

A Report on the Use of Hot Lime Renders



**A Case Study of Works completed at
The Parish of St Nicholas Church, Thorney Island
&
The Church of St Mary the Virgin, Oxted**

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Introduction

This report highlights the key aspects associated with the use of hot mixed lime mortars for render repairs to historic rubble masonry and is based upon findings uncovered during works at two Grade I listed places of worship (see Photographic Plates 1 & 2 below and overleaf). The scope of works at both sites was similar in composition and comprised careful removal of existing defective render finishes, stabilisation and repointing to the substructure and then re-application of new render surfaces using a hot mixed lime mortar. The masonry substructure to both buildings was similar in make-up and formed of a combination of soft Limestones and Sandstones, including examples of: Reigate, Caen, Fittleworth and even a Magnesian Limestone.

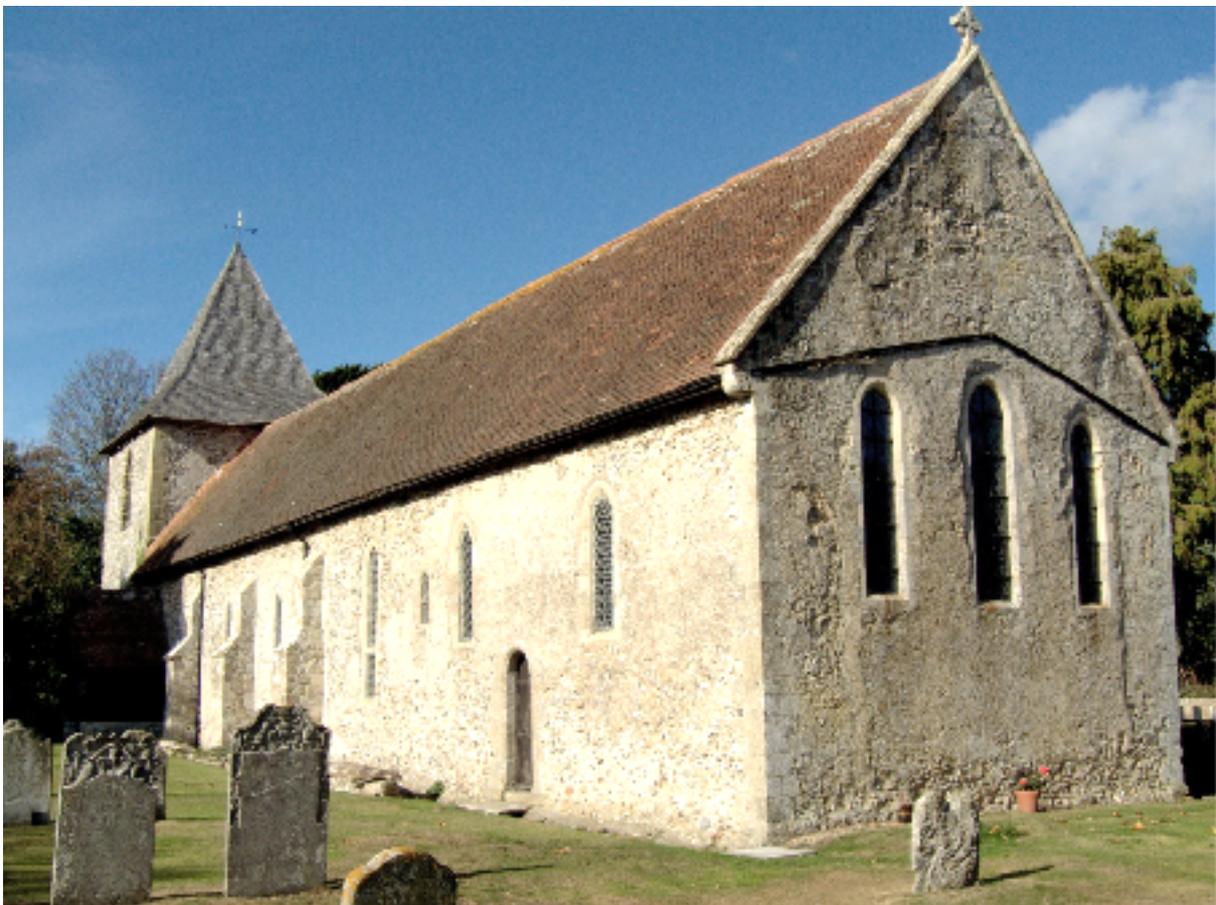


Plate 1: The Parish of St Nicholas Church, Thorney Island viewed from the South East



