

MORTAR ANALYSIS REPORT

JOB REFERENCE	White Horse Whaley Bridge	SAMPLE	1	PAGE 1
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ANALYSIS DATE	October 2023
SITE	White Horse
CLIENT	Crowstone Ltd
DATE RECEIVED	October 2023
CLIENT REQUIREMENTS	Analyse mortar samples
LOCATION/ FUNCTION IN BUILDING	Building/pointing mortar
CONDITION OF SAMPLE RECEIVED/ COLLECTED	Bound mortar

GENERAL COMMENTS/ SUMMARY

From the nature of the binding matrix of the mortar sample and from information gained from the analysis, it is probable that the mortar was made from 1 part hydraulic lime, some of which was inert lime, to 1½ parts fine quartz based sand, and waste ash, originating from the lime/cement production process.

SUGGESTED REPLACEMENT MORTAR (Taking account of prevailing site conditions, building materials and condition, location, and function of the new mortar, building details, exposure, seasonal working etc.)

It is suggested that any rebuilding or pointing mortar be comprised of one part Ionic Old White NHL3.5, to 2 parts Nosterfield sand, to 1 part Sherborne sand.

MORTAR ANALYSIS REPORT

JOB REFERENCE	White Horse Whaley Bridge	SAMPLE	1	PAGE 2
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ANALYTICAL PROCEDURES

The selected sample of material was dried, weighed and examined both by eye and under a binocular microscope at x 20 & x 35 magnification. The sample was crushed, the binder separated from the aggregate by dissolution in dilute hydrochloric acid and the relative proportions of binder (lime, cement and gypsum) to aggregate determined. Aggregate (and other acid-insoluble materials) characterisation was undertaken by means of sieve separation and further microscopic examination.

The analysis and interpretation provide information on the composition and characteristics of the mortar sample(s) received by us. Assuming that the sample was representative of the mortar generally, then analysis will give a reasonable indication of the original materials and provide a basis for specification of repair or replacement mortars.

If more detailed information is required (for example for purposes of historic research) more sophisticated analytical procedures can be undertaken to determine chemistry and mineralogical composition.

MORTAR EXAMINATION AND ANALYSIS

PROCEDURE	DESCRIPTION / COMMENTS
PRELIMINARY EXAMINATION OF SAMPLE BY EYE	A light yellow, dirty cream, coloured mortar, with small darker aggregate pieces, presenting a dense fine, but open textured dusty finish.
EXAMINATION OF PREPARED SAMPLE BY BINOCULAR MICROSCOPE x20 MAG	Quartz and a few clinker fragments within a rich cream binder, and the mortar has an open texture.

MORTAR ANALYSIS REPORT

JOB REFERENCE	White Horse Whaley Bridge	SAMPLE	1	PAGE 3
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ACID DISSOLUTION

PROCEDURE	DESCRIPTION ~ COMMENTS
10% HCL ACID DISSOLUTION	Easy to crush. Upon dissolution there was a strong reaction
FILTER GRADE (PORE SIZE) & TYPE	Whatman Type 1

AGGREGATE SEPARATION

BS SIEVE Mesh Size	Residue Retained in g's	Undissolved binder %	Aggregate wt excluding undissolved binder - gs	Aggregate weight %	Comments
4.75 mm	0				
2.36 mm	0.29	30	0.2	n/a	Iron stained, clear and pink quartz, and a few small ash fragments
1.18 mm	0.39	10	0.35	n/a	Iron stained, clear and pink quartz, shale fragments, and a few small ash fragments
0.60 mm (600µm)	2.51	8	2.31	n/a	Iron stained, clear and pink quartz, and a few small ash fragments
300 µm	10.35	7	9.63	n/a	Iron stained, clear and pink quartz, and a few small ash fragments
150 µm	0.28	10	0.25	n/a	Iron stained and clear quartz, and ash fragments
< 150 µm including filter residue	0.76	80	0.15	n/a	Ash, & pink, iron stained and clear quartz. Alite & Belite binder residue.

All the quartz aggregate is sub-angular

MORTAR ANALYSIS REPORT

JOB REFERENCE	White Horse Whaley Bridge	SAMPLE	1	PAGE 4
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AGGREGATE CHARACTERISTICS

A quartz based sand, ash, and inert burnt lime, formed the main aggregates.

Because sand and gravel aggregates are ultimately derived from the weathering of solid rock most aggregates contain coarse grained rock fragments and finer mineral grains. Weathering breaks down the rock fragments within the aggregate into the constituent minerals, resulting in smaller and rounder particles; chemical weathering breaks down unstable minerals, such as feldspars, into clays which may be washed away, both processes eventually result in a quartz-rich sand.

CONSTITUENTS OF ANALYSIS SAMPLE

<i>MATERIAL</i>	<i>WEIGHT (g)</i>	<i>COMMENTS</i>
A: DRY WEIGHT OF- ANALYSIS SAMPLE	20.82	
B: DRY WEIGHT OF ALL INSOLUBLES	14.58	
C: DRY WEIGHT OF INSOLUBLE BINDER	1.69	
D: (B-C) DRY WEIGHT OF AGGREGATE	12.89	
E: (A-B+C)) DRY WEIGHT OF LIME & BINDERS	7.93	
F: DRY WEIGHT OF LIME	6.24	
OTHER		

MORTAR ANALYSIS REPORT

JOB REFERENCE	White Horse Whaley Bridge	SAMPLE	1	PAGE 5
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PROPORTIONS OF ANALYSIS SAMPLE

The sample proportions give the relative weights of aggregate and carbonated or set lime.

FREE LIME: AGGREGATE

1: 2

With 30% hydraulic residue to the volume of lime

PROBABLE ORIGINAL MIX

From the nature of the binding matrix of the mortar sample and from information gained from the analysis, it is probable that the mortar was made from 1 part hydraulic lime, some of which was inert lime, to 1½ parts fine quartz based sand, and waste ash, originating from the lime/cement production process.

Sample analysis, interpretation and report carried out by: Mark Womersley.
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