

Masonry repairs. Jun 2018. Adrian Paye

32 years ago, I worked for a national company which repaired masonry buildings. Their repairs failed, but no one knew why. I wanted to find out.

I spoke to all the old stonemasons and read all the books I could find. One book in particular proved extremely helpful 'Arthur Warnes' BUILDING STONES: Properties, Decay & Preservation' published in 1926. At this time our cities were very heavily polluted with sulphates from the burning of coal.

This book became my guide. It contained the chemical analysis of 54 building stones, 18 of which were used in London. A few were very commonly used. I realised that the nature of decay fell into categories depending on the type of stone, and these categories also reflected the most appropriate methods of cleaning their soiled surfaces.

There are few places in the world which have more freeze/thaw and wet/dry cycles than the UK. This takes its toll on our building stones, which need to be carefully selected to ensure failure does not occur within too short a lifespan. Local sources of stone might be more economic due to the high cost of transport (throughout the middle ages, one day's travel by oxcart equalled the value of the stone). There are many examples of poorly-performing facades where stones have been selected on the basis of expediency rather than durability.

Simplistically, limestone facades, of which there are many thousands in London, dissolve in acidic atmospheres in exposed locations at the rate of approx. 1mm every 100 years. This rate used to be 1mm every 10 years before the 1956 Clean Air Act. Limestones are best cleaned with copious amounts of clean water. Sandstones, which are relatively rare in London, are more complex in chemical terms and tend to fail by delamination parallel to the masonry surface regardless of the orientation of bedding planes. Sandstones cannot be cleaned simply with water. Granites, gneisses, porphyry, etc are relatively inert in terms of the life of a building facade.

The best way to preserve a stone façade is to regularly/carefully remove any harmful atmospheric pollutants and protect the masonry to ensure the stone does not become saturated.

Such was the extent of decay caused by the polluted city atmospheres, that the application of preservation treatments was seen as commercial opportunities.

With the benefit of hindsight, we now know that any 'preservation' solution applied to the surface of the stone which has the effect of reducing the permeability of the treated surface, actually accelerates its failure. The mechanics of failure will vary from one type of stone to another but, essentially, any moisture trapped within the stone's pore structure will tend to degrade the stone at the point where the permeability abruptly changes. Inappropriate treatments applied with the intention of preserving the stone from the late 19th century which we now know to have had a detrimental effect include paraffin wax, resins, hydrochloric acid, linseed oil, caustic soda, shellac, and, as recently as the 1980's, various silicon-based solutions. Once this principle was understood, more appropriate treatments were developed, typically

based on siloxanes which allow moisture to evaporate away through treated surfaces but still reduce the amount of water absorbed by the stone. Though I would always prefer not to treat any natural stone unless there was a specific reason for so doing, I am aware of several stone facades treated with siloxanes since the late 1980's which have yet to display any sign of failure.

Traditionally, lime was the base component of masonry mortars. Lime technology was developed by the Romans, and its use spread throughout their empire. However, local sources of lime varied considerably from one region to another, as did the techniques of firing a kiln and slaking. Lime mortars are variable and prone to failure. Furthermore, they are susceptible to frost damage for periods of months after laying. For this reason, masonry works would traditionally cease after Michaelmas and not start again until Easter. After the Great War, cement mortars became more widely used. They were much less variable and achieved frost resistance within days. This led to a loss of knowledge in the use of lime as a base component in masonry mortars.

In the late 20th century it was recognized that cement mortars were having a detrimental effect on natural stones for the same reasons that inappropriate surface sealers had had 100 years earlier. This realisation resulted in a return to the use of lime mortars, and there is currently much debate about which particular slaking method should be used. My belief is that the slaking method should be a secondary consideration since achieving a mortar with sufficient strength/longevity and appropriate permeability should be the ultimate goal.