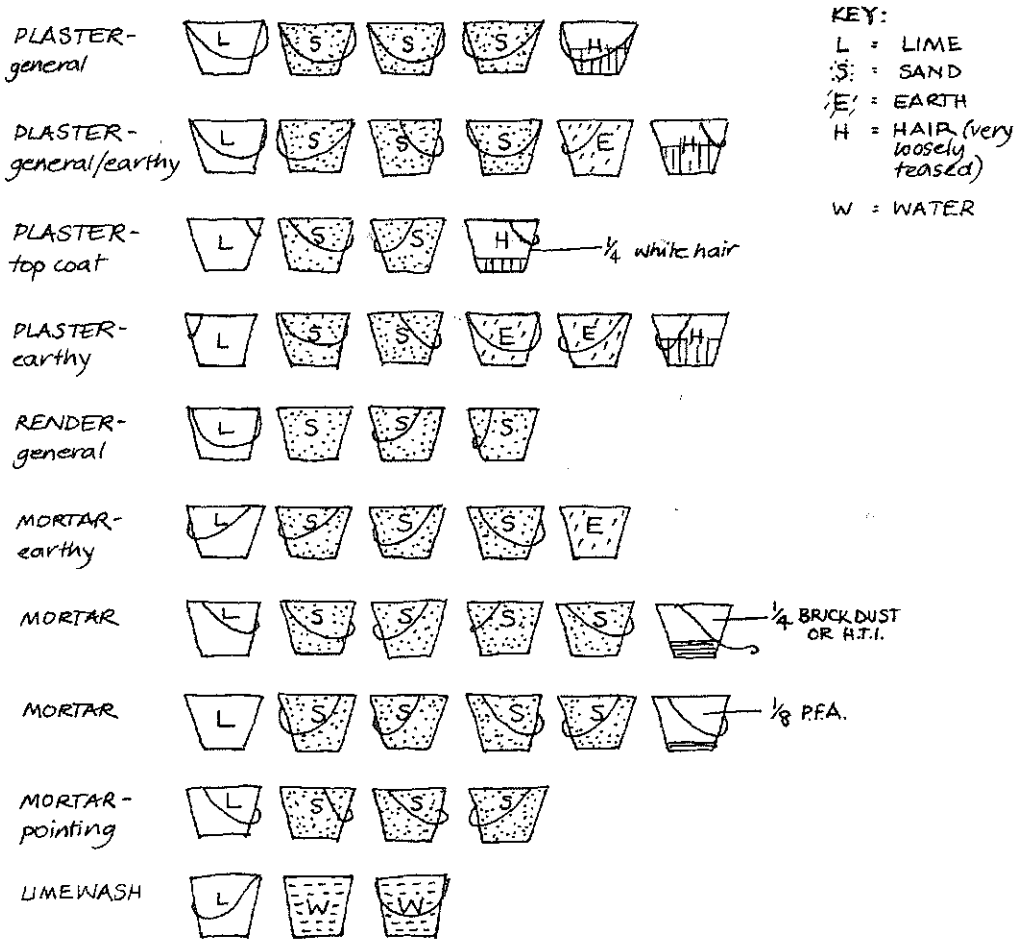
LIME MORTAR

Although the same basic techniques and ingredients as plaster are used, lime mortar, when used for building, sometimes contains pozzolanic additives (see Materials) which must be added immediately before the mix is used. Proportions can vary, but as a guide, a minimum of 20 parts mortar to 1 part brick dust or H.T.I., or 40 parts mortar to 1 part P.F.A. should be used. Any left over mortar should be discarded, and under no circumstances mixed back in with the coarse stuff, or setting will start to take place.

Mortar used for pointing does not usually need a pozzolanic additive as the depth of the joints is not usually so great that the lime is unable to make its set. Observation of existing mortar in old walls should suggest the colour of sand used locally and an attempt should be made to match this as closely as possible.

Mixing

Fig. 8 SOME POSSIBLE MIXES



Application

LIMEWASH

Limewash must be applied in several thin coats, as many as six over new surfaces. Although it is tempting to slap it on more thickly, unless it is put on almost invisibly thinly, limewash will drag, craze, and brush off when dry. The initial coat should be put onto a damp wall, brushing in all directions to scrub well into the surface. Each coat must be allowed to dry before the next is applied. Under normal conditions, a coat of limewash should dry sufficiently overnight. The action of brushing helps bond the lime to the surface, so sprayed limewash may be less hardwearing. The limewash should feel and look like water being brushed onto the wall. When wet, the lime is virtually transparent; as it dries it becomes opaque (and continues to do so over several days). Thus coloured limewash appears much darker when wet, as only the colour of the pigment is visible. As it dries, the lime lightens the overall colour considerably. If limewashing stops in the middle of a wall, the join will show. Working from the top down, and brushing out any drips, each area of the wall should be coated in one go. If the brush drags over a particularly absorbent area, it should be sprayed with water again immediately before limewashing.

Where a coloured finish is required, this may be achieved in various ways. The coloured limewash may be used for every coat to achieve a deep and even finish (although by its nature, limewash is rarely entirely flat) or the earlier coats may be of basic white with pigment used in the last coat or two. An interesting finish can be made by using slightly different tints in the last two coats e.g. yellow ochre tint over a pink undercoat, which will give a slightly two-colour brush marked finish. Experiments can be made freely, as any unsuccessful results may be limewashed over again, improving the finish all the time. 24 hours should elapse to judge the finished result.

Identical colour-matching between batches of limewash is almost impossible to achieve, so before a large area is tackled, sufficient limewash should be amalgamated in one vessel. Frequent stirring during application is also necessary as the lime particles quickly sink to the bottom. If the limewash appears to be thicker at the bottom of the bucket, then it should be diluted with more water. Brushing in all directions results in the best finish, although excessive overbrushing should be avoided as the damp lime will be dragged off. Even thin limewash is a caustic material when wet, and so goggles and gloves are a sensible precaution, especially when working on a ceiling. A thin, watery paint is also likely to splash and drip, although the true extent of the mess will not be evident until the limewash has dried. All floors, furniture etc.. should be well protected.

