FREE

A Practical Guide to

Traditional Building Maintenance

Cob & stone repairs, lime pointing, lime plastering & lime rendering, limewashing, dealing with dampness and much more

Natural Building & Decorating Products

"Better for you, your home & the environment"

Mike Wye & Associates Ltd

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SUPPLY OF  MATERIALS

Many materials mentioned in this guide are either manufactured or supplied by Mike Wye & Associates. Most materials are usually supplied ex-works and can be delivered to anywhere in the UK or abroad as required. From a small packet to an articulated lorry, simply call to discuss your needs. Details of products and prices can be found on our website.

	**Lime putty** is the oldest form of lime and can be used to create limewash, plasters, mortars, frescos, fine decorative plasters etc. It is supplied in easy to handle plastic tubs for customers to make into their own usable finished product. Lime putty literally lasts indefinitely, and as long as it is not allowed to dry and carbonate it improves with age. Lime putty mortars usually benefit from mixing up a couple of weeks before use and storing free from suction or the atmosphere before knocking up again on the day of use. We can advise on the best sands if you intend to go down this route.
	**Pre-mixed lime putty mortars and plasters** can be supplied in a range of sizes from 17kg tubs up to 1,000kg dumpy bags. Again, these can last indefinitely if kept stored correctly with no additives. Once animal hair is added the hair has a fairly short time span and should ideally used within a month of the hair being mixed in with the lime. External lime putty mortars benefit from the addition of a pozzolan to create a hydraulic set. We supply a calcined clay, called Argical for this.
	**Limewash** is made with lime putty and our natural limewash comes as a bright white colour. Limewash can also be supplied pre-pigmented from our range of 54 standard colours or bespoke colours can be matched for a small fee. Limewash can be used inside or outside and offers a very cost effective and traditional means of decoration and protection. We supply a relatively thick limewash that can be watered down if desired.
	**Natural Hydraulic Limes** are created by burning limestones with impurities. They are a powdered form of lime that comes in 25kg bags which when mixed with sand and water will have an earlier set than pure lime putty based mortars. There are a range of minimum strengths: NHL2, NHL3.5 and NHL5. NHLs from different manufacturers may also produce different results, so its important to choose the appropriate one for the task.
	**Natural building products** ranging from oak lintels, sawn larch lath and riven oak lath to complement traditional buildings. We also supply a range of clay plasters, reed lath on a roll, reed boards and cob blocks.
	**Natural Insulation** such as cork render/plaster, sheepswool, cellulose fibre, wood fibre boards, reed boards and insulating clay aggregates can all be supplied to help create a healthy and warm building. As well as for loose fill insulation, clay aggregates can be used with natural hydraulic limes to create a limecrete floor for extra insulation.
	**Natural Paints, Oils & Waxes** are much healthier for your home, the environment and for you. We supply an extensive range of breathable paints for both inside and outside walls and joinery including clay paints, casein, distemper, natural emulsions, linseed stand oil paints etc. We stock a wide range of oils, waxes and water-based varnishes for furniture, floors, joinery etc.

Visit our acclaimed website for full technical specifications, unbeatable prices and special offers and to sign up for our e-newsletter

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Introduction

Why use lime?
Prior to the 20th century building techniques and materials were very different from those employed today. Traditional properties need to "breathe" to allow moisture inherent in a solid wall construction without a damp proof course to evaporate from the external stonework or render. Many old buildings are constructed from materials such as brick, cob and stone which are relatively porous and often of lower strength. Lime putty mortars were normally used for bedding and plastering. Lime mortar is a relatively softer mortar and therefore it is able to withstand a certain amount of movement (without cracking) that comes with settlement and seasonal changes in ground conditions. Lime mortar is porous and allows moisture to evaporate, helping to keep a building free of dampness.

On the other hand the cement-rich repairs used by many general builders are often very damaging to the structure resulting in:

- a tendency to crack rather than absorb movement
- water entering the structure via cracks and then being trapped, creating damp conditions
- a tendency for renders to separate from the wall, increasing dampness
- cob walls can progressively deform and can fail

These problems are often compounded by the use of modern acrylic paints which trap moisture in the walls.

Which lime do I use? - A rough guide
Pure limes only set by carbonation where the lime (calcium hydroxide) reacts with carbon dioxide from the air to form calcium carbonates. Mortars and plasters based on pure limes are suitable for internal work or sheltered conditions where hydraulicity and frost resistance are not necessary. They offer maximum breathability and their lower compressive strengths can be an advantage in accommodating stress and movement.

From the time of the Romans, lime mortars for building or external rendering had added ingredients to increase their compressive strength, improve frost resistance and make them hydraulic. Originally these additives were volcanic ashes from the vicinity of the Italian town called Pozzuoli – hence the term pozzolans. Hydraulic mortars are so called for this ability to set under or in the presence of water. The degree of hydraulicity of the mortar will affect many of its characteristics e.g. compressive strength, speed of set in the presence of water, water vapour permeability.

