

Heritage Building Conservation

Technical Advice Sheet 6

Repointing lime mortar joints

Repointing is the process of replacing the outer part of mortar joints with new mortar.

This technical advice sheet follows on from *4 Limestone walls need lime mortars* which should be read first. This sheet explains the practical aspects of repointing lime mortar joints in brick and stone masonry. It covers preparing the joints, mixing lime mortars, using the right tools to fill the joints, and the importance of maintaining good curing conditions so that the new mortar hardens well.



Historic photographs can provide good evidence of original pointing styles. (Students at Richmond State School, 1938, Fremantle History Centre)

Why repoint?

Mortar may have deteriorated and fallen out of the joints, leaving gaps between the bricks or stones. This commonly occurs at the base of walls that are affected by rising dampness and associated salts (see technical advice sheet *5 Dealing with dampness in old walls*). Another reason for repointing is to remove previous cement pointing which is preventing the joints from 'breathing' and allowing the walls to dry in the way intended (see technical advice sheet *4 Limestone walls need lime mortars*).

When to repoint?

Minor losses of mortar should be left alone and accepted as part of the natural ageing process. Aim to keep as much original material as possible - good practice is based on a cautious approach of doing as much as necessary to make the building work, but otherwise minimising changes to it so that its heritage value is not diminished. Only when the depth of mortar loss is greater than the width of the joints (i.e. about 10 mm in brickwork) should joints be repointed. Joints that are cracked and allowing water entry should also be repointed.



This wall requires repointing to replace deteriorated mortar joints as well as poor maintenance work from the past which has used damaging cement mortar.



Always get a Structural Engineer to check cracks in case remedial works need to be carried out.

Understand your building

- look carefully for original pointing to match in repair works

- Walk around your building and look carefully for remnants of original joint finishes — check in inaccessible places such as under eaves, behind meter boxes and downpipes.
- Remember that in traditional buildings more elaborate finishes (e.g. tuck pointing) were often only used on the front, with plain finishes (e.g. flush jointing) used on the sides and rear of the building. Keep this pattern — don't try to 'improve' on the original.
- The pointing mortar, which finishes the joint, is often different to the bedding mortar. The bedding mortar between the stones or bricks may be a relatively lean mix, as it is protected by the pointing.



Traditional Western Australian cut and struck (or overhand struck) pointing.



Remnants of 1890s tuck-pointing of bichrome brickwork.



Modern brickwork with rolled or bucket handle joints c. 1970s.



Remnant of original joint with mortar coloured with 'Spearwood Red' sand to school building c. 1900.



Original flush pointing to side wall of house c. 1890s.



Remnants of original raised ribbon pointing to limestone wall.

Preparing the joints — raking out

The process of removing decaying mortar back to a sound base ready for repointing is known as raking out. A variety of hand tools, including chisels and scrapers, can be used to remove lime mortars which are relatively soft (compared to cement). Power tools, such as oscillating blade or multi-tools, can be very useful, but disc cutters and angle grinders can be very damaging as their torque makes them more difficult to control.

Joints should be raked out to a minimum depth of 25 mm, and more where the existing mortar is deeply eroded. Leave the rear of the joints square, and clean the side surfaces of bricks and stones to ensure the new mortar will bond well. Catch the raked-out debris on drop sheets: don't let it lie on the ground or any salts that it contains will be recycled through the soil and back into the walls.

Wet the walls thoroughly — pre-wetting

Porous walls such as those made of limestone and old bricks have high suctions which must be controlled ('killed') by thorough dampening down with clean water from a hose. Start spraying the day before, and then several times on the day, the last just before repointing.

Don't overdo it — remember that apparently 'solid' walls can have large voids in the core (see Advice Sheet 3 Looking after limestone walls). Too much water may destabilise very old walls with bad damp problems, particularly walls that may have lost some of their structural integrity (see Technical Advice Sheet 5 Dealing with dampness in old walls).



