MORTAR ANALYSIS REPORT

JOB REFERENCE	**India House**	SAMPLE	**5**	PAGE **1**

ANALYSIS DATE	**September 2024**
SITE	**India House, Manchester**
CLIENT	**Bernard Taylor Partnership**
DATE/ TAKEN RECEIVED	**September 2024**
CLIENT REQUIREMENTS	**Analyse mortar sample**
LOCATION/ FUNCTION IN BUILDING	**India House Original Mortar High-Level Chimney 1.**
CONDITION OF SAMPLE RECEIVED/ COLLECTED	**Bound mortar**

GENERAL COMMENTS/ SUMMARY

The nature of the binding matrix of the mortar sample and information gained from the analysis suggest that the mortar was probably made by volume from 1 part early OPC cement, 10 parts lime binder and inert lime, 4 parts fine-graded quartz-based sand, and some waste ash. Some of the ash in the mortar comes from the lime and cement production process.

MORTAR ANALYSIS REPORT

JOB REFERENCE	**India House**	SAMPLE	**5**	PAGE **2**

ANALYTICAL PROCEDURES

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

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

If more detailed information is required (for example, for historical research purposes), 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 very fine-grained, dirty-cream-coloured mortar with clinker fragments
EXAMINATION OF PREPARED SAMPLE BY BINOCULAR MICROSCOPE x20 MAG	The mortar has a closed, crystaline finish. It contains clear, red/pink, iron-stained quartz and clinker ash in a rich cream binder.

MORTAR ANALYSIS REPORT

JOB REFERENCE	**India House**	SAMPLE	**5**	PAGE **3**

ACID DISSOLUTION

PROCEDURE	**DESCRIPTION ~ COMMENTS**
10% HCL ACID DISSOLUTION	It is relatively difficult to crush. There was a slow reaction upon dissolution.
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	0.91	30	0.64	n/a	Clear, pink and iron-stained quartz & clinker ash and terracotta fragments
1.18 mm	0.76	30	0.53	n/a	Clear and iron-stained quartz & clinker ash
0.60 mm (600 μm)	0.43	20	0.34	9.5	Clear, pink and iron-stained quartz & clinker ash and terracotta fragments
300 μm	1.89	10	1.7	48	Clear, pink and iron-stained quartz & clinker ash fragments
150 μm	0.22	50	0.11	3	Clear and pink quartz, & clinker ash fragments. Belite and Alite binder residue
< 150 μm, including filter residue	0.28	20	0.22	6	Clear quartz and clinker ash. Belite and Alite binder residue.

All the quartz aggregate is sub-rounded.

MORTAR ANALYSIS REPORT

JOB REFERENCE	**India House**	SAMPLE	**5**	PAGE **4**

AGGREGATE CHARACTERISTICS

Clear quartz-based sand, inert lime and ash formed the primary 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

MATERIAL	***WEIGHT (g)***	**COMMENTS**
A: DRY WEIGHT OF-ANALYSIS SAMPLE	14.4	
B: DRY WEIGHT OF ALL INSOLUBLE	4.49	
C: DRY WEIGHT OF INSOLUBLE BINDER	0.95	
D: (B-C) DRY WEIGHT OF AGGREGATE	3.54	
E: (A-B+C)) DRY WEIGHT OF LIME & BINDERS	10.86	
F: DRY WEIGHT OF LIME	9.91	
OTHER		

MORTAR ANALYSIS REPORT

JOB REFERENCE	**India House**	SAMPLE	**5**	PAGE **5**

PROPORTIONS OF ANALYSIS SAMPLE

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

FREE LIME: OPC-BASED BINDER: AGGREGATE

10: 1: 4

PROBABLE ORIGINAL MIX

The nature of the binding matrix of the mortar sample and information gained from the analysis suggest that the mortar was probably made by volume from 1 part early OPC cement, 10 parts lime binder and inert lime, 4 parts fine-graded quartz-based sand, and some waste ash. Some of the ash in the mortar comes from the lime and cement production process.

Sample analysis, interpretation and report carried out by: Mark Womersley.
www.mwomersleys.co.uk