

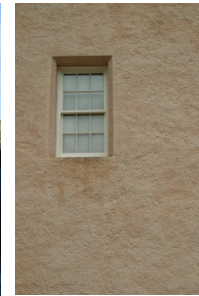


## **Technical Advice Guide: Mortar Specification**

### **Non-Hydraulic Lime**

For building purposes, high calcium, non-hydraulic quicklime can be used on-site for making 'hot lime' mortars. More commonly however, quicklime is slaked either to a dry hydrate or lime putty. In hydrate form, non-hydraulic lime is suitable for use as a plasticiser in a cement mortar. Lime putty is eminently suitable for mortars and particularly internal plasterwork when knocked up with sand and hair, but is not always suitable for outdoor use, particularly in environments with high relative humidity, as this affects the materials ability to carbonate. The required proportions of lime: sand will vary depending of the grading and void ratio of the specific sand.

Here at SLCT, we always recommend lime putty which has been matured for a minimum of 90 days prior to use, and has a minimum bulk density of 1.35kg/ litre. Lime putty with a lower bulk density will have a higher water and lower lime content—excess water means greater drying shrinkage. Lime putty is normally available both by the tonne and in 25kg bags or tubs. Well made and properly cured non-hydraulic lime mortars may readily achieve strengths of up to 3N/mm<sup>2</sup> over a period of time. BS EN 459-1 covers building lime classifications. In the UK lime putty is manufactured by, and available through, a network of specialist suppliers.



### **Natural Hydraulic Lime**

Natural Hydraulic Limes (NHL's) are available only as a dry hydrate, commonly in 25kg bags, although modern silo systems are becoming available for large scale works. Classifications for hydraulic limes in BS EN 459-1 are based on minimum strength requirements;

Feebly hydraulic limes	NHL 2	2 N/mm <sup>2</sup> @28days
Moderately hydraulic limes	NHL 3.5	3.5 N/mm <sup>2</sup> @28days
Eminently hydraulic lime	NHL 5	5 N/mm <sup>2</sup> @28days

Whilst strength development is relatively fast for cement mortars, lime mortars strengthen over a much longer period of time—this must be considered when specifying such materials. Natural Hydraulic Limes are produced primarily in Continental Europe, and are available through a network of specialist suppliers in the UK. Widely used materials include those produced by Cimpor (NHL5 only), Otterbein, SOCLI and St. Astier (all NHL 2, 3.5 & 5). Given the wide range of NHL's available, here at SLCT, we evaluate suitability of materials based on an evaluation of the performance requirements for conservation and repair mortars. Evaluation of issues such as performance in use, ease of use and compatibility are all integral to the specification process. NHL's require to be gauged by weight to take into account the wide variation in relative bulk density of hydrates. This will ensure adherence to any specification and avoid inconsistency in colour and texture.

### **Aggregates in Lime Mortars**

The current standard for aggregates in mortars, plasters, renders (including harls) and bedding is BS EN 13139. Ultimately aggregates must be suitable for their purpose—whether for new work or for conservation and repair work. For the latter, it may be necessary to match aggregates visually in terms of colour and texture—this can be achieved easily through mortar analysis and grading of the aggregate. SLCT hold an aggregates database which contains data on around 500 different commercially available aggregates.

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Characteristics of repair mortars should always be based on a holistic evaluation of the building which can then lead to the determination of performance requirements for the specific situation. Performance requirements cover a range of issues such as performance of the mortar in use, its ease of use, and compatibility with original and/or other surviving historic materials. There may, in some cases, be a conflict between specific requirements and judgement will be required in achieving a final specification. To determine if new materials will be compatible with surviving historic materials, information on both old and new materials must be available. Analysis of original/surviving historic mortars should be carried out to provide relevant information on their constituents and performance. Technical information and performance data available for new materials can then be evaluated against information on existing materials. Issues to consider include:

### **Performance in use**

The hardened mortar should have:-

- adequate vapour permeability.
- an appropriate degree of capillarity for the proposed use.
- a water absorption rate not significantly greater than the host substrate.
- a modulus of elasticity which reflects the built condition and scale of the works.
- sufficient tensile strength to suit the construction requirements.
- compressive strength to suit the construction requirements (usually quite low).
- a bond strength sufficient to achieve a good wind and watertight bond, never greater than the host masonry, nor so feeble as to result in separation of mortar, leading to capillary ingress of water at masonry/mortar interface.

### **Ease of use**

- The fresh mortar should have appropriate workability characteristics to allow the work to be undertaken correctly.
- The mortar should remain workable for a sufficient length of time to allow appropriate finishing.
- The mortar should achieve an adequate degree of frost resistance at a sufficiently early age to avoid potential freeze/thaw risk.
- Requirements for protection and curing should be taken into account at the specification stage.

### **Compatibility with original historic materials**

- The hardened mortar should have a vapour permeability similar to, or greater than, that of adjacent historic materials.
- The hardened mortar should be visually compatible with surviving mortars and/or with the original appearance of the building.
- Where practicable the new mortar should reflect the historic integrity of the original materials and methods of construction.