So the original hydraulic lime was in fact a combination of pure lime putty and a pozzolan that can still be replicated and is usually used these days in the UK to render and point externally or internally on to walls that are inherently damp and require the hydraulic set as pure limes can't carbonate in damp conditions. Substitute materials have long been used instead of volcanic ash, hence any burnt clay that reacts with a pure lime to create an hydraulic set is referred to as a pozzolan. Argical is an excellent pozzolan for this purpose.

A powdered Natural Hydraulic Lime was introduced much later in the 19th century when limestone was discovered with natural impurities that when burnt mimicked the pozzolans used by the Romans. This is perhaps more like a weaker, early form of OPC (Ordinary Portland Cement) as it needs to be dry stored and a chemical set begins once water is absorbed into it. Care should be given to selecting the most appropriate Natural Hydraulic lime as they come in different minimum strengths designated NHL2, NHL3.5 and NHL5. These numbers refer to the minimum strengths and the actual range of the strengths are 2-7N/mm^2 (NHL2), 3.5-10N/mm^2 (NHL3.5) and 5-15N/mm^2 (NHL5). Different manufacturers actual strengths vary widely within these bands. A strong version of NHL5 is ideal for Limecrete floors, chimney flaunching, coping or ridge tiles. Obtain guidance from our technical advisors before selecting the lime for your project if in any doubt.

Practical Considerations
When specifying a lime mortar, consider:

- its purpose - bedding, pointing, rendering, plastering - and their different requirements
- the nature of the substrate - its strength, durability, porosity, water vapour permeability
- the environmental conditions to which substrate and mortar are exposed
- the need to match existing mortars
- the cost may also have a bearing on the approach chosen

The photo shows an extreme example of what can happen with poor or inappropriate maintenance

Dampness in Older Buildings

It is necessary to work out where dampness is coming from before making any final decisions on a course of action. Issues such as water table level, soil drainage, exterior ground levels compared to the interior levels, inappropriate external renders, acrylic masonry paints, inappropriate pointing mortars, porous substrates (e.g. brick and some stone types) rainwater goods such as guttering, dew point/humidity in the rooms, poor air circulation and ventilation, damp proofing membranes, floor coverings etc. all play a part, together with the degree of exposure to the weather. It is vital that you understand all the issues having an effect on the building and what the results might be if certain actions are taken.

Moisture in old buildings goes with the territory to some respect but it's still important to know whether it's a result of penetrating rain, rising moisture, condensation on cold surfaces or a combination of all three.

If you have penetrating dampness then you may have to consider whether the stone or brick has become excessively porous or any pointing or external render is failing or inappropriate. Walls may be relatively thin so extra protection might be needed outside in the form of render/slate hanging etc. Lime mortars used for pointing and rendering are more porous than a cement render, this depends on the proportions of sand to binder, but this can be a mixed blessing on a permanently saturated westerly wall. Limewashes would be used to help resist penetrating rain and were often mixed with oils, tallow or other ingredients to reduce water penetration. Small quantities of linseed oil can be added into the backing coats of lime render or into a mortar for pointing. So if penetrating rain is the problem the right mix of lime mortar/limewash is needed otherwise there's no improvement other than a lime render will crack less and will breathe more if you get warm dry sunny days!

This image shows a cob and stone wall with cement render.

Damp is entering the cracked external render and into the building.

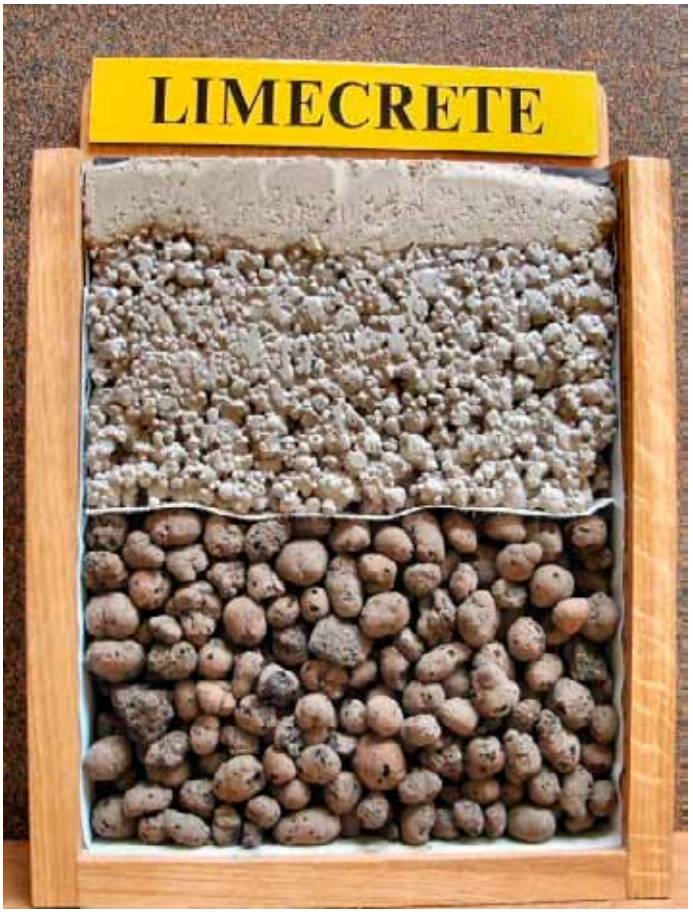
The horizontal crack is caused by a concrete block extension and differential movement in different materials.

