FACULTY OF ENGINEERING & TECHNOLOGY

TOPIC : BRICKS (L-4)

❖ The Civil Construction Cost of a normal residential building can be distributed to the following principal items:

- Cement -18%,
- Steel -12%,
- Bricks - 20%,- Bricks are one of the major building materials.
- Stone chips - 5%,
- Sand - 5%,
- Wood -15% and
- Labour Charges - 25%.

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❖ CONSTITUENTS OF GOOD BRICK EARTH

❑ Bricks are the most commonly used construction material. Bricks are prepared by moulding clay in rectangular blocks of uniform size and then drying and burning these blocks. In order to get a good quality brick, the brick earth should contain the following constituents.

1. Silica
2. Alumina
3. Lime
4. Iron oxide
5. Magnesia

❑ SILICA

1. Brick earth should contain about 50 to % of silica.
2. It is responsible for preventing cracking, shrinking and warping of raw bricks.
3. It also affects the durability of bricks.
4. If present in excess, then it destroys the cohesion between particles and the brick becomes brittle.

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❑ ALUMINA

1. Good brick earth should contain about 20% to 30% of alumina.
2. It is responsible for plasticity characteristic of earth, which is important in moulding operation.
3. If present in excess, then the raw brick shrink and warp during drying.

❑ LIME

1. The percentage of lime should be in the range of 5% to 10% in a good brick earth.
2. It prevents shrinkage of bricks on drying.
3. It causes silica in clay to melt on burning and thus helps to bind it.
4. Excess of lime causes the brick to melt and brick looses its shape.

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❑ IRON OXIDE

1. A good brick earth should contain about 5% to 7% of iron oxide.
2. It gives red colour to the bricks.
3. It improves impermeability and durability.
4. It gives strength and hardness.
5. If present in excess, then the colour of brick becomes dark blue or blakish.
6. If the quantity of iron oxide is comparatively less, the brick becomes yellowish in colour.

❑ MAGNESIA

1. Good brick earth should contain less a small quantity of magnesia about1%)
2. Magnesium in brick earth imparts yellow tint to the brick.
3. It is responsible for reducing shrinkage
4. Excess of magnesia leads to the decay of bricks.

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❖ HARMFUL INGREDIENTS IN BRICK EARTH:

❑ LIME

1. A small quantity of lime is required in brick earth. But if present in excess, it causes the brick to melt and hence brick looses its shape.
2. If lime is present in the form of lumps, then it is converted into quick lime after burning. This quick lime slakes and expands in presence of moisture, causing splitting of bricks into pieces.

❑ IRON PYRITES

1. The presence of iron pyrites in brick earth causes the brick to get crystallized and disintegrated during burning, because of the oxidation of the iron pyrites.
2. Pyrites decolorize the bricks.

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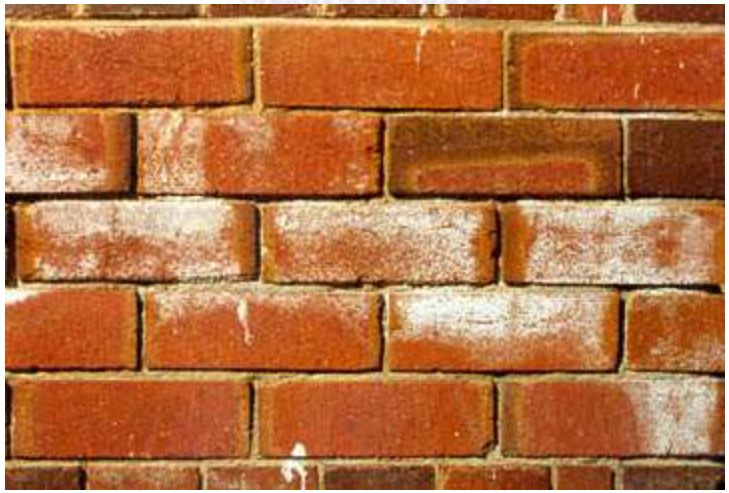
❑ ALKALIS

1. These are exist in the brick earth in the form of soda and potash. It acts as a flux in the kiln during burning and it causes bricks to fuse, twist and warp. Because of this, bricks are melted and they loose their shape.
2. The alkalis remaining in bricks will absorb moisture from the atmosphere, when bricks are used in masonry. With the passage of time, the moisture gets evaporated leaving grey or white deposits on the wall surface (known as **efflorescence**). This white patch affects the appearance of the building structure.



