

TR7-195-198 R. 414

CLAY FROM LAUNCESTON

This report deals with the examination of three samples of clay from McHugh Brothers and stated to be from deposits at Prospect and Glen Dhu at Launceston. Samples of Ballarat and Enfield clay were also examined to provide data for comparison with the clays from Launceston. The samples were tested for both brick and pipe manufacture by de-aired extrusion. Clays LB 1, LB 2, and blends of LB 1 and LB 3 containing up to 50 percent of LB 3 were suitable for pipe extrusion, the fired pipes withstanding a pressure up to 40 lbs. per square inch without leaking. Sample LB 3, LP 1, and blends of LB 1 with sand were unsuitable for pipe extrusion, the pipes being porous and leaking at 20 lbs. per square inch pressure. Bricks extruded from LB 1 and LB 2 showed some signs of core cracking. This cracking has been eliminated from LB 1 by blending with LB 3 or sand in the proportions shown. Bricks extruded from LB 3 alone are satisfactory. These dry and fire without cracks. Bricks extruded from LP 1 fire with curved surfaces, and are easily abraded.

Sample Details Supplied by McHugh Brothers

Sample LB1. Plastic clay, Bradford's prospect, extends approximately 8 feet to 40 feet from the surface.

Sample LB 2. Surface clay, Bradford's prospect, about 8 feet deep. Below top soils 12 inches to 24 inches deep.

Sample LB 3. Plastic clay up to 60 feet deep below 12 inches to 24 inches of top soil. Northwest of works.

Sample LP 1. Glen Dhu clay.

Sample B. Ballarat clay.

Sample E. Enfield clay.

Blend B1, 1 part LB 1, 1 part LB 3.

Blend B2, 2 parts LB 1, 1 part LB 3.

Blend B3, 3 parts LB 1, 1 part Relbia Sand.

Blend B4, 10 parts LB 1, 1 part Relbia Sand.

Blend B5, 6 parts LB 1, 1 part Relbia Sand.

Preparation and Testing

The samples of clay were dried where necessary and roll crushed to pass an $\frac{1}{8}$ inch screen. All blends were thoroughly mixed first in the dry state. For extrusion the samples were thoroughly pugged after the addition of the required water, dried naturally and fired at the range of temperatures shown, and soaked for 2 hours. The modulus of rupture of bricks both dried and fired to 1050° C was tested. Fired bricks were tested for efflorescence.

Power consumption represents the kilowatt hours of power needed to extrude 1000 grams of clay 1.25 inch x 1.5 inch cross section.

The furnace firing schedule adopted was as follows:—

0-50° C	8 hours
50-100° C	12 hours
100-500° C	24 hours
500-max. temp.	12 hours
Soak at max. temp.	2 hours

Modulus of rupture results are calculated from the weight necessary to rupture a bar 1.25 x 1.5 inches cross section supported by knife edges 2.75 inches apart.

Results

Sizing Analysis

	LB 1	LB 2	LB 3	LP 1
Percent + 200 mesh	11.7	12.6	21.9	47.2
Percent — 200 mesh	88.3	87.4	78.1	52.8

The plus 200 mesh fractions with the exception of LP 1, were essentially clean quartz with small amounts of ironstone. LP 1 contained an appreciable amount of large particles of magnetic iron oxides.

Sizing

Blending Sand

	B.S. Screen	Percent Weight
+ 44	5.3
+ 60	13.0
+ 100	45.4
+ 200	27.9
— 200	8.4
Composite	100.0

De-aired Extrusion

Sample Description	% Tempering Water	% Drying Contraction	Percent Firing Contractions					Percent Loss of Weight on Firing
			1000	1050	1100	1150	1200	
LB 1 pipe	29.1	6.5	2.5	4.0	5.25	6.00	6.00	
brick	31.1	6.5	3.5	6.0	7.5	7.5	7.5	7.5
LB 2 pipe	27.6	6.5	2.0	3.5	5.0	5.75	6.0	
brick	27.5	7.0	3.0	5.0	6.5	6.5	6.5	8.1
LB 3 pipe	33.3	6.0	2.25	3.0	5.0	7.5	8.5	
brick	33.4	7.0	2.0	3.0	6.0	7.75	7.75	8.4
LP 1 pipe	26.0	5.75	1.5	2.75	4.75	5.00	5.00	
brick	25.6	7.00	1.0	2.0	4.0	4.5	4.5	5.8
Ballarat pipe	21.9	5.00	3.0	3.0	3.0	—	4.75	
brick	22.4	6.00	2.0	2.25	3.0	—	4.0	4.4
Enfield pipe	25.4	5.00	3.75	4.0	4.75	—	5.75	
brick	25.3	6.00	4.0	4.5	5.0	—	6.0	5.8
Blend 1 pipe	33.3	7.00	—	4.5	6.5	—	—	
brick	33.3	8.00	—	5.0	6.25	—	—	8.3
Blend 2 pipe	33.4	7.00	—	4.5	6.5	—	—	
brick	33.6	7.75	—	5.25	6.5	—	—	8.3
Blend 3 pipe	25.9	6.50	—	2.5	3.75	—	—	
brick	26.7	6.00	—	4.0	5.0	—	—	5.9
Blend 4 pipe	30.4	7.50	—	3.5	4.25	—	—	
brick	30.3	7.00	—	4.5	5.00	—	—	7.1
Blend 5 pipe	29.0	7.50	—	3.25	3.75	—	—	
brick	30.9	7.00	—	5.00	5.50	—	—	6.9

The above extrusions were conducted in a vacuum amounting to 27 inches of mercury.

