

This document was produced
by scanning the original publication.

Ce document est le produit d'une
numérisation par balayage
de la publication originale.

IR 58-154
FOR REFERENCE

NOT TO BE TAKEN FROM THIS ROOM

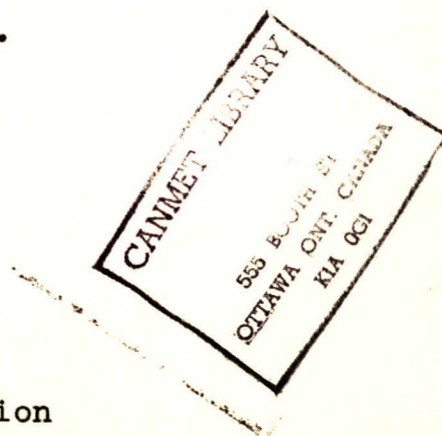
CAT. NO. 4 L.-M.CO.

CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS
OTTAWA

Mines Branch Investigation Report IR 58-154

EVALUATION OF CLAY SAMPLES
FOR TORONTO BRICK CO. LTD.

by
J.G. Brady
Industrial Minerals Division



September 3, 1958

INTRODUCTION

Forty seven small samples of clay from two bore holes in the Don Valley, Toronto, were submitted by the Toronto Brick Company Limited for evaluation in the manufacture of building brick. The samples were approximately one hundred grams each and were obtained from various depths. A cross-section of each hole giving the sample numbers and their depths is shown in a copy of a bore hole report submitted to the company by the Soils Test Division of the Raymond Concrete Pile Company Ltd. A copy of this report is labelled Figure 1.

PROCEDURE

The individual samples were very small and represented too small a depth to evaluate separately. Consequently, the smaller samples were combined into five larger samples, three of which were from bore hole number 1 and two from bore hole number 2. The composition of the five combined samples, the depth they represent and the laboratory numbers assigned to them are as follows:

Bore Hole No. 1

1. Laboratory number 243. This sample consists of numbers 1 to 8 inclusive from ground level to 21'6".
2. Laboratory number 244. This sample consists of numbers 9 to 21 inclusive from 21'6" to 54'0".
3. Laboratory number 245. This sample consists of numbers 22 to 30 inclusive from 54'0" to 76'3".

Bore Hole No. 2

4. Laboratory number 246. This sample consists of numbers 1 to 10 inclusive from ground level to 25'5".
5. Laboratory number 247. This sample consists of numbers 11 to 17 inclusive from 25'5" to 43'3".

TEST BORING REPORT RAYMOND

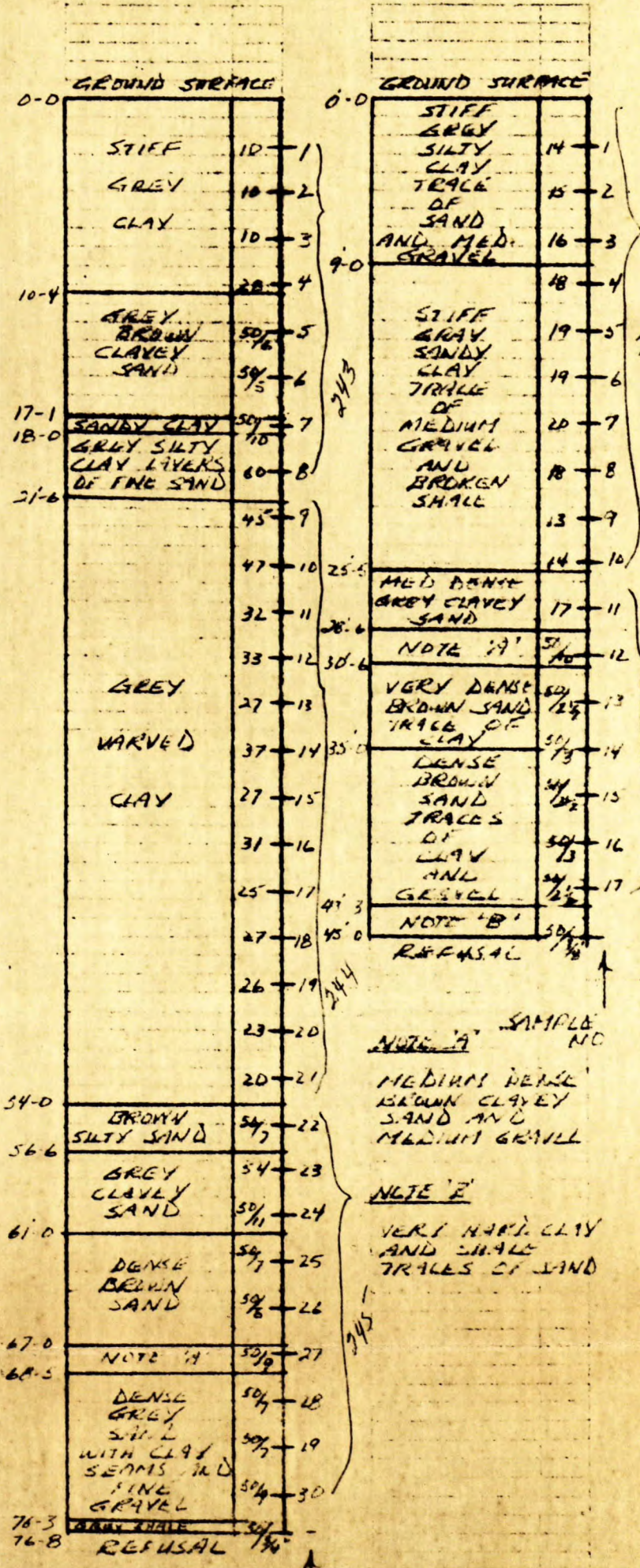
CONCRETE PILE COMPANY LTD.

