5. BRICKS

COMPOSITION OF GOOD BRICK EARTH

Following are the constituents of brick earth:

1. **Alumina**
   It is the chief constituent of every kind of clay. A good brick earth should contain about 20 to 30 per cent of alumina. This constituent imparts plasticity to earth so that it can be moulded.
2. **Silica**
   - A good brick earth should contain about 50 to 60 per cent of silica. Presence of this constituent prevents cracking, shrinking and warping of raw bricks. It thus imparts uniform shape to the bricks.
   - Excess of silica destroys the cohesion between particles and bricks become brittle.
3. **Lime**
   - It should be present in a finely powdered state and not in lump.
   - Lime prevents shrinkage of raw bricks. Sand alone is infusible. But it slightly fuses at kiln temperature in presence of lime.
   - Excess of lime causes the brick to melt and hence, its shape is lost. Lumps of lime are converted into quick lime after burning and this quicklime slakes and expands in presence of moisture.
4. **Oxide of Iron**
   - About 5 to 6 per cent is desirable in good brick earth. It helps lime to fuse sand. It also imparts red colour to bricks.
   - Excess of oxide of iron makes the bricks dark blue or blackish.
5. **Magnesia**
   A small quantity of magnesia in brick earth imparts yellow tint colour to bricks and decreases shrinkage. But excess of magnesia leads to the decay of bricks.

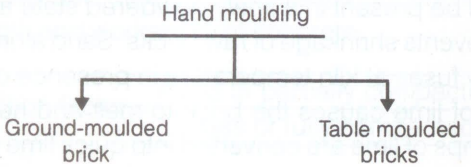
HARMFUL INGREDIENTS IN BRICK EARTH

1. **Lime**
   - It causes unsoundness in brick if present in excess amounts.
2. **Iron pyrites**
   - If iron pyrites are present in brick earth, bricks are crystallized and disintegrated during burning.

3. **Alkalies**
   These are mainly in the form of soda and potash.
4. **Pebbles**
   The presence of pebbles or grits of any kind is undesirable in brick earth because it will not allow the clay to be mixed uniformly and thoroughly which will result in weak and porous bricks.
5. **Organic Matter**
   Presence of organic matter in brick earth assists in burning. But if such matter is not completely burnt, bricks become porous.

MANUFACTURE OF BRICKS

1. **Preparation of clay**
   Clay of bricks is prepared in the following order:
   (i) Unsoiling (ii) Digging
   (iii) Cleaning (iv) Weathering
   (v) Blending (vi) Tempering
2. **Moulding**
   - Hand Moulding



   - Machine Moulding
     - Plastic Clay Machine
     - Dry Clay Machines
3. **Drying**
4. **Burning:** Burning of bricks is done either in clamps or in kilns.

   (a) Clamps: Its shape in plan is generally trapezoidal. Floor of clamp is prepared in such a way that short end is slightly in the excavation and wider end is raised at an angle of about 15° from ground level.

   (b) Kilns: A kiln is a large over which is used to burn bricks. The kiln which are used in the manufacture of bricks are of the following two types.
   (i) Intermittent kilns (ii) Continuous kilns

   (i) **Intermittent Kiln:** This may be over ground or under ground they are classified in two ways: (a) Intermittent up-drought kilns, (b) Intermittent down-drought kilns

COMPARISON BETWEEN BULL'S TRENCH KILN AND HOFFMAN'S KILN

No. Item	Bull's trench kiln	Hoffman's kiln
1. Burning capacity	About 3 Lakhs in 12 days	About 40 lakhs in one season
2. Continuity of working	It stops functioning during monsoon as it is not provided with a permanent roof	It functions all the year with a permanent roof
3. Cost of fuel	High as consumption of fuel is more	Low
4. Drying space	It requires more space	It requires less space
5. Initial cost	Low	High
6. Nature	It is semi-continuous in loose sense	It is continuous is nature
7. Popularity	More popular because of less initial cost	Less popular because of high initial cost
8. Quality of bricks	Percentage of good quality brick is small	Percentage of good quality bricks is more.

