DAVID MUNSON CONSTRUCTION LIMITED

'Your complete building and maintenance service'

7 St Mary's Meadows, Gedney, Spalding, Lincolnshire. PE12 0DL

Registered in England 4423539
VAT No. 796 7446 61

Telephone
(01406) 362066
Fax
(01406) 362663

South Holland District Council
Council Offices
Priory Road
Spalding
Lincolnshire
PE11 2XE

SHDC
Planning & Development
05 MAR 2010
Ref: CC

Your Ref: CC
Our Ref: DM/03/10/05
Date: 4th March 2010

FOR THE ATTENTION OF: Mr. C. Crew

RE: Mortar samples analysis for Pacey's Bakery, Red Lion St. Spalding

Please find enclosed mortar analysis report for Pacey's Bakery, Red Lion St. Spalding, Lincolnshire for your review.

Could you please contact David Munson regarding the mortar analysis report to discuss details at your earliest convenience.

I hope that the enclosed mortar analysis report is acceptable. Should you have any queries or require additional information regarding the works please do not hesitate to contact us.

Yours faithfully

S. Munson

DETERMINED PLAN

SOUTH HOLLAND DISTRICT COUNCIL
- 5 MAR 2010

constructionline

CHAS Accredited Contractor
www.chas.gov.uk

SKILLINGTONS www.skillingtons.co.uk
in partnership with Philip A. Gaches Plasterers
Baxter's Yard, 35-40 Stuart Street, Grantham, Lincolnshire NG31 9AF T: 01476 565671 F: 01476 566524 E: Skillwork@aol.com

Report describing the results of the analysis of a mortar sample from Red Lion Street, Spalding

Introduction

The analysis described in this report was commissioned David Munson of David Munson Construction.

The samples were taken by David Munson together with David Carrington of Skillington Workshop Ltd on 1 December 2009.

The samples were taken from 19th century brickwork recently uncovered from behind cement render. The sample received clearly contains a lime based binder.

Sample Ref.	Position sample taken from
Sample A	Core mortar, front façade, 0.5m above ground level
Sample B	Adjacent to 2nd floor window, core mortar
Sample C	Pointing mortar 2nd floor

The analysis aims to provide the following information:

1. Visual description of the sample.
2. Assessment to ratio of insoluble: soluble portions in hydrochloric acid.
3. Interpretation and inferences regarding binder: aggregate ratios.
4. Characterisation of the binder.
5. Characterisation of insoluble aggregate.
6. Indication of suitable mortar mix for repair work.

Note that there are limitations both to the relatively simple analysis carried out and to carrying out such analysis without good prior knowledge of the context. As such it is strongly recommended that the results are taken as an indication towards site mortar mix trials rather than as a stand alone answer.

General description

All sample was inspected by naked eye and by microscope (x10 - x20) prior to crushing or dissolving in hydrochloric acid. The results of this visual examination are given in Table 1, below.

Table 1: Summary of visual and pre-dissolution assessment of sample.

Sample Ref.	Colour	Texture	Hardness	Inclusions
Sample A	Light cream	Fine with medium inclusions	soft	Medium inclusions of course aggregate. Numerous fine to large chalky inclusions the largest being 7mm
Sample B	Light cream	Very fine	Fairly soft	Very fine inclusions 2-3mm
Sample C	Mid brown	Fine with mediuin inclusions	Soft	Very fine inclusions 2-3mm

The hardness in the above table is assessed by thumb pressure. A sample described as 'soft' will easily crumble under light pressure, one described as 'fairly soft' will start to crumble under moderate pressure, one which is 'fairly hard' only starts to crumble under great pressure and will not scratch easily, whereas 'hard samples are all but impossible to crumble between thumb and forefinger.

Solubility in 1.18 Hydrochloric acid

Standard solubility test

For each sample a weighed amount of oven-dried mortar was dissolved in standard strength hydrochloric acid, observing the form of reaction. Once the reaction was complete in excess acid, each sample was washed in de-ionised water and oven dried. The weight of the remaining insoluble portion can then be compared to that of the soluble part to indicate the proportion (by mass) of calcareous matter to inert material. For the standard solubility test the aggregate was further analysed using a set of British Standard sieves. The results are given in Table 2, 3 and 4 below.

