Pointing Stone and Brick Walling

by
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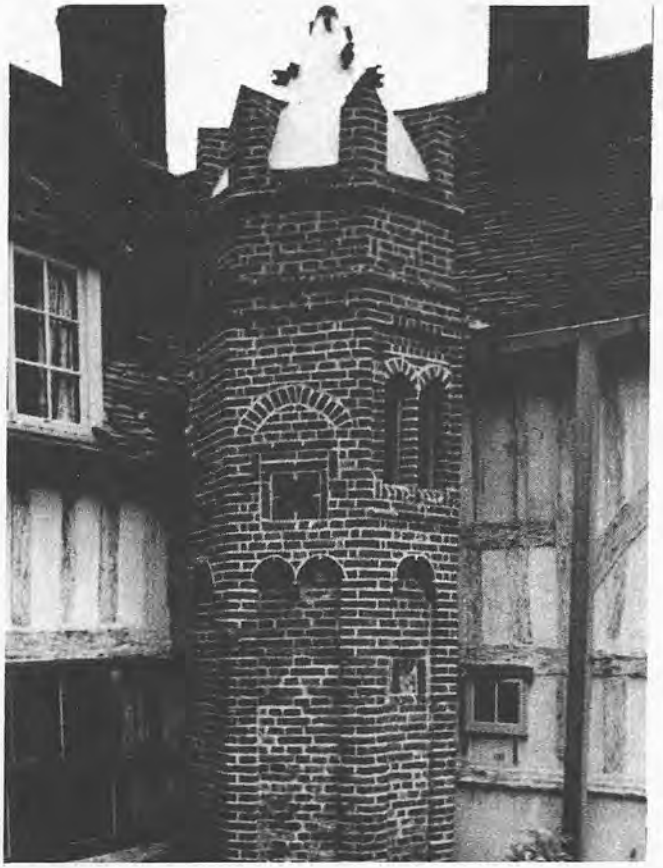
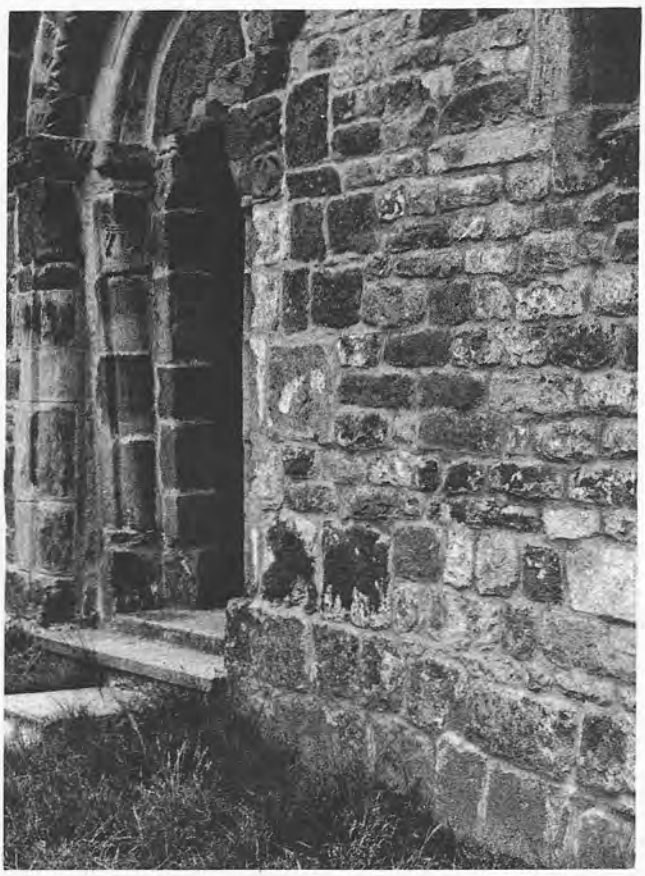
FRIBA

Technical pamphlet 5





The Society for the Protection of Ancient Buildings

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Length of life and the appearance of old buildings can be changed for the worse by bad pointing. The aim of this pamphlet is to describe and illustrate the pointing of different types of walling, from both the practical and aesthetic points of view. A degree of repetition is deliberate and is done so that if, for example, the reader wishes to investigate the pointing of brickwork he can go direct to this without having to read the sections on the pointing of stone.

1 Mortar: function, composition, weathering

First it is necessary to discuss the function which mortar plays in a masonry wall. Except for dry-stone walling all masonry, whether it be of stone or brick, uses mortar as a bed to even out the irregularities of the individual blocks. The more uneven the surface and shape of the individual stones or bricks, the thicker will be the mortar bed and conversely the more precise the stones, or the more accurately shaped the bricks, the thinner will be the mortar bed. Indeed its thickness may vary between 50 mm and 5 mm.

A secondary function of the mortar is to provide some adhesion between the individual stones or bricks. But in old buildings, the degree of adhesion produced by some lime mortars is minimal, and is not intended to give any tensile strength.

In old buildings lime mortar was always used for bedding. Until the 18th century the joints were usually finished flush as the stones or bricks were laid; in other words, there was no separate pointing process. However the slow development of strength in weak lime mortars together with the scouring action of wind-borne grit and rain, and the spalling action of salt crystalization and/or frost, gradually causes the exposed face of the mortar to disintegrate or 'weather' back. This process will be accelerated by other factors:

— Parapet walling where, if there is no damp proof course, the wall is vulnerable to rain falling not only on top of the wall, but also to wind carrying rain to both sides, so that the whole wall becomes saturated. Free standing garden walls, gate piers, and chimneys are similarly vulnerable.

