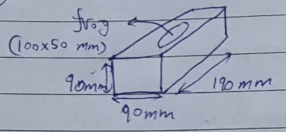
BRICKS

→ Obtained by molding clay in rectangular blocks of uniform size and then by drying and burning these blocks.

→ These replace stones as they are uniform in size, light in weight and can be properly arranged



Standard size of brick as per IS code = 190x90x90mm

Manufacturing of clay bricks

→ 1 Selecting a good earth

* Constituents of good brick earth

→ Alumina	(20-30 %)
Silica	(50-60 %)
Lime	(5 %)
Oxide of iron	(5-6 %)
Magnesia	(1-2 %)

2 Excavation of soil → cleaning, removing unwanted material

3 Dry and sieve → soil is dried & further sieved to clean

4 Water is mixed with soil

5 Moulding of bricks → ground molding → table moulding

6 Drying of bricks → Natural drying → artificial

7 Burning of bricks → Clamp burning → kiln burning

8 Transportation of bricks

Classification of bricks

① Unburnt or sundried bricks

→ dried with help of heat received from sun after moulding

→ only used in construction of temp & cheap structures.

→ should not be used at places exposed to heavy rain

② Burnt bricks

i) First class brick

→ Table molded → are standard shape

→ surface & edges are sharp, square, smooth, straight

→ have all good qualities of bricks and used for superior work of permanent nature.

ii) Second class brick

→ Ground molded → burnt in kilns

→ surface → somewhat rough & shape is slightly irregular

→ commonly used at places where brickwork is to be provided with a coat of plaster.

iii) Third Class brick

→ Ground moulded → burnt in clamps.

→ Not hard → have rough surfaces with irregular, distorted edges.

→ gives dull sound when struck together

→ used for unimportant and temporary structures & at places where rainfall is not heavy.

iv) Fourth Class bricks (Thama overburnt bricks)
→ Over burnt bricks with irregular shape & dark color.
→ used as aggregate for concrete in foundation, floors, roads etc.
→ Cuz they are over burnt → have compacted structure → sometimes stronger than first class bricks.

Good qualities of bricks
→ Charry red colour uniform throughout the surface & core.
→ shape & size must be as per standard code
→ Sharp & uniform edges
→ smooth surface with no cracks
→ If thrown on ground from 1m, should not break.
→ water absorption % should be less than 20 % of its weight.
→ When struck together clear sweet metallic ringing sound must be produced
→ Compressive strength of bricks must be more than 105 kg/cm².

Tests on brick

1) Compressive strength test
→ carried out on UTM → kept on UTM & force is applied until it fails.
→ force at which it fails is known as its strength.
→ Crushing of good brick should not be less than 105 kg/cm².

2) water absorption test
→ brick sample is taken & kept in oven for 24 hrs at 105°C.
→ taken out & weight is taken (W_1).
→ immersed in water for 24 hrs again weight is taken (W_2).
→ should not absorb water more than 20 % of its dry weight
% absorption of water by brick = $\frac{W_2 - W_1}{W_2} \times 100$

3) Efflorescence
→ If water is absorbed by brick is more than 20% of its dry weight; it will react with salts present in brick & when water gets evaporated salts deposit on surface of bricks. This is called efflorescence
→ These white deposits or salts damages bricks & causes ugly appearance.
→ Good bricks do not exhibit efflorescence.

Mortar

→ Workable paste used to bind bricks or blocks together & fill gaps b/w them.

→ Paste prepared by adding required quantity of water to mixture of binding material like cement or Lime and fine aggregates like Sand.

→ The two components of mortar namely the binding material & fine aggregates are some times referred to as matrix.

→ Durability quality & strength of mortar depends on quantity & quality of matrix.

→ The combined effect of the two components of Mortar is that the mass that is able to bind the bricks or stones firmly.

Uses of Mortar

i) Bind building units such as bricks, stones etc
ii) To carry out pointing and plaster works on exposed surfaces of masonry.
iii) To form an even bedding layer for building units.
iv) To form joints of pipes
v) To improve appearance of structure.