Table 1

Sample A	Sample X/25/A Red Lion Street, Spalding
Oven dry mass prior to dissolution (g)	7.57
Reaction with hydrochloric acid	Very vigorous effervescence, being complete within minutes, the sample rapidly losing cohesion.
Mass of oven-dry insoluble portion (g)	3.40
Portion greater than 2.36mm in size (g/%)	0.17 (5%)
Portion between 2.36 and 1.18mm (g/%)	0.15 (4%)

0.6-1.18mm (g/%)	0.33 (10%)
0.3-0.6mm (g/%)	0.63 (18%)
0.15-0.3mm (g/%)	0.25 (7%)
0.075-0.15mm (g/%)	0.2 (6%)
Less than 0.075mm (g/%)	1.79 (53%)

N.B. The total % does not add up to 100 due to rounding.

Table 2

Sample B	Sample X/25/B Red Lion Street, Spalding
Oven dry mass prior to dissolution (g)	10.63
Reaction with hydrochloric acid	Very vigorous effervescence, being complete within minutes.
Mass of oven-dry insoluble portion (g)	3.68
Portion greater than 2.36mm in size (g/%)	0 (0%)
Portion between 2.36 and 1.18mm (g/%)	0.18 (5%)
0.6-1.18mm (g/%)	0.64 (17%)
0.3-0.6mm (g/%)	2.16 (59%)
0.15-0.3mm (g/%)	0.58 (16%)
0.075-0.15mm (g/%)	0.09 (2%)
Less than 0.075mm (g/%)	0.1 (3%)

N.B. The total % does not add up to 100 due to rounding.

Table 3

Sample C	Sample X/25/C Red Lion Street, Spalding
Oven dry mass prior to dissolution (g)	2.07
Reaction with hydrochloric acid	Very vigorous effervescence, being complete within minutes.
Mass of oven-dry insoluble portion (g)	0.76
Portion greater than 2.36mm in size (g/%)	0 (0%)
Portion between 2.36 and 1.18mm (g/%)	0.05 (7%)
0.6-1.18mm (g/%)	0.23 (30%)
0.3-0.6mm (g/%)	0.36 (47%)
0.15-0.3mm (g/%)	0.1 (13%)
0.075-0.15mm (g/%)	0.02 (3%)
Less than 0.075mm (g/%)	0.01 (1%)

N.B. The total % does not add up to 100 due to rounding.

Visual assessment of insoluble portion

Sample A: Much Very fine material with some medium sized course sharp aggregate. Some flints like material the largest being 5mm. The colour of the remaining insoluble portion is a medium brown.

Sample B: A range of fine to medium size sharp course aggregate (under 1mm to 4mm) the colour of the remaining insoluble portion is a light brown.

Sample C: A range of fine to medium size sharp course aggregate (under 1mm to 4mm) the colour of the remaining insoluble portion is a medium to light brown.

Interpretation

Approximately 45% of sample A and approximately 35% of samples B and C dissolved in hydrochloric acid. The dissolved matter is likely to be calcareous but may either be lime present as a binder or as an aggregate (e.g. crushed chalk, stone dust, etc.), or naturally occurring as broken down limestone in the soil.

It is possible to speculate that Sample A is made from clay-like subsoil, possible mixed with some sharp aggregate/ballast, made as a 'hot' mix with lime burnt on the site, in the ratio of between 2 parts and 4 parts of soil/clay/aggregate to 1 part lime – depending on how much of the soluble matter is in the aggregate/soil. In samples B and C It is unlikely that there is any clay or soil present due to very few fine particles (below 0.15mm).

The nature of the reaction of the samples viewed in conjunction with its hardness strongly implies either a non-hydraulic lime binder or only a very feebly weak hydraulic lime binder.

Conclusions: Recommendations for mortars for re-pointing

It is certainly recommended that lime putty or NHL2 be used as the binder for the proposed mixes. This will give good water porosity and flexibility to the mortar and be extremely beneficial to any historic brickwork.

For the building and consolidation of core work I would suggest that a 1 part lime putty to 3 parts aggregate or 1 part NHL2 hydraulic lime to 3 parts aggregate mortar would be suitable. The aggregate may simply be suitably sourced sharp sand, or may include crushed chalk or limestone as well. Also the inclusion of some flint shards could be considered.

For the bedding of brickwork or re pointing I would suggest that a 1 part lime putty to 3 parts aggregate or 1 part NHL2 hydraulic lime to 3 parts aggregate mortar would been suitable. The aggregate could be made up of 1 ½ sharp sand and 1 ½ building sand and again may include some crushed chalk or limestone.

I would always recommend carrying out samples of pointing for approval by the client or conservation officer or architect/surveyor before going ahead with the work as a whole.

Simon Ebbs
14 January 2010