— Local concentrations of moisture caused by blocked or cracked rainwater pipes, or by erosion or damage to drip mouldings, etc.

— Defects in design such as inadequate overhangs to copings or cills, absence of drips, etc. etc.

— The corners of a building which are particularly vulnerable to saturation, rapid and frequent wetting and drying cycles, and to scouring action.

— Unsuitable mortar materials such as gypsum, ash, and unwashed sea sand, which are sources of soluble salts.

— Disintegrating effects of ivy growing on a wall, which penetrates the joints and feeds on the lime.

— Birds attacking loose lime mortar for grit.

Two examples of walling, showing the possible variations in the thickness of mortar joints. Square knapped flint wall, Bridewell, Norwich. Rubble stone wall at North Elmham, Norfolk

Ideally the gradual erosion of the exposed face of the mortar bed should take place at the same rate as the erosion of the exposed face of the stone or brick of which the wall is built. In practice, there is always some difference, but if the strength of the mortar is properly adjusted such differences will only become apparent after many decades. The exposed face of the mortar will then begin to recede behind the outer wall face, making the arrises of the masonry more vulnerable to erosion. Eventually the joints become so worn that water may readily permeate the whole wall.

It is rare for the original mortar mix to be too strong for the stones or bricks but if it is, then evaporation of moisture, instead of taking place over the whole wall, including the joints, can only take place through the external face of the brick or stone. The exposed faces will then tend to flake off, either through frost action or the crystallisation of salts, resulting in a wall in which the mortar face stands proud. It should be noted that stronger mortars were frequently used in the 19th century and were obtained by adding additional substances to the normal lime/sand mix, such as iron filings, powdered brick, or coal ash. Various specifications and patents exist from the end of the 18th century — of which selenitic cement is an interesting example — which have had particularly destructive effects.

Selenitic 'cement' was a quick-setting cement composed of hydraulic lime gauged with approximately 5% of plaster of paris. A specification of this kind was patented in 1870. An alternative method of making selenitic 'cement' involved mixing the lime with sulphuric acid. The selenitic 'cement' thus formed was mixed with sand or, frequently, with crushed brick. This formed a quick-setting, initially strong pointing mix. Unfortunately, however, water and salts already present in the masonry almost inevitably led to the transfer of calcium sulphate from the joints which encouraged rapid local decay.

2 Pointing: function, composition and weathering

It is rare for the walls of an old building to present the face of their original mortar bed. The weathering processes will mean that this original mortar face will have been replaced by new mortar and this process is known as pointing. If carried out more than 150 years ago pointing would, most probably, have been in lime mortar and the weathering process therefore would have been as described. If pointing is more recent, a hydraulic cement mortar might well have been used. This forms a strong rather impervious joint so that damp in the wall is

encouraged to dry out through the face of the stone or brick and not through the joint, with the same unfortunate results as if too strong a bedding mix had been used when the wall was originally built. The erosion of pointing can be accelerated by defects in the original construction or design, or by lack of maintenance as discussed above. 'Ribbon pointing' is a particularly objectional form in which the joints stand proud of the wall face thus concentrating interest on the 'ribbons' of pointing rather than the masonry. It is most often seen in the pointing of random rubble stone walls, and is usually carried out in cement-rich mortar.

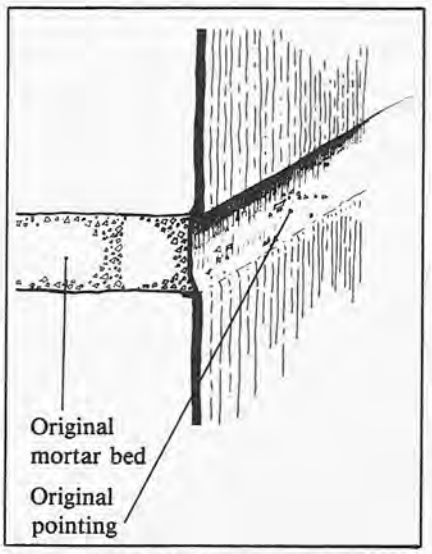
A further problem with cement pointing is that a rich cement mix shrinks on setting, producing cracks in the pointing through which water can penetrate while at the same time inhibiting evaporation.

Even in fine brickwork the mortar bed is of such a thickness as to be always noticeable. To achieve a consistent visual effect, the face of the original mortar bed was purposely recessed when the wall was built. The whole wall was then pointed on completion as one operation so that such a wall was pointed from the beginning, even if it has been repointed since.

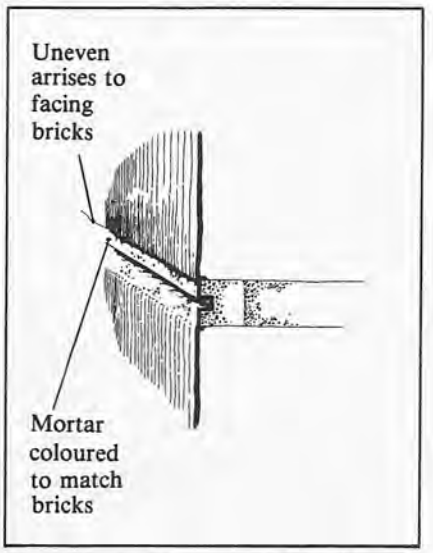
There are very few facing bricks, excluding terracotta and autoclaved bricks, which have the geometrical exactness which can be achieved with fine-sawn ashlar stone. In an attempt to simulate this exactness in a brick wall, 'tuck' pointing was sometimes used. The wall was first pointed in a coloured mortar to match the brickwork. The horizontal and vertical joints were then grooved down their centre to a width of up to 6 mm using a batten as a straight edge, and a white lime putty often gauged 1:1 with silver sand 'tucked' or pressed into the grooves. The geometrical exactness of the white pointing thus disguised any irregularity in the bricks.