If there is rising dampness, this is usually caused by factors such as a high water table, a high external ground level, inappropriate external renders and paints, a porous substrate e.g. brick, some stones or earth etc. In many types of stone wall damp proof injection can be a total waste of time and money as you can't get a continuous barrier in a bedding mortar. The worst case scenario is 90% success where any rising dampness is then concentrated into the 10% failure. Where it does work it can concentrate any rising dampness in vulnerable areas such as timber joists, window seats, sills or occasionally electric sockets. It is important to assess the condition of external renders and paints to see weather lime mortars and limewash would help the building breathe.

Many damp proofers insist on removing internal plaster to a height of 1 – 1.5 m and putting on a cementitious waterproofing plaster system to mask whether the injection actually works. In time you may get a tide mark as the tanking drives moisture ever higher - above the tanked level - causing structural damage to any timber fixings e.g. joists, window seats, sole plates in partition walls, studs for plaster lath etc. If you have condensation this can be caused by a number of factors e.g., modern dense plasters, damp wall through penetrating or rising dampness, soluble salts deposited on wall as moisture evaporates etc. and then water vapour in the room condenses on a colder surface.

Salts may have been drawn up by ground water or been included in the mortars or plasters mixed with the aggregates when applied .This can be a vicious downwards spiral as the condensation gets absorbed, lowers the wall temperature and so on. Ideally you need to know the moisture content at the centre of the wall - surface meter readings can be totally misleading as salts deposited on an inner surface will carry electric current even if the wall itself is relatively dry. A lime plaster is useful as it is more porous than a modern gypsum plaster and reduces condensation problems. Typically a coarse haired mix 3/1 sand/lime putty for the scratch coat, an unhaired float coat and a 2/1, 3/2 or Regency fine sand/lime putty mix for the finishing coat. It can then be painted with a limewash or alternative breathable paint. All these products we make or supply and specification sheets are on the website for internal plastering, external rendering, limewashing etc.

Typical problems that may occur when the floor has been sealed and the outside render is a hard cement covered with a modern non-breathing masonry paint.



Limecrete can help maintain the balance of a breathing building.

There are additives for lime plasters to help them set in damp conditions. These are called pozzolans, and are types of burnt clay. Clay plasters only set by evaporation of the moisture in the plaster so may not be suitable if you have an area of permanent dampness. It's best to look for and take action with the easiest and cheapest solutions first. If the problem is serious enough it may be necessary to consider having moisture readings taken in the centre of the wall but this can be a disruptive and expensive option.

Our modern way of living often is the biggest cause of dampness. Showers, washing machines, cooking, some forms of heating and even simply breathing are all sources of water vapour that potentially contribute to condensation. Without the draughts through windows, doors and open fireplaces, the modern trend of sealing all gaps keeps the built up moisture trapped within the building. This can lead to condensation and mould forming on cold surfaces.

Some people turn to extra insulation on the inside of external walls to avoid condensation problems. Insulating the walls may help reduce or remove condensation but if carried out by somebody who does not fully understand exactly what is happening to the building, problems may be transferred to another area or created where there weren't any in the first place. By preventing warmth being absorbed by walls, this will reduce the temperature of that or adjacent walls and can therefore allow condensation or mould to form where the adjacent, uninsulated walls were previously absorbing enough warmth not to have condensation problems.

Consult an appropriate specialist before undertaking work on a traditional building.
If the building is listed, always discuss proposals with your conservation officer.

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COB BUILDINGS ~ A RICH TRADITION

Building with earth has been a popular and comparatively cheap option throughout the ages. In the South West we have a rich tradition of cob buildings based on mixing sub-soil with straw. There is an old Devon saying that "All cob needs is a good hat and a good pair of boots". A stone plinth usually provides the boots and the hat was traditionally thatch.

When repairs do become a necessity its important to work with sympathetic materials and techniques to ensure a good looking and long lasting result.

The first priority is to identify the cause of any cracking or damage.

How old is the damage?
Has the wall been decorated and when?
Can neighbours remember any history of movement?
Is it connected with changes to the structure? (e.g. extensions, patios, paths, new roof, drains, defective renders, new doorways, windows etc.)

How severe is it?
Cob can often show cracks and defects because old buildings gradually move on shallow foundations. Recent movement is of more concern than an old defect.

If the cracks are located around doors and windows the damage is likely to have arisen from changing stress loadings or rotten timber lintels. Movement in an elevation wall is often revealed by bulges along its length, internal gaps with partition walls, floor joist movement becoming visible.