An oscillating blade tool can be used to cut out soft to moderately hard joints without damaging the masonry units. (Photograph: David Young)



Damage to brickwork from the use of an angle grinder or disc cutter. The torque produced by rotating tools makes them difficult to control. (Photograph: David Young)



Small pneumatic hammer tools can be used judiciously to remove hard pointing. (Photograph: Piero Casellati)

Make a batch of lime mortar

Original lime mortar joints should be repaired with lime mortar. For buildings of particular heritage value consideration should be given to using sand-slaked quicklime mortars (i.e. traditional practice, see Young, 2017), but for many projects lime putty is an acceptable alternative. Properly used, lime putty will make better mortars than dry hydrated lime.

Do not use cement — not even ‘just a little bit to make sure the lime goes off’, as this will produce mortars with poor breathing characteristics. Refer to technical advice sheet 4 *Limestone walls need lime mortars* for further explanation. For more exposed walls it may be appropriate to add 5% of pozzolan, such as ground slag (GGBFS), but for most domestic applications this will not be necessary.

Source the right sand – Different coloured sands make



Lime putty should be drained so that it is stiff and stands like feta cheese (at the rear); creamy putty (in front) is too wet and not mature enough (Photograph: Paul McGahan).



Basalt sand



Silica Sand



Lime sand



Crushed limestone

different coloured mortars. Making a mortar that matches the colour of original pointing may take some experimentation. First make some sample ‘biscuits’, then prepare a sample panel of the best looking mix in an inconspicuous location and leave it to dry to determine if it is the right match before proceeding. Match the sand and mortar to the fresh (inside) colour of the original material, not to a weathered surface.

Using lime putty - Allow the lime putty to settle, then drain the liquid from the top so that only stiff putty remains — it should stand without slumping, like feta cheese. Measure batches by volume using regular containers kept expressly for the purpose; shovel batching is bad practice.

Mix the stiff putty with clean, dry, sharp, washed sand, such as is used for concrete or plaster (but not brickies sand, which is likely to contain clay).

Mix proportions should be about 1:2.5, i.e. one part lime putty to two and a half parts of sand. If the sand is fine-grained the mix will need to be made richer, e.g. 1:2, or even 1:1.5 if the sand is very fine.

Mix thoroughly

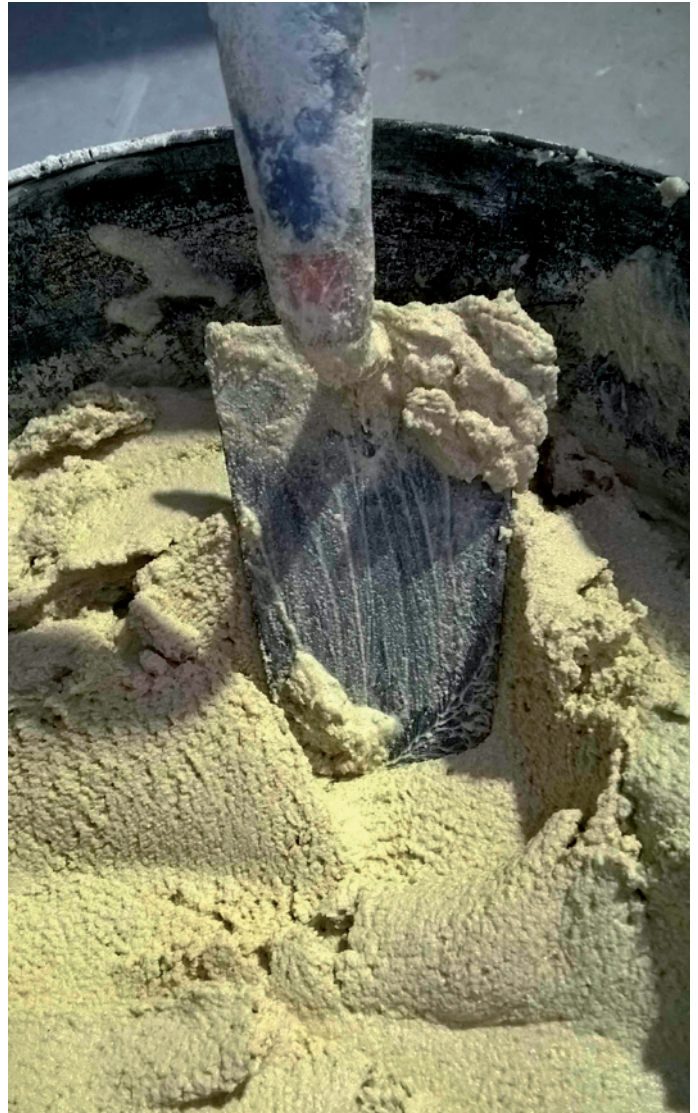
Small batches (which are often sufficient for repointing) can be mixed in a plastic tub by pounding the mix with the broad end of a mattock handle — simply turning the mix over with a trowel or spade will not be sufficient to force the lime and sand together.