Where 'tuck' pointing could not be afforded but an approximation of the effect was required, the wall was pointed in the normal way and then a thin line was incised into the horizontal joints and vertical perpends, or sometimes just into the horizontals. This was sometimes referred to as 'penny round' pointing be-

Erosion caused by impervious cement mortar limiting evaporation to the face of the stones



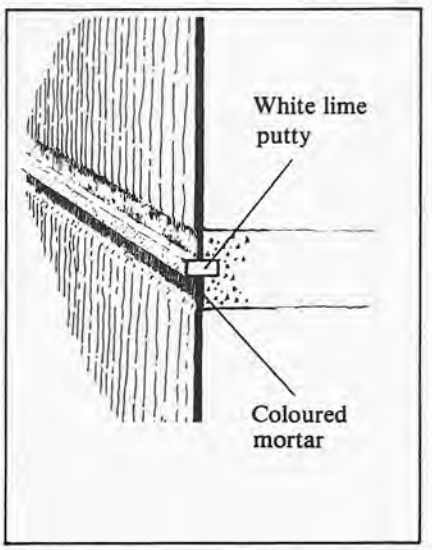
Walling pointed in one operation as soon as the walling is completed



Mortar incised to receive the 'tuck'

'Ribbon' pointing — unpleasant aesthetically and likely to lead to erosion of the stone

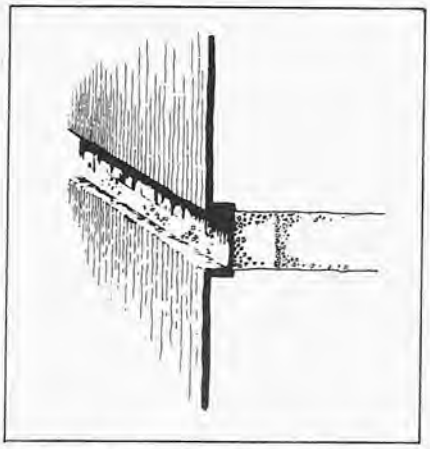
Pointing done at the time of original construction showing flush pointing in high quality brickwork with narrow joints and good arrises



'Tuck' pointing

cause the edge of a penny would achieve this effect, or perhaps it was a satirical reference to a cheap variant on 'tuck' pointing. Similar 'joints jointed' were lined with a stick or trowel edge. These types of pointing are commonly found in 18th and 19th century buildings.

Another example of specialised pointing is the double struck or beak joint (see drawing).



Pointing in sound condition, although slightly eroded (that is to a depth not more than half the height of the joint)

Wall in need of careful repointing

In practice, whether the pointing is original or recent, if the exposed surface of the mortar is weathering back fast and is soft, friable, and crumbly, then repointing is desirable. On the other hand, provided it is firm but recessed only slightly behind the general wall surface, it can safely be left. Sound pointing can only be got out of the joint with carborundum discs or hammers and chisels and in so doing the surrounding arrises of the stone or brick wall will inevitably be damaged and the exercise will do more harm than good. This factor must be considered when for reasons of visual effect or historical accuracy it is considered desirable to remove unsightly repointing.

In the remainder of this pamphlet the term 'pointing' will be used to describe the exposed face of the joint, whether or not it is the original mortar face, original pointing, or a later repointing.

The term 'repointing' is used as generally understood in the building industry, i.e. to describe the operation of preparing for, and then pointing afresh, an existing wall.

It cannot be emphasised too strongly that sound pointing should be left undisturbed, even if it has weathered back behind the general wall face to as much as half the width of the joint.

3 Repointing: technical factors

Original mortar still in good condition

If it has weathered back more than this, or the face of the pointing is soft and crumbly and readily raked out with the point of a screwdriver, then repointing should be considered.

Factors to remember

1) Old stone walls may be so covered with organisms such as lichen, or alternatively so encrusted with dirt from atmospheric pollution, that the condition of the pointing is very difficult to determine. It may be necessary therefore to clean the wall, and this involves other decisions, aesthetic and practical.

2) The need for repointing may be so general that the whole wall requires treatment. If so, scaffolding may be required. The repointing may then need to be phased in with other maintenance work, such as repainting of windows, re-leading of parapet gutters, roof repairs, etc.

3) If the areas requiring repointing are in small isolated sections, such as exposed parapets or behind defective rain-water pipes, great care must be taken to avoid a patch-work appearance, particularly in fine brickwork.

4) If the repointing is necessitated by too strong a pointing mortar having been used it may be best, unless the pointing is causing significant decay, to leave this hard pointing to erode and fall out rather than attempt to rake it out, with the attendant risk of extensive damage to the stones or bricks.

Slightly recessed pointing to emphasise the character of the individual stones

5) Are masons or bricklayers of adequate skill available to do the work, or will they become available if the work is deferred?

6) Is the time of year suitable? Pointing cannot be carried out in frosty weather particularly with weaker mortars. The SPAB does not recommend the use of anti-freezing agents in mortar mixes.