Movement in a gable wall can be a problem if the crack widens significantly as it goes up the wall.
Unfortunately modern cement renders, plasters, masonry paints and emulsions conspire to trap moisture in the wall and damp cob can lead to structural problems. Once the moisture level exceeds about 10-12% the strength of the cob drops dramatically. But don't be mislead by damp-proofing firms using surface moisture meters. Condensation and hygroscopic (water seeking) salts can both give high meter readings for basically dry walls. The moisture needs to be measured in the centre of the wall by taking a core reading. New concrete floors with damp proof membranes can also cause damp to be concentrated in the walls.

Repairing cob depends on the size of the problem. Non-structural cracks can be repaired with cob bricks, larger cracks or defects with cob blocks.
Rebuilding and repairing cob structures with cob blocks offer advantages over masonry and aerated blocks:

- They will match the existing structure for porosity and density, allowing moisture to move in a similar way.
- They won't introduce hot or cold spots where differential thermal movement can cause renders and plasters to crack.
- They have a similar compressive strength to the original cob and can therefore accommodate general movement better without detaching from the original structure.
- They allow recycling of material with savings in energy consumption.
- Cob blocks and bricks are ready dried and won't shrink away from adjoining surfaces.

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Before starting any work ask yourself; 'Do I need planning permission and listed building consent?' Once this has been dealt with, work may begin.

1. Preparation
When using cob blocks and cob bricks for repair, its important to ensure that they are bedded on flat surfaces as far as possible. Damaged and unsound cob in adjoining surfaces must be pared back. Differing methods have been suggested of getting a mechanical fixing to the adjoining surfaces. As well as chasing the blocks into adjoining cob, stainless steel helifix bars can be driven into the existing cob and bedded in the joints of the repair.

2. Damping
It is very important to control suction from the cob. Both the surfaces of adjoining cob and the cob blocks and bricks must be dampened with a light spray before use.

3. Bedding mortars
The aim of the bedding mortar is to spread the load evenly onto the block and it should be kept to a minimum thickness. The mortar can be a weak mix of earth/lime/sand mix of varying proportions dependent on whether the cob blocks are to be exposed and weathered to match or rendered or plastered. In the latter case a 4/1 mix of coarse sand/lime putty will be suitable. These mixes are intended to be of similar strength and porosity as the blocks.

4. Materials
We recommend that all renders and plasters should be lime putty based materials as these offer the best breathability and flexibility.

5. Protection
Please note that great care should be taken not to apply lime mortars when there is a risk of frost damage due to ice crystals forming within the lime mortar. It is important to prevent frost crystals forming within the mortar soon after application. Carbonation takes at least a month for each millimetre of thickness, therefore it may take over 20 months before lime mortar has carbonated to a depth of 20mm. It may be necessary to increase the amount of Argical added. It is important to ensure complete weather protection of the work at all times of the year.

6. Quantities
For 1 square metre of wall, 225mm thick - 20 blocks of size 18" x 9" x 4"
For 1 cubic metre of wall, - 80 blocks of size 18" x 9" x 4"
1 tonne of ready mixed 4/1 lime mortar will lay around 160 cob blocks, depending on the shape of the repair and the thickness of the bedding joints

It's also possible to put up shuttering and tamp down a drier mix of cob, but this method is generally slower as only a couple of feet can be rebuilt at a time, as each layer must have enough time to dry.

Larger problems may need to be tackled differently. The need for buttresses, tie-bars and underpinning is best discussed with an expert familiar with cob.

Safety:
Limes are caustic. Always wear eye protection and protective gloves and clothing and follow the safety instructions on the labels. Our advice and information are given in good faith. It's important that users satisfy themselves that they've chosen an appropriate product and have a suitably skilled workforce

Rebuilding a stone wall

The size of the job and whether it is a listed property will affect the questions below, which should be checked with your local council;

- Do I need planning permission and listed building consent?
- Do I need Building Regulations approval?
- What size foundations are necessary?

The requirements for repairs to an existing wall will differ from a new wall separating your patio from the neighbour's! The type of stone or brick used will affect the strength of mortar in which to bed them. Prior to 1919 most walls were of traditional solid construction and masonry bedded in lime putty mortars, often with earth (subsoil) mixed in as well. Rebuilding and repairing with lime mortars offers a number of advantages:

- they will match the existing structure for porosity and density, allowing moisture to move in a similar way
- they can accommodate general movement better than a hard mortar
- soluble salts will be less likely to crystallise in the stone or brick faces
- they will match existing walls aesthetically

Preparation:
Try to select stone from a local quarry to match the existing. Take a sample along to the quarry if you're not sure. You can usually get two size ranges; 4"-6" and 6" - 9". For the bedding mortar use a volume mix of 7 parts coarse sharp well graded sand (from fine up to 6-8mm size) and 2 parts mature lime putty, mixed in advance for at least a week. Lime mortars gain strength from carbonation with carbon dioxide from the air. In damp, frost prone or very exposed situations it may be appropriate to add an extra ingredient to a lime mortar to increase its compressive strength and frost resistance. Traditionally volcanic ash or brick dust were added, these are forms of burnt clay called pozzolans after the Italian town of Pozzuoli where volcanic ash was used by the Romans. We use a calcined clay from called Argical at a volume gauge of 10 -25% depending on the degree of exposure. It won't give an overnight set but will slowly begin to add extra compressive strength to the mortar after a couple of weeks.

