

MORTAR ANALYSIS REPORT

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ANALYSIS DATE	June 2021
SITE	St Wilfrids Church, Cotton
CLIENT	Amos Contracting Ltd
DATE/ TAKEN RECEIVED	June 2021
CLIENT REQUIREMENTS	Analyse Sample
LOCATION/ FUNCTION IN BUILDING	Building and pointing mortar
SAMPLE	Loose Sample

GENERAL COMMENTS/ SUMMARY

The original mix is likely to comprise by volume of 2-parts lime: 1-part fine pink silica sand. The lime appears to have a hydraulic component within itself, and a small amount of free lime would have also reacted with some of the fine ash content. The White Peak limestone area is just to the north of the site, and this has been used since 1957 to produce cement, such as at nearby Cauldon. The local Carboniferous Limestone may have been burnt to produce a hydraulic quick lime, which would then have been slaked, and sieved, with perhaps the unslaked residue crushed and added back into the mix.

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

For repointing and rebuilding: one-part Ionic NHL2, to two-parts Waddington fell sand (or a similar sharp well graded red sand), to ½ part pink silica sand.

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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 x20 & x35 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 dirty pink fine-grained mortar with visible lime inclusions and clinker ash
EXAMINATION OF PREPARED SAMPLE BY BINOCULAR MICROSCOPE x35 MAG	A fine-grained mortar with visible quartz and clinker ash

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ACID DISSOLUTION

PROCEDURE	DESCRIPTION ~ COMMENTS
ACID DISSOLUTION	Initial strong reaction
FILTER GRADE (PORE SIZE) & TYPE	Whatman Type 4

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				
1.18 mm	0.62	30	0.43	n/a	Clear and pink quartz and ash
0.60 mm (600µm)	3.24	25	2.43	n/a	Clear and pink quartz, ash, red sandstone fragments
300 µm	5.93	2	5.81	n/a	Clear, cream and pink quartz and ash
150 µm	2.31	0	2.31	n/a	Clear, cream and pink quartz and ash
< 150 µm including filter residue	1.94	2	1.90	n/a	Clear, cream and pink quartz and ash

All the quartz aggregate is sub-angular

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AGGREGATE CHARACTERISTICS

Fine silica sand, ash and under and over burnt crushed lime used in the mix.

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	24.65	
B: DRY WEIGHT OF ALL INSOLUBLES	14.04	
C: DRY WEIGHT OF INSOLUBLE BINDER	1.16	
D: (B-C) DRY WEIGHT OF INSOLUBLE AGGREGATE	12.88	
E: DRY WEIGHT OF LIME	10.61	
OTHER		

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PROPORTIONS OF ANALYSIS SAMPLE

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

LIME: AGGREGATE RATIO & 10% hydraulic binder to the weight of lime

1 : 1.2

PROBABLE ORIGINAL MIX

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