7) The practical consequences of incorrect pointing or delaying repointing are an increasing penetration of mois-

ture into the wall leading to an increased erosion of the wall face. There can also be other consequences, for example, dry rot in timbers such as bonders and joists ends buried in the wall, and a breakdown of internal decorations.

4 Repointing: aesthetics

Rubble Stone

In rubble stone the thickness of the mortar bed is such that the thickness of the pointing will inevitably involve large exposed surface areas of mortar. Nevertheless the stone should be emphasised more than the pointing so that the two aims should be: first, by recessing the pointing very slightly to emphasise each stone's individual shape and character. Second, to further subordinate the pointing by giving it a colour and texture that will be an approximation of the stone colour and texture.

An example of flint walling with recessed pointing

There may be special local circumstances which override the above points. For example, in some areas, such as Rutland, there is a local tradition of 'buttering' over the face of original rubble stonework with the pointing, so that the appearance of the wall is more akin to a rendered wall through which the high points of the stone break through. Such local circumstances should always be respected in new pointing.

Similarly, in rubble walls with a thick mortar bed the surface area of the pointing was often reduced by pressing small chips of stone into the pointing. This is known as 'galletting' or 'garnetting'. If found in existing walling the method should be repeated when repointing; this minimises the likelihood of shrinkage cracking and reduces the surface area of mortar exposed to weathering.

Many rubble walls have extra wide joints occurring occasionally and these can be reduced by letting a small slither of stone, slate, oyster shell, or tile into the joint, the choice being determined by local tradition.

Ashlar

In fine ashlar work the mortar bed is so thin that the joints may be virtually invisible and great care should be taken not to increase the width of the joint when repointing. Similar care should be taken when repointing gauged brickwork.

Carstone wall with galletting

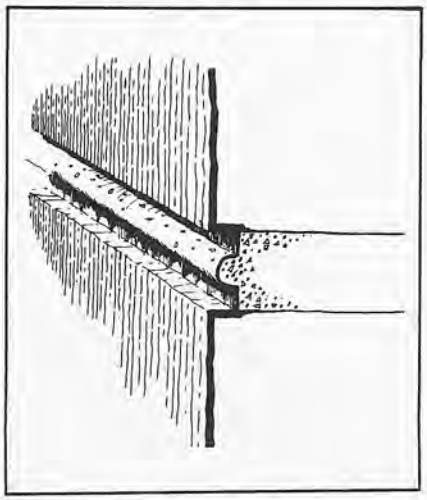
Brickwork

In any kind of brick walling except cut or gauged brickwork, the 10 mm to 16 mm of pointing will always be noticeable. It is of a lighter colour in contrast to the generally dark colour of most clay bricks. Factors to bear in mind:

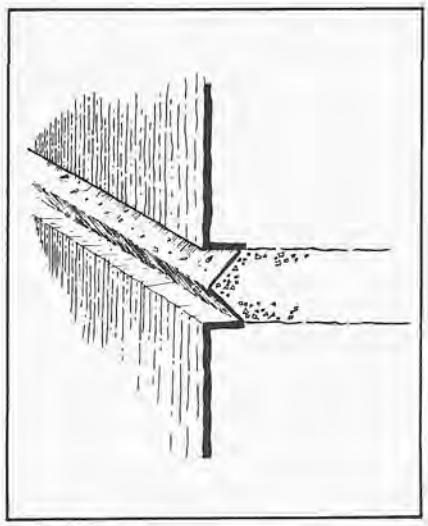
—in every case the repointing should be kept either flush or very slightly behind the face of each brick. Sometimes a slight hollowing or concavity in the joint is effective.

—The texture of the pointing should match the surviving weathered pointing.

—Occasionally pointing was artificially blackened, particularly in the 19th century, possibly to allow the natural colour of the bricks to predominate. Whether to continue this effect, and not use naturally coloured pointing, is a matter which can only be decided on the individual merits of each case. Nevertheless artificially coloured pointing should not be used, unless it has been used before.



Double struck joint



Beak joint

—Characteristics of existing pointing should normally be repeated when repointing. Examples include tuck pointing or 'moulded' or double struck joints, as well as any very fine pointing as found in gauged or rubbed brickwork.

5 Preparation

Rubble Stone

The joints should be carefully raked out to a depth equivalent to at least the width of the joint, but never at the expense of damaging the arrises of the stone. A suitable tool is a bent screwdriver or spike which will remove soft mortar but leave the arrises of the stone unharmed. The general rule is that if it is necessary to remove the existing pointing with hammer and chisel, then repointing is not required. In exceptional circumstances a hammer and claw chisel could be used to remove isolated sections of hard mortar, but always with the greatest care. For raking out fine joints, a mason's saw or hacksaw may be used. In no circumstances should a power saw be used because of the difficulty of controlling the cut.

When the raking out is completed, all loose material should be brushed or gently washed out of the joints, by hosing downward with fine spray.