Hot limewash is an exception to the general rules that can be useful in certain circumstances. It is possible to apply freshly slaked lime as a thick single coat of limewash, but it must be done whilst the lime is still hot from slaking. In practice this means that the lime is slaked by the (metal) bucketful, and brushed on immediately. It doesn't work once it has got cold. This is a useful technique for covering large areas fast (e.g. in a barn) although the finish is a little coarser. (You may need to sieve it.) A finishing coat of conventional cold limewash (made from older putty) can be used to refine the surface or add colour.

COSMETIC LIMEWASH

In the event of limewash being used as a purely visual measure to cover a wall which has an impermeable surface (e.g. emulsion paint), then a layer of dilute PVA should be painted on first, and then the first coat of limewash mixed with a little more PVA. This is a purely cosmetic (and short term) operation, and structurally a waste of time. The limewash will look nice, but it will not have bonded with the wall, and will be liable to chip and flake. Of course the wall will still not be able to breathe, but this method can improve the look of a plasterboard ceiling. An alternative measure for plasterboard ceilings is using a white matt emulsion coloured with the same pigment used on the walls. If imperfectly mixed, this can result in an interestingly patchy finish!

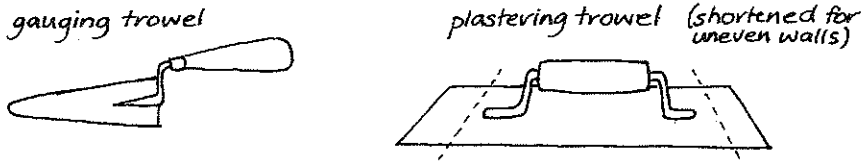
LIMED WOOD

'Limed' oak kitchens are widely advertised although no lime is involved, and a white, plastic-based paint or stain is used to achieve the desired finish.

However, liming wood is a very simple and useful process. The wood (which must be free of polish or varnish) is painted, or rubbed over, if smooth enough, with a thin limewash. When dry, the wood is vigorously brushed or rubbed with a dry cloth so that all the surface limewash is removed, but the grain remains white. If a lighter finish is required, the procedure may be repeated. Liming wood is a very useful solution where timbers are exposed but are not of sufficient quality, or are unsuitable, to polish. Limed wood is a traditional finish, especially on timber-framed buildings, and a certain degree of protection is afforded to the timber by the lime. In fact timber is often found thickly limewashed, although this has a tendency to flake and chip. It is a useful way of making new timbers less obtrusive, and helps to unite all the surface areas into a sculptural whole. It is particularly effective when a coloured limewash is used, and the timber takes on a tint similar to the surrounding walls.

If the timber is to be stripped to receive a lime finish, then a poultice-type stripper should be used which will draw the old paint, varnish or polish out of the grain so that the lime can replace it. Merely scraping the surface will not result in a good finish. Timber which has been limewashed previously, or stained or bleached by being plastered may need only a good scrubbing with a stiff bristle brush. As with all limewash preparation, any old nails or bits of ironwork should be removed or sealed (possibly with a touch of red oxide paint). Limed wood should not be polished.

Fig. 9 PLASTERING TOOLS



LIME PLASTER - SOLID WALLS

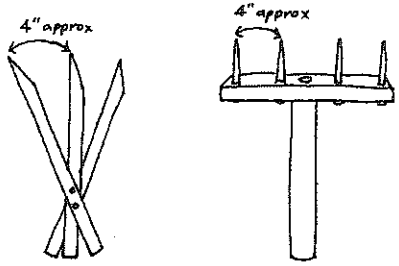
Do not use plastering bead, metal corners or any fixed guides. Lime plaster should follow the lines of the building. Use your eyes, there will be plenty of time for adjustments to be made.

Lime plaster should be well mixed or 'knocked up' prior to plastering. This will make the lime (and therefore the plaster) as plastic as possible without the addition of water. After knocking up thoroughly, it may still be necessary to add a small amount of water, although lime plaster should always be considerably thicker and stiffer than its gypsum counterpart. Until you are used to the material (and even when you are) it will probably be easier to apply with a gauging trowel rather than a plastering trowel (rectangular, with a handle on the back) as each trowelful needs to be pressed firmly into place, and on anything other than a completely flat surface, this can be difficult with the larger tool. The most 'authentic' finish is achieved by following the natural undulations of the wall with two thin (1/4") coats. Any attempt to make an 'Old' finish will look unsatisfactory.

Practice will dictate whether you work from left to right, or top to bottom; choose the method that suits you best. Start with a clean floor. If the plaster starts to slump, it is too wet : scrape it off and let it dry out a bit before reapplying.If it starts to bulge from the wall and can be pushed in and out, then it hasn't been pressed to the wall hard enough, or the wall is insufficiently wetted : scrape it off, knock it up again and alter your technique - perhaps using a smaller tool. Plaster which falls onto a clean floor can be scraped up and re-used. Do not overwork the plaster once it is well stuck to the wall - this can draw the lime to the surface where it can form a hard crust over a soft backing. The first coat should be scored in a diamond pattern (3" diamonds approx.) to provide a key for the second coat. If this is done evenly all over it also has the effect of regulating any shrinkage cracks which may occur as they tend to follow the score lines. A small amount of shrinkage in the first coat is not disastrous, but serves as a warning that either the lime is too fresh, the mix is too wet, or the plaster is too thick : the second coat should be applied thinly as a safeguard.