Building:
If you're a novice, position a stone dry first to make sure it looks right and you have got the best face showing. Stagger the vertical joints so there isn't a vertical joint running continuously up the wall

Premixing:
All pure lime putty mortars benefit from being pre-mixed then "knocked up" again prior to use to plasticise them - this reduces shrinkage in the mortar. Natural hydraulic limes (NHL) benefit from premixing by an hour then mixing again just prior to use.

Application:
Use a mortar bed just thick enough to spread the load evenly, finishing just beyond the front face and then trimming flush with the edge of the gauging trowel. Use a through stone that can tie together the entire thickness of the wall or thereabouts, one every square metre of wall face, pinning the wall together from both faces. The mortar shouldn't dry out too quickly - protect from sun, wind and rain with damp hessian cloth. Protect from rain if necessary. Build up to a maximum of 1 metre high at a time and then let the lime mortar cure for 2 to 3 days. When dry, the joints can be brushed with a stiff brush to expose the aggregate.

Protection
Please note that great care should be taken not to apply lime mortars when there is a risk of frost damage due to ice crystals forming within the lime mortar. It is important to prevent frost crystals forming within the mortar soon after application. Carbonation takes at least a month for each millimetre of thickness, therefore it may take over 20 months before lime mortar has carbonated to a depth of 20mm. It may be necessary to increase the amount of Argical added. It is important to ensure complete weather protection of the work at all times of the year.

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Lime Pointing

Lime putty mortars and natural hydraulic limes (NHL) offer advantages over cement based mortars. They are generally a softer, more porous material allowing moisture to evaporate from the joints in preference to the stone. This will help to lower moisture levels in the wall and reduce the build up of soluble salts in the stone face. As with all lime putty based materials the best outcome requires patience and careful control of drying and suction, the reward being a good looking and long lasting mortar.

	
Damage caused by inappropriate, hard cement pointing	The correct way to point a stone rubble wall

Preparation:
Any existing defective pointing must be raked out to a depth usually equal to twice the width of the joint, but not less than 20mm. The back of the joint should be roughly square in profile. Plugging chisels ensure that the stone or bricks aren't forced apart.

Damping:
The joints must be dampened, with enough time left for the stone or brick faces to dry to prevent smearing. The mortar should be as dry as it is practicable to point with. This allows maximum compaction in the joint, reduces shrinkage cracking and reduces the tendency to smear on the stone faces.

Premixing:
All pure lime putty mortars benefit from being pre-mixed and then "knocked up" again prior to use to plasticise them - this reduces shrinkage in the mortar.

Gauging:
We suggest a 3/1mix of coarse sharp well graded sand to mature lime putty internally and a 3.5/1mix externally where a Argical is to be added. In damp, frost prone or very exposed situations it may be appropriate to add the Argical to a lime putty mortar to increase its compressive strength and frost resistance. It won't give an overnight set but will slowly begin to add a little extra compressive strength to the mortar after a couple of weeks. Alternatively an NHL mortar may be used.

Pointing:
Start at the top of a wall to allow for cleaning up and spraying to continue. Use a pointing key or metal spatula and force the mortar in from a hawk. Joints deeper than 20mm will need an initial dubbing out as shrinkage can occur otherwise. Finish flush or rebate a little if the joints have widened with age or for personal preference as rebating highlights the stone more.

Brushing:
When the mortar is "green hard" (firm enough to brush without smearing but still maliable enough to work), brush or tamp the joints with a churn brush to enhance the aggregate and give a coarser texture to the pointing.

Protection:
External pointing should be mist sprayed to control drying and protected from direct sun and wind. In winter it should be protected from rain and frost. Hessian cloth is recommended.

Quantities:
20kg of lime putty mortar will point 2-3 square metres of stonework or 1- 1.5 square metres of brickwork based on a 10mm joint and 20mm depth.

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Lime Rendering ~ the need to “breathe”

Many older properties can suffer from damp problems, cracking or hollow render and flaking paint. It can be difficult to pin down the causes and there is often conflicting advice to contend with even before taking the plunge with expensive repairs or damp treatment.
Before the twentieth century building techniques and materials were very different from those employed today. Traditional properties need to “breathe” to allow moisture inherent in a solid wall construction to evaporate from the external stonework or render. Lime Putty was the base product widely used to produce mortar, plaster and limewash for traditional buildings. Lime putty mortars offer advantages over cement based mortars for the external rendering of these properties, especially when decorated with a breathable paint such as limewash.

- Their porosity allows the structure to breathe.
- They can accommodate general movement better.
- Their self healing nature reduces cracking problems.

In contrast to these breathable lime materials, too many traditional buildings are repaired and renovated using harder and impermeable materials designed for modern buildings of completely different construction methods. The result is often worse dampness problems.