COMPARISON BETWEEN CLAMP BURNING AND KILN BURNING

No. Item	Clamp-burning	Kiln burning
1. Capacity	About 20000-100000	avg. 25000
2. Cost of fuel	Low as grass, cow dung, litter may be used	High because of coal dust is to be used
3. Initial cost	Very low as no structures are to be built	More as permanent structures are to be constructed
4. Quality of bricks	The percentage of good quality bricks is small about 60%	Percentage of good quality bricks is high 90%
5. Regulation of fire	It is not possible to control or regulate fire during the process of burning	The fire is under control throughout the process of burning
6. Skilled supervision	Not necessary through out the process of burning	The continuous skilled supervision is necessary
7. Structure	Temporary structure	Permanent structure
8. Suitability	For small scale	For large scale
9. Time of burning and cooling	It requires about 2-6 months.	Actual burning times is 24 hr. and 12 days are required for cooling of bricks.

TESTS FOR BRICKS

1. **Absorption**
   - A brick is taken and it is weighed dry. It is then immersed in water for a period of 16 hours.
   - Then weight again and the difference in weight should not, in any case, exceed

(a) 20 per cent of weight of dry brick for first class bricks.
(b) 22.5 per cent for second class bricks.
(c) 25 per cent for third class bricks.

2. **Crushing strength**
   - Minimum crushing strength for first class bricks $\not< 10$ N/mm^2 and for second class bricks $\not< 7.5$ N/mm^2

3. **Hardness**
   In this test, a scratch is made on brick surface with the help of a finger nail. If no impression is left on the surface, brick is treated to be sufficiently hard.

4. **Presence of soluble salts**
   - Soluble salts, if present in bricks, will cause efflorescence on the surface of bricks.
   - It is immersed in water for 24 hours. It is then taken out and allowed to dry in shade. Absence of grey or white deposits on its surface indicates absence of soluble salts.
   - If the white deposits cover about 10% surface, the efflorescence is said to be slight.
   - When white deposit cover about 50% of surface thin it is said to be moderate.
   - If grey or white deposits are found on more than 50% of surface, the efflorescence becomes heavy and it is treated as serious.

5. **Shape and Size**
   - Its shape should be truly rectangular with sharp edges.
   - 20 bricks are randomly selected of standard size (19 × 9 × 9 cm) for good quality bricks, the results should be within the following permissible limits:
     Length – 368 cm to 392 cm
     Width – 174 cm to 186 cm
     Height – 174 to 186 cm

6. **Soundness**
   - In this test, two bricks are taken and they are struck with each other.
   - Bricks should not break and a clear ringing sound should be produced.

7. **Structure**
   - It should be homogeneous, compact and free from any defects such as holes, lumps, etc.
   - High duty fire-clays can resist temperature range of 1482°C to 1648°C; medium duty fire-clays can resist temperature range of 1315°C to 1482°C and low duty fire-clays can resist temperature up to 870°C only.

QUALITY OF GOOD BRICKS

- The bricks should be table-moulded, well burnt in kilns, copper-coloured free from cracks and with sharp and square edges.
- The bricks should be uniform in shape and should be of standard size.
- The bricks should give a clear metallic ringing sound when struck with each other.
- The bricks when broken or fractured should show a bright homogeneous and uniform compact structure free from voids.
- The brick should be sufficiently hard. No impression should be left on brick surface, when it is scratched with finger hail.
- The bricks should not break into pieces when dropped flat on hard ground from a height of about one meter.
- The bricks, when soaked in water for 24 hour should not show deposits of white salts when allowed to dry in shade.
- No brick should have the crushing strength below 5.50 N/MM^2.

CLASSIFICATION OF BRICKS

The bricks can broadly be divided into two categories:

1. **Unburnt Bricks:** The unburnt or sun dried bricks are dried with the help of heat received from sun after the process of moulding. These bricks can only be used in the construction of temporary and cheap structures. Such bricks should not be used at places exposed to heavy rains.
2. **Burnt Bricks:** These are classified in four categories:

   (i) First Class Bricks
   - These bricks are table-moulded and of standard shape and they are burnt in kilns.
   - The surfaces and edges of the bricks are sharp square smooth and straight.
   - First class bricks have all qualities of good bricks.
   - These bricks are used for superior work of permanent nature

   (ii) Second Class Bricks
   - These bricks are ground moulded and they are burnt in kilns.
   - The surface of these bricks is some what rough and shape is also slightly irregular.
   - These bricks are commonly used at places where bricks work is to be provided with a coat of plaster.