The second coat should go on when the first is 'green hard' (i.e. too hard to dent with a knuckle, but just soft enough to mark with a thumbnail). Knock off any lumps around the score marks and spray the first coat with water before re-coating. When the second coat is hardening, it may be worked over again to improve the finish, remove any rough spots and push closed any small cracks. However, the surface should not be burnished or polished as it will not provide such a good key for the limewash. Plaster, unlike pointing or occasionally render should not be finished by brushing which forms a uncomfortably scratchy surface for an interior.

wooden float

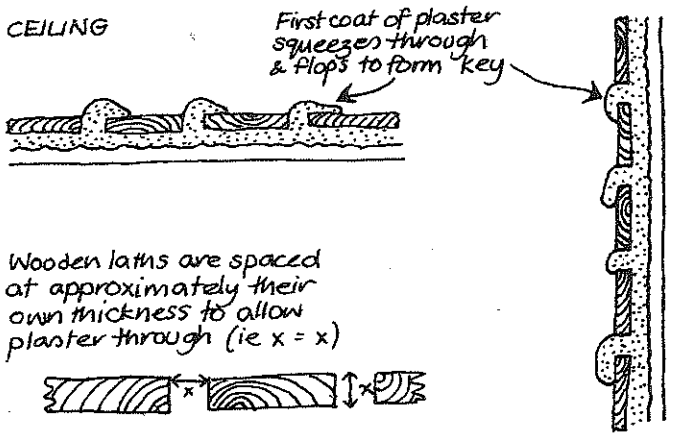


homemade scratchers (for scoring)

LIME PLASTER - ON LATH

On lath, the first coat of plaster forms all the little hooks (the key) that hold the plaster in place. The plaster must be pressed on hard enough to be forced through the laths where it flops over, but not so hard that the amount pressed through is excessive and falls off under its own weight. It is also important not to overwork the first coat (it should be applied in a very direct manner) or to press so hard that the laths flex and break the key off in that way. A few experiments with technique will be worthwhile before a large area is attempted. The first coat should not be scored before it is starting to harden a little and so is less vulnerable. Sharp, slippery stainless steel lath is more difficult to plaster onto as the plaster key is sliced off very easily. Extra hair in the mix may help.

Fig 10. PLASTER ON LATH



PATCHING PLASTER

When patching, care must be taken to pack the new plaster tightly against the sides of the original - with a relatively small hole it might be best to work all round the edge first. If the surrounding plaster is rather weak, it might be safer to allow the first coat time to harden rather more than usual so that the second coat is less likely to spring the old and new apart. The final coat should be applied without any smearing over the surface of the retained old plaster. A tidy butt joint is needed with a very slight bulge towards the centre of the patch. Shrinkage is more noticeable when patching, and it is worth working over the patch as it shrinks, pushing it back to the wall. The bulge is to allow sufficient plaster to make the repair flat after pushing back. The join will always show a little, though subsequent limewashing will make it less obvious. If the join really is unacceptable, a small amount of proprietary filler can be used to improve it, but only at the join. Smearing it over old and new plaster will form an impermeable zone and subsequent problems. The filler should be smoothed out with a wet brush, never sanded which would ruin the lime plaster. For really small holes, where two coats are impractical, a dusting of filler may be mixed with the plaster and used immediately. This will help to prevent it shrinking and dropping out.

RENDER - EXTERNAL

Under no circumstances should metal lathing, chicken wire, beads or stops be used. Plaster should feather away at its edges - e.g. against stone jambs - and subsequent limewash carried over both. There are two main methods of application : a trowelled or floated render and a roughcast or thrown render. Render may be applied exclusively by one method or other, or sometimes as a combination of the two.

SOLID WALLS - ROUGH CAST

Generally speaking, a thrown render sticks better as long as the technique has been mastered, and it is certainly more suitable for a relatively smooth wall (i.e. without joints) such as cob. Although two coats are the usual number, it is sometimes possible to render cob in one single cast coat, provided it is not too thick. Ideally each coat should not exceed 1/4", although with an uneven wall and a really coarse mix, this can only be an approximate guide. There is little to be gained by building up a thick layer of render, and the excessive weight will be a disadvantage. When patching, the new render must obviously be built up until it matches the old, but this may have to be done gradually.

The render is used wetter for casting - it must be able to slip around on the trowel (and so slip off when **you** want it to!) The tool used is a dashing trowel (also called a hurling trowel) although an adapted coal shovel can work quite effectively : the end should be cut off (and smoothed down) to make the shovel area roughly square. The render is flicked onto the wall with a sharp backhand or forehand action, from quite close range. If two coats are being applied, then sufficient practice should be gained in applying the first coat. If you are attempting a one-coat render, then it might be sensible to practice somewhere unobtrusive first. The covering should be even, without obvious lines of direction on the surface. If two coats are used, the first coat should be quickly rubbed over with a block of wood to remove any very high points when it is green hard. After re-wetting, the second coat can be cast on.

SOLID WALLS - SMOOTH RENDER

Even if a smooth finish is required, the first of the two coats can be cast on as above as it will stick to the wall better (especially on cob) and also provide a good key for the subsequent coats which should be put on with a wooden float, kept to about 1/4" thick, and finished with circular strokes to leave a smooth but not polished finish. If both coats are to be floated, then the first must be scored with a diamond pattern (diamonds about 3" wide) to provide a good key for the next.

TIMBER-FRAMED WALLS

Where render is applied to laths, the same problems and procedures apply as for internal plaster (see Lime plaster on lath). On daub panels, the render may be cast or floated, depending on local traditions, and observation of other areas of the building. It may be appropriate to carry the limewash of such panels over and across timbers and render alike in the traditional manner, although brushing away the excess from the timbers will prevent future flaking as the wood expands and contracts (see Limed wood).