Don't add water to the lime putty — even when drained there's enough water in a stiff putty to make a workable repointing mortar. The sand should be dry, not damp. The mix should be quite stiff, yet still plastic enough to be workable. Repointing mortars should be much stiffer (drier) than those used for laying bricks or stones. If, after thorough mixing, the mortar is not sufficiently workable, correct it by adding a small amount of lime putty, but not water.

Large batches should be mixed in a forced action (screed) mixer for a minimum of ten minutes. Conventional rotary cement mixers will not deliver the force required to properly mix the lime and sand together.



Forced action (screed) mixers. These have small blades rotating around a vertical shaft. (Photograph: Piero Casellati)



Mixed lime mortar — note that it is not wet and sloppy. Because of the much greater workability of lime it can be used much drier than contemporary cement mortars. Relatively stiff dryish mortars are important for repointing. (Photograph: Piero Casellati)



Caulking or finger trowels are used to place mortar into the back of raked-out joints. Different size trowels are needed for different joint widths. With care, no mortar need be smeared on the face of the bricks or stones. (Photographs: David Young)

Use the right tools for repointing

Packing mortar tightly into the back of open joints requires tools that fit within the joints — narrow caulking or finger trowels, of a range of widths to suit the varying joints. Triangular pointing trowels are not suitable for this stage of repointing. Plasterers' small tools may be suitable for the wider joints that are common in rubble stonework.

Work from right to left if right-handed, and left to right if left-handed, compacting the mortar into the back of the joint and against that just applied. Considerable force is needed to tightly compact the mortar, so as to leave no gaps and to ensure a good bond with the bricks and stones. Fill the horizontal (bed) joints first, then do the perpendicular joints (perps).

Slightly overfill the joints leaving any excess for cleaning up later. Spray the new work with fine water sprays as soon as it will take it. Keep it damp.

Build out in layers

If the joints are deeply eroded they should be repointed in layers of about 15–20 mm at a time, leaving three days between layers to allow the previous one to stiffen and begin hardening. Applying too much mortar at a time will result in shrinkage cracking. Compact each layer tightly and tamp with small pieces of wood or plywood as it stiffens up. Keep damp by spraying between layers.

Very deep voids between stones and in the cores of the walls may need grouting to fill the spaces and regain the structural integrity of the wall (see technical advice sheet 5 *Dealing with dampness in old walls*).

Finishing the joints

Allow one to three days depending on the season (shorter in dry summers, longer in damp winters) for the mortar to stiffen and begin hardening, keeping it dampened during this time. Trim loose material and any mortar 'crumbs' with a pointing trowel or small tool held on its edge. Then apply the required profile, matching the original if it can be identified elsewhere on the building (refer to page 2 of this technical advice sheet). Use a plain flush finish if there's no evidence of the original — it's better not to pretend. Never replace flush finishes on limestone walls with recessed or scalloped pointing designed to 'show' the stone. As well as not being historically accurate, such finishes will promote water entry into walls which are already quite porous.

Often a slightly weathered or aged appearance is needed to match the surrounding masonry, and this can be achieved by tamping the surface with a stiff bristled brush, such as a traditional churn brush. Do not brush or sweep, but use a direct end-on tamping action, the amount of tamping will depend on the degree of weathering required. Timing is critical: too soon and lime will be spread over the face of the masonry, too late and it will be too hard to tamp without causing damage to softer bricks or stones.

Tamping has the additional benefits of compacting the mortar, preventing shrinkage and removing the skin (laitance) that forms on the surface and slows hardening. Tamping also exposes the colour and texture of the sand grains.