To manufacture lime putty, first limestone is burnt in a kiln to produce quicklime. The quicklime is then mixed with water to produce a boiling liquid which is passed through a sieve and then left to mature in a pit or tanks for a number of months. This process is called slaking and the resultant lime putty ends up the consistency of cream cheese.
The mature lime putty is then mixed with a sand to make a lime mortar. Coarse sands are typically used for building and pointing and finer sands for finer plastering. Animal hair is teased into the mixes for backing coats of plaster. The mixed lime mortars should be left to mature for a further week or two before use as this minimizes any tendency for the mortar to shrink and crack during curing.

In particular, hard cement renders and many masonry paints fail to allow the moisture that is continually being sucked up from the ground to evaporate easily to the outside. This may result in damp, cold walls, condensation, flaking paint, rotten skirting boards, joists and other timber fittings, increased heating bills and a never ending battle to hold back the dampness from the inside. Chemical damp course injections, tanking and even drylining are common prescriptions wherever the “professional” has failed to understand the basic requirements of a traditional property. In the worst case scenario the combination of sealing the external and internal walls leads to a dramatic rise in the moisture levels in the wall, causing severe damage to earth and timber framed structures.

Some helpful guidelines to rendering are set out below:
1. Try and establish the nature of the existing render and paint. Get as many opinions as possible on the causes of any dampness problems and other, possibly cheaper solutions.
2. Before commencing work on a listed building ensure that you have the necessary consents
3. If you’re using a builder, see their previous work and talk to the clients. If undertaking the work yourself attending a practical course can be of enormous benefit.

A typical render specification:
1. Ensure that appropriate scaffolding is in place and the worksite safe for workers and public.
2. Take off the existing render, except any existing sound lime mortars, taking care not to damage the structure. Look out for very thick patches of render that are effectively load bearing. It may be preferable to render on top rather than risk rebuilding an area.
3. Dub out any deep holes in the wall with a haired lime putty mortar, rebuilding defects with cob blocks, bricks or stone as appropriate.
4. Treat wooden lintels with preservative and counter batten with oak lath if rendering over them.
5. Apply one hand harled coat of lime putty mortar to provide a key to the wall. This is usual with cob and brick but depends on the state and size of stone.
6. Apply sufficient coats of haired lime putty mortar to smooth the contours of the wall as required. With a suitable animal hair in the mortar coats can be applied up to 20mm thick rather than the 8 –10mm thickness of unhaired mortar. The hair reduces any slumping whilst applying and shrinkage cracking whilst curing. Each backing is keyed with a scratch comb.
7. Apply a top coat of floated or hand harled lime putty mortar as desired.

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Learning to 'Harl' or 'Scat' on the lime course	**Haired scratch coat**

Damping:
It is very important to control suction from the wall by light spraying with water half an hour before applying each coat (especially cob and porous brick) and in warm weather it will be necessary to spray each coat afterward.

Protection:
Please note that great care should be taken not to apply lime mortars when there is a risk of frost damage due to ice crystals forming within the lime mortar. It is important to prevent frost crystals forming within the mortar soon after application. Carbonation takes at least a month for each millimetre of thickness, therefore it may take over 20 months before lime mortar has carbonated to a depth of 20mm. It may be necessary to increase the amount of pozzolan added. It is important to ensure complete weather protection of the work at all times of the year.

Materials:
Lime putty mortars gain added strength by carbonating over many months with atmospheric carbon dioxide. Whilst pure lime putty mortars are suitable inside or for sheltered locations, it's recommended that for exposed elevations each coat of lime mortar has the pozzolan such as Argical added. These are burnt clays that react with the lime to give harder more frost resistant renders and historically ranged from volcanic ash, crushed bricks and other forms of burnt clay.

Curing:
All coats need to be given a few days to harden before subsequent coats are applied. To test whether a coat is 'green hard' the surface should be resistant to a fingernail. Many factors will influence the timing such as the season, exposure of wall and the thickness of the coat but it's normal to expect a couple of days for the harled coat to harden and perhaps 4 - 6 days for each of the thicker coats.

Painting:
It is important that lime renders are not totally sealed with an inappropriate paint. Limewash is the most cost effective paint to apply, offers the most traditional finish and will aid rainwater shedding . A minimum of four coats of limewash incorporating a little linseed oil should be painted on the final coat of render. Where a mixture of differing wall surfaces is to be painted it's possible that a silicate masonry paint will also be suitable.

Conclusions:
The best time to carry out external work is late spring so the lime has the whole summer to harden and carbonate. Lime mortars are easy to use and can readily be applied by the enthusiastic amateur given a little tuition and guidance. Although, the work needs to be carried out correctly, the beauty of the traditional building is that it rarely looks right when everything is straight and perfect, so the DIY owner can begin work comfortable in the knowledge that a certain amount of 'character' would not look out of place.

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Lime Plastering

Lime putty plasters offer advantages over cement based mortars and pure gypsum plasters for the internal plastering of traditional properties, especially when decorated with a traditional limewash.

- their porosity allows the structure to "breathe".
- they can accommodate general movement better.
- their self-healing nature reduces cracking problems.
- they can reduce condensation problems.

As with all lime putty based materials the best outcome requires patience and careful control of drying and suction, the reward being a good looking and long lasting plaster. We also supply a range of clay plasters for use in traditional properties and new build. They are designed to be used over cob, clay boards and reed mat and include a range of self-coloured finishing plasters that don't require painting.

