

Mr M Axell
M. Axell Stone Restoration Ltd
Crutches Gate Cottage
Old Watling Street
Higham
ME2 3UG

9th August 2021

Receipted Invoice Number 2021/30

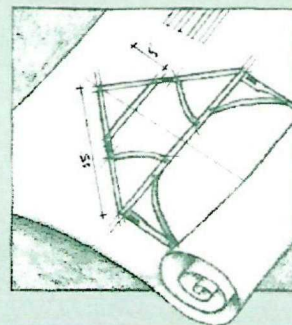
Re: Mortar Analysis Crutches Gate Cottage

Provide mortar analysis for one sample from brickwork including a report with chart and sieve grading.



Payment received by BACs with thanks

Paul Reed



Paul Reed M.A.Cons York
**Historic Buildings
Consultant**

- ◆ Specialist conservation advice
- ◆ Traditional building design
- ◆ Traditional craft skills



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Client: Mr M Axell
M. Axell Stone Restoration Ltd.
Crutches Gate Cottage, Old Watling Street
Higham, Kent
ME2 3UG

7th August 2021
Mortar Analysis Report

Test method: Ashurst method using 18% acid to neutralise the pure lime present.

In appearance the sample was off white in colour in mainly dust form however some small, whole lumps between 5-3mm in size were retrieved to make up a test sample. A fine texture mortar with fine sand particles, containing brick chippings and lumps of chalk or possibly unburnt lime.

The dry weight of the sample was **17.14 g**

The dry weight after dispersion **6.83g**

The sample fizzed vigorously with the acid and after dispersion the residue was washed and dried. The weight compared to the original sample showed a **38.5%** loss of free lime binder and possible unburnt chalk giving a calculated very strong mix of **1:2.5**.

The sample was passed through the graded sieves and at more than 4.75mm there was a piece of ironstone. Under the microscope x40 magnification, pieces of brick chips, a granite pebble and unknown piece of sandstone/quartz were evident at 4.75mm.

2.36mm showed brick dust, quartz, two pieces of wood and a small fragment of ironstone.

1.18 mm showed more brick dust, fragments of wood, charcoal, ironstone, quartz silica and about 10% glomerate of fine sand and cementitious binder.

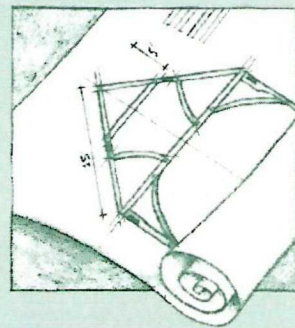
600-150µm same as for 1.18mm containing 10% cementitious binder. Very fine silica sand at 300-150µm. At 150µm the chart shows that the mortar contained a very high percentage of very fine sand which could be from clay used as an aggregate. This may be the reason why the mortar had failed and become dusty.

It is surprising to find that the binder for the mortar was feebly hydraulic and a strong mix, showing a cementitious binder as often found from mortar mixed with quick lime from the north downs. This mortar would have been expected to be well cured and dense, however, the opposite is found and it had become dust with very little binding properties. It is also a mystery to find a high percentage of brick dust in amongst the mortar lumps. Could the brick dust from local brick cutting have contaminated the sample. If the brick dust was added to the mortar when it was first made, which is often the case, it would have reacted with the quick lime as a pozzolan and would have produced a very hard mortar which was not the case.

Recommended mix:

To match this sample, it is suggested to use a well graded sand hot mixed as produced by Chalk Down Lime Ltd or other lime mortar suppliers. Or use well graded sand mixed with NHL 2 Hydraulic lime mix 3 sand to 1 lime, do not add Portland cement to the mix.

On the analysis chart showing the percentages of the graded aggregates under the red curve indicates the ideal proportions that should be present for an effective mix.