Ashlar

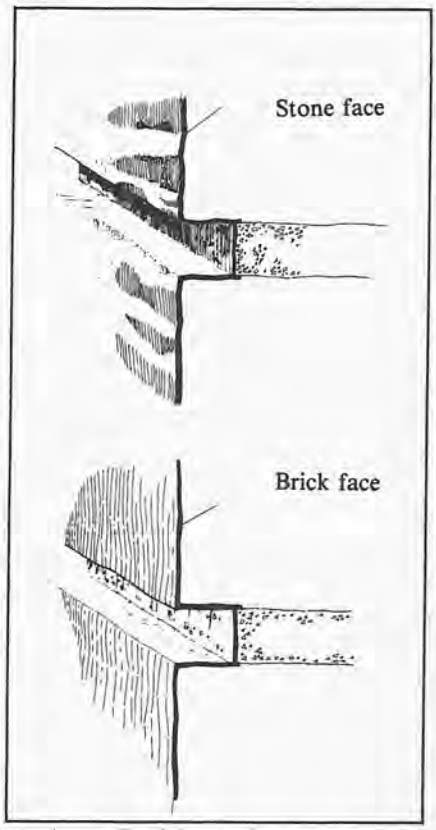
This follows the same procedure as for rubble walls except that it is even more important to remove the old defective pointing with great care. The more finely executed the wall the more obvious will be damage to arrises. A power saw or carborundum should not be used, they are difficult to control. A mason's saw or hacksaw blade may be useful.

Brick Walls:
Medieval and Tudor

The joints should be carefully raked out to a depth of between the width and twice the width of joint, but generally to a depth of not less than 20 mm. The same cautions apply as to raking out joints in rubble walls. When the raking out is completed, all loose material should be brushed or gently washed out of the joints.

17th century and later

This follows the same procedure as for medieval brickwork except that it is even more important to remove the old defective pointing with great care, so as not to damage the arrises of fine precise brickwork.



Joints raked out to a depth not less than their height in preparation for pointing, arrises undamaged by careful raking out

This particularly applies to rubbed bricks which are very soft and easily damaged.

Pavings

The pointing of stone pavings, brick pavings, and pamments, is as important as the pointing of stone or brick walls and much the same aesthetic and practical considerations apply. In other words, the rougher and more irregular the material, the wider and more roughly textured are likely to be the joints. The pointing of paving is, however, much more exposed to the weather, and as pavings materials are generally stronger than walling materials, a stronger mix is needed.

Particular care is necessary to avoid the pointing spreading out over the face of the flags or pavings. If only small areas are involved the joint can be filled with dry mix and packed down. It can then be swept with a brush and finally dampened with a fine spray.

There is an unfortunate modern practice of slurrying entire areas of paving, brushing the mix into the joints, and leaving the surplus to weather away. This does not happen in practice, so the method is to be deplored on aesthetic grounds, and on practical grounds, since the joint is not properly compacted.

Paving, recently relaid in Queen's Gate, Chester (Donald Insall Associates)

6 Mortar Mixes

Rubble Stone,
Medieval and Tudor
Brick

The mortar mix should have a strength no greater than the strength of the walling, and match its colour and texture, and/or match the original weathered mortar as closely as possible. Only sharp, well washed coarse sands and grits should be used even though this makes a less workable mix. Only the minimum amount of water should be used.

The exact proportions of the mix, the colour and character of its ingredients, and very thorough mixing are all extremely important. No hard and fast rules can be laid down, for they will vary from building to building. Examples are given in the tables.

The use of white cement generally makes it easier to obtain the final colour desired, which will then derive from the colour of the sand in the mix.

Sometimes old mortar (excluding ash, selenitic or salt contaminated), crushed and riddled, can be used as an alternative of up to half the coarse sand.

The lime in any of these mixes can be hydrated (powder) lime or lime putty slaked from quick lime. Lime putty can be made from powder lime (see section 7 below) and it can also be obtained ready-made in sealed polythene bags. A more cohesive mortar is obtained when lime putty is used rather than hydrated lime. The batching of the mix should be carefully done, using gauge boxes if necessary, and very well mixed with the minimum amount of water necessary for a workable consistency. Good mortar can only result from really thorough mixing. Note that hydraulic lime is now only available as an imported dry hydrate and when mixed should be used at once; it can be supplied by the Cathedral Workshop Office, Chichester, Sussex.

It should be emphasised that especially if cement or hydraulic lime is included in the mix, only enough should be mixed as can be used in one operation, and anything left over should be thrown away and no attempt made to work it up afresh, as the hydraulic setting action will already have begun. Pointing should be prevented from drying out completely for seven days by means of sacking, or tarpaulins, together with occasional gentle wetting if required. Rapid drying in hot sun will produce light coloured joints with an increase in the deposition of lime binder on the surface. Finally, it should be emphasised that with all pointing a slightly stronger mix may be necessary in cold weather. No pointing should ever be done when frost is at all likely. A slightly stronger mix should also be used in very exposed situations. An example would be using a 1:1:6 mix where a 1:2:9 would normally be used.

Ashlar

The mix must be adjusted to the colour, texture and strength of the stone. Due to the thinness of the joints, coarse sand cannot be used and finely crushed stone is often used instead.

Brick Walls
17th century and later

Here again, the mix must be adjusted to the degree of exposure, the strength, colour and texture of the brick. As the bricks will be more regular and the thickness of the joint less than in medieval brickwork, a rather less coarse sand will be necessary.

7 Lime putty prepared from slaking quick lime

Quick lime is usually supplied in lumps in 50 kg sacks. It should be freshly burnt and this may necessitate giving 24 hours' notice to the supplier before collection. Slaking should take place immediately following delivery. A clean steel domestic-sized water cistern is a suitable and convenient receptacle for slaking. Fill to a depth of 300 mm with water. Cover the bottom to about half the depth of the water, with lumps of lime. The lumps should not protrude above the surface. Stir continuously. The commencement of the reaction will be indicated by the splitting and breaking down of the lumps, the emission of gas and considerable heat. The latter will be sufficient to raise the temperature to boiling point. Further water and lime should be added alternately and stirring and hoeing continue until the process is completed.

