EXPERIMENT NO.- 7

BDS 208: 1980

a) Determination of dimensions and appearance of clay brick

b) Field test of clay brick

c) Determination of crushing strength of clay brick

d) Determination of water absorption and density of clay brick

INTRODUCTION

- **BDS 208: 1980** - Bangladesh standard specification for common building clay bricks.
- Bangladesh Standards and Testing Institution (BSTI) adopted the standard on 11 July 1980 after the BDS 208: 1962
- Relevant standards are IS 1077: 1970 and IS 5454: 1969

7 (a) Determination of dimensions and appearance of clay brick

SAMPLING

- Random sampling -
- Stratified sampling - convenient section
- Sampling in motion – loading/unloading
  ≥ 10 from each lorries
- Sampling from a stuck – upper layer should be removed

** The number of bricks to be selected from a lot shall depend upon the size of the lot as given in Table 1.*

Table 1: Scale of sampling and permissible number of defectives for visual and dimensional characteristic's

No. of bricks in the lot	*No. of bricks to be selected in the sample*	*Permissible no of defectives in the sample*
1	2	3
2001 to 10000	20	1
10001 to 35000	32	2
35001 to 50000	50	3

** If the number of defective bricks in the sample is greater than the corresponding permissible number of defective, the lot shall be deemed as not having met the visual and dimensional requirements.*

STANDARD DIMENSIONS OF COMMON CLAY BURNT BRICKS

Length	*24 cm*	*9.5″*
Width	*11.5 cm*	*4.5″*
Depth/Height	*7 cm*	*2.75″*

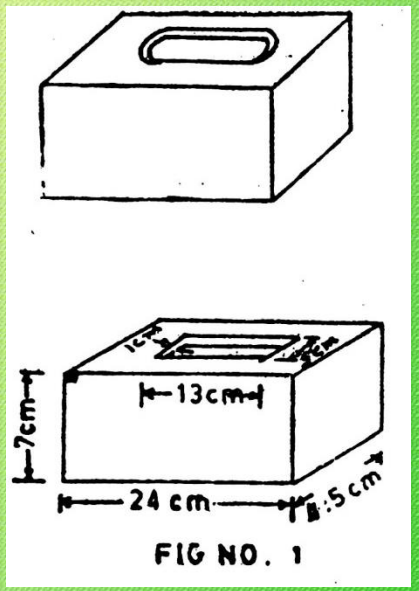

FIG NO. 1

Note: One bedding face of each brick shall have a recess, pannel or frog. The size of the frog for the standard brick shall not exceed 13 cm×5 cm×1 cm $\left(5\frac{1}{6}'' \times 2\frac{1}{8}'' \times \frac{1}{3}''\right)$

VARIATION

- Small variation in the dimension shall be permissible to the following extent only:

Specified Dimensions	Maximum Permissible Variation
Over 5 cm (2″) & up to 7.5 cm (3″)	± 1.5 mm ($\frac{1}{16}$″)
Over 7.5 cm (3″) & up to 10 cm (4″)	± 3.0 mm ($\frac{1}{8}$″)
Over 10 cm (4″) & up to15 cm (6″)	± 5.0 mm ($\frac{3}{16}$″)
Over 15 cm (6″) & up to 25 cm (10″)	± 6.0 mm ($\frac{1}{4}$″)

SPECIMEN NO AND PREPARATION

- 24 bricks, for carrying out dimensional tests
- Any blister or other small project together with any loose particles of clay which might have adhered to the face of brick shall be removed before the bricks are assembled for measurement

MEASUREMENT - LENGTH

- a) 24 bricks laid end to end on a level surface in contact in a straight line shall measure between 568 cm (227″) to 588 cm (235″) when all frog face upward as shown in Figure 2.
- b) 24 bricks laid in similar manner as in (a) but having alternate frogs facing upward and downwards shall also measure between 568 cm (227″) to 588 cm (235″).