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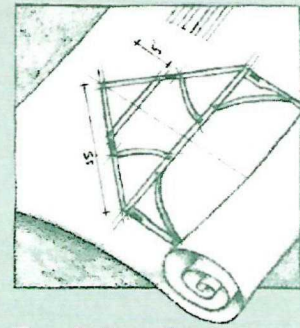
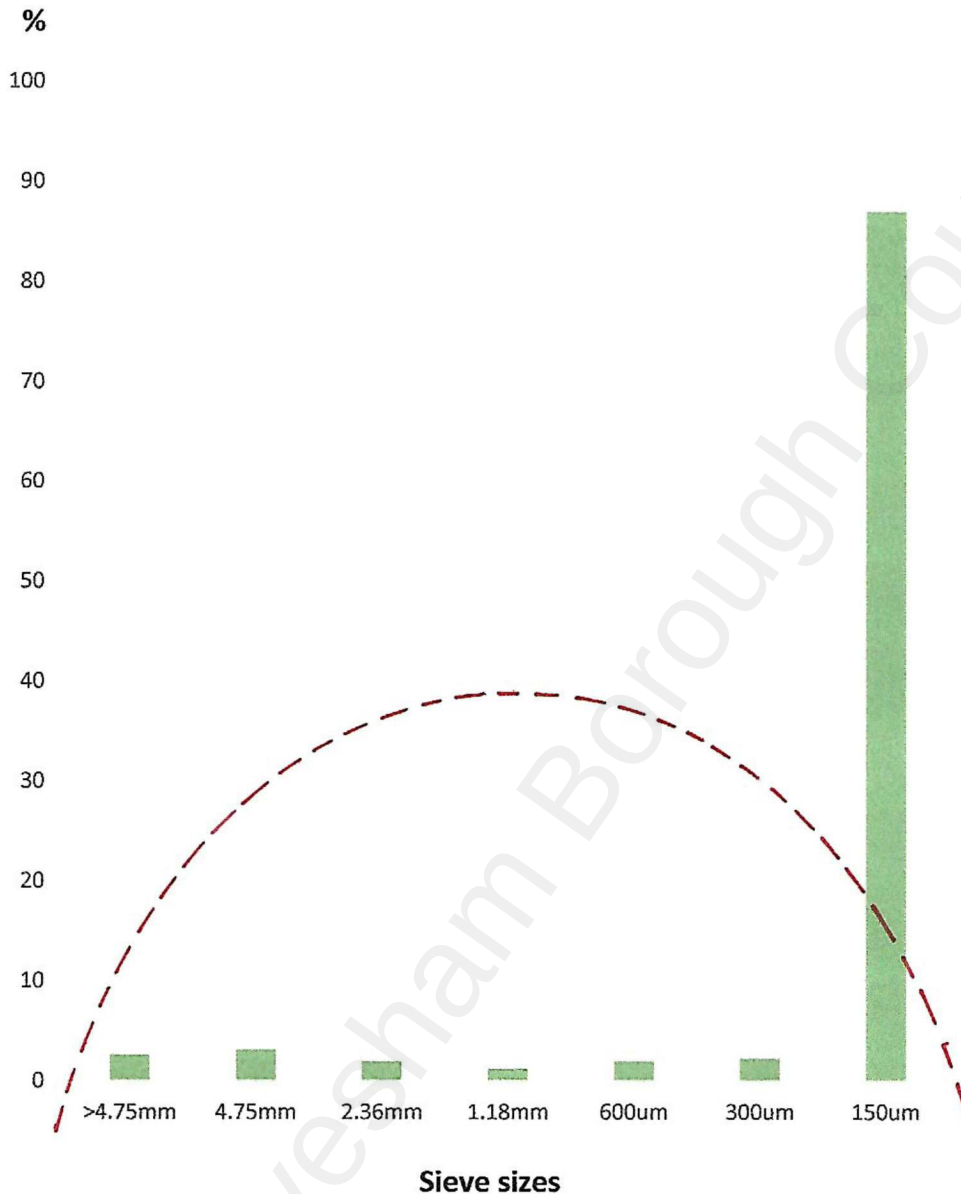
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MORTAR ANALYSIS CHART

Crutches Gate Cottage, Kent

7th August 2021



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Dry weight of sample	17.14g
Oven dry weight after dispersion	6.83g
Difference % loss of binder	38.5%
Assumed mix approximately	1:2.5



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