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Mortar Analysis Report: North Lodge, Heath House Prepared for: Donald Insall Associates

We were provided with samples of mortar from 2 different locations at North Lodge, Heath House for the purpose of dissolution analysis. Sample 1 was taken from the joints in the ashlar stonework in the entrance porch, and Sample 2 was taken from a section of the external garden retaining wall.

Each sample was dried, weighed and photographed before undergoing timed acid dissolution. The remaining aggregates were sieve graded (using Lab Test Sieves to BS 410 1986) and each grade of aggregate was re-weighed and photographed.

The results for each sample were analysed visually and the data collated for assessment of the likely make up of the mortar binder and the aggregate particle size distribution.

Summary of Findings

Both of the samples tested showed all the hallmarks of being non-hydraulic “Fat Lime” mortars, with a high ratio of lime (approximately 1:1 by volume with the aggregate) in the mix, which indicates that these were made using the hot mix method.

In both samples there was a mix of aggregate sizes and except for one or two large pieces, the grading was surprisingly close to our Shropshire aggregate, albeit with a higher proportion of the finest particles.

Conclusions

It is no longer possible to replicate the exact make-up of historic mortars, since we no longer have access to the same sources of aggregate, and the quick limes used for the hot mix method of production are now produced industrially using pure limestone without the impurities that may be associated with local production in charcoal fired kilns.

Sometimes it is not even desirable to exactly replicate historic mortars in order to maintain a clear historic timeline of interventions, or because the original application could be considered as sub-optimal.

On this occasion, however, our Shropshire Aggregate proved to be a remarkably close match to the aggregate used for both samples tested, although to obtain a close colour match with the actual mortar it would be necessary for us to produce a custom mortar with a significantly higher lime content to our standard mortars.



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Mortar / Plaster Analysis Report

Job Details

Client name	Donald Insall Associates
Sample no.	Location 1
Site	Heath House, North Lodge
Sample type	Mortar
Location in building	Entrance Porch
Analysis date	03/01/2025
Analysis carried out by	Jon Paish

Visual Analysis

The sample of mortar provided for analysis consisted of consolidated pieces of pale, pinkish grey mortar. On close inspection there were small inclusions of white material visible as well as some larger particles of aggregate.

Although quite solid, the mortar could be easily broken by hand, and could be crumbled between the fingers. It was also relatively absorbent to water.

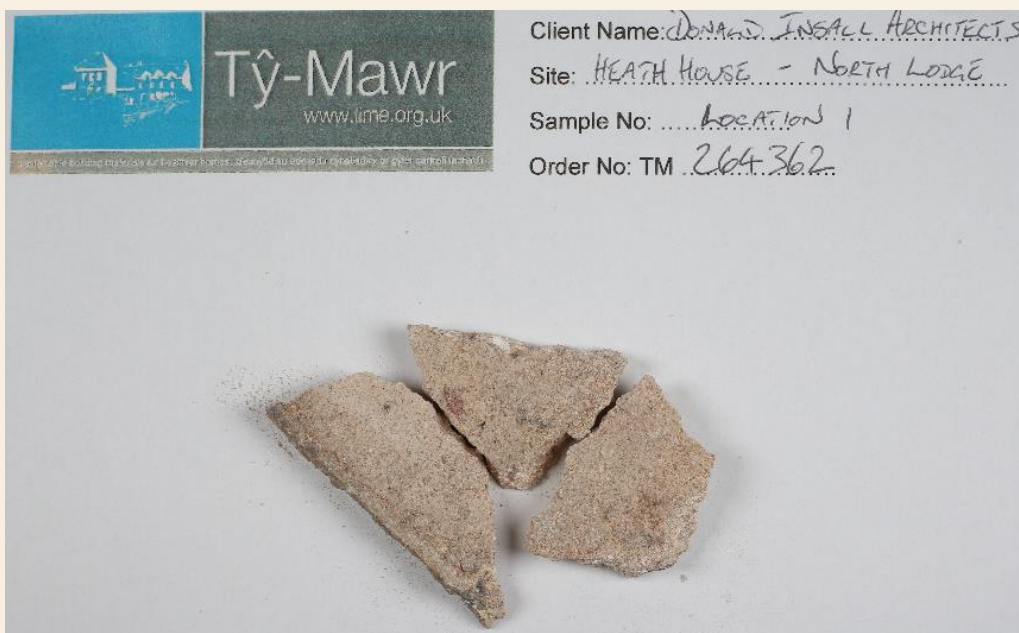


Photo of Sample Received

Acid Dissolution and Particulate Size Analysis

Dissolution of the sample material in acid resulted in a moderately active reaction, which started to slow down after 3 minutes, continuing to slow until ending after 8 minutes. There was clear evidence of incomplete dissolution in quite a number of the remaining particles.