SOIL TEST DIVISION

To TORONTO BRICK COMPANY LIMITED Date JULY 1958 Job No. B-783-7
 Location of Borings - DON VALLEY PLANT TORONTO

All borings are plotted to a scale of 1" = 8' ft. using _____ as a fixed datum.

No. _____ No. 1 No. 2 No. _____



NOTE 'A'
DENSE GREY SAND WITH CLAY SEAMS

NOTE 'A' SAMPLE NO
MEDIUM DENSE BROWN CLAYEY SAND AND MEDIUM GRAVEL

NOTE 'B'
REFUSAL

NOTE 'C'
VERY HARD CLAY AND SHALE TRACES OF SAND

246

247

The clay as received was ground to pass a 16 mesh Tyler screen. Trial briquettes, $\frac{1}{2}$ " x $\frac{1}{2}$ " x $1\frac{1}{2}$ ", were prepared from the five combined samples. The samples were worked into a plastic mass and the briquettes were hand molded in steel molds. No de-airing was employed since the sizes of the combined samples were too small for use with a laboratory de-airing extrusion machine. The amount of water required was noted and the water of plasticity calculated. The plasticity and workability were noted. One briquette from each combined sample was placed immediately into a laboratory drier at 185°F and any tendency to crack with rapid drying was observed. The remainder of the briquettes were air dried for twenty four hours and dried finally at 185°F for twenty four hours. The drying shrinkage was measured. The briquettes were fired in an electric laboratory kiln in an oxidizing atmosphere. The kiln was brought up to approximately 1500°F overnight and finished at the appropriate cone in approximately four hours the next day. The fired color, hardness, shrinkage, and absorption after a twenty four hour soak in cold water were observed. The pyrometric cone equivalents (PCEs) were obtained for the combined samples.

RESULTS

The results of the tests are shown in Table 1.

The temperatures corresponding to the cones used in the report are as follows:

Table 1 - Physical Properties of Combined Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS				REMARKS	
			Cone No.	Fired Skg. %	Abs. %	Colour		Hardness
Laboratory 243	Bore hole #1 - samples 1 to 8; mixture is plastic, works well, water of plasticity 19.4%, some stones, calcareous, safe drying, drying shrinkage 6.4%.	2	04	0.7	16.4	light buff	fairly soft	Stones will make grinding difficult. This is a safe drying buff firing clay with a short firing range.
			02	2.3	12.3	buff	hard	
Laboratory 244	Bore hole #1 - samples 9 to 21; Mixture is plastic, works well, water of plasticity 23.9%, no stones slightly calcareous, safe drying, drying shrinkage 7.6%	3½	04	0.5	16.2	salmon	fairly hard	This is a plastic, red firing material with a fairly high drying shrinkage. It has a short firing range.
			02	1.3	7.3	brownish red	hard	
			1	7.3	0	dark red	vitrified	
Laboratory 245	Bore hole #1 - samples 22 to 30; mixture is very sandy and has poor plasticity, water of plasticity 15.6%, contains stones, calcareous, safe drying, drying shrinkage 3.9%	4	04	+0.3	Lime pebbles	brownish salmon	soft disintegrated in H ₂ O/ soft	This mixture contains excessive lime pebbles or limestone and is undesirable unless finely ground. The material has a short firing range
			02	0	15.7	brownish buff	fairly hard	
			1	2.1	9.1	greenish buff		
Laboratory 246	Bore hole #2, samples 1 to 10; mixture is plastic and works well, water of plasticity 19.4%, calcareous, contains stones, safe drying, drying shrinkage 6.3%	2-	04	0.3	15.2	light buff	fairly soft	This is fairly plastic buff firing mixture. Stones will require careful grinding. The mixture has a short firing range
			02	2.5	10.7	buff	hard	
Laboratory 247	Bore hole #2, samples 11 to 17; mixture is very sandy and has poor plasticity, contains stones, calcareous, water of plasticity 15.8%, safe drying, drying shrinkage 3.0%	4	04	+0.7	14	pinkish buff	soft	This mixture contains stones and has poor plasticity. It has a fairly short firing range and fires to a buff color.
			02	0	11.8	brownish buff	fairly hard	
			1	0.3	6.7	greenish buff	hard	

