The Problem with NHLs

- Minimal historic precedent for above ground construction – some increasing use late C19/first quarter of C20 before lessons learned and displacement by more predictable and stable cement-lime mortars.
- Some historic precedent for underwater/underground construction, But fat lime plus pozzolan generally preferred for this, except for concrete. Pozzolans are generally porous. Vicat lobbied for hydraulic lime use in the air, but did not trust NHL for this – making an artificial hydraulic lime.
- Excessive variability between 'brands' and within same brand – first call to ban them for these reasons by Le Sage in France 1777.
- Poor workability, air entrainers in pursuit of some workability compromise bond
- Poor water retentivity, leading to deficient bond
- High demand for on-going hydration and protection. Perhaps only gets enough underwater or in wet ground
- Low free lime content in its modern form. Traditional forms had more free lime and were often gauged with pozzolan for water works.
- Tricalcium silicates and aluminates in its modern form due to higher than traditional firing temperatures – over-rapid initial set and over-hard
- Often too hard, brittle and rigid. An NHL 3.5 at 6Mpa is 18 times harder than needed.
- Low capillarity and low effective porosity
- Low carbon recapture
- Generally incompatible with earth, earth-lime and pure or nearly pure hot mixed lime mortars. And with porous sandstones and limestones.
- Poor resistance to squeeze unless mixed too dry
- Free water available to run down masonry
- High later shrinkage potential after hardening leading to loss of bond with stone or brick units and allowing water ingress.
- Often durable but at what cost to traditional building fabric and its performance?

Traditional mortar proportions:

Pure and feebly hydraulic limes – 1 part quicklime to 2 or 3 parts aggregate, giving 1:2 or 2:3 slaked lime: aggregate, or richer in lime than this. This considered the MOST sand that 1 quicklime could take without compromising workability and performance. With powdered quicklime, 1:4 will work.

Moderately to eminently hydraulic lime: 1 part quicklime to 2 parts aggregate, or 1:1, depending upon hydraulicity. The more hydraulic, the less expansion upon slaking, as only the free lime can slake.

Holy Island late 1990s, NHL 3.5. Shrinkage away from stone/no bond, due to on-going set and inadequate hydration. Softer sandstones behaving sacrificially under salt attack

Cement-lime and pozzolanic air limes reach their maximum strength after 90 days (1:1:6 generally too hard and dense, though with as much free lime (or more) than currently available NHLs)