LIME MORTAR

As lime mortar takes longer to set than cement mortar, time must be allowed for building work to progress at the appropriate pace for the material. Joints should not be over thick, or the mix too wet, or the weight of the stones or bricks will squeeze the mortar out. Also, thick joints are visually too dominant. Careful observation will reveal the speed of building possible. Wall-tops should be carefully covered at the end of the days work, with damp sacking and polythene, both to protect the wall from the weather and to ensure that the mortar dries out as slowly as possible.

POINTING

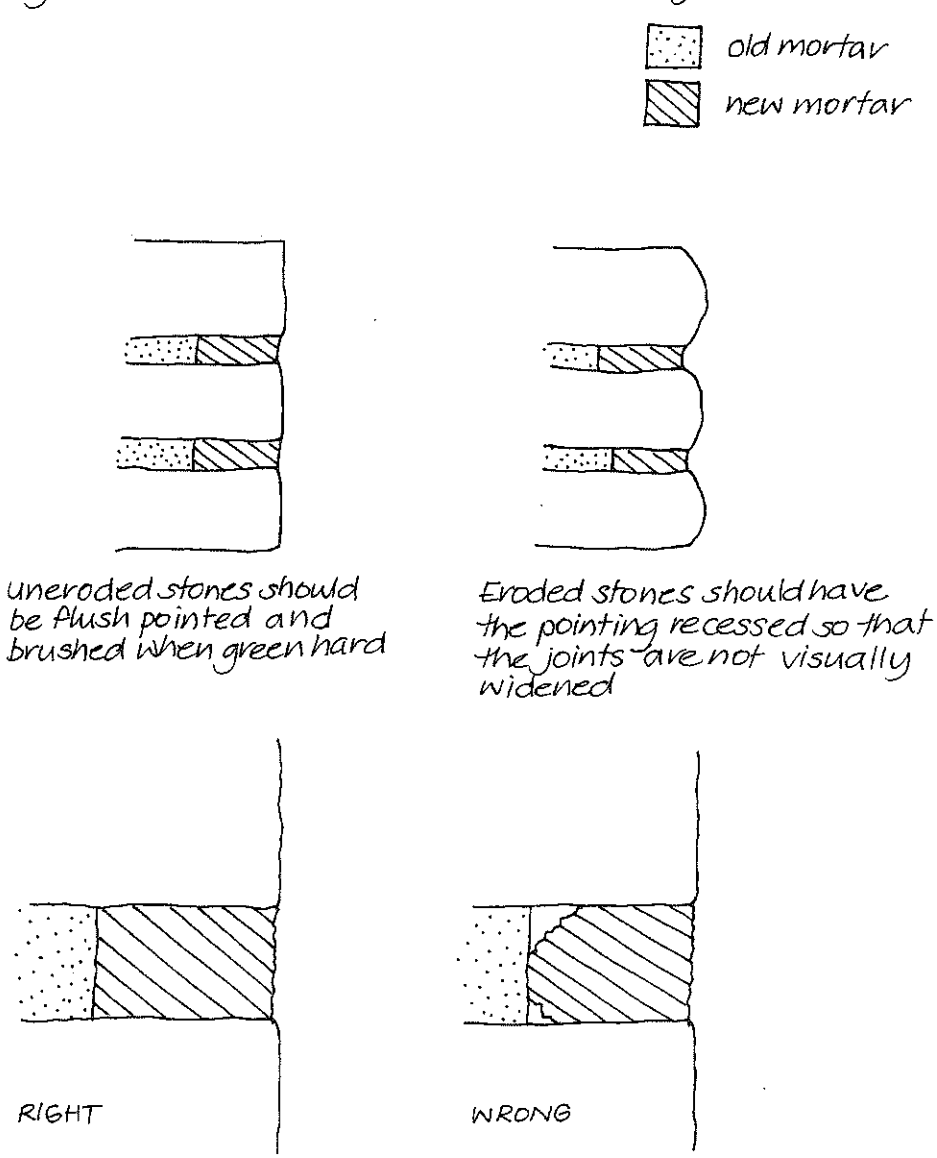
The mortar that shows between the joints of the stones is of both physical and visual importance. The objective must be to prevent the erosion of the stones for as long as possible as well as enhancing their appearance. If the mortar is softer than the stones then it will take the brunt of the effects of damp and weathering, whilst the stones remain in good condition. If the mortar overlaps the stones then it encourages damp to linger on the faces, and particularly the edges where most damage occurs. The aim should be to fill the joints roughly flush (or just back from the wall face if the stones are eroded at the edges) pressing the mortar firmly into the joints when pointing, or trimming it off neatly flush when building. (After a bit of shrinkage and brushing they will be taken back slightly further.)

A 'pointing' trowel or a bricklayers trowel will not be the ideal tool to press the mortar into the joints as pointed tools tend to produce a 'struck' (sloping) rather than flush joint. Improvising with a cut down gauging trowel, pointing iron, spatula or even an old kitchen knife may prove more effective. A few trowelfuls of mortar should be slapped onto a hawk (so it sticks) and then small 'slices' may be cut to fit the dampened joint and pressed in place, avoiding smearing the mortar on the face of the stone. Little attempt should be made at this stage to achieve a smooth, tidy joint - it just needs to be filled firmly with the right amount of mortar, leaving no air pockets in the back of the joint, and bringing the face of the mortar roughly level with the face of the stones (or slightly recessed if they are badly eroded). The mortar should not be 'struck' at an angle as it is not intended to shed water like a cement joint.