The end product is of a consistency of thick cream, suitable for 'running' through a 3 mm sieve. Sieving is essential to remove unslaked lumps which would cause trouble later. The liquid lime is run through the sieve into a 'pit'. This may be an actual pit in the ground, lined with boarding or formed from the sand to be used in the mortar. The pit is covered up to prevent drying out and contamination, and left for two weeks for the lime to 'fatten up'. By this time it will have the consistency of something between yoghurt and soft cheese. It should be noted that semi-hydraulic limes will lose some or all of their hydraulic properties in maturing.

Special notes:
1. Quick lime is corrosive and requires careful handling. Furthermore, the slaking process may become fierce and involve spitting of unslaked particles. To reduce spitting add the lime to the water, not the other way around. Wear protective clothing including gloves and safety goggles, and have clean or distilled water on hand for immediate washing out of an injured eye.

2. Keep inquisitive children and animals at a distance.

3. Do not hesitate to add more water if reaction becomes too fierce.

4. Slaking is a messy operation and should take place in a situation where this is of little consequence.

Lime putty prepared from hydrated lime

Lime putty can also be prepared from hydrated lime. The latter is prepared commercially by slaking with accurately measured quantities of water. The end result is a fine powder, and this is readily available in 50 kg bags.

The hydrated lime should be added to the water (and not the other way around) and mixed to the consistency of thick cream. It should be left to 'fatten up' for a minimum period of 24 hours.

Preparation of coarse stuff

All of the coarse stuff for the pointing should be prepared at the outset to maintain consistency of colour. Gauging should be carried out accurately, and separate measures should be used for lime putty and the sand. Standard size kitchen mixing bowls may be adequate for the limited quantities required for a small job.

The lime putty and sand should be thoroughly mixed together so that the lime is evenly distributed. When mixed, the coarse stuff should be covered to prevent drying out and contamination. Storage of wet coarse stuff will result in good dispersion of the lime binder and will improve the eventual performance of the mortar; kept damp and isolated from the air its workability and final durability will improve progressively. It can be 'knocked up' as often as required.

If cement is to be added to the mix this should be immediately before use. In 'knocking up' the mix the workability will improve without the addition of further water. An inexperienced workman may not realise this and the end result will be so sloppy that it cannot be used.

Remember that the addition of cement will start an hydraulic set and the mortar cannot be knocked up again.

Note: Slaking lime is potentially dangerous. The process should be undertaken with great caution, making sure the eyes are protected.

8 Application

Rubble, Medieval and Tudor Brick Walls

Pointing should always begin from the top of the wall and proceed downwards, so that the work can be cleaned down as it progresses and before the scaffolding is struck.

Before beginning repointing, the wall should be wetted to control the suction of dry, porous brick or stone, especially during hot, dry, weather. Rapid drying of the mortar mix leads to shrinkage and loss of strength as well as to the light colour developing.

The mortar should be rammed well home into the joints so that no voids are left.

The mortar should not encroach over the arrises of the stones but be kept slightly recessed, so that the integrity of each stone or brick is preserved and also to avoid vulnerable feather edges to the pointing.

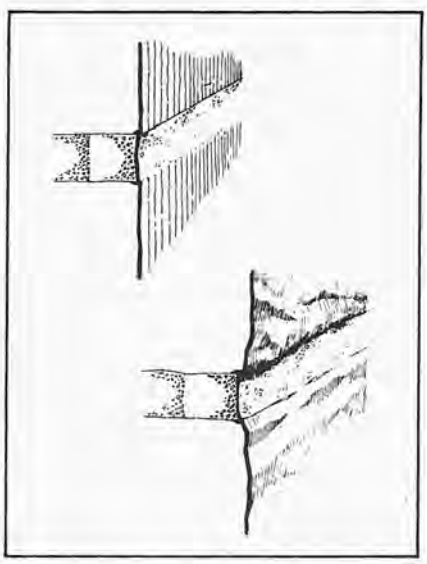
When mortar is applied with a steel trowel or other pointing tool, the fine ingredients will be left on the surface, giving a hard, smooth and characterless joint. After some hours, therefore, when the mortar will have begun to stiffen, the texture of the coarse sand should be exposed by stippling with a stiff bristle brush at right angles to the wall surface, or by a fine water spray. In other cases, rubbing the joint with sacking, or the point of a stick, gives a less immaculate and more appropriate finish. This is where the skill of the individual craftsman is of paramount importance. If there is any doubt on this score, or on the final appearance of the mortar mix chosen, a trial patch of wall in an inconspicuous position should be chosen so as to experiment with different mixes and methods of finishing the joint. For the best effect it is generally advisable for the pointing to have a rather coarser texture than the wall.

