Colonial Bricks by Randy George
Part 3—Mortar & Repair

Handmade antique bricks are literally a world apart from modern bricks. For one, they are brittle. Compared to modern bricks, they are porous, water-absorbent, and evaporate quickly after wetting. Moisture from the air continually 'breathes' in and out, causing the bricks gradually to decay.

MORTAR

Ancient masons discovered that lime mortar was even more porous and more 'breathable' than the bricks that it supported, and that moisture would escape more easily through it. Lime thus became the sacrificial material meant to break down first, protecting the longevity of the soft bricks for hundreds of years.

OYSTER SHELL LIME

In seaside locations, lime mortar was made traditionally from oyster shells which are largely composed of Calcium Carbonate—$CaCO_3$. When burned at 1650-2200°F, the shell material is 'calcined', converted to Calcium Oxide—CaO, a compound called quicklime. When quicklime is hydrated (slaked), the result is Calcium Hydroxide—$Ca(OH)_2$. Carbon dioxide in the water and air slowly replaces the hydroxide moiety to again form $CaCO_3$, the hard crystalline matrix in lime mortar.

QUARRIED LIME

Today, a modern substitute for oyster shell lime is quarried dolomitic limestone. This manufactured product when 'slaked' or hydrated becomes $Ca(OH)_2$ + $Mg(OH)_2$, a white powder. Additional water is then added to create a paste-like lime putty which, along with sand and other additives, constitutes mortar. This lime, over time, takes on carbon dioxide from the air (carbonation) and becomes crystalline Calcium Magnesium Carbonate — $CaMg(CO_3)_2$.

PORTLAND CEMENT

Portland cement was invented in England in the 1840s by the kiln heating of limestone and clay to form 'clinker' (hydraulic Calcium Silicate and Calcium Sulfate) which is ground into a white or gray powder, often containing aluminum and iron. When hydrated, the material becomes a water-impermeable cement. Natural

hydraulic limes are used in the manufacture of portland cements and set by hydration, even under water. Portland cements, either white or gray, are standard mortar materials for modern hard, extruded brick but should **not be used** for antique brick.

Photo: Scott Sidler, The Craftsman Blog thecraftsmanblog.com

Most modern cements are extremely nonporous and when used with antique brick, force the brick to bear the entire process of transpiration, leading to eventual decay. 'Breathing' is so important to an ancient brick that if water is trapped within it by hard mortars, paint, or silicone, then changes in temperature (especially freezing) will cause it to soften, crack, and 'spawl'. Salts in the brick or mortar migrate to the surface and cannot escape, causing structural decay. Similarly, interior painted brick walls also trap moisture. Salts in the brick or mortar migrate to the surface (efflorescence), resulting in blistering called 'rising damp.'

REMOVING OLD MORTAR

There is no quick and easy way to remove mortar from ancient brickwork. Repairing mortar joints requires a degree of delicacy to prevent injury to friable brick edges, and rough treatment will result in lost brick, widened joints, and a botched appearance. Older lime mortar should be removed to a depth of one inch with sharpened mason's chisels, joint chisels, and a lightweight soft mallet with a broad peen. A barbed scraping tool may be used to remove mortar at depth.

Toolkit for removing & replacing mortar

Harder portland cement is best removed with a small power circular saw blade placed at the center of the joint, taking care never to touch the blade to brick. This is most tedious on the shorter vertical joints. Chisels need to be resharpened frequently, as dull edges smash the mortar, resulting in adjacent brick damage. Repointing usually includes removing damaged bricks and reconstruction with 18th century bricks, which, though rare, are still available with careful search.

MIXING LIME MORTAR

In general, the ratio of sand to mortar has for centuries been roughly 3:1. Many formulas have been designed to achieve the desired degree of strength and porosity. An ideal historical recipe is shown here, using a 5-gallon bucket and handheld electric mixing drill.

HISTORIC RECIPE:
1 part crushed oyster shell
1 part slaked lime
1 ½ parts white sand
¼ part hydraulic lime
water

A small amount of brick dust which contains silicates (possolan) may be added to the mix to give additional strength. In summer, a little wood ash may be added as a 'gauge' to hasten the set. Attempts to match mortar color are generally fruitless and should be left to time and weather.

There are simpler, modern but acceptable alternative formulas with a predominance of slaked lime. However, certain portland cements have been shown to have adequate porosity when combined with lime. Some modern recipes:

1 1/2 —2 parts lime putty
1 part white portland (type 0)
6-8 parts white sand
Water

1 part hydrated lime
¼ part white portland (Type 0)
3 parts white sand
Water

REPLACING MORTAR

The clean opened joint is spritzed with water before applying the mortar to depth. Both pointing and tuck-pointing trowels are used entirely to fill each gap. To smooth the surface, the first strike uses the lower brick edge as a border, while the finish strike is drawn below the edge of the upper brick.

Since antique hand-molded brick is irregular in shape, the mortar joints, both horizontal and vertical, are finished off with a 'grapevine' by slightly indenting the freshly smoothed surface with a thin grape-vining jointer tool, drawn along a straight-edged board or ruler. This creates a uniform line in the finished mortar joint, adding an illusion of uniformity.

As the mortar begins to dry, any remnants clinging to brick edges are removed with a fine wire brush. Because mortar sets slowly, it creates a firmer crystalline structure and bond. The brick is again spritzed to slow the drying process. Moist burlap may be laid over the surface. The 'set' occurs by carbonation from the air over a period of months or years.

Incorrect portland repair needing replacement

After replacement

Colonial Bricks *(cont'd)*

In summary, preserving old brick structures does not lend itself to shortcuts. The use of any hard modern brick or mortar material will create difficulties far more expensive and unsightly than existed before the repair. Most skilled modern masons, unless trained in handling antique brick, risk doing more harm than good. Fortunately, there is enough work to support a small, select band of historic masons, especially along the eastern seaboard.

The take-away message is: **When restoring precious colonial era brick structures, don't cut corners. Hire an expert.**

Find recommended masons in our *Contractor & Services Directory* on our website schtrust.org/contractor-directory

Ray Cannetti, master restoration mason

REFERENCES

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