These roughly packed joints are left until the mortar becomes 'green hard' (i.e. too hard to dent with a knuckle, but soft enough to mark with a thumbnail). The timing of this stage varies according to conditions - anything from three hours to three days - but it is ideally achieved over about 24 hours, as the mortar should not be encouraged to dry out too fast. At the green hard stage the joints need to be brushed, using a stiff-bristled churn brush. (Brushing too early smears lime over the stones and pulls the aggregate off the surface). Brushing is vital, and fulfils four purposes: it cleans any blobs and smears of mortar off the edges of the stones; it improves the contact between the stones and the mortar; it cleans the lime off the large particles of the mix so that the shapes and colours of the aggregate are exposed, giving the joints a much more interesting finish and it also removes any 'spare' surface lime which might be washed over the stonework by the rain, causing white stains. In short, vigorous brushing along the joints makes even fairly rough amateur pointing look very good.

The pointing will continue to dry and carbonate over several weeks, and should be protected from the effects of severe weather where feasible.

Fig. 11 POINTING



Suppliers

N.B. Not all of these outlets are shops. Please contact them before making a visit to avoid a wasted journey.

Q = Quicklime
P = Putty Lime
RM = Readymix
LW = Limewash
H = Hydraulic Lime
H-uk = UK produced Hydraulic Lime
Pg = Pigment
C = Courses / Training

AREA 1 (NORTH & SCOTLAND)

Masons Mortar Ltd., 77 Salamander St., Leith, Edinburgh, EH6 7JZ. Tel: 0131 555 0503 and Merryhill Steading, Charlestown, Fife KY11 3DR Tel: 01383 873049 sales@masonsmortar.co.uk www.masonsmortars.co.uk
(Q,P,RM,LW,H & Pg)

Elaine Rigby & Charles Blackett-Ord, Intake Side, Brough, Kirkby Stephen, Cumbria, CA17 4EA. Tel: 01768 352572 & 01768 341502 (P,LW,Pg & C)

AREA 2 (WALES & WEST)

Gary Coates, Severn Valley Stone, Rockridge Farm, Mill Lane, Strensham, Hereford & Worcester. Tel: 01684 297102 garycoates@stonearts.net www.stonearts.net
(Q,P,RM,LW, Pg & C)

Robert Fiddes, Fiddes Woodfinishes, Florence Works, Brindley Road, Cardiff, S.Glamorgan, CF11 8TX. Tel: 02920 340323 finishes@fiddes.co.uk www.fiddes.co.uk (Pg)

Heritage Lime, Henley Farm, Miserden, Gloucs. GL6 7HZ. Tel: 01285 821751 www.restorationmortars.co.uk
(Q, P, RM, LW, H & Pg)

Lime Green Products Ltd, Coates Kiln, Stretton Road, Much Wenlock, TF13 6DG Tel: 01952 728611 enquire@lime-green.co.uk www.lime-green.co.uk
(Q, P, RM, LW, H, Pg & C)

Precious Earth, 22 Corve Street, Ludlow, Shropshire, SY8 1DA Tel: 01584 878633 info@preciousearth.co.uk www.preciousearth.co.uk (Q,P,RM,LW,Pg & C)

The Traditional Lime Co., Church Farm, Leckhampton, Cheltenham, Gloucs.,GL53 0QJ. Tel: 01242 525444 info@trad-lime.co.uk www.trad-lime.co.uk
(Q,P,RM,LW,H & Pg)

Ty-Mawr Lime Ltd., Ty-Mawr Farm, Llangasty, Brecon, Powys, LD3 7PJ. Tel: 01874 658249 tymawr@lime.org.uk www.lime.org.uk
(Q,P,RM,LW, H, H-uk, Pg & C)

Whitford Sand Lime & Mortar Co., Bedw Cottage, Whitford Road, Holywell, Clwyd, CH8 9AE. Tel: 01352 714144. (P)

AREA 3 (MIDLAND & EAST)

Bleaklow Industries Ltd., Hassop Ave., Hassop, Bakewell, Derbyshire, DE45 1NS. Tel: 01246 582284 www.bleaklow.co.uk
(P & RM)

Building Conservation Services, Horbury Hall, Church Street, Horbury, Wakefield, W. Yorks, WF4 6LT Tel: 01924 277552 build-conserve@geo2.poptel.org.uk (P,RM & LW)

Chalk Hill Lime Products Ltd., Rosewood, Terrington, York, YO60 6QB Tel: 01653 648112 robertperkins@talktalk.net www.chalkhill-lime.co.uk (Q, P, RM & LW)

Cy Pres (Brigstock)Ltd., 14 Bells Close, Brigstock, Kettering, Northants.,NG14 3JG Tel: 01536 373158 (P,RM & LW)

Hirst Conservation Materials Ltd., Laughton, Sleaford, Lincs., NG34 OHE Tel: 01529 497517 hirst@hirst-conservation.com www.hirst-conservation.com (P,RM,LW,H & Pg)

Lhoist, Hindlow, Buxton, Derbyshire, SK17 OEL Tel: 01298 768666 uksales@lhoist.co.uk www.lhoist.co.uk (Q)

Liver Grease, Oil & Chemical Co. Ltd., 11 Norfolk Street, Liverpool, L1 0BE Tel: 0151 709 7494 www.livergrease.co.uk (Q, P, LW)

Railton Price, The Old Farmhouse, Winterton, North Lincolnshire, DN15 9UB Tel: 01724 737248 & 07796 351913 limesales@railtonprice.co.uk www.railtonprice.co.uk (Q,P, RM,LW,H, H-uk,Pg & C)

Singleton Birch Ltd., Melton Ross Quarry, Barnetby, N Lincolnshire, DN38 6AE Tel: 01652 686000 sales@singletonbirch.co.uk www.singletonbirch.co.uk (Q & H-uk)

Skillington Workshop, Baxters Yard, 35 - 40 Stuart Street, Grantham, Lincs., NG31 9AF Tel: 01476 565671 & 07713 647225 skillwork@aol.com www.skillington.org
(P, RM, LW, H, H-uk & Pg)