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❖ PRODUCTION OF BRICKS

❑ **SUITABLE EARTH OR CLAY:** Brick making requires adequate supplies of suitable soil, sand, water and fuel. Most suitable soil is the silty deposits of the rivers in southern Bengal where the plasticity properties are moderate. This soil is required to be modified by way of mixing the clay with sand in required proportion. Excessive clay particles present in the soil require more water for moulding bricks, but the bricks thus produced invariably crack while drying. Again, the presence of excessive sand particles in the soil will make the bricks extremely fragile when dried and this is also not desirable. Hence a suitable mix of both is desirable to ensure a balance for the best result.

❑ **MANUFACURING PROCESS:**

- Preparation Of Clay and Clay Mixing
- Moulding
- Drying
- Arrangements of Bricks
- Firing of Bricks

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- **PREPARATION OF CLAY AND CLAY MIXING:** The clay derived from digging or from alluvial river silt is properly and uniformly mixed with required quantities and qualities of sand and water. A pug mill is a most useful contrivance for proper mixing of wet clay ready for moulding. Cheap animal (mainly Bull) powered pug mills are produced locally and have been used for centuries and continue to prove successful even now. At present some brick manufactures use machines in pug mills. Animal powered pug mills are made of strong circular metal or timber tub approximately I meter high, with a vertical driven shaft in the center fitted with near horizontal blades. Wet clay is driven downwards by rotation of angled blades, get out and mixed by other blades and emerges from a small hole near the base of the tub. Animals are yoked to a beam which rotates the shaft. Foot treading can also be done but the same is not a very efficient process.

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- **MOULDING:** In moulding process, a wet mix of clay is thrown into a watted bottomless mould of wood or steel as it rests upon a wooden pallet. Excess clay is scrapped off by a straight wooden bar or iron bar called “striker”. Usually, the mould is removed immediately and returned to the moulding bench, re-wetted in a tub of water and used again. The mould has a fixed bottom with trade mark on it. The bricks are finally demoulded at the drying ground. This method of moulding produces bricks with a regular shape and a good finish including the fine detail of the trade mark in the frog of the bricks. Generally , one labour can mould 900 - 1000 numbers of bricks per day. Transportation of Green Bricks Specially designed large flat top wheel barrows are used to carry 20 to 30 bricks at a time to the drying area. The transportation of green bricks from drying area to chimney place where arrangement of bricks in clamp, by head load specially female worker may be used to carry 8 to 10 numbers bricks at a time.

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- **DRYING:** Drying can be done naturally by using the summer sun in tropical countries like ours. Of course this involves some land. On the contrary, artificial drying can also be done by utilising the hot flues of the chimneys and that can be arranged only in the case of the permanent brick production units. For minimizing the risk, the bricks are made as dry as possible before being put into the burning process.

- **ARRANGEMENTS OF BRICKS:** The arrangement of bricks requires different types of clamps for burning of clay bricks and considering their physical properties, certain imperatives are emphasized, as indicated in what follows. First, there should be 75 m.m thick coal on the periphery of the clamp in alternate layers excepting in the layers where pocket of coal is provided. Secondly, there should be 5 columns of coal from the bottom to the top, with 4 at the four comers and one at the centre. Finally, coal in pockets are to be provided after two solid layers from the bottom and then three solid layers are required to be repeated twice. Next, there should be 4 solid layers of bricks till the top is reached. Total quantity of coal needed varies between 22 and 23 tones per 100000 units of brick. This is adequate only if the quality of the coal is not very inferior. The capacity of the clamps should preferably be produced 30000 to 40000 numbers for the sake of economy. The size of the clamps should be 5.5 m x5.5mx 3.5 m (height).