   (iii) Third Class Bricks
   - These are ground moulded and they are burnt in clamps.

- These bricks are not hard and they have rough surface with irregular and distorted edges.
- These bricks gives dull sound when struck together.
- They are used for unimportant and temporary structures.

SIZE AND WEIGHT OF BRICKS

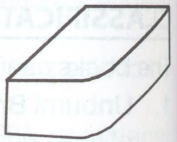
For India

- Standard size of bricks is 19 cm × 9 cm × 9 cm
- Nominal size (with mortar) is 20 cm × 10 × 10 cm.
- The commonly adopted nominal size of traditional bricks is 23 cm × 11.4 cm × 7.6 cm.
- It is found that the weight of 1 m^3 of bricks earth is about 1800 kg. Hence the average weight of a brick will be about 3 to 3.50 kg.

SHAPE OF BRICKS

1. Bullnose Brick

- A brick moulded with a rounded angle is termed as a bullnose. It is used for a rounded quoin.
- A connection which is formed when a wall takes a turn is known as quoin.



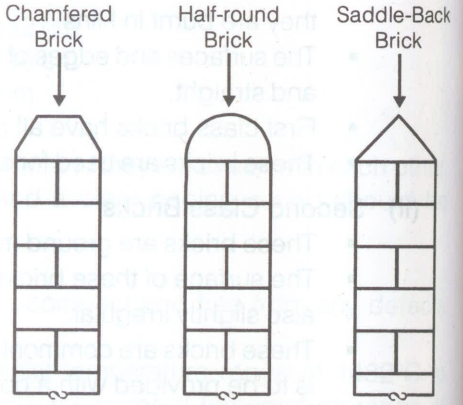
Bullnose Brick

2. Channel Bricks

- These bricks are moulded to the shape of a gutter or a channel and they are very often glazed.
- These bricks are used to function as drain.

3. Coping bricks

- These bricks are made to suit the thickness of walls on which coping is to be provided.
- Such bricks take various forms such as chamfered half-round or saddle-back.



Brick Copings

4. Cownose Bricks

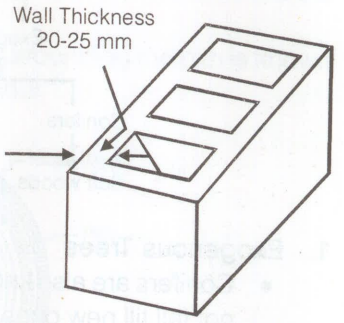
- A brick moulded with a double bullnose on end is known as cownose.

5. Curved Sector Bricks

- These bricks are in the form of curved sector and they are used in the construction of circular brick masonry pillars, brick chimneys.
- The perforation may be circular, square, rectangular or any other regular shape in cross-section.
- The water absorption after immersion for 24 hour in water should not exceed 15% by water.
- compressive strength of perforated bricks should not be less than 7 N/mm^2 on gross area.

6. Hollow Bricks

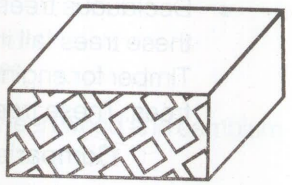
- These are also known as cellular or cavity bricks. Such bricks have wall thickness of about 20 mm to 25 mm. They are prepared from special homogeneous clay. They are light in weight about one third the weight of the ordinary bricks of the same size. The use of such bricks leads to speedy construction. They also reduce the transmission of heat, sound and damp. They are used in the construction of brick partitioning.



Hollow Brick

7. Paving bricks

- These bricks are prepared from clay containing a higher percentage of iron. Excess iron vitrifies the bricks at a low temperature. Such bricks resist better the abrasive action of traffic. Paving bricks may be plain or checkered.



Chequered Brick

8. Perforated Bricks

- Perforated bricks are used in the construction of brick panels for lightweight structures and multi-storeyed framed structures.

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