Properties of good mortar

1) Should be capable of developing good adhesion with the building units such as bricks, stones etc.
2) It should be capable of developing designed stresses
3) Should be capable of resisting penetration of rainwater
4) It should be cheap.
5) It should be durable
6) " " " easily workable
7) It should not affect the durability of materials with which it comes into contact with.

Cement

→ A substance which acts as a binding agent for materials.

→ Natural Cement (Roman cement) is obtained by burning and crushing the stones containing clay, carbonates of lime & magnesia

→ Chemical composition of raw material used for manufacturing of cement.

1)	Lime	$CaCO_3$	60 – 70 %
2)	silica	SiO_2	17 – 25 %
Clay 3)	Alumina	Al_2O_3	3.0 – 8 %
Clay 4)	Iron oxide	Fe_2O_3	0.1 – 4 %
Clay 5)	Magnesia	MgO	1 – 3 %
Clay 6)	Sulphur trioxide	SO_3	1 – 3 %
Clay 7)	Soda & potash	Na_2O & K_2O	0.4 1.3 %

Types of Cement

1) OPC Ordinary portland cement
2) PPC Portland Pozzolana cement
3) White cement - white washing
4) Coloured cement - fill gaps, decoration
5) Quick setting cement → settles faster
6) High Alumina
7) High Strength
8) Low Heat
9) Rapid hardening
10) Sulphate Resisting

Lab test on Cement

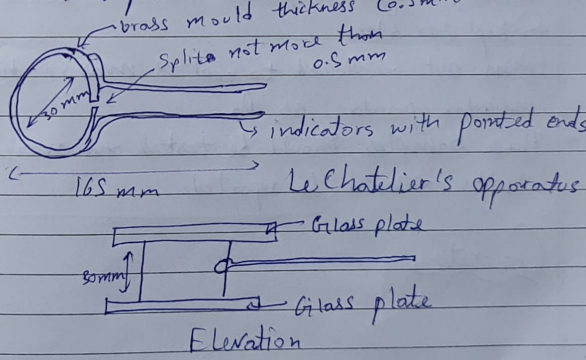
1) Compressive strength test
2) Soundness test
3) Setting time test
4) Fitness test

Soundness Test of cement

→ said to be sound when percentage of free lime & magnesia is within specified limits.
→ these materials expand in structure thus concrete & mortar also expands causing unequal expansion of paste.

Apparatus & Materials

→ Le-Chatelier apparatus
→ Weighing balance accurate up to 0.1gm.
→ Water bath with electric heating arrangement
→ Measuring cylinder
→ Glass plates



→ Prepare a cement paste by gauging cement 0.78 times water required to give paste of standard consistency

→ 3< gauging time <5
→ Mould is kept on a glass plate and is oiled
→ Oil the inner surface of mould & place the mould on glass sheet & fill it with cement paste making sure to keep edges of mould gently together.
→ Cover mould with another piece of glass sheet over which a small weight is kept
→ This apparatus is immediatly submerged the whole in water at temp 27°c & kept for 24 hrs
→ taken out → after 24 hrs → ~~indic~~ dist b/w indicators is recorded as D1.
→ submerged again → after water has boiled for 25-30 min & kept for 3 hrs
→ taken out → allowed to cool → measure dist. b/w indicator points as D_2
→ Three samples should be tested and average of results should be reported

Concrete

- Mixture of cement, sand, pebbles or crushed rock & water.
→ When placed in skeleton of forms and allowed to cool, becomes hard like a stone.

It is imp building material due of following reasons.
→ It can be moulded into any size & shape of durable structural member.
→ Possible to control properties of cement concrete
→ Possible to mechanize preparation and placing processes.
→ It possesses enough plasticity for mechanical working.

Ingredients of Concrete

→ Coarse aggregate
→ Fine aggregate
→ cement
→ Water
→ Admixtures

Two types of mixing proportioning

Nominal mix
~~Regio~~ Design mix

Requirements of Good Concrete

1) Aggregates should be hard & durable & properly graded, 20 mm size of aggregate is suitable
2) Cement should be in sufficient quantity.
3) Water should be free from oil and organic matter.
4) Mixing should be done thoroughly.

5) The quantity of water should be sufficient to produce the needed consistency.

6) Concrete should be compacted properly to prevent it from being porous