Preparation:
Any existing plaster must be removed, except any sound lime mortars. Care must obviously be taken to ensure that the structure isn't damaged. Look out for very thick patches of plaster that are effectively load bearing. It may be necessary to plaster on top rather than risk rebuilding an area.

Damping:
It is very important to control suction from the background material (substrate) by spraying with water before applying each coat of plaster, especially onto cob or porous brick.

Learning how to plaster with lime at a Mike Wye course

Devil float coat

Premixing:
All pure lime putty skimming plasters benefit from being pre-mixed for a minimum of a couple of weeks and then "knocked up" again prior to use to plasticise them - this reduces shrinkage in the plaster.

Example Specification:

- dub out any deep holes in the wall with a haired lime putty mortar, rebuilding defects with 'like for like' materials.
- treat wooden lintels with preservative and counter batten with oak lath.
- apply one hand harled coat of lime putty mortar, 3/1 unhaired to provide a key to cob or brick. With stone this is a matter of judgment depending on the friability, texture and size of stone and joint.
- apply sufficient coats of haired lime putty mortar, 3/1 haired, to smooth the contours of the wall.
- apply a float coat of unhaired lime putty mortar, floated with a wood float and then 'Devil' floated to give a key.
- apply a top coat of our 2/1or 3/2 unhaired, lime-rich plaster, based on a very fine sand and lime putty. For the finest trowelled finishes, use our Regency lime plaster. These finishing plasters are typically applied in 2 thin coats, the first to take the key from the float coat and control suction and the second to plaster to a fine finish.

Gauging:
If there is a high residual level of moisture in a wall that cannot be eradicated (e.g a high external ground level) it may be necessary to sandwich a waterproof barrier between the coats of lime mortar. We supply a waterproofing slurry for this purpose. Backing coats of lime mortar can be gauged with 10% of Argical by volume to get a hydraulic set, this being especially important for the harled coat. A 10% gauge of Argical by volume can also be added to the top coat plaster to add extra durability where knocks are expected.

Plaster Skim:
Our finest Regency or or 3/2 lime plasters are ideal for a thin skim over a wide variety of backgrounds such as plasterboard, blocks and mixtures of old and new plaster, old paint etc. For plasterboard it will be necessary to tape and plaster the joints and then prime with Bayosan DG27 before applying a thin coat of 3/2 lime putty plaster followed by a final coat of Regency lime plaster for the finest of finishes.

Quantities:
for the Example Specification per square metre
one scat coat of 6kg 3/1 lime mortar 3/1 unhaired (3mm) + a minimum of 10% Argical by volume
one scratch coat of 30kg 3/1 lime putty mortar haired (15mm)
one float coat of 16kg 3/1 lime putty mortar unhaired (8mm)
one top coat of 6kg of 2/1 lime putty plaster (3mm)

Safety:
Limes are caustic. Always wear eye protection and protective gloves and clothing and follow the safety instructions on the labels. Our advice and information are given in good faith. It's important that users satisfy themselves that they've chosen an appropriate product and have a suitably skilled workforce.

Lime Plastering onto Lath

Types of Lath:
Traditional timber laths were commonly riven oak or chestnut. These are laths that have been split along the grain of the wood by hand. They are generally irregular in shape, width and thickness with a textured surface that provides extra key. Laths varied between 1 1/4" to 1 1/2" (31 - 37mm) in width and were around 1/4 " thick. The main key is formed by the lime plaster being squeezed between the lath by the trowelling action. Backing coats of lime plaster were typically haired to help the plaster keys stay in place whilst drying and curing occurs.

By the end of the 19th century sawn lath produced by machinery was also much in evidence. This is much more uniform in nature and has a smoother surface giving less key to the mortar. Hence the key formed by the plaster squeezed between the lath is of even greater importance. Sawn laths are generally a little narrower at around an inch (25mm). Timber laths were generally spaced out by around 1/4" to 3/8", and a lath on its edge was used to set the spacing.

During the 20th century, expanded metal lath (EML) began to supercede timber lath both in new work and often in renovation work as well, being cheaper to buy and quicker to fix. Lime plasters stick less easily to EML and there was also a move towards using harder cementitious plasters and gypsums. Many of these developments were out of keeping with the properties for which they were specified but also introduced their own problems due to their relative lack of breathability.

This image shows haired lime mortar pushed through a lath wall producing a key

Preparation:
It is recommended to moisten new lath with water before fixing to avoid swelling when wet mortar is applied. It is also important to control suction from dry, already fixed timber lath by lightly spraying with water 30 minutes before the first coat and allow the water to be absorbed.

Premixing:
All pure lime putty plasters benefit from being pre-mixed for a minimum of a couple of weeks and then "knocked up" again prior to use to plasticise them - this reduces shrinkage in the plaster. Do not do this for hydraulic mortars.