Plate 2: The Church of St Mary the Virgin, Oxted viewed from the South East



Plate 3: The site set up at Church of St Mary the Virgin, Oxted

Preparation & Mortar Mixes

For both projects, hot lime render mixes had been specified by the respective project architects and it was agreed at pre-commencement stage that the mixes and methodology of application would be further refined through a series of trials. PAYE masons worked with conservation consultants Ben Bosence and Nigel Copsey to formulate appropriate mortar mixes for both buildings, during this process the following key pointers were noted:

Quicklime Ratio:

When formulating hot lime mixes, an allowance must be made for the expansion of the quicklime during the slaking process. This is important, so as to not result in a mortar mix which is lime rich and can be prone to cracking. For example, where a mortar has a specified mix ratio of 3 parts sand to 1 part quicklime - to allow for this expansion, the percentage of quicklime must be halved, giving a revised ratio of 3:½ of sand and quicklime. Plate 3 below shows an example photograph of this cracking to a hot mixed sample panel which has been deemed to be too 'lime rich'.



Plate 4: Lime rich mortar samples that were subject to failure at The Church of St Mary the Virgin, Oxted



Incorrect Slaking:

During the exothermic reaction which takes place during slaking, it was noted that excessive temperatures are reached only when the insufficient amounts of water are added to the quicklime. Incorrect slaking can result in the quicklime reaching temperatures of up to 200 degrees Celsius, which can potentially present a health and safety issue to the operatives using the product. These excessively high temperatures occur when too little water is added to the quicklime and the mixture is 'under-slaked'. To prevent this, it is therefore essential to ensure that a large supply of water is to hand when this is being undertaken.

Banking:

Prior to applying new renders, it is advisable to complete a bulk action of slaking quicklime to form the mortar mix required. This can be done by setting up a mixing area with timber ply sheeting on the ground, together with suitable containers where the lime can be banked and left to slake. It was found that in completing this process, the quicklime is given time to thoroughly slake and the mortar is more extensively mixed. This prevents nodules of quicklime sitting in the mix which pose the issue of a further reaction occurring post application, leading to the subsequent failure of the render. This is particularly relevant when using larger aggregate or kibbled quicklime.

It was also found that banking the hot mixed lime mortar produces a more fatty and consistent mix, which is much more workable and easy to apply. This is particularly useful when rendering large surface areas. An important point to consider when banking a hot mixed mortar is that the mix must be kept thoroughly saturated and preferably stored in an airtight plastic container with a thick gauged sheet of plastic under the lid, preventing the mortar carbonating prematurely whilst banked.

Quicklime Aggregate/Suppliers:

Buxton is a common manufacturer of quicklime and it can be procured from a number of suppliers including The Lime Centre and Chalkdown Lime, details of both are included below:

Chalkdown Lime – Contact Declan Reed. Tel: 01580 830 092,

email: sales@chalkdownlime.com Note: Declan has extensive experience in the supply and use of hot lime and can provide advice on this if required.

