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Fax

To: Florian - London Stone Conservation
Contact details: N/A
Fax number: 08702360564
From:
Contact details:
Date: Tuesday, 18 March 2008
Subject: Mortar Analysis Results for West Moat Wall TOL
Number of pages: 4 (inc this one)

Florian,

Please find the report for your attention.

I am happy that we use 2 mortars in this instance- a course lime mortar based around hydraulic lime NHL 3.5 for bedding, dubbing out etc. (Use small rubble infill where practicable to minimise excessive pockets of mortar and build up layers.)

Ensure the masonry is adequately wetted prior to application of mortar to reduce suction and prevent shrinkage and premature drying.

Protect from frost and exposure to winds for at least 7 days while the mortar takes its initial set using polythene and wetted Hessian. This may be secured into the wall using stainless steel nails in the mortar joints.

The pointing mortar: as per the report substituting NHL 3.5 for NHL 2 and particle size approx no greater than 6mm. Again build up in layers no greater than 25mm.

Compact well into the joints when 'leather hard' using stiff bristle brushes exposing the aggregate.

Yours sincerely

Jamie

Peter Ellis

Historic Buildings Consultancy
Materials, Method and Mortar Analysis

Mortar Analysis

Test Report No. 3315.

Tower of London – West Curtain Wall

Sample E.

One sample of bedding/pointing mortar has been analysed chemically, microscopically, and by Differential Thermal Analysis (DTA).

Later, apparently cementitious, pointing mortar excluded from analysis.

Chemical Analysis Results:

% Moisture	2.4
% Insolubles	77.2
% CaO	12.5
% Soluble SiO ₂ (colorimetric)	1.4
% Soluble SiO ₂ (ppt method)	1.5
% Soluble SO ₃	0.1

Reaction Comments:

Vigorous effervescence

D.T.A. Results

Results show the principal constituent to be Calcium carbonate. Calcium silicate hydrates, Calcium hydroxide (lime) and Calcium sulphate (gypsum) are not present.

BINDER

The binder in this sample is carbonated lime. Some weak hydraulicity of binder is indicated by the soluble SiO₂ results but not confirmed by positive DTA hydrate peaks. Full carbonation has taken place.

AGGREGATE

Insoluble particle size range: 6mm to 150µm (83.2%) : < 150µm (16.8%)

The insoluble residue is a mixed coarse sand comprising:

Cream/ Yellow Quartz

Flint

Occasional particles of various mineral type

Grey/ Cream Clay.

(cont.)

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MORTAR BY VOLUME

Occasional acid-soluble limestone sand particles were observed to be present and an allowance has been made. The results after allowance for typical bulk density, indicate a calculated volumetric mix of approximately:

- 1 part Lime
- 2.5 parts Combined Aggregate.

SUGGESTED MATCHING MIX

If it is decided that the repair mortar is to be matched on a "like for like" basis, the recipe could be in the following approximate proportions:

- 1 part Mature Chalk Lime Putty
- 2.5 parts Quartz/ flint/ limestone sand. (< 6mm)

The addition of a pozzolan such as Metastar 501 @ c.10% should be considered.

Note: Hydraulic lime NHL2 could be considered in place of putty + pozzolan

SOURCES OF MATERIALS

All limes and most aggregates are available from Rose of Jericho. (01935 83676)
A ready-mixed putty mortar could also be supplied. The pozzolan to be site-gauged.

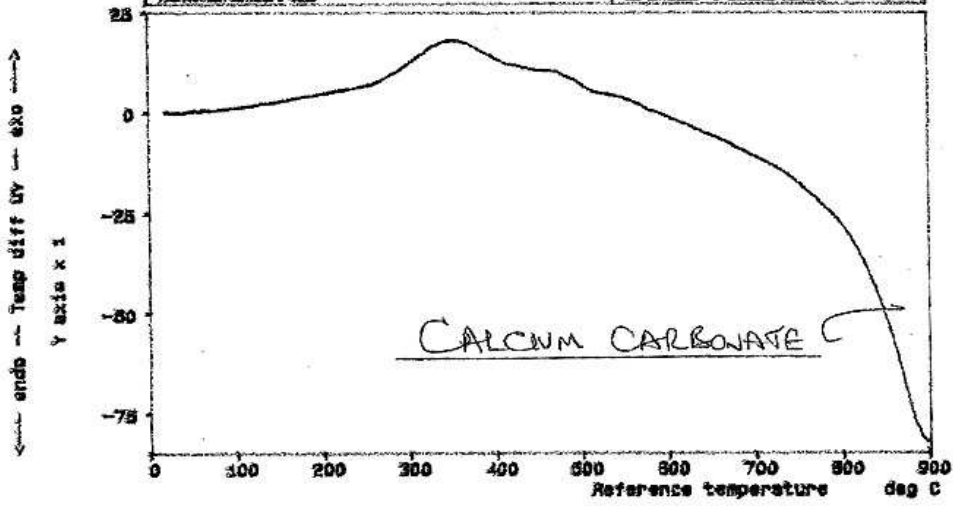
NOTES:

1. Sample mixes must always be prepared to ensure suitability and an accurate colour and texture match. Granite sands are best avoided.
2. Aggregates with a particle size and grading appropriate for the intended use must be selected. Washed BS sands only should be used with hydraulic limes.
3. This mortar should be no weaker than 1:2½. Manufacturers recommended application mix proportions and 'Best Practice' guides must be complied with.
4. The "Suggested matching mix" listed above does not necessarily imply that I recommend a mix design on a "like for like" basis in this particular context. It is not a specification for a repair mortar, nor must it be treated as one.
5. It should be remembered that mortars change over time. When analysing an aged material, one is ascertaining what it now is and looking for evidence for what it originally was. Calcium silicate hydrates, the principal hydraulic reaction products in cements, hydraulic limes and pozzolanic limes themselves react over time with atmospheric CO₂ to produce calcium carbonate, hydrated silica and silico-aluminate gels and only limited calcium silicate hydrate gel. These gels can leach out from external mortars and evidence of original hydraulicity can be lost.

28.02.2008

DSC ANALYSIS REPORT

SCANNING : 100	DATE : 2007	INSTRUMENT : DSC Q10
END NO : 100	SAMPLE WEIGHT : 0.0147 g	CELL TYPE : PDS THERMOC
START : 20-07-2007	HEATING : 0.5	ATMOSPHERE : N
TIME : 00:00:00	STARTING RATE : 100 deg C	FLUX RATE : 0.000
RESOLUTION : 0.001	END TEMP : 900 deg C	ANALYSIS TEMP : 25 deg C
PARAMETER ANALYSIS : 0.001		IMP MATERIAL : CALCIUM CARBONATE



TOWER OF LONDON W CURTAIN WALL