A stiff-bristled churn brush being used to tamp the new work, compacting the mortar, exposing the sand grains, and producing an aged appearance. (Photograph: David Young)

Protect the new work

Rain, sun, and particularly wind, are the enemies of new mortars, which, if they dry too quickly, will not harden well and are likely to fail prematurely.

For works that require scaffolding, it should be tightly enclosed to control the climate within. Misting systems may be needed in warm weather to raise the humidity to suitable levels (above 60% RH).

Smaller scale works such as at the base of walls can be protected by removalists' blankets or old carpet draped from simple timber frames, that can be tipped back to allow access to the walls. Keep the covers damp to maintain the humidity against the new work.

Curing is critical

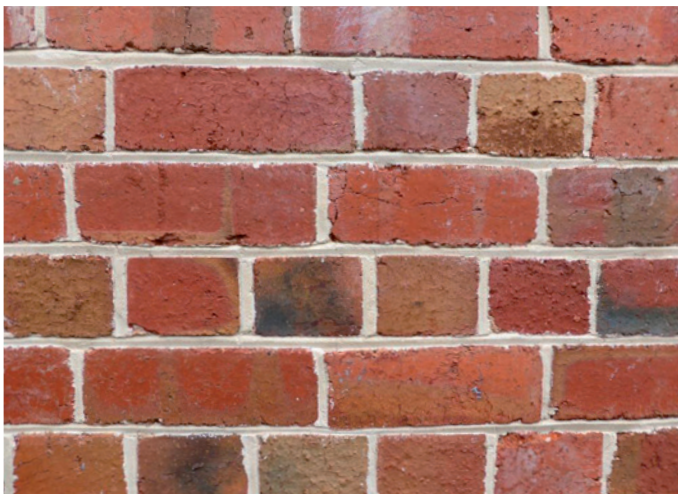
Lime mortars will only harden in the presence of liquid water: they must be kept damp for a period after repointing. Rapid drying is to be avoided at all costs, which means beginning spraying immediately after joint finishing or tamping is complete, and keeping it damp. Waiting until Monday morning to begin curing is not good enough.

A suitable curing regime is a 28 day period of alternate weeks of wetting and 'drying', during which the protection must be maintained. Fine water sprays are used to keep the new work very damp (but not running with water) for the first week of wetting. The second week is a period of 'drying', during which the relative humidity is maintained above 60%. In warm weather the walls may need light sprays in the middle and late afternoons. The third week is back to wetting, though this can be a series of thorough wetting events three times a day, rather than continuous dampness. The fourth week is again protected drying, and adding a little water in the afternoons in warm or windy weather.

The weather will play a big part in determining how much wetting and light spraying is required; the aim should be to keep the relative humidity above 60%. At the end of the works, thoroughly wet the walls as the scaffolding and protection is being removed. Then stand back and admire!



Recently completed repointing to limestone garden wall dating from 1850s but with a number of modifications made in the 1890s. Different pointing styles and colours were identified from the different eras of development and replicated to retain the evidence of change. All repointing used lime mortars and the colour variation is due to the type of sand used in the mix. It is thought that the earliest section of wall (left) used sand dug up on site whereas the later sections (central and right) were sourced from local quarries.



Recently completed cut and struck repointing to brick outbuilding c. 1890s.

Further reading

Young, David. 2017. *Mortars: materials, mixes and methods — a guide to repointing mortar joints in older buildings*. Heritage Councils of New South Wales, Queensland, South Australia, Tasmania, Western Australia and Victoria, Melbourne.

Young, David and Elisha Long. 2011. Repointing lime mortar joints — some important points. Heritage Council of NSW Technical Note. <http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/tagrepointjointsupdate.pdf>

Other technical advice sheets in this series

City of Fremantle Technical Advice Sheet 1

Introduction to good conservation practice.

City of Fremantle Technical Advice Sheet 2

Checklist for inspections.

City of Fremantle Technical Advice Sheet 3

Looking after limestone walls.

City of Fremantle Technical Advice Sheet 4

Limestone walls need lime mortars.

City of Fremantle Technical Advice Sheet 5

Dealing with dampness in old walls.

Look out for further technical advice sheets in this series in 2017 - 2018

These sheets can be downloaded from

www.fremantle.wa.gov.au/city-services/planning/conservationandcareof-heritagebuilding

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