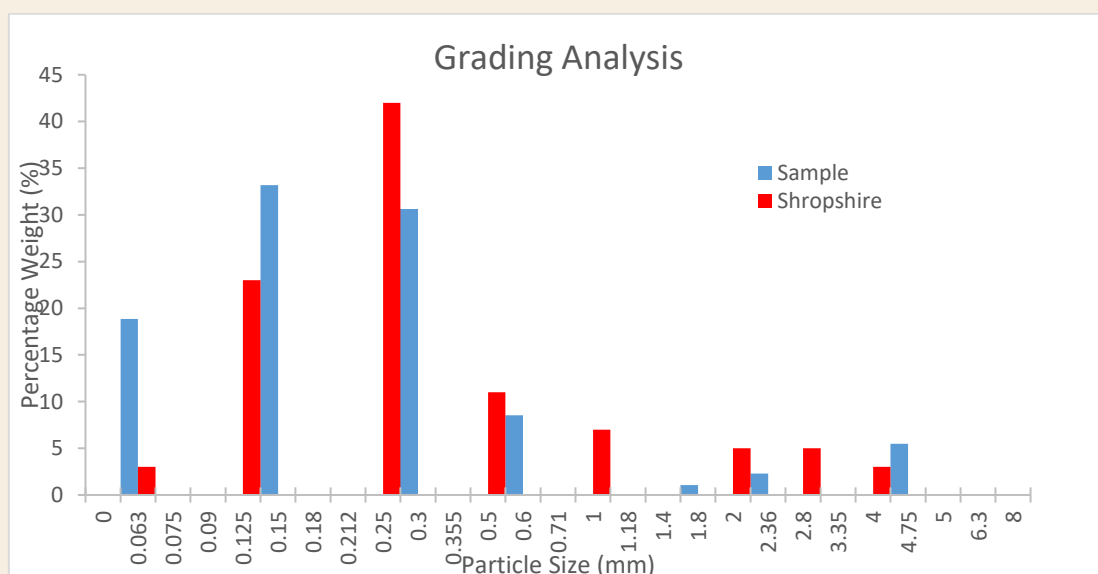
The dissolution process removed 46% of the sample material, suggesting a mix ratio of 1.1:1 aggregate to binder, although incomplete dissolution will have skewed these figures.



Sieve Analysis of Aggregate Particle Size

Excluding the particles not fully dissolved, the aggregate particles ranged in size from under 1.8mm to very fine dust under 0.15mm. There also appeared to be some small pieces of consolidated clay which turned to fine powder on touch. Almost 83% of the particles were under 0.6mm in size.

This grading proved to be somewhat similar to our Shropshire aggregate but with a higher proportion of fine particles. The colour was also remarkably similar to the Shropshire aggregate.



Conclusions

The pure white inclusions in the sample were most likely to be patches of unslaked lime, suggesting that this was a hot mixed non-hydraulic lime mortar. The duration of the reaction with acid was within the parameters expected of this type of lime mortar, whilst the high lime content is also indicative.

Whilst the mortar was somewhat harder than might generally be expected, and the duration of the reaction with acid was more extended than is often the case, this could be explained by the presence of brick dust within the mortar, which would act as a pozzolan to increase the hardness and speed of set of the mortar.

Replacement Material Recommendation

Although the aggregate particles in the sample bear a very close similarity to our Shropshire aggregate, the colour of the actual mortar is significantly paler than our standard Shropshire mortar due to the higher proportion of lime in the mix.

Generally, the choice of mortar is made on the basis of the hardness of the masonry and the exposure of the elevation. The choice needs to be agreed between the architect, client and contractor.

The method of finish affects texture and tone enormously, a pointing iron struck lightly onto the mortar surface will create a bland, smooth surface. Brushing, scraping or sponging will impart texture and character to the finished pointing by revealing the shapes and colours of the aggregate.

Please note that mortar colour, texture and finish may also need to be agreed with the relevant local planning authority.

NOTE: It is not recommended to use lime products (lime mortars, renders and limewashes) when temperatures are liable to fall below 5°C (41°F) for several weeks/months after the products have been used. This is especially true for Non-Hydraulic/Fat Limes/Air Limes and the weaker Natural Hydraulic Limes (NHLs).

Any mortar samples provided to Ty Mawr Lime Ltd for the purpose of dissolution analysis will be disposed of 1 month after the issue of our report.

The information provided in this report is provided in good faith after receipt of samples. It is suggested that you satisfy yourself with the technical characteristics of the suggested products for the specific applications (see published technical sheets – copies available on www.lime.org.uk) and if necessary ask the contractor to produce samples so that the suitability, timescales and finish can be checked and agreed.