Ashlar Walls

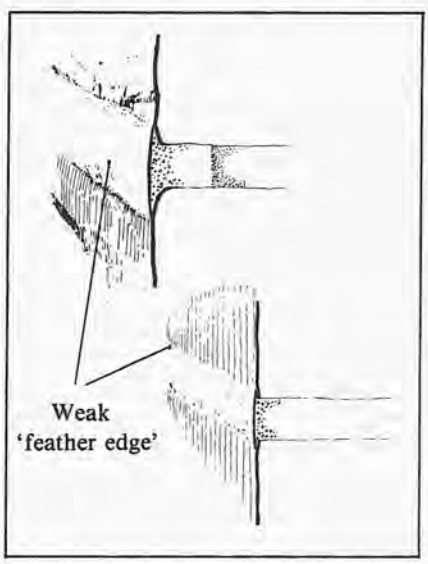
After wetting of the wall as required, the mortar should be pressed home into the joint and struck off flush with the wall face with no 'buttering' over the adjoining stones. This can be prevented in very fine joints by inserting lime putty into the joint sandwiched between two pieces of waxed paper (or plastic sheet) approximately 150 mm by 75 mm. The joint will need to have been carefully cleared with a hacksaw blade and a water spray. The papers are then carefully withdrawn, holding a flat edged tool such as a pointing iron tight against the joint, leaving the putty behind. The process may be repeated for the whole length of the joint. A slight roughening of the joint may be necessary depending on the fineness of the joint, and may be achieved by stippling with a bristle brush after the initial set. As always, work should begin from the top of the wall and continue downwards. Trial panels should be executed first if there is any doubt as to the finished appearance of the mortar mix chosen, and the method of finishing the joints.

Flint Walls

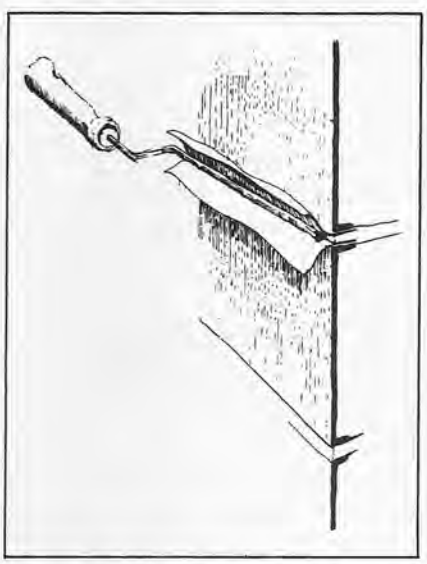
These are a special case, in that flint is an impervious and hard material but it does not need a very strong mortar. This is because the flints are small in size compared with bricks or stones, and generally irregular in shape, so that the wall can be conceived as being of mortar into which flints are embedded. If a strong mortar is used significant shrinkage cracking will take place around all the flints, thus al-



Correct pointing in brick and stone walls should be slightly recessed leaving the arrises exposed



Stone and brickwork incorrectly pointed. Mortar 'buttered' over arrises creates weak 'feather edges' behind which damp can enter



Inserting lime putty into fine brickwork between greased paper to avoid 'buttering' the joint

Recessed repointing below the stringcourse in character with original pointing above

enough additional water to reach a plastic, fatty consistency. Make a smooth heap on a clean boarded platform and cover it with thick layers of wet sacking. Keep under wet covers for at least 24 hours. When ready to use, remove the sacking and re-mix very thoroughly. Any of this lime and sand not used can be reformed into a smooth heap and put back under plenty of wet covers.

Gauging with cement or pozzolanic additives These materials must only be added to the wet coarse stuff just before use, and very thoroughly mixed. Do not keep any coarse stuff which has been gauged with pozzolan or cement or attempt to 'knock it up' after it has stiffened.

Remember when proportioning that the lime fills the spaces between the aggregate particles without adding to the overall volume, so the volume of coarse stuff is equal to the volume of its aggregate. Thus if a 1:3:12 mix is being proportioned, the lime/sand coarse stuff will consist of three parts of lime and twelve parts of aggregate, but only twelve parts of the coarse stuff (not fifteen) will be mixed with the one part of cement.

The addition of very small amounts of cement will often enable a weak lime sand mix to weather satisfactorily if conditions are not too extreme. Thus a $\frac{1}{2}$ or $\frac{1}{4}$ part gauging of a 2:5 lime/sand mix may bring it up to '7' grade (cf table 2).

Aggregates These must be thoroughly washed and as well graded as matching the original material permits. Higher proportions of aggregate to binder can be used without loss of strength if a wide range of aggregate size is used rather than a uniformly fine or coarse aggregate. Where alternative aggregate proportions are given in the table, select the highest proportion for well-graded aggregates, and the lowest for more uniform aggregates.

Distinctive Local Pointing Where pointing has a very distinctive local character, for instance in some of the carstone, chalk or conglomerate areas the importance of making every possible effort to match the constituents and, above all, the character of the original cannot be over-emphasised, whilst keeping within the general guidelines laid down in this pamphlet.

The following tables give some guidance on suitable mixes for the wide range of conditions likely to be met with in repointing old masonry.

TABLE 1 — MORTAR GROUPS

Group Number	Cement	Hydraulic Lime	Lime	Pozzolanic Additive* PFA or Brick Dust	Aggregate
1	1		$\frac{1}{2}$		4
2	1		1		5–6
3	1		2		8–9
4		2			5
5		1			3
6	1		3		10–12
7			2	$\frac{1}{2}$ or 2	5
8			2		5
9			1	$\frac{1}{4}$ or 1	1
10			1		1

*N.B. The pozzolanic additives may significantly affect the final colour of the mortar, especially if light coloured aggregates are used. PFA is normally dark grey, and brick dusts vary, of course, with type and firing condition.