Power consumption during extrusion of bricks and moduli of rupture of dried and fired bricks were determined as follows:—

	Power KHW/1000 gms.	Modulus of Rupture lbs./sq. in. (mean of 2 tests)	
		Dried	Fired
LB 1 .....	.0182	140	700
LB 2 .....	.0128	215	540
LB 3 .....	.0195	120	330
LP 1 .....	.0198	260	530
Ballarat clay .....	.0134	360	1050
Enfield clay .....	.0107	500	1180

S.A.A. Standard test 323 shows a minimum of 280 lbs. per square inch as acceptable in a fired brick.

Pugging and Extrusion Characteristics

- LB 1. Pugging and extrusion free and easy with good green strength ware.
- LB 2. Pugging rather stiffer than LB 1, but extrudes easily with good green strength.
- LB 3. Pugging and extrusion easy with good green strength ware.
- LP 1. Slight notching on extruded bars due to hard particles of ironstone. Extruded pipes fairly weak green strength.
- "B". Very clean clay pugs and extrudes very easily with good green strength. Clay very easily parted from metal surfaces.
- "E". Pugs and extrudes very easily. Pipes not very strong green strength.
- Blends 1-5. Pug and extrude well with good green strength ware.

Drying Characteristics

All pipes dried rapidly at 105° C without cracking. LB 1 and LB 2 bricks showed signs of core cracking on rapid drying at 105° C.

LB 3 bricks dried rapidly without cracking but showed some evidence of spalling on cooling.

LP 1 bricks showed bad cracking in direction of extrusion, probably due to the high percentage of sand. "B" bricks dried rapidly at 105° C without cracking. "E" bricks showed some signs of core cracking on rapid drying. Blend 1-5 bricks showed signs of core cracking on rapid drying.

Firing Characteristics After Natural Air Drying

All pipes fired without cracking or warping. LB 1 and LB 2 bricks core cracked on firing. Well fired at 1000° C.

LB 3 bricks showed surface cracks at 1050° increasing up to 1200°. LP 1 bricks fired with curved faces. Fine hair cracks at 1050° increasing to 1200° C. "B" bricks showed no sign of cracking. Vitrification at 1200° C. "E" bricks showed no sign of cracking. Vitrification at 1200° C. Blend 1-5 bricks showed no signs of cracking.

All bricks except LP 1 have a good sound ring and are well fired at 1050° C. LP 1 is easily abraded and has very poor ring.

Porosity of Pipes

All pipes were tested hydraulically at 20 lbs. per square inch pressure for 4 minutes. If no leaking was apparent the pressure was then raised to 40 lbs. per square inch for a further minute. Results were as follows:—

LB 1	....	Did not leak up to 40 lbs. per square inch.
LB 2	....	Did not leak up to 40 lbs. per square inch.
LB 3	....	Leaks at 20 lbs. per square inch.
LP 1	....	Leaks at 20 lbs. per square inch.
"B"	....	Leaks at 20 lbs. when fired at 1100°. Stands 40 lbs. fired at 1200°.
"E"	....	Did not leak up to 40 lbs. per square inch.
Blend 1	....	Did not leak up to 40 lbs. per square inch.
Blend 2	....	Did not leak up to 40 lbs. per square inch.
Blend 3	....	Leaks at 20 lbs. per square inch.
Blend 4	....	Leaks at 20 lbs. per square inch.
Blend 5	....	Leaks at 20 lbs. per square inch.

All pipes were unglazed but specimens of LB 1, LB 2, LB 3, and LP 1 glazed by McHugh's and tested in a similar manner showed similar results.

Colour of Bricks

	Firing Temperature ° C				
	1000	1050	1100	1150	1200
LB 1	Light pink	Light pink	Light pink	Dark pink	Reddish pink
LB 2	Light pink	Light pink	Dark pink	Dark pink	Reddish pink
LB 3	Light pink	Light pink	Dark pink	Red	Red
LP 1	Light red	Light red	Dark red	Dark red	Dark red
"B"	Deep pink	Deep pink	Deep pink		Mottled red brown
"E"	Light red buff	Light red buff	Light red buff		
Blend 1		Light pink	Reddish pink		
Blend 2		Light pink	Reddish pink		
Blend 3		Reddish pink	Reddish pink		
Blend 4		Reddish pink	Reddish pink		
Blend 5		Reddish pink	Reddish pink		

Efflorescence

LB 1	.....	Slight vanadium efflorescence at 1000° and 1050° C.
LB 2	.....	No vanadium efflorescence at 1000° to 1200° C.
LB 3	.....	Vanadium efflorescence very pronounced at 1150° and 1200° C.
LP 1	.....	Slight vanadium efflorescence at all temperatures.
Blend 1-5	....	Slight vanadium efflorescence which is more prominent in Blend 3.
"B"	.....	No sign of efflorescence.
"E"	.....	No sign of efflorescence.

Modulus of rupture tests were undertaken by Mr. K. Payne, Officer-in-Charge, Engineering Department, Technical College, Launceston.