Example Specification:
Apply a first scratch coat of 3/1 haired lime mortar through the lath, leaving around 1/3" (8mm) on top of the lath itself. Do not over trowel this coat otherwise too much plaster may be lost through the lath. Do not trowel this coat too smooth but instead leave an open textured surface for extra key for the next coat of plaster. For ceilings we can also supply a double haired mortar.

- lightly scratch this coat with a lath scratcher and leave to dry and cure until green hard. A lime mortar or plaster is green hard when it can only be marked with a metal tool. It is then dry enough for any shrinkage to have taken place without having to be completely dry. This is likely to take 7-14 days..
- apply one float coat of 3/1 haired or unhaired lime mortar to straighten the surface as required. This coat may be 1/3" - 1/2 " (8 - 12mm) thick. Float this coat with a wooden devil float to provide a suitable surface for the final skim coat and leave to dry and cure until green hard. This is likely to be 5-10 days..
- trowel on a double top coat of our lime-rich plaster, 3/2 unhaired, based on a very fine sand and lime putty. This can be in a single coat or two very thin coats for a better finish. For the finest trowelled finishes use a maximum of 1mm of our Regency lime plaster for the final coat instead of a second coat of 3/2 plaster.

Gauging:
Where it is a ceiling that is being plastered and there is a floor above that will be walked on, sufficient time MUST be left for the plaster coats to carbonate to gain sufficient strength before using the room above.

This time will depend on circumstances such as time of year, ventilation etc but may be a minimum of 6 months. This is especially true if there is any play in the joists that cannot be eradicated or if works are being undertaken above i.e. fixing floorboards. Then it is essential that the first scratch coat is double haired and that it is gauged with 10% Argical by volume to get an earlier set.

Even so floorboards should be screwed rather than nailed down. Argical can also be added to the top coat plaster to ensure extra durability where knocks are expected.

This shows a lath ceiling finished with an NBT emulsion breathable paint

Example quantities:
one coat 3/1 haired lime putty mortar, 30kg per m2 (15mm)
one coat 3/1 unhaired lime putty mortar, 20kg per m2 (10mm)
two top coats of 3/2 lime putty plaster, totalling 6kg m2 (3mm)

For the very finest finish, instead of two coats of 3/2 plaster, use:
one coat of 3/2 lime putty plaster 4kg per m2 (2mm)
one coat of Regency lime plaster 2kg per m2 (1mm)
Please be aware that a well trowelled surface offers a poorer surface for limewash to adhere.

Safety:
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Limewashing

Limewash is the preferred finish on traditional buildings as it allows the structure to "breathe", allowing any damp present to evaporate away rather than be trapped in the wall. It has a matt finish and helps consolidate and improve the surface of both old and new plaster physically and visually. We supply a range of colours as well as white. Because limewashes are porous paints they shade in depth of colour to reflect the dampness of the background material.
Generally limewash should be applied thinly and be allowed to dry out slowly. Our limewash is prepared from the finest quality lime putty slaked from Buxton quicklime. It will develop a fine finish over several coats, we recommend a minimum of three coats onto new lime plaster and four coats onto new lime render. Supplied in a huge range of colours, our limewash has a small quantity of linseed oil added to reduce "dusting" and improve external water shedding. Historically, many ingredients were added to limewashes to modify their performance such as common salt, casein, tallow and linseed oil.

Preparation
The surface to be limewashed should be brushed and washed free of any loose particles, dust, dirt, lichen etc. If there is mould growth the surface should be treated with a fungicide (e.g. a weak bleach solution) which should be rinsed off before limewashing. Old coats of limewash can be cleaned with a solution of citric acid crystals.

Damping
It is very important to damp dry surfaces but may not be necessary if limewashing new lime render or lime plaster which has yet to totally dry out. Spray the area before limewashing with water as this prevents the water in the limewash from being sucked out too quickly on application. The water must be allowed to suck into the substrate or the limewash may fail after a week or so.

First Coat
Whisk the limewash thoroughly before use as the putty will settle out. Using a large emulsion brush or paint pad apply the limewash onto the dampened area. Work it well into any cracks or joints but don't let it build up too thickly as it can craze on drying out. Remember it's a wash and will look transparent on application but will dry opaque. Coloured limewashes dry to a much lighter shade than the wet limewash.

Subsequent coats
Four or five coats are recommended on new external lime render, three coats on new internal lime plaster. Ideally leave each coat to cure for a minimum of a day. For each further coat, follow the same procedure of misting well before limewashing and allowing to dry out slowly, with light spraying if necessary. Protect external limewash from the weather if necessary. A thin coat curing slowly in the presence of moisture will form a more crystalline, hardwearing surface compared to a chalky finish if a thick coat dries out too quickly. After the initial carbonation and curing limewash will continue to strengthen for several weeks.

Frost
As limewash is a water-based paint, it shouldn't be applied in low temperatures of less than 5ºC or if there's a risk of frost or rain.

Quantities
A litre of limewash will cover 3 - 6 square metres for one coat, depending on the smoothness and porosity of the surface being limewashed.

N.B. Under no circumstances use a modern acrylic masonry paint on a breathing wall, although an alternative to limewash can be a silicate masonry paint.

Safety:
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