Tarmac Buxton Lime & Cement, Buxton, Derbyshire, SK17 8TG Tel: 01298 768444 buxton.sales@buxtonlime.co.uk www.buxtonlime.co.uk & www.whitepeaklimewash.co.uk (Q,P,RM,LW & H)

Travis Perkins Ltd., Foss Islands Road, York, YO31 7UY Tel: 01904 638742 mail@jhwalker.co.uk www.jhwalker.co.uk
(P, H & H-uk)

White Rose Lime, Glasshouses Mill, Glasshouses, Nr.Harrogate, N.Yorks., HG3 3QH Tel: 01423 780621 (P,RM & LW)

Womersley's Ltd., Walkley Lane, Heckmondwike, W. Yorks WF16 0PG Tel: 01924 400651 markwomersley@aol.com www.womersleys.co.uk
(P, RM, LW, H, H-uk, Pg & C)

AREA 4 (SOUTH WEST)

Acanthus Lime Products, 5 Hansford Square, Coombe Down, Bath, BA2 5LQ Tel: 01225 837223 (Q,P,RM)

Chris Brookman, Back to Earth, Jubilee House, Cheriton Fitzpaine, Crediton, EX17 4JH Tel:01363 866999 chris@backtoearth.co.uk www.backtoearth.co.uk (P,RM & LW)

H.J.Chard & Sons, 1 Cole Road, Bristol, Avon, BS2 0UG Tel: 01179 777681 (Q,P,RM,H & Pg)

H.J.Chard & Sons, Springway Lane, Westonzoyland, Bridgwater, TA7 QJS Tel: 01278 691193 (Q,P,RM & Pg)

Cornish Lime Co., Brims Park, Old Callywith Road, Bodmin, Cornwall, PL31 2DZ Tel: 01208 79779 phil@cornishlime.co.uk www.cornishlime.co.uk (P,RM,LW,H, Pg & C)

Farrow & Ball, Uddens Estate, Wimborne, Dorset, BH21 7NL Tel: 01202 876141 info@farrow-ball.com www.farrow-ball.com (LW & Pg)

A.E.Griffin & Son, Bere Regis, Wareham, Dorset, BH20 7LA aegriffinandson@aol.com Tel: 01929 471253 (P & H)

R.J. & C.M. Lancaster, Helliers Farm, Aveton Gifford, Kingsbridge, S. Devon, TQ7 4ND Tel: 01548 550689 (P, LW & H)

Leigh le Noury, Limeworks, Les Caches Farm, Rue de la Cache, Vale, Guernsey, GY6 8LJ Tel: 01481 259414 leigh@limeworks.co.uk www.limeworks.co.uk (P,RM,LW,H & Pg)

J. Layzell & Sons, Stoneleigh, Pound Road, Horton, Ilminster, Somerset, TA19 9QT Tel: 01460 52855 jlayzellandsons@aol.com (P, RM, LW & Pg)

Limebase Products Ltd., Walronds Park, Isle Brewers, Nr Taunton, Somerset, TA3 6QP Tel: 01460 281921 info@limebase.co.uk www.limebase.co.uk (Q,P,RM,LW,H, H-uk & Pg)

Kevin McCabe, Keppel Gate, Higher Ridgeway, Ottery St. Mary, EX11 1TJ Tel: 01404 8142700 kevin.mccabe2@btopenworld.com www.buildsomethingbeautiful.com
(Q,P,RM,LW, Pg & C)

Potmolen Paint, 27 Woodcock Industrial Estate, Warminster, Wilts., BA12 9DX Tel: 01985 213960 (P,LW & Pg)

Matt Robinson, Caervallack, St.Martin, Helston, Cornwall, TR12 6DF Tel: 01326 221339 & 07795 560907 matt@build-art.co.uk www.build-art.co.uk (P)

Rose of Jericho Ltd., Horchester, Holywell, Dorchester, DT2 0LL Tel: 01935 83676 info@rose-of-jericho.demon.co.uk www.rose-of-jericho.demon.co.uk
(P,RM,LW,H, H-uk & Pg, & Feebly Hydraulic P)

J & J Sharpe, Furzedon, Bounsells Lane, Merton, Okehampton, EX20 3DS Tel: 01805 603587 mail@jjsharpe.co.uk www.jjsharpe.co.uk
(Q, P, RM, LW, H, Pg & C)

Suppliers

Tamar Trading Co. Ltd., 15 Bodmin Street, Holsworthy, Devon, EX22 6BB Tel: 01409 253555 sales@tamartrading.com (H-uk)

Twyford Lime Products, 1 Twyford Place, Tiverton, Devon, EX16 6AP
Tel: 01884 255407 & 07747 024558
limewashman@fhsinternet.com (P,RM,LW & Pg)

Rory Young, 7 Park Street, Cirencester, Gloucs., GL7 2BX Tel: 01285 658826 (LW)

Wells Cathedral Masons Ltd., Brunel Stoneworks, Station Road, Cheddar, Someret, BS27 3AH
Tel:01934 743544 wcs@stone-mason.co.uk
www.stone-mason.co.uk (P & H)

Mike Wye & Associates, Buckland Filleigh Sawmills, Buckland Filleigh, Beaworthy, Devon, EX21 5RN Tel: 01409 281644
sales@mikewye.co.uk www.mikewye.co.uk
(Q,P,RM,LW,H,Pg & C)

AREA 5 (SOUTH EAST)

Anglia Lime Co., Fishers Farm, Belchamp Walter, Sudbury, Suffolk, CO10 7AP Tel: 01787 313974
info@anglialime.com www.anglialime.com
(P,RM,LW, H, Pg & C)

Between Time Ltd., Bachelors Hall, High Street Stanstead Abbots, Nr. Ware, Herts SG12 8AB
Tel: 01920 877822 (P, RM, LW & H-uk)