The Lime Centre – Tel: 01962 717 636, email: info@thelimecentre.co.uk

Quicklime is available in two forms, this being kibbled and finely powdered. During sampling it was found that the powdered quicklime can produce a mix which was more susceptible to cracking, however this may have been due to other contributing factors, some of which are mentioned above. The advantages and disadvantages of each form of quicklime are summarised within the table beneath sourced from www.buildingconservation.com

POWDERED VERSUS KIBBLED QUICKLIME	
POWDERED QUICKLIME	KIBBLED QUICKLIME
Reacts faster than kibbled – a quicker reaction can be harder to control and mix as it stiffens	Reacts a little more slowly than powder
No hotspots – as a powder it is all of similar granulometry	Hotspots – larger pebbles can reach higher temperatures during slaking causing spitting
Plumes – powdered quicklime can be thrown into the air during mixing, posing significant health and safety issue (eyes, inhalation, skin)	No plumes – granules and pebbles are heavier and denser than the powder
Limited pop outs – less prone to latent expansion after the mortar has been placed as almost all of it converts to lime	Pop outs – some larger pebbles can be slow to slake, causing delayed expansion which can disrupt the mortar face

Table 1: Showing the advantages and disadvantages of powdered and kibbled quicklime sourced from www.buildingconservation.com

Tools & Equipment



When mixing, storing and distributing hot lime, it is advisable to procure steel or heat resistance containers, buckets and mixing larries; that can withstand the increased temperatures of the quicklime during slaking. These can be easily procured online or from a range of builders merchants.

The Application of Hot Mixed Lime Renders

Harling:

During the sampling process completed on site at The Parish of St Nicholas Church, Thorney Island; it was recommended that the hot lime render be harled onto the rubble masonry as opposed to being applied conventionally with a mason's trowel. The process of harling consists of the mortar being thrown from the trowel and onto the face of the wall and is understood to provide a render with a more porous and permeable consistency when compared to that of conventionally applied render. Harling the render into place also prevents the mortar from being over-applied, as the excess quantities will simply fall to the ground. As one would expect, it was found that areas of render which were applied too thickly would be more prone to cracking and so a consistent depth of finish should be aimed for.

In addition, the harled render produces a more authentic and less homogenous aesthetic than that of traditionally troweled render. Historic renders can often be undulated and inconsistent in appearance and this method of application can prove advantageous when striving to achieve such a finish. Photographic Plates 5 & 6 overleaf are images of the harled render completed by PAYE to the East Gable at The Parish of St Nicholas Church, Thorney Island.



Plate 5: Completed harled render to the East Gable at The Parish of St Nicholas Church, Thorney Island



Plate 6: Completed harled render to the East Gable at The Parish of St Nicholas Church, Thorney Island



Plate 7: Scratch coat render applied traditionally at Church of St Mary, Oxted



Plate 8: Completed render applied traditionally at Church of St Mary, Oxted



Tending & Aftercare

It is important to ensure that hot mixed lime mortars are properly tended post application and the requirements for doing so can change depending on a number of factors. In the case of the projects detailed within this report, it was found that shrinkage cracking may sometimes occur, particularly to the areas of thick or deeply applied render and this must be addressed. If the render remains workable, it is advisable to gently brush the cracks with a soft bristled brush and subsequently sponge over with a damp, clean sponge until the crack is infilled. This process was adhered to daily, and as the render began to cure, the extent of cracking reduced. However, it is important to define the difference between shrinkage cracks and failure and this can be determined by assessing the consistency and appearance of the mortar. If shrinkage cracking occurs, the render will remain elastic and malleable and it will be possible to remedy the cracks using the method noted above. However, if the render appears flaky, dry and starts to resonate hollow when tapped, then failure has likely occurred, and the render must be removed and reapplied.

Summary of Key Points

Mix Ratio – Ensure that an allowance is made for the expansion of the quicklime when compiling a mortar mix ratio. It is generally assumed that the percentage ratio of quicklime will double during slaking.

Slaking – Ensure that a sufficient amount of water is added to the quicklime during slaking to prevent under slaking and the creation of excessive temperatures.

Banking – It is prudent to slake and mix a considerable amount of lime mortar pre-application of render, to give the quicklime sufficient time to slake (thus producing a more workable and durable mortar).

Application – Thought should be given to the aesthetics of the new rendered surfaces to ensure it is an accurate match to the pre-existing render and is suitably in-keeping with the character of the building.