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- **FIRING OF BRICKS:** Low heat is first applied to the green bricks in order to drive off any residual moisture. This should continue until no more steam comes off. Then the rate of increase of temperature of 50° c per hour may be safe. The temperature is required to the maximum extent of 900° c. Very careful burning is essential as the bricks are matured and acquire strength and durability during the final state of burning

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❖ **Various types of bricks used in masonry are** :

1. Common Burnt Clay/Mud Bricks.
2. Sand Lime Bricks (Calcium Silicate Bricks)
3. Engineering Bricks
4. Concrete Bricks
5. Fly ash Bricks
6. Fire Clay Bricks
7. Autoclaved Aerated Concrete (AAC) Bricks.
8. Hollow Bricks.

❖ Raw Materials for Brick

❑ Common Burnt Clay/Mud Bricks: mixture of loam, mud, sand and water mixed with a binding material such as rice husks or straw

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- Sand Lime Bricks (Calcium Silicate Bricks): silica sand, quick lime and water.
- Concrete Bricks: mixture of powdered Portland cement, water, sand, and gravel.
- **Fly Ash Bricks:** Fly ash, Sand/River Sand or stone dust, Sludge Lime/Hydrated Lime , Gypsum/Cement.
- Fire Clay Bricks: Fireclay, a normal mud, simple as that, but a mud with higher Alumina (Al) content.
- Autoclaved Aerated Concrete (AAC) Bricks: Fly ash or sand, Limestone powder, Cement, Gypsum, Aluminum powder/paste.
- Hollow Bricks: Portland cement, 10mm stone chips, sand and stone dust.

- Sizes of Brick

- Common Burnt Clay/Mud Bricks:- In accordance to IS Code sizes are:-

- Standard Modular Size : Length(L) x Width(W) x Height(H)

  190mm x 90mm x 90mm 190 90 40

- Non-modular size : 230mm x 110mm x 70mm

- In Eastern Part of India: 250mm x 125mm x 75mm

- Standard size used in other Parts of India: 230mm x 115mm x 75mm

- **Sand Lime Bricks (Calcium Silicate Bricks):** 190mm x 90mm x 90mm

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- **Concrete Bricks:** 390mm x 190mm x 190mm

  390mm x 190mm x 140mm

  390mm x 190mm x 125mm

  390mm x 190mm x

- **Fly Ash Brick:** 230mm x 150mm x 120mm

  230mm x 150mm x 100mm

  230mm x 100mm x 100mm

  230mm x 100mm x 75mm

- **Fire Clay Brick:** 229mm x 114mm x 64/32mm
- **Autoclaved aerated Concrete (AAC) Bricks:** 600mm x 200mm x 100mm to 300mm
- **Hollow Bricks:** 390mm x 125mm x 190mm

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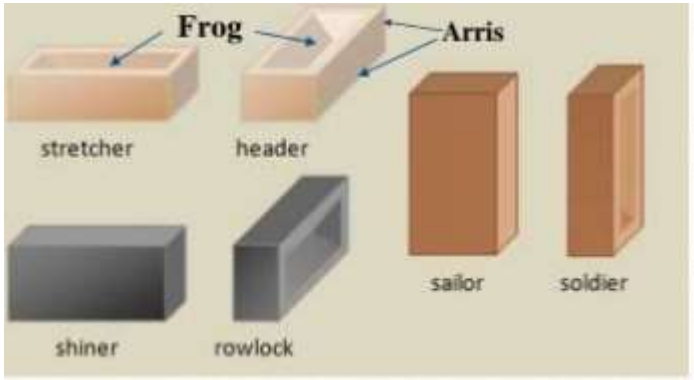
Fly ash Bricks

Fire Clay Bricks

Autoclaved aerated concrete (AAC) Bricks.

Hollow Bricks.



Thank You