Bursledon Brickworks, Coal Park Lane, Swanwick, Southampton, SO31 7GW Tel: 01489 576248
enquiries@hampshirebuildings.org.uk
www.hampshirebuildings.org.uk
(P, RM,LW,H,H-uk,Pg & C)

CWO Ltd., Terminus Road, Chichester, W.Sussex, PO19 8TX Tel: 01243 784225 info@cwo.uk.com
www.cwo.uk.com (P & H)

Chalk Down Lime Ltd., The Yard, Gate Farm, Northiam Road, Staplecross, TN32 5RP
Tel: 01580 830092 chalkdownlime@aol.com
www.chalkdownlime.co.uk (P.RM,LW & Pg)

L. Cornelissen & Son, 105 Great Russell St., London, WC1B 3RY Tel: 0207 636 1045
info@cornelissen.com (Pg)

Dorset Centre for Rural Skills, West Farm Barn, Farrington, Blandford, Dorset, DT11 8RA
Tel: 01747 811099 info@dorsetruralskills.co.uk
www.dorsetruralskills.co.uk (Q, P, RM, Pg & C)

Earth & Reed, 48-50 High Street, Needham Market, Suffolk, IP6 8AP
Tel: 01449 722255 sales@earth-and-reed.co.uk
www.earth-and-reed.co.uk (P, RM, LW, H, Pg & C)

Ecomerchant Ltd., Head Hill Road, Goodnestone, Nr. Faversham, Kent, ME13 9BU Tel 01795 530130 sales@ecomerchant.co.uk
www.ecomerchant.co.uk (P,RM,LW,H,H-uk,Pg & C)

Hendry & Sons Builders, Station Road, Foulsham, Dereham, Norfolk, NR20 5RG Tel: 01362 683249
(P,RM,LW,H-uk & Pg)

Old House Store Ltd., Hampstead Farm, Binfield Heath, Nr. Henley-on-Thames, Oxon., RG9 4LG
Tel: 0118 969 7711
info@OldHouseStore.co.uk
www.OldHouseStore.co.uk
(P,RM,LW, H, H-uk & Pg)

Liz Induni, 17 King's Road East, Swanage, Dorset, BH19 1ER Tel: 01929 423776 (LW)

Liberon Ltd., Learoyd Road, Mountfield Industrial Estate, New Romney, Kent, TN28 8XU
Tel: 01797 367555 www.liberon.co.uk (Pg)

The Lime Centre, Long Barn, Morestead, Winchester, Hants., SO21 1LZ Tel: 01962 713636
bob@thelimecentre.co.uk
www.thelimecentre.co.uk
(P,RM,LW,H & C)

Papers and Paints Ltd., 4 Park Walk, London SW10 OAD Tel: 0171 352 8626
sales@papers-paints.co.uk
www.papers-paints.co.uk (P & Pg)

Tilcon Ltd., Central Order Service, Sevenoaks Quarry, Bat & Ball Road, Sevenoaks, Kent, TN13 5SR Tel: 01732 453633 (P)

AREA 6 (IRELAND)

Narrow Water Lime Service, 67 Newry Road, Warrenpoint, Co. Down, BT34 3LE
Tel: 028 4175 3073 dan@nwls.fsnet.co.uk
(P, RM, LW)

Roundtower Quality Building Limes, The Forge, Innishannon, Co.Cork Tel: 353 21 477 6677
mail@roundtowerlime.com
www.roundtowerlime.com (P,RM,LW,H,Pg & C)

Stoneware Studios, Pillmore, Youghal, Co. Cork, Ireland Tel: 024 90117
mail@stonewarestudios.com
www.stonewarestudios.com
(P, RM, LW, H, Pg & C)

Traditional Lime Co., Rath, Shillellagh Rd., Tullow, Co.Carlow Tel: 059 915 1750
office@traditionallime.com
(Q,P,RM,LW,H & Pg & C)

This Suppliers List is updated annually. Please let me know of any changes or additions.
Jane Schofield Tel: 01884 861181 jane@blackdog.ukf.net

Useful Addresses

Society for the Protection of Ancient Buildings (SPAB),
37 Spital Square, London, El 6DY
Tel: 020 7377 1644 Email: info@spab.org.uk Web: www.spab.org.uk

English Heritage,
Fortress House, 23 Savile Row, London, W1X 1AB
Tel: 020 7973 3000 Email: customers@english-heritage.org.uk
Web: www.english-heritage.org.uk

CADW - Welsh Historic Monuments,
2nd Floor, Crown Building CP2, Cathays Park, Cardiff, CF10 3NQ
Tel: 029 2050 0200 Email: cadw@wales.gsi.gov.uk
Web: www.cadw.wales.gov.uk

Historic Scotland, Scottish Conservation Bureau,
Longmore House, Salisbury Place, Edinburgh, EH9 1SH
Tel: 0131 668 8606 Email: hs.conservation.bureau@scotland.gov.uk
Web: www.historic-scotland.gov.uk

The Georgian Group,
6 Fitzroy Square, London, W1T 5DX
Tel: 020 7387 1720 Email: office@georgiangroup.org.uk

The Building Limes Forum,
c/o Glasite Meeting House, 33 Barony Street, Edinburgh, EH3 6NX

Devon Earth Building Association, (DEBA), c/o Peter Child,
South Coombe, Cheriton Fitzpaine, Crediton EX17 4HP
peter@prchild.freeserve.co.uk www.devonearthbuilding.com

Further Information & Reading

This book is available in French:

'La Chaux dans la Construction – Guide Practique' Jane Schofield, adapté par Alain Hervé (Black Dog Press 2005)

S.P.A.B. Information Sheet No.4 'The Need for Old Buildings to Breathe' Philip Hughes

S.P.A.B. Information Sheet No.7 'First Aid Repair to Traditional Farm Buildings' John Sell

