BRIEFING PAPER - ASBP Lime Group | July 2026 (Version 1)

Building with Lime

> *This briefing provides a short introduction to building limes: what they are, how they work, and why they are being widely adopted in both conservation and modern low-carbon construction. The paper has been developed thanks to technical input from the ASBP Lime Building Products Group.*

1. What is building lime?

Building lime is made from limestone. In simple terms, limestone is heated to produce quicklime; quicklime is then combined with water to make slaked lime. That slaked lime becomes the binder in mortars, plasters, renders and limewashes. The two most common families used in building are:

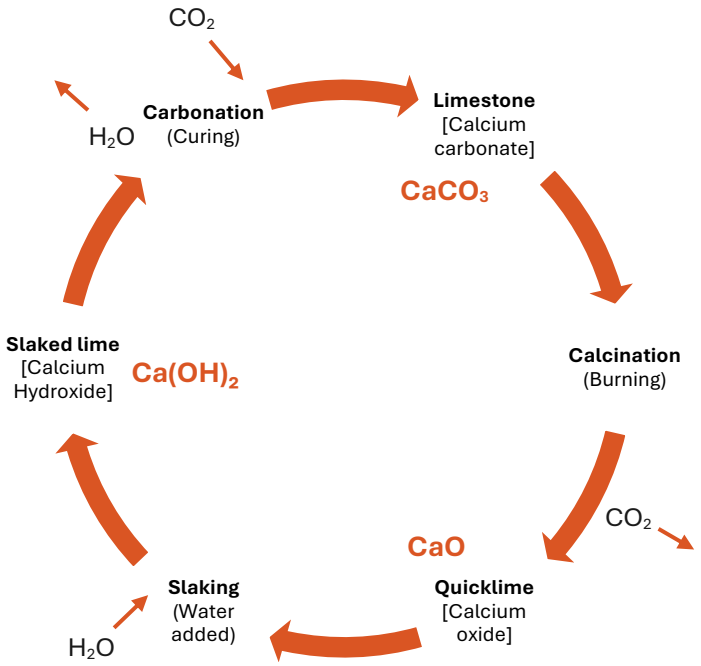
- Non-hydraulic lime (often supplied as lime putty): sets mainly by reacting with carbon dioxide in the air (carbonation).
- Natural Hydraulic Lime (NHL): sets by hydraulic reactions (it can set in damp conditions) and also contains 'free lime' that continues to carbonate over time.

2. A brief history (why we're talking about lime again)

Lime mortars and plasters have been used for thousands of years and dominate much of Europe's traditional building stock. In the 20th century, lime was widely replaced by Portland cement because cement sets quickly and reaches high early strength. However, cement's hardness and low vapour permeability can be problematic in older, moisture-sensitive masonry. Lime's current resurgence is driven by better understanding of building physics, moisture safety, heritage conservation needs, and the push toward healthier, lower-carbon construction.

3. The lime cycle (simple science)

The 'lime cycle' describes lime's chemistry from stone to binder and back again:



- Calcination (burning): Limestone (calcium carbonate, $CaCO_3$) is heated in a kiln and releases CO_2, forming quicklime (calcium oxide, CaO).
- Slaking: Quicklime is combined with water to form slaked lime (calcium hydroxide, $Ca(OH)_2$). This reaction gives off heat.
- Carbonation (curing): Over time, slaked lime reacts with CO_2 from the air and turns back into calcium carbonate ($CaCO_3$), effectively becoming stone again.

This slow, reversible chemistry is one reason lime can be so durable in the right conditions: it can continue to develop strength, and in some cases can 'self-heal' very small cracks through ongoing carbonation and re-precipitation of carbonate in the pore structure.

4. Lime putty vs NHLs (what's the difference?)

4.1 Lime putty (non-hydraulic / 'fat limes')

Lime putty is quicklime added to water which then matures to a creamy paste over a period of months. This slaking process creates a vigorous exothermic reaction resulting in high temperatures and steam. Lime putty is widely used as the binder for traditional mortars, fine internal plasters and as the basis for limewash. It is non-hydraulic and cures through carbonation by absorbing CO_2 from the atmosphere.

Specialist suppliers note that lime putty is often considered the most appropriate binder for conservation where maximum flexibility and vapour permeability are desired. In similar territory we find hot lime, where the quicklime is directly mixed with sand and water, a method which can give good results in the hands of a skilled practitioner.

These mortars and plasters will in some circumstances have pozzolans added before use. Originally these were volcanic materials but other substances such as ash, brick dust or metakaolin can have the same influence. Pozzolans introduce some hydraulic activity encouraging an accelerated set and some early strength. This will be helpful in damp or poorly ventilated applications where carbonation could be inhibited, or for external work where there is vulnerability to frost and the elements in general. The amount and type of pozzolan should be chosen carefully for conservation work.

4.2 Natural Hydraulic Lime (NHL)

NHL is produced from limestone that naturally contains clay/silicate impurities. Those minerals enable a hydraulic set (i.e., it can set in damp conditions), while some free lime remains available for longer-term carbonation. In practice, NHLs are often chosen for external work, exposed locations, or where earlier strength is needed.

