

building blocks

Yes, It Does Matter What Mortar You Use!

The Use of Lime in Historic Preservation

By Jeffrey B. Price

Today, building professionals are challenged with finding ways to help our environment, save the integrity of a landscape or cityscape, offer an interesting design to the structure that they are developing, and do it all cost effectively. Low profile buildings are being built to preserve the look of an area, or buildings are made of “natural” materials. Another solution exists: preserving our built heritage. Many of our historic buildings, having stood for 100 + years, are destroyed to be replaced with “disposable” structures that have a life span of around than 50 years.

“Preserving our built heritage is a logical approach.”

Historic buildings are often over looked because they are “no longer feasible” or need “too much work.” However, with the right team in place, the saving of a structure for preservation or adaptive re-use can leave all parties involved satisfied and happy. Adaptive re-use is a noble approach, but should go hand in hand with preservation. A preservation mentality must be adopted if the project is going to be a success. Preserving our built heritage is a logical approach. Traditional masonry buildings have stood the test of time. The Coliseum in Rome, the Tower of London, Herod’s Palace in Israel, and the White House all have one thing in common: they are all masonry buildings that have been put together using lime mortars.

“Lime is a versatile material.”

Why Use Lime?

Lime Mortars have been around for at least 6,000 years; it has only been in the last 70 years that they have faded from prominence. For the past 50 years, inappropriate repairs to historic buildings have caused more problems than what the repair was to take care of. Yes, it does matter what mortar you use! Lime is a



Chaux Enduits Saint Astier: This traditional lime producer from France has been making natural hydraulic limes for over 150 years

versatile material. They are breathable, which is an important factor when addressing today’s cases of “unhealthy building syndrome”. They are flexible, which allows for great walls without the need for expansion joints. And, they are environmentally friendly (lime is good for soil and the carbon dioxide that is released from the stone during burning is re-absorbed into the mortar as it sets).

“Great care should be exercised in specifying a lime mortar.”

What is Lime?

All limes are not created equal. Just as all situations are not the same, *one type of lime is not a cure-all for every situation.* There are a wide range of traditional building limes that are produced throughout the world that can be used depending on job requirements. Lime putties and Feebly Hydraulic Limes are ideal for southern climates and soft friable masonry. Moderately and Eminently Hydraulic Limes and Natural Cements can be used in northern climates where the building season is limited and the weather is harsher. Also, combinations of lime putty, hydraulic limes, and natural cements (gauged mixes) can offer

solutions to many mortar problems. Great care should be exercised in specifying a lime mortar. Questions must be asked to ensure that your project will be a success. How is the lime produced? What are the lime’s properties? What are you trying to achieve with the lime that you are using?

Raw limestone, when burned, releases carbon dioxide and moisture. Firing lime kilns with wood or with coal was a common and effective burning method. When burning with wood, the fire is relatively low in temperature with long flames and steam released. This keeps burning temperatures ideal for the calcining (the process of burning) of limestone. This process of burning produces calcium oxide, or quicklime. Care should be taken in the burning of limestone, so that the material is never over-burnt. The quicklime is then taken from the kiln and is introduced to water, which is also called slaking. Slaking can be done with a minimum of moisture to produce a hydrate, or in the case of lime putty with an excess of water.

When moisture comes into contact with a reactive quicklime a violent reaction takes place, generating steam, heat, and breaking the quicklime down forming calcium hydroxide. This calcium hydroxide, or its common name lime putty (or in its dry form, hydrated lime), can be put into vats or tubs to age. If lime is used prematurely, particles of unslaked lime can air-slake causing pitting or spalling, especially in plaster. Once the lime is sufficiently aged it can be added to sand to produce lime mortars or plasters. Traditionally, lime putty mortars



Using wood to fire a traditional lime kiln

were made by combining lime and sand together by hand using a hoe and shovel, and then beating the mixture with some form of pestle. Also, the mortar can be made in a roller pan mixer which mills the lime and sand together under large steel wheels.

Proper compression is the key to lime mortars. Lime putties have a tremendous amount of water retention and can be made with little or no addition of water. After making the mortar, it can be used immediately, or it can be aged as long as it is kept air tight. Over time, lime will begin to etch the individual grains of sand forming a tighter, richer and more cohesive mix. When lime mortars/plasters are applied, they set through carbonation (carbon dioxide enters into the mortar and moisture is given off). The mortar then reverts back to calcium carbonate.

What should you know about the lime you are using?

To ensure performance of lime mortars, make yourself aware of how the particular lime is made. When in doubt, use a lime that has been burned at relatively low temperatures and slaked using only water. Also, the form that your lime arrives can make a difference. When lime hydrates are used, there is a risk of the calcium hydroxide being carbonated, which is an inert material. Hydrated limes are a wonderful additive to Portland Cement to aid in workability, but should not be used in a “stand alone situation”. When using non-hydraulic limes, it is often safer to use lime putty that has been slaked directly from Quicklime to ensure that you are working with calcium hydroxide.

How can I learn more about traditional lime mortars?

To learn more about lime mortars, the American Lime Conference will be held at Sweet Briar College, VA on May 20-21, 2004. This conference will host an international group of professionals (architects, engineers, material scientists, craftspeople) who deal with historic buildings on a daily basis. Another invaluable source of traditional lime information is the International Building Limes Forum, a non-profit/non-commercial organization, dedicated to promoting the best advice for historic masonry.

So what should I do?

Most importantly, a “like for like” mentality is often the best way of determining a repair philosophy. If a traditional lime was used for mortar, then a compatible building lime should be used for replacement. If Ordinary Portland Cement was originally used, then OPC should be considered for the repair. There are also other binders, such as Natural Cements which differ from OPC, that were used traditionally. The “like for like” mentality should not be viewed as a cure all, but it should be used as a starting point when structuring the work to be performed. If the structure has survived with minimal problems for 150 years, doesn't that seem like a reasonable maintenance schedule?

“...the form that your lime arrives can make a difference.”



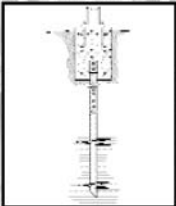
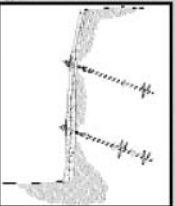
Using Traditional Lime Mortars in the reconstruction of the 17th Century Chapel at St. Mary's City, MD


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