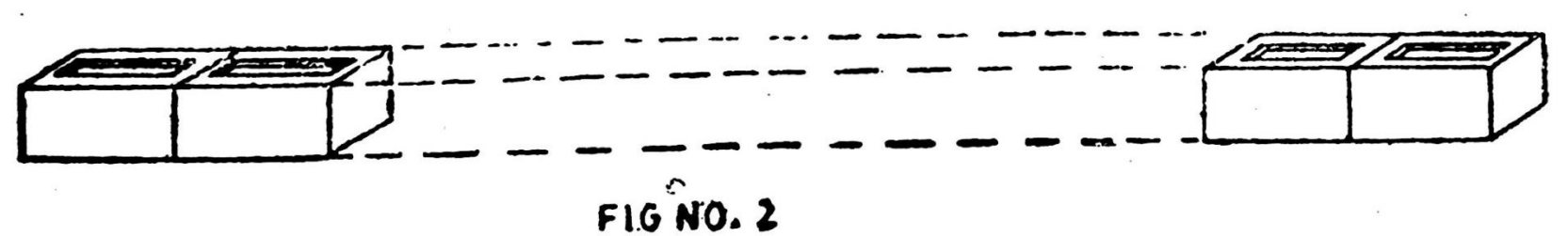

FIG NO. 2

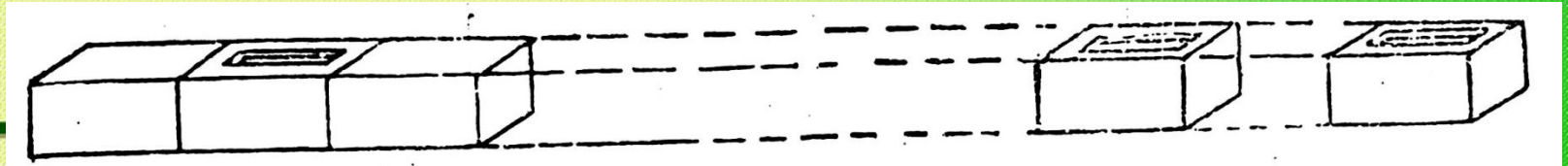

FIG NO. 3

MEASUREMENT - WIDTH

- a) 24 bricks laid side by side on level surface in contact in a straight line shall measure between 281 cm (112″) to 291 cm (116″) when all frogs face upwards as shown in Fig. 4.
- b) 24 bricks laid in a similar as in clause (a) above, but having alternate frogs facing upward and downward shall also measure between 281 cm (112″) to 291 cm (116″) as shown in Fig. 5. The difference between the length noted in clause (a) and this system shall not be more than 8 mm ($3\frac{1}{3}$″).

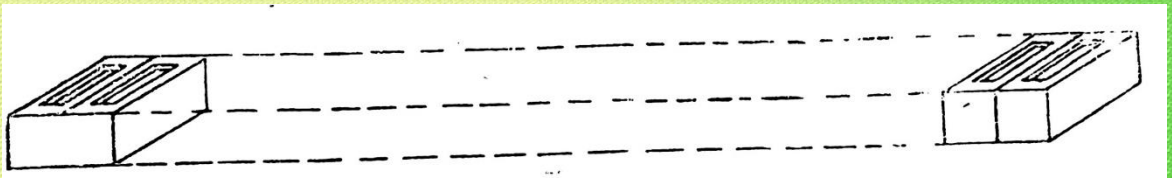

FIG NO . 4

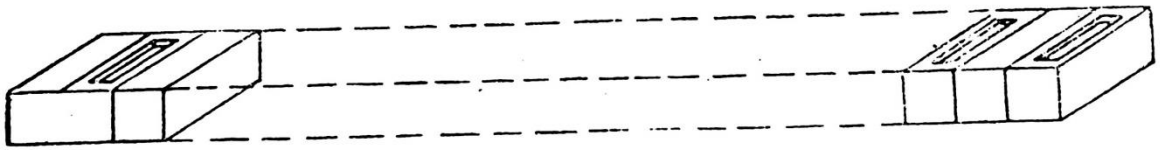

FIG NO. 5

MEASUREMENT - DEPTH

24 bricks laid on edge bedding surface to bedding surface in contact in a straight line will measure between 165 cm (6.5”) to 171 cm (6.7”) as shown in Fig. 6.