TABLE 2 — SELECTION OF MORTAR GROUP NUMBERS

	CONDITIONS					
MASONRY TYPE	Internal Walls	External Walls — Sheltered	External Walls — Moderate Exposure	External Walls — Severe and Marine Exposure	Paving Internal	Paving External
High durable stones and bricks of low porosity	3, 4, 5, 6	3, 4, 5, 6	2, 3, 4, 5	1	2, 3, 4, 5	1
Average durability and porosity stones and bricks	4, 5, 6, 7, 8	4, 5, 6, 7, 8	3, 4, 5, 6, 7	2, 3	3, 4, 5, 6, 7	2, 3
Lower durability or decayed, friable stones or under-fired bricks	4, 5, 6, 7, 8	4, 5, 6, 7, 8	4, 5, 6, 7	4	—	—
Very fine jointed ashlar or gauged and rubbed brickwork	10	10	9, 10	9, 10	9, 10	9, 10

N.B. Where alternative group numbers are given, select the lower group numbers for more durable stones or bricks within the category, or for the more severe exposure.

10 Glossary

Arrises The edges of building blocks (stone or brick).

Ashlar Areas of accurately cut (sawn) rectangular blocks of stone which are laid in regular coarses.

Bed The natural bedding planes of sedimentary limestones and sandstones; the horizontal surface on which the building blocks rest.

Carbonisation The reaction of carbon dioxide in the atmosphere with non-hydraulic lime mortar – causing it to harden into calcium carbonate.

Cement

1. A general term denoting a binding material of plastic consistency with adhesive properties and an hydraulic setting action.

2. Specifically as Portland cement: a powder made from crushing the clinker resulting from burning lime and clay, producing a fast and hard set when mixed with water.

Coarse Stuff

1. With reference to mortar, a wet mix of lime and sand.

2. With reference to plaster, a wet mix of lime and hair.

Compo Mortar A term with more than one definition. In the 19th century it was usually applied to a lime mortar with extra additives such as cow hair. In the 20th century it is usually applied to lime mortar gauged with cement.

Dense Used to describe a hard or strong (usually cement) impervious mortar.

Dressed face The external surface of stone which has been textured by a hand or mechanical tool, as distinct from a sawn or natural face.

Weather face The outer weathering surfaces of a building block.

Fatty Mortar A workable cohesive mix which sticks (hangs) on the trowel.

Gauged

1. Bricks measured and cut to accurate dimensions.

2. Is also used to describe the process of an additional material to a mix, e.g. gauging a lime mortar with cement, or dry components with water.

Hydraulic Lime A term used to describe an impure lime (burnt from limestone containing a percentage of clay materials) which, when used in mortar, will allow the mortar to set, not solely by the evaporation of the water in the mix, but also by chemical action.

Hydrated Lime A term used to describe any lime processed to a dry powder.

Knapped Flint The process by which irregularly shaped flints are struck to present an approximately flush face.

See also *Square Knapped Flint*

'Knocking up' Reworking coarse stuff or mortar in order to restore workability.

Lime The traditional binding material of mortar.

Lime Putty The plastic material resulting from slaking quick lime with an excess of water, or by adding hydrated lime powder to water.

Lump Lime See Quick Lime.

Masonry Walls built of building blocks of stone, brick, concrete, or any other material.

Mix The various materials, and their relative proportions used in a mortar.

Mortar The initially plastic material used in masonry to provide even bedding and jointing.

Pulverised Fuel Ash (PFA) Fine aggregates, produced as a by-product from pulverising the waste products of the combustion process in power stations.

Non-hydraulic A term used to describe pure lime burnt from limestones containing no significant amounts of clay material.

Perpends The vertical joints in a wall.

Pointing

1. The outer face of the mortar joint.

2. The word is also used to describe the full depth of a mortar which has been inserted at a later date than the original bed.

Pozzolanic A term used to describe a fine aggregate which, when incorporated in a mix, gives that mix the ability to set in damp conditions.

Quick Lime Calcium oxide (CaO), the unstable material produced when limestone is burnt and water and carbon dioxide are driven off.

Quoins

1. The building blocks at the corners of a building.

2. The surrounds to an opening in masonry.

Repointing The process of raking out and replacing the original pointing.

Roman Cement Natural hydraulic cements containing a high percentage of clay materials. Parker's Cement patented in 1796 was prepared by calcining nodules of septaria from the London Clay. The brown colour of the cement was thought to resemble the appearance of Roman mortar, hence the name. Although used principally as a rendering material, it was used extensively in nineteenth century pointing, especially in restoration and repair.

Rubber Bricks of a uniform and sandy consistency throughout which have been lightly fired so that they can be readily cut or rubbed to allow fine joints in arches or quoins.

Rubble A wall built of undressed or roughly dressed stones necessarily laid with wide joints.

Sand

1. The usual filling material in mortar.

2. Clean: Sand with a small amount of fine grains.

3. Dirty: Sand with too much silt and clay or organic contamination.

4. Sharp: Sand with coarse, harsh, angular grains.

5. Soft: Sand with a mostly fine and clayey content.

6. Clayey: Sand with a lot of 'fines', mostly clay.

7. Loamy: Sand with a lot of organic matter, i.e. humus from soil.

8. Washed: Sand from which salt or other impurities described above has been washed out.

Square Knapped Flint The process by which irregularly shaped flints are struck to present an approximately rectangular face to the outside of the wall.

Sulphation Term used to describe the irregular crystaline skin which is formed by the reaction of sulphur gases in the atmosphere with lime stone or lime mortar causing decay.

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'Limes for Building'

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(All from HMSO, 49 High Holborn, London, WC1 9NH)

BS 5390: 1976 'Code of Practice for Stone Masonry'

(From British Standards Institution, 101 Pentonville Road, London, N1 9ND)

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Repointed Tudor brickwork at Jacobes Hall, Brightlingsea

Bottom Left
Sympathetic repointing of stone walling at Yatton church, Hertfordshire

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