European NHL classifications are commonly: NHL 2, NHL 3.5 and NHL 5. These classes are based on compressive strength of standard mortars at 28 days (laboratory conditions).

- NHL 2: generally used for sheltered or internal work, soft or friable substrates, and situations where vapour openness and flexibility are the priority.
- NHL 3.5: a widely used 'general purpose' option for many external renders and for bedding/pointing reasonably strong masonry.
- NHL 5: typically reserved for very exposed conditions, chimneys, and higher-strength work such as limecrete floor screeds.

These 'strength' labels are helpful shorthand, but they are not a substitute for design judgement: the right NHL depends on substrate strength, exposure, detailing, and moisture behaviour. Higher designations of NHL set more rapidly, an important consideration in floor screeds, for example, where this will permit timely progress with the following stages and not hold up the schedule of works.

5. Why lime is useful in buildings (performance in plain English)

Lime's value is not just 'it's traditional'. It's material behaviour. Compared with many cement-rich mixes, lime mortars and plasters tend to be:

- More vapour permeable (breathable): allowing water vapour to move through the fabric rather than being trapped.
- Hygroscopic and moisture-buffering: taking up and releasing humidity, which can stabilise indoor relative humidity and reduce condensation risk.
- More accommodating of movement: lime mortars are typically less stiff, helping masonry cope with small thermal and structural movements.
- Alkaline: high pH tends to discourage mould growth on the surface (though good detailing and ventilation remain essential).
- More 'sacrificial': in historic masonry, a mortar that is slightly weaker than the surrounding stone/brick can protect the masonry by taking weathering and salt crystallisation stresses first.

6. Lime in historic conservation

Traditional solid-wall buildings were usually built to manage moisture by allowing it to move and evaporate. In that context, lime mortars, plasters and renders are often specified because they:

- Match historic material behaviour more closely than rigid, dense cement mortars.
- Reduce the risk of trapping moisture (which can contribute to salt damage, spalling and timber decay).
- Enable repairs that remain maintainable: future work can often be done without harming surrounding masonry.

> *Conservation principle in a sentence: use a mortar that is compatible with the building fabric and exposure, so the wall can dry and the repair can be reversed or renewed without collateral damage.*

7. Lime in modern construction (healthy, low-carbon, moisture safe)

Lime is also used in contemporary design, especially where breathable wall build-ups, natural materials and healthy indoor environments are priorities. NHL renders and mortars can provide robust external weathering while still allowing vapour movement. Lime plasters can contribute to comfortable interior conditions by buffering humidity and creating durable, repairable finishes.

Note: lime is not a universal replacement for cement in every structural situation. The sensible approach is ‘right binder, right place’, guided by exposure, structural demands and moisture modelling where appropriate.

8. Lime with natural fibre insulation (a particularly good pairing)

Natural fibre insulations (e.g., wood fibre, hemp, cellulose, cork) are valued for vapour openness and moisture buffering, properties that support healthy moisture movement in walls. Lime plasters and renders complement these assemblies because they are also vapour open and hygroscopic. This helps create wall build-ups that:

- Reduce trapped moisture and interstitial condensation risk (when correctly detailed).
- Support better indoor air quality by discouraging persistent damp and mould.
- Remain repairable, resilient and compatible with bio-based materials.

In practice, these assemblies perform best when combined with good airtightness detailing and appropriate ventilation, saving energy without trapping moisture.

9. Aesthetics and finishes

Lime finishes can be as subtle or expressive as you like:

- Soft, light-reflective internal plasters with a ‘warm’ mineral feel.
- Textured and traditional external renders.
- Fine decorative finishes (including polished lime plasters) where appropriate.

Because lime finishes are repairable and can age gracefully, they are often chosen where long service life and low-toxicity materials are priorities.

10. Practical notes

- Curing matters: lime needs the right moisture and temperature conditions. Too fast drying can cause shrinkage cracking; freezing can damage green work.
- Mix design and aggregates matter as much as the binder. Seek supplier guidance and test panels for finishes.
- Exposure and detailing decide success: good drip details, capillary breaks, and maintenance planning are part of 'lime design'.
- Avoid over-strong mixes on weak masonry: strength should be compatible with the substrate.

11. Comparing lime and cement

Cement-rich mortars can be appropriate where high early strength and low permeability are required, but they can be risky in moisture-sensitive traditional masonry. Lime mortars and plasters are typically slower to gain strength, more vapour open and more flexible, which often makes them the better choice for solid walls, historic fabric, and breathable bio-based assemblies.

12. Conclusion

Lime is an old material with very modern relevance: it helps buildings manage moisture safely, supports conservation, and pairs naturally with bio-based insulation for healthier indoor environments.

> *Used with sound detailing and good curing practice, lime offers a resilient, repairable approach to both retrofit and new build.*

Find out more about lime at https://asbp.org.uk/lime-building-products.

With thanks to the members of the ASBP Lime Building Products Group for authoring this paper

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