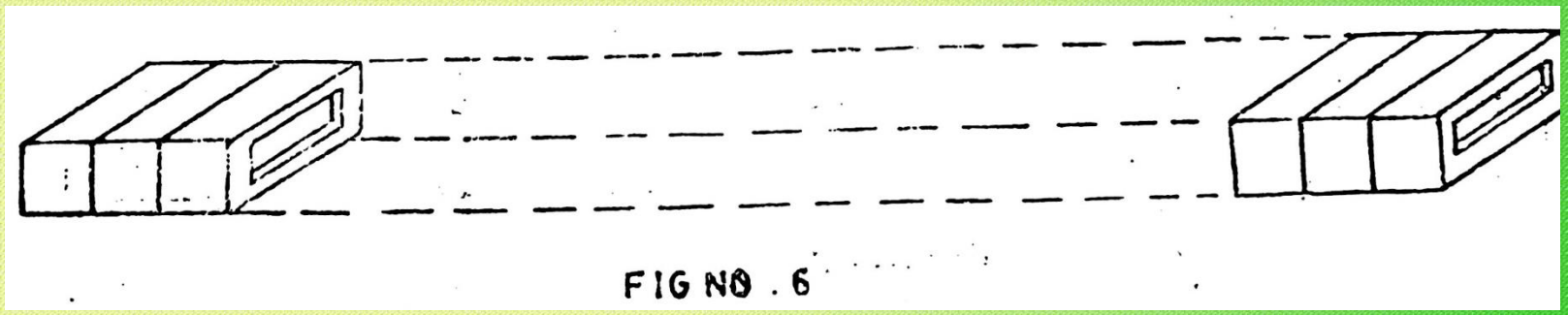

FIG NO . 6

MEASUREMENT - PROCEDURE

- The overall length of the assembled bricks shall be measured with a steel tape or other suitable inextensible measure long enough to measure the whole row at once.
- Measurement by repeated application of a short rule or measure shall not be considered satisfactory.
- If for any reason, it is found impracticable to measure 24 bricks in one row the samples may be divided into two rows of 12 bricks which shall be measured separately to the nearest of 1.5 mm ($\frac{1}{16}$″) their measurements added.

Compliance: If measurements are not fulfilled as required, the specimens do not comply and the whole consignment from which the specimens are drawn shall be **rejected and no further tests in regard to crushing strength, water absorption and efflorescence** need to be carried out.

WORKMANSHIP AND FINISH

- The bricks shall have rectangular plain faces with parallel sides sharp straight right angled edges.
- The bricks shall have thoroughly brunt but not over or under brunt.
- The bricks shall be sound of compact structure, uniform in shape and colour, free from cracks, chips warps, twists, pebbles, nodules of line and other ingredients which may eventually effect the serviceability or strength or may cause staining.
- Right angled edges and plain faces can be observed with a steel trisquare. There is no other special test for checking the workmanship and finish of bricks except the visual test.

FIELD TESTS

- T – test
- Sound test
- Nail test

CRUSHING STRENGTH

Specimens – Twelve bricks taken at random from samples shall be halved and one half from each whole brick used for determining the crushing strength.

The overall dimensions of each bedding face shall be measured to the nearest 1.3 mm ($\frac{1}{20}$″) and the smaller area between the faces shall be used for calculating crushing strength of brick.

Sampling -

Lot size	Sample size
2001 to 10000	5
10001 to 35000	10
35001 to 50000	15

APPARATUS

- Balance
- Mixing plate
- Trowels
- Compression Testing machine
- Scale

MATERIALS

- Sand
- Cement
- Water

PROCEDURE - BRICKS WITH FROGS

- These shall be immersed in water at 15 ºC to 20 ºC for 24 hours.
- They shall then be removed and allow to dry at room temperate for about 5 minutes, their frogs shall be filled with cement-sand mortar of $1{:}1\frac{1}{2}$.
- Sand being clean and well graded passing 3.2 mm ($\frac{1}{8}''$) sieve. *(#8 passing and #16 retained)*
- The mortar should be trawled off flush with surface of the bricks.
- The bricks shall then be stored under the damp sacks for 24 hours and then be immersed in water for six days before compression testing.

