

TRB-238-242

R. 443-4, R. 444-5, REG. NO. 2416

CLAY AND SAND FROM WYNYARD

A sample of quartz sand, Reg. No. 2416, was received from Brian R. Archer Pty. Ltd. for the purpose of blending with a mixture of equal parts of two shale samples, R.443—4 and R.444—5, and testing the blends for brick manufacture by pressing methods. Brick manufacturing tests were also requested on the mixture of the two shale samples.

The Sample

Reg. No. 2416, *Quartz sand, Wynyard*.—The sample was roll crushed to minus 10 mesh. A screen analysis was made of the crushed sample with the following results:—

Screen Size B.S.S.	Per Cent Weight
—10 + 22	28.2
+ 36	20.7
+ 52	40.4
+ 85	6.7
+ 100	1.2
+ 200	1.1
— 200	1.7

R.443—4 and R.444—5, shale samples, have been previously tested individually for brick manufacture and the results have been presented in Research Investigation R.440 to R.448. (See above p. 234).

Summary

1. Blends of equal parts by weight of the shale samples R.443—4 and R.444—5 with various proportions of sand have been tested for brick manufacture by semi-dry and stiff-plastic pressing methods.

The blending proportions range from 5 parts by weight of shale to 1 part sand to 2 parts shale to 1 part sand.

For comparative purposes, brick manufacturing tests were performed also on the mixture of the two shale samples without addition of sand.

Firing of test pieces was performed at one temperature only—1050°C.

2. Good quality bricks have been made from all blends tested, except Blend D, 2 shale/1 sand. Bricks from this blend barely meet the S.A.A. modulus of rupture specification of 400 lbs. per square inch. Colour of bricks is medium rust red and does not vary with different proportions of added sand. Bricks have a good ring and appear to be well fired at 1050°C.

3. Bricks from all shale-sand blends show slight random surface cracks and imperfections. This effect increases with increasing sand content and is rather marked in bricks from Blend D, 2 shale/1 sand.

4. Bricks made from the shale mixture without addition of sand show the same characteristics as individual samples R.443—4 and R.444—5, noted in Research Investigation R.440 to R.448. These are slight glazing, slightly roughened surfaces and a tendency to curved surfaces.

5. All blends have a tendency to lamination in the pressed bricks. This was only noted in occasional pieces and is not considered a serious disability.

6. Increase of the proportion of sand in the blend results in a marked reduction in firing contractions.

Preparation of Samples for Testing

As stated previously, the sand was roll crushed to pass a 10 mesh screen. The two shale samples were similarly treated and equal weights of these two samples were then blended by thorough hand mixing and rolling. This composite shale sample was then used as a base for blending with various proportions of the sand.

Blends of shale and sand were made in the following proportions:—

Blend A	Shale: 5 parts	Sand: 1 part
Blend B	Shale: 4 parts	Sand: 1 part
Blend C	Shale: 3 parts	Sand: 1 part
Blend D	Shale: 2 parts	Sand: 1 part
Blend 4/5	Equal parts of Shale R.443—4 and Shale R.444—5.	

All blends were thoroughly mixed in the dry state. The required amount of water was then incorporated by hand mixing, followed by a pass through the Rawdon Pug Mill.

Pressing

Both semi-dry and stiff-plastic methods were employed on each sample.

No difficulties were encountered in either method of pressing except that in the case of Blend D there was a tendency for the green pressed bricks, particularly of the stiff-plastic mix, to adhere to the die surfaces. However, this tendency is slight enough to be regarded as not significant.

All blends except the undiluted shale composite showed a tendency to lamination. This was equally apparent in bricks pressed from both semi-dry and stiff-plastic mixes.

Green semi-dry pressed bricks were well formed and hard with good green strength, but the edges were rather easily abraded. Bricks from Blend D were rather brittle and chipped easily at the corners.

Green stiff-plastic pressed bricks were well formed but rather soft. However, green strength in all cases was good.

Moisture Contents of the Pressed Bricks

The following tabulation shows (A) the per cent moisture in the green bricks and (B) the per cent water added to the dry clay:—

	Semi-dry		Stiff-plastic	
	(A)	(B)	(A)	(B)
Blend A	10.9	12.2	17.1	20.7
Blend B	9.9	11.0	16.9	20.4
Blend C	9.8	10.9	16.5	19.8
Blend D	9.8	10.9	15.0	17.6
Blend 4/5	9.3	10.2	18.9	23.4

Drying and Firing

The pressed bricks were allowed to dry naturally for several days and finished by heating at 110°C in an electric oven.

The dried bricks were fired at a temperature of 1050°C, soaking for two hours at this temperature.

The drying and firing contractions of the bricks made from the various blends are shown in the following tabulation. All contractions are based on the original length of green pressed bricks.

Blend	Contractions: Per Cent					
	Semi-dry			Stiff-plastic		
	Drying 110°C	Firing 1050°C	Total	Drying 110°C	Firing 1050°C	Total
A	1	3	4	3	7	10
B	1	2	3	3	6	9
C	$\frac{1}{2}$	2	$2\frac{1}{2}$	3	5	8
D	$\frac{1}{2}$	$1\frac{1}{2}$	2	3	4	7
4/5	1	5	6	$3\frac{1}{2}$	$8\frac{1}{2}$	12

The firing losses of the various bricks fired at 1050°C are shown below. Calculations are based on the weight of brick dried at 110°C.

Blend	Firing Loss— Per Cent Weight
A	5.4
B	4.7
C	4.6
D	4.4
4/5	6.5

Colour of Bricks

Bricks from all blends fired to a colour approximating medium rust-red. No colour variation takes place with variations in proportions of added sand in the range of blends tested at a firing temperature of 1050°C.

Refractoriness

Refractoriness tests were performed on shale samples R.443—4 and R.444—5 and Blend 4/5, made up from equal weights of these two shale samples.

Sample	Softening Point	Fusion Point
R.443—4	1360°C	1400°C—1420°C
R.444—5	1340°C	1400°C—1420°C
Blend 4/5	1340°C	1400°C—1420°C

Modulus of Rupture

Modulus of rupture tests have been performed on fired bricks made by both methods of pressing. These tests were carried out by Mr. K. Payne, Officer-in-Charge, Engineering Department, Launceston Technical College.

Tests were performed on one brick specimen only.

Blend	Modulus of Rupture: Lbs. per sq. inch	
	Semi-dry press	press Stiff-plastic
A	900	1400
B	600	1000
C	500	1000
D	400	500
4/5	2100	2200