* a plus sign indicates expansion.

<u>Cone Number</u>	<u>Temperature °F</u>
04	1922°
02	2014
1	2077
2	2088
3	2106
4	2134

DISCUSSION OF RESULTS

All combined samples were calcareous, dried safely, and had a short firing range. Samples 243, 245, 246 and 247 were buff firing and 244 was red firing. With the exception of 244, all combined samples contained stones.

Since all samples had short firing ranges, there will be difficulty in obtaining a uniform size, color, absorption and hardness after firing. A uniform and careful control of temperature is required in the kilns.

The presence of stones in the samples makes a difficult grinding problem. For best results the stones should be crushed to a fine size. This applies particularly to raw material containing lime pebbles or limestone.

Sample 243 which is from the upper portion of bore hole number 1 (0 to 21'6") is a fairly plastic buff firing clay with a very short firing range. Some stones were present. If care is exercised in grinding and firing this material could be used with difficulty in the manufacture of buff building brick. Indications are that this material should be fired to approximately cone 02 to obtain a hard, fairly dense buff product.

Sample 244 is a plastic, red firing clay with a very short firing range. It is a combination of samples in bore hole #1 from 21'6" to 54'. This material will likely require very uniform firing conditions. Indications are that a hard dense red building brick could be obtained with difficulty at approximately cone 02. The drying shrinkage of this material is inclined to be high and it has very good plasticity. An addition of a non plastic shale with a longer firing range would likely be beneficial. This material by itself does not appear to be a desirable raw material for brick.

Sample 245 from bore hole #1 (54' to 76'3") is a buff firing material containing an excessive amount of lime pebbles or limestone. It has poor plasticity and a short firing range. When the test pieces were fired to cone 04 and soaked in water they completely disintegrated. This is not a desirable raw material for the manufacture of building brick.

Sample 246 from the upper portion of bore hole number 2 (0 to 25'5") is a fairly plastic buff firing material with a short firing range. The presence of stones makes grinding difficult. The material fires to a hard, fairly dense product at approximately cone 02. Indications are that buff building brick could be manufactured from this material with difficulty if very careful firing control is maintained.

Sample 247 from bore hole number 2 (25'5" to 43'3") has poor plasticity and so difficulty would likely be encountered with extrusion. The sample contains an excessive quantity of sand and stones and considerable calcium carbonate. The

expansion at cone 04 and the buff color are due to the carbonate. The fired color is variable. Because of the apparent lack of plasticity, the presence of stones and sand, and the variable fired color, indications are that this material is not desirable for building brick manufacture unless it is mixed with some more plastic material.

CONCLUSIONS

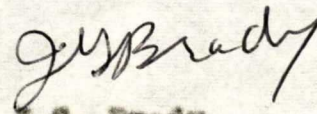
In general all samples were calcareous, low fusion, common clays with short firing ranges. Indications are that samples 243 and 246 could be used with difficulty in the manufacture of buff building brick. These samples would require fine grinding and very careful control in firing. They occur in the upper portions of bore holes number 1 and number 2 respectively.

Sample 244 could be used with difficulty in production of a salmon-red building brick. It has an extremely short firing range. Indications are that this material should be mixed with a non plastic clay or shale with a longer firing range.

Sample 245 is non plastic and contains limestone or lime pebbles. It is not a desirable material for building brick production.

Sample 247 is non plastic and contains excessive sand and stones. These factors make this material undesirable for building brick manufacture.

JGB/LHD


J.C. Brady
Ceramic Engineer