PROCEDURE - BRICKS WITH FROGS

- The specimens will be taken out, wiped dry with damp cloth and placed with flat surface horizontally and the mortar filled face facing upward between two number 3 plywood sheets each approximately of 3 mm thickness and carefully centred between the plates of the compression testing machine.
- The compressing plates of the testing machine shall have a ball seating in the form of a portion of sphere.
- The centre of each coinciding with the centre of the face of the plate. The load shall be applied axially at a uniform rate of 2000 psi per minute until failure.

Note: The mortar compressive strength on cubes shall not give less than 4000 psi and not exceeding 6000 psi.

RESULTS

Maximum load in lbs at failure divided by the minimum area of bedding surface of the half brick in square inch shall be taken as the crushing strength.

LIMITING VALUE

Grade	*Mean strength for twelve halved bricks, psi*	*Minimum strength for individual halved bricks, psi*
A	4000	3000
B	2500	2000
C	1500	1200

COMPLIANCE CRUSHING STRENGTH

- If the mean crushing strength of twelve bricks fails below the limiting crushing strengths given above, the batch from which the sample is taken shall be deemed not to comply.
- If, however, any individual bricks gives the crushing strength less than the minimum value for individual bricks given above, the test will be repeated over twice the number of bricks that have failed provided that the number of individual bricks not complying of any does not exceed 3.
- If on retest the crushing strength of any bricks still fails below the minimum value the sample as whole shall be deemed not to comply with the crushing strength value.

WATER ABSORPTION

Specimens –

Test specimen shall consists of whole bricks. Six specimens shall be tested for water absorption.

WATER ABSORPTION - PROCEDURE

- The test specimens shall be dried in a ventilated oven at 110 ºC – 115 ºC for 48 hours or more until constant weight. The specimen shall be deemed to have reached the constant weight when after 2 hours drying in the same over the loss in weight does not exceed 0.1%.
- Each specimen shall immediately be weighed which shall be called the dry weight of the specimen. The dry specimen shall then be cooled in air at room temperature for about 2 hours after which they shall be immersed completely in clean soft water at 15 ºC for 24 hours.
- After 24 hours each specimens shall be weighed under water
- The specimens shall then be removed from the water, the surface wiped off with a damp cloth and the specimen weighted. Weighing of any specimen shall be completed within 3 minutes after removing the specimen from water. This shall be called wet weight.

CALCULATION

The percentage of water absorption and unit weight shall be calculated as:

$$\%\ water\ absorption = \frac{W_2 - W_1}{W_1} \times 100$$

$$\text{Density (OD), kg/m}^3 = 997.5 \times \frac{W_1}{W_2 - W_3}$$

Where, W_1 = Dry weight of the specimen

W_2 = Wet weight of the specimen; and

W_3 = Underwater weight of the specimen

LIMITING VALUE WATER ABSORPTION

The average value of the six specimen shall taken as the water absorption of the batch. In no case shall the water absorption by weight exceed 16% for bricks of C grade and 12% for bricks of A and B grade classified in accordance with the crushing strength.

COMPLIANCE WATER ABSORPTION

In case the average absorption value of the specimen exceeds the limiting value given above the test will be repeated on the same number of bricks. If on retest the absorption value exceeded the prescribed limit the batch from which the sample is taken shall be deemed not to comply to the clause.

SAMPLE DATA SHEET

Data Sheet

Sl. No.	Specimen Area	Maximum Load, lb	Crushing Strength, psi	Average Crushing Strength, psi
1.				
2.				
3.				
4.				
5.				

SAMPLE DATA SHEET

Data Sheet

Sample No.	Oven-dry Weight of Sample, W_1 (gm)	Weight of S.S.D. Sample, W_2 (gm)	Weight of S.S.D. Sample in Water, W_3 (gm)	Absorption Capacity (%)	Average Absorption Capacity (%)
1.					
2.					
3.					
4.					
5.					
6.					

REPORT

The Report shall include the following information:

- Source of bricks
- Frog Mark of brick
- Dimension and appearance and compliance
- Field test results
- Mean crushing strength of twelve half bricks along with that of each individual brick shall be reported.
- Mean absorption capacity and density of six bricks along with that of each individual brick shall be reported.