This report is not an engineer's report. It is based on our professional experience of assessing historic buildings and mortars over many years. Ty-Mawr Lime Ltd are committed to providing the highest level of support to ensure a successful job, if you have any concerns at any stage of the project, email us on tymawr@lime.org.uk



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Mortar / Plaster Analysis Report

Job Details

Client name	Donald Insall Associates
Sample no.	Location 3
Site	Heath House, North Lodge
Sample type	Mortar
Location in building	Garden Retaining Wall
Analysis date	04/01/2025
Analysis carried out by	Jon Paish

Visual Analysis

The sample presented for analysis consisted of four consolidated pieces of mortar, with clear signs of algal growth, which was rather obscuring its pinkish white colour. The mortar could be readily broken and crumbled between fingers and was moderately absorbent to water.

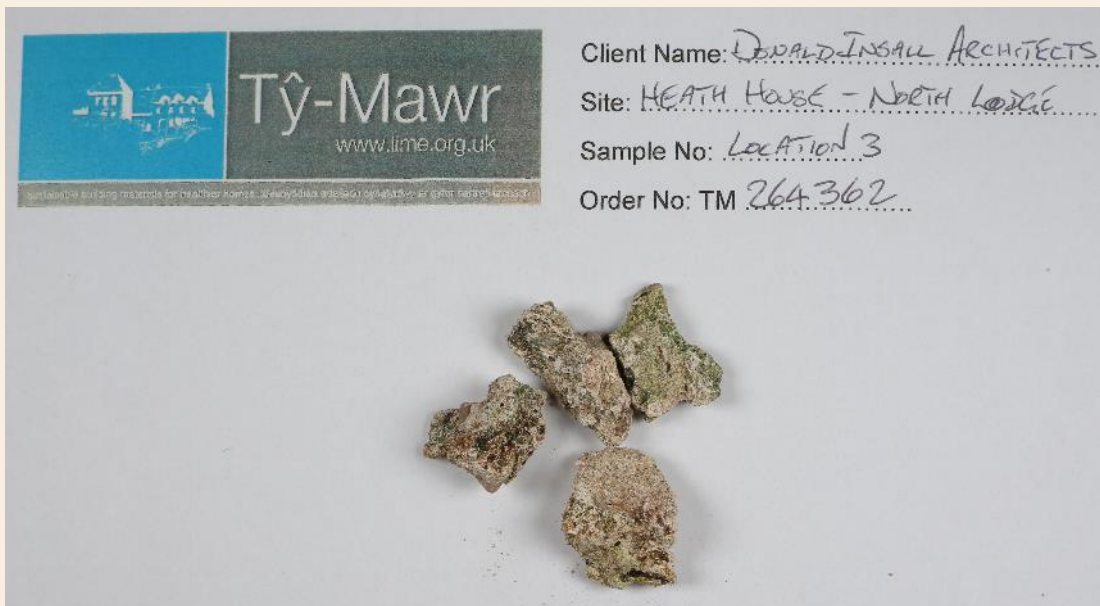
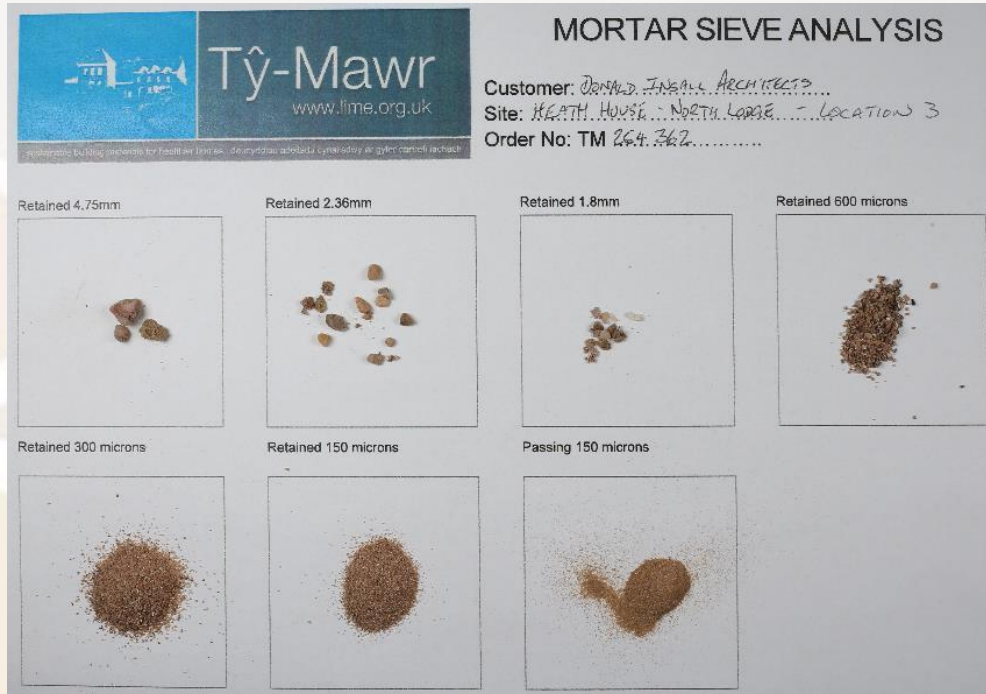


