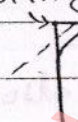

* Types of Mortar to be used for diff^t Constructⁿ Activities :-

Type of Const ⁿ	Types of Mortar
(1) Pointing Works	Cement Mortar 1:1
(2) Damp proofing Course (DPC)	" " 1:2
(3) Concrete Pavement	" " 1:2
(4) Plastering	" " 1:3 / Lime Mortar - 1:2
(5) Masonry in Super - Structure	