The importance of aggregate

Sand selection and its influence on lime mixes

So, having read the preceding articles in this series, you're now confident that you understand the basic benefits of using lime in the renovation of your listed property and which type of lime should be used – right?

What we've told you so far is enough to give you the minimum understanding to help select sympathetic, functional materials which will not contribute to problems with damp, spalling of masonry and other long term damage that is often experienced with the use of inappropriate materials. This is helpful if you're purchasing pre-mixed lime mortars and plasters – but what if you have a quantity of lime binder and need to mix this yourself? Aggregates (or sands) provide structure to mortars and plasters, and their careful selection for use in a lime mix can be just as important as choosing the correct type of lime. Here I'll explain how you decide which aggregates to use (and what the specialists should be supplying you with) and the reasons for doing so.

It may seem obvious, but the first thing to consider is what you will be using the lime mix for. For example, traditional stone pointing mixes will require a different grade of aggregate than a fine lime plaster skim. You may also be looking to match a historic mix, which could be a condition of the listing, and therefore aggregate size and local colour needs to be replicated as closely as possible.

The size and colour of aggregates used in historic mixes can vary significantly, as can the blend with other impurities such as clays, ash or charcoal from lime burning kilns. These days the process is slightly more refined due to the use of fine grade limes and readily available bulk or bagged aggregates – but that doesn't mean a sacrifice in terms of quality or the ability to match the aesthetics of the property. If you want to go all out in trying to match the lime mix there are a number of specialist suppliers and independent laboratories who can provide an analysis on the composition of the mix, although a physical inspection is generally sufficient.

Various studies have shown that some aggregates can produce higher strengths in lime mortars but relatively little is known about the reasons why. One explanation, born of recent studies at the University of Bath, shows that the porosity of an aggregate can impact mortar strength due to effects on the rate of diffusion of carbon dioxide (for those of you who are scientifically minded!).

Today, the majority of aggregates used in construction mixes come from silica sands (quartz) which has been screened and washed to remove impurities such as clay and silt. Silica sands are exceptionally hard wearing which contributes to the durability of the mortar or plaster.

Sands are graded in size – anything from a fraction of a millimetre up to 64 millimetres

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in diameter (although technically aggregates from 2 millimetres up to 64 millimetres is classified as a gravel).

Sand isn't the only aggregate used in lime mixes, fine polished plasters often contain marble dust, and by-products such as blast furnace slag may also be used for floor screeds or exposed works.

And so now to the practical selection of the correct sand for the job at hand...

RENDER AND BACKING PLASTERS

Thicker coats of lime mixes used for renders and plasters generally require a slightly bulkier sand to provide strength and to minimise shrinkage when used with modern limes. A well graded sand which contains both fine and coarse particles is essential – too much grit will result in a poorly bound mix which is difficult to plaster and too many fines can result in longer drying times and a weaker mix. A sharp sand is always preferred to rounded aggregates as this provides a good bond due to the increased surface area and is known to improve vapour exchange – a function essential to allow traditional buildings to breathe. Sand colour for lime render and backing plaster mixes is generally irrelevant as the recommendation is for a protective wash or paint externally, and a finer plaster with or without paint internally.

Therefore, as a guide, for most standard applications (8–15 millimetres depth) the sand should be a sharp, washed sand with a good blend of particle size between 0.1 to 4 millimetres in diameter. If the render coats are being applied thinner than 8 millimetres then the sand size should also be reduced to accommodate this (e.g. 0.1 to 2 millimetres).

Standard mix ratios used today are typically 1 part lime to 2.5 or 3 parts sand by volume.

Tip: It is often beneficial to allow time for lime mortars and plasters to rest before knocking up again before use which results in a richer more workable mix.

TOP COAT PLASTERS

Fine lime plasters should result in the smooth finishes we recognise and expect from internally skimmed walls. To achieve this, a suitably fine sand or marble dust should be selected, along with a richer lime mix compared to the coarser backing coats. The maximum grain size will influence the texture of the lime plaster and the control of plaster thickness. A fine sand in the region of 0.1 to 0.5 millimetres would create a traditional lime plaster finish consisting 2 parts lime to 3 parts sand by volume at an application thickness of 2-4 millimetres. Very fine lime plaster skims and polished plasters use an even finer sand or marble dust with a richer lime mix (e.g. 1 part lime to 1 part aggregate by volume).

BEDDING AND POINTING MORTARS

As a guide, the maximum grain size for pointing and bedding sands should be approximately a third of the height of the joint. For example, a 10 millimetre high mortar joint would use a 0.1 to 3 millimetre sharp, washed sand at a mix ratio of 1 part lime to 2.5 or 3 parts sand by volume. However, this rule is sometimes overlooked in order to replicate historic mixes which may contain finer or coarser aggregates. Coloured sands and blends of two or more sands are sometimes used to affect the appearance. Deep red sands mixed with light lime binders result in a pink coloured mortar. Similarly, dark golden sands create a buff coloured mortar. Remember, when selecting coloured sands for mortar mixes try and order the full amount of sand in full to avoid issues with batch variation – sand colour can vary (sometimes significantly) through the natural seams of the quarry it's sourced from.

This guidance should cover the majority of applications for the keen DIY enthusiast or tradesperson who is a newcomer to the wonderful world of lime. Specialist aggregates used in polished plasters and finishes should still be left to the experts – unless you're prepared to make some trials and errors along the way.

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