MORTAR ANALYSIS REPORT

JOB REFERENCE	**Midland Hotel, Grey Granite Mortar**	SAMPLE	**2**	PAGE **1**

ANALYSIS DATE	**April 2025**
SITE	**Midland Hotel**
CLIENT	**Bullen Conservation**
DATE/ TAKEN RECEIVED	**April 2025**
CLIENT REQUIREMENTS	**Mortar Sample Analysis**
LOCATION/ FUNCTION IN BUILDING	**Pointing sample**
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 one part early cement, including much inert lime, and two parts waste clinker ash.

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ANALYTICAL PROCEDURES

The selected material sample was dried, weighed, and examined 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 fine-grained, warm grey ash mortar with visible small lime inclusions.
EXAMINATION OF PREPARED SAMPLE BY BINOCULAR MICROSCOPE x20 MAG	The fine-grained binder-rich mortar has an open texture. The rich cream binder contains inert lime and clinker ash.



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ACID DISSOLUTION

PROCEDURE	**DESCRIPTION ~ COMMENTS**
10% HCL ACID DISSOLUTION	It is easy to crush. There was a steady 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 excluding undissolved binder – gs***	**Aggregate weight %**	**Comments**	
4.75 mm	0					
2.36 mm	0.07	30	0.05	n/a	Fine clinker ash with Alite binder residue.	
1.18 mm	1.12	30	0.78	n/a	Fine clinker ash and iron-stained quartz, with Alite binder residue.	

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0.60 mm (600 µm)	2.25	10	2.03	n/a	Fine clinker ash and iron-stained quartz, with Alite binder residue.	
300 µm	2.57	10	2.31	n/a	Fine clinker ash and iron-stained quartz, with Alite binder residue.	
150 µm	0.36	20	0.29	n/a	Fine clinker ash and iron-stained quartz, with Alite binder residue.	
< 150 µm, including filter residue	0.87	50	0.44	n/a	Fine clinker ash and iron-stained quartz, with Alite and Belite binder residue.	

The quartz aggregate is all sub-rounded

*The aggregate weight is a proportion of the combined weight of lime and aggregate, the lime being lighter.

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AGGREGATE CHARACTERISTICS

The primary aggregate is clinker ash and inert lime.
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 that may be washed away. Both processes eventually result in quartz-rich sand.

CONSTITUENTS OF ANALYSIS SAMPLE

MATERIAL	***WEIGHT (g)***	**COMMENTS**
A: DRY WEIGHT OF ANALYSIS SAMPLE	10.82	
B: DRY WEIGHT OF ALL INSOLUBLE	7.24	
C: DRY WEIGHT OF INSOLUBLE BINDER	1.34	
D: (B-C) DRY WEIGHT OF AGGREGATE	5.9	
E: (A-B+C)) DRY WEIGHT OF LIME & BINDERS	4.92	
F: DRY WEIGHT OF LIME	3.58	
OTHER		

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PROPORTIONS OF ANALYSIS SAMPLE

The sample proportions give aggregate and carbonated or set lime relative volumes within the weights recorded for each sieve collection.

FREE LIME: AGGREGATE

1: 1.6

With 27% cementitious residue to the volume of lime and binder

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 one part early cement, including much inert lime, and two parts waste clinker ash.

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