S.P.A.B. Information Sheet No.9 'An Introduction to Building Limes' Michael Wingate

S.P.A.B. Information Sheet No.12 'Lime Ash and Plaster Floors' Philip Hartley

S.P.A.B. Technical Pamphlet No.5 'Pointing Stone & Brick Walling'

'Conservation of Clay and Chalk Buildings' Gordon Pearson (Donhead 1992)

'The Smeaton Project: Factors Affecting the Properties of Lime-Based Mortars' (English Heritage)

'Building with Lime' Stafford Holmes & Michael Wingate (Intermediate Technology Publications 1997)

Historic Scotland Technical Advice Note No.1 'Preparation and Use of Lime Mortars' (1995)

Historic Scotland Case Studies Series 'Traditional Lime Harling' (1996)

'Mortars, Plasters & Renders in Conservation' John Ashhurst (E.A.S.A. Out of Print)

'Directory of Building Limes' English Heritage (Donhead 1997)

'Cob Buildings - A Practical Guide' Jane Schofield & Jill Smallcombe (Black Dog Press 2004)

Practical Courses

Anglia Lime Co., Fishers Farm, Belchamp Walter, Sudbury, Suffolk, CO10 7AP
Tel: 01787 313974 info@anglialime.com www.anglialime.com

Bursledon Brickworks, Coal Park Lane, Swanwick, Southampton, SO31 7GW
Tel: 01489 576248 enquiries@hampshirebuildings.org.uk
www.hampshirebuildings.org.uk

Centre for Alternative Technology (CAT), Machynlleth, Powys, SY20 9AZ Tel: 01654 705981 courses@cat.org.uk www.cat.org.uk

Chalk Down Lime Ltd., The Yard, Gate Farm, Northiam Road, Staplecross, TN32 5RP
Tel: 01580 830092 chalkdownlime@aol.com www.chalkdownlime@aol.com

Charlestown Workshops, The Scottish Lime Centre Trust, Rocks Road, Charlestown, Fife, KY11 3EN
Tel: 01383 872722 admin@scotlime.org www.scotlime.org

Gary Coates, Severn Valley Stone, Rockridge Farm, Mill Lane, Strensham, Hereford & Worcester Tel:01684 297102 garycoates@stonearts.net
www.stonearts.net

Cornish Lime Co., Brims Park, Old Callywith Road, Bodmin, Cornwall, PL31 2DZ
Tel: 01208 79779 phil@cornishlime.co.uk www.cornishlime.co.uk

Dorset Centre for Rural Skills, West Farm Barn, Farrington, Blandford, Dorset, DT11 8RA Tel: 01747 811099 info@dorsetruralskills.co.uk www.dorsetruralskills.co.uk

Earth & Reed, 48-50 High Street, Needham Market, Suffolk IP6 8AP
Tel: 01449 722255 sales@earth-and-reed.co.uk www.earth-and-reed.co.uk

Ecomerchant Ltd., Head Hill Road, Goodnestone, Nr. Faversham, Kent, ME13 9BU
Tel: 01795 530130 sales@ecomerchant.co.uk www.ecomerchant.co.uk

Ironbridge Institute, Coalbrookdale, Telford, Shropshire, TF8 7DF Tel: 01952 435969 harriet.devlin@ironbridge.org.uk

The Lime Centre, Long Barn, Morestead, Nr. Winchester, Hants., SO21 1LZ
Tel: 01962 713636 bob@thelimecentre.co.uk www.thelimecentre.co.uk

Lime Green Products Ltd, Coates Kilns, Stretton Road, Much Wenlock, Shropshire, TF13 6DG Tel: 01952 728611 enquiries@lime-green.co.uk www.lime-green.co.uk

Precious Earth, 22 Corve Street, Ludlow, Shropshire SY8 1DA Tel: 01584 878633
Email: info@preciousearth.co.uk www.preciousearth.co.uk

Railton Price, The Old Farmhouse, Winterton, North Lincolnshire, DN15 9UB
Tel: 01724 737248 & 07796 351913 limesales@railtonprice.co.uk www.railtonprice.co.uk

Elaine Rigby & Charles Blackett-Ord, Intake Side, Kirkby Stephen, Cumbria, CA17 4EA
Tel:01768 352572 & 01768 341502

Roundtower Quality Building Limes, The Forge, Innishannon, Co Cork, Ireland.
Tel: 35321 477 6677 Email: mail@roundtowerlime.com www.roundtowerlime.com

J & J Sharpe, Furzedon, Bounsells Lane, Merton, Okehampton, Devon, EX20 3DS
Tel: 01805 603587 mail@jjsharpe.co.uk www.jjsharpe.co.uk

Stoneware Studios, Pillmore, Youghal, Co. Cork, Ireland
Tel: 024 90117 mail@stonewarestudios.com www.stonewarestudios.com

Ty Mawr Lime Ltd, Ty-Mawr Farm, Llangasty, Breacon, Powys LD3 7PJ
Tel: 01874 658249 tymawr@lime.org.uk www.lime.org.uk

Vaynol Conservation Centre, Vaynol Hall, Vaynol Estate, Bangor, Gwynedd, LL57 4BP
Tel: 01248 670444 info@vaynol.co.uk www.vaynol.co.uk

Woodchester Mansion Trust Ltd., Woodchester Park, Nympsfield, Stonehouse, Gloucs. GL10 3TS Tel:01453 861541 www.woodchestermansion.org.uk

Mark Womersley, Walkley Lane, Heckmondwike, W. Yorks., WF16 0PG.
Tel: 01924 400651 markwomersley@aol.com www.womersleys.co.uk

Mike Wye & Associates, Buckland Filleigh Sawmills, Buckland Filleigh, Beaworthy, Devon, EX21 5RN Tel: 01409 281644 sales@mikewye.co.uk www.mikewye.co.uk

Index