# An Introduction to Lime

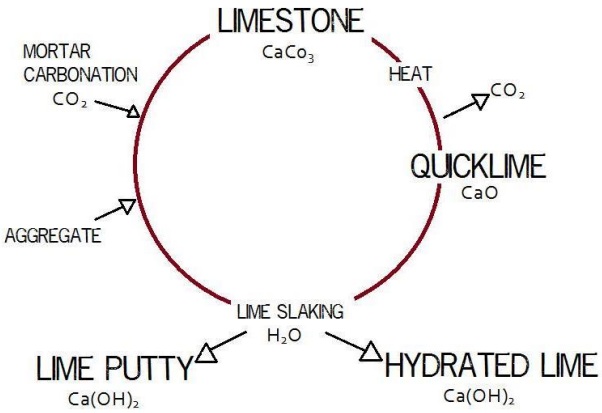
## A History of Lime and it's Uses

Lime has been used as a building material for thousands of year3s; the Egyptian Pyramids, the Coliseum in Rome, and the Great Wall of China all boost lime mortar cement. Yet, since the invention and widespread use of Portland cement from the mid-1800s, lime has faded into obscurity and few people know how to correctly use lime. This guide is a short introduction to this forgotten building material: how it is made, how to use it, and why lime is an attractive alternative to cement, modern plasters, and paints for both historic and contemporary buildings.

## What is Lime?

'Lime' refers to quicklime and is made by heating limestone (Calcium Carbonate) at high temperatures in a kiln. The lime (Calcium Oxide) produced can then by rehydrated to form Hydrated Lime (a powdery substance) or 'slaked' and matured for at least 2-3 months in an excess of water to create lime putty (which has a similar texture to toothpaste). These products form the basis of lime plasters, mortars, and washes.

## The Lime Cycle




When lime is heated, carbon dioxide is emitted. This is reabsorbed when the lime materials slowly dry, set and harden. The re-absorption of Carbon Dioxide completes the 'lime cycle' and makes using lime environmentally friendly and sustainable.

Depending on the purity of the limestone used, types of lime can be produced with varying properties and strengths. Pure limestone produces Non-Hydraulic Lime (termed CL by European standards), meaning that it won't set under water. This is ideal to use inside a building for plasters and decorations, but does not suit outside work unless you can guarantee fine summer weather for many weeks. However, limestone with clay particles produces Naturally Hydraulic Lime (NHL) which can set (like concrete) in the presence of water due to the presence of silicates in the clay and this is classified into three different strengths: 2, 3.5, and 5. Non-Hydraulic Lime can also have particles artificially added to quicken drying time and make the lime hydraulic, these are termed HL or NHL-Z.

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## Why Use Lime?

Lime products do take a long time to make, apply, and dry, and finding a specialist to carry out the work can be difficult. However, the benefits of lime for both old and new buildings outweigh these negative aspects. In addition to being carbon neutral, lime products have the following benefits:

**Breathability and Flexibility** – lime finishes allow the building to breathe and prevent damage caused by trapped moisture and allow buildings to move and settle without cracking

**Sustainability** – lime mortar and plasters are softer than surrounding masonry, meaning that the lime will deteriorate first rather than the stonework, thus prolonging the life of masonry

**Durability** – if applied correctly, lime can last up to two hundred years without needing to be replaced

**Anti-Bacterial** – The alkaline properties of lime make it naturally bacteria repellent

**Aesthetic Appeal** – lime plasters, mortars and paints are unique, change with the weather, and have a beautiful matt finish which alters with changing light conditions. Lime washes are thin and as a result protect architectural details.

# How to Use Lime

When deciding the type of lime suitable for your job, it is important to understand that "The more hydraulic the lime, the greater its strength, nut the lower its permeability and flexibility (SPAB), so the right balance must be struck. The type of lime and aggregate used should be appropriate for the building and the local area. Slaked lime in any form (hydrated powder or putty) can be caustic and cause burns, so hand and eye protection must be worn.

## Do's and Don't's

Do make sure the lime and aggregate are thoroughly mixed

Do follow manufacturer's instructions and allow ample drying time

Do wear appropriate PPE

Don't use lime putty that has not been well matured for at least 2-3 months

Don't use lime is very exposed areas that are subject to heavy frost

Don't use lime when the temperature is above 30$^{o}$C or below 5$^{o}$C

**Lime Mortars -** Lime mortars can be prepared from lime putty, or hydrates can be made in to putty by soaking in clean water for at least 24 hours. The putty should then be well mixed with aggregate in a 1:3 lime: aggregate ratio. The aggregrate, usually sharp well graded sand, should match the original mortar colour as much as possible if used on an historic building.

**Lime Plasters -** Lime plaster is made up in the same way as lime mortar, but with a ratio of 1:2.5 lime: aggregrate, with finer sand used for a smoother finish. Interior plasters are applied in three coats. Before plastering, the wall should be uniformly damp, by spraying with water, then a first coat applied as a base. The first coats should be no thicker than 10mm and should be scored and left to dry for at least two weeks, with a final cost of not thicker than 5mm.

**Lime Washes -** Limewash is created by diluting lime putty with water until it has the consistency of milk, and applied to clean damp walls. Colour can be added to limewash using natural pigments, but colour matching can be difficult so enough limewash for several costs to cover the entire area should be made up. Lime washes can be used inside and outside and should be renewed every five years.

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