Photo of Sample Received

Acid Dissolution and Particulate Size Analysis

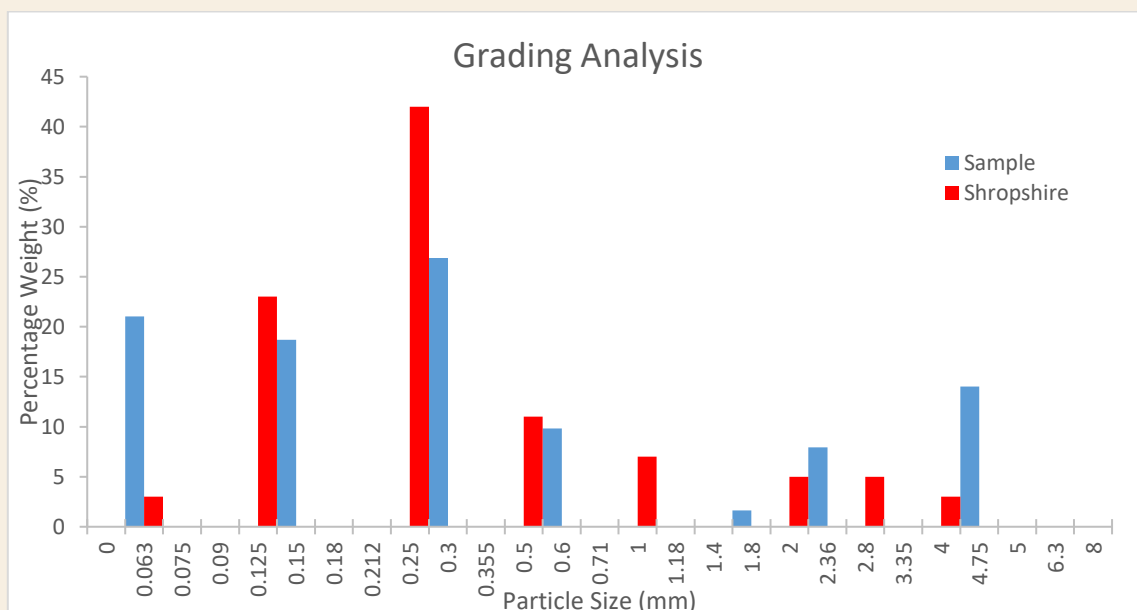
Dissolution of the sample in acid resulted in a moderately active reaction, which started slowing down after 4 minutes and continued to slow before ending after 6 minutes. At the end of the reaction there were still a few particles not fully dissolved.

The dissolution process removed just over 50% of the sample material, suggesting a volumetric mix ratio of approximately 0.9:1 aggregate to binder.



Sieve Analysis of Aggregate Particle Size

The grading of the aggregate particles ranged from approximately 8mm to below 0.15mm, with almost 67% being under 0.6mm. With the exception of the two largest particles, the aggregate showed a similar grading profile to our Shropshire aggregate but with a higher proportion of the finest aggregate particles. The colour of the aggregate overall was also relatively similar to that of the Shropshire.



Conclusions

The moderately vigorous nature and relatively short duration of the reaction fall within the parameters of this being a non-hydraulic lime mortar, albeit at the slower end of what might be expected, and the high ratio of lime binder to aggregate would suggest that this was a hot mixed mortar. It is likely that the high ratio of lime in the sample would account for the slightly longer reaction time to the acid than might otherwise have been expected.

The small sample size makes it impossible to tell whether the two larger particles are typical of the aggregate grading throughout the mortar in this structure, or were just random outliers.

Replacement Material Recommendation

Although the aggregate from the sample was of similar colour to our Shropshire, the colour of the actual mortar is significantly paler than our standard Shropshire mortar mainly due to the higher proportion of lime in the mix.

Generally, the choice of mortar is made on the basis of the hardness of the masonry and the exposure of the elevation. The choice needs to be agreed between the architect, client and contractor.

The method of finish affects texture and tone enormously, a pointing iron struck lightly onto the mortar surface will create a bland, smooth surface. Brushing, scraping or sponging will impart texture and character to the finished pointing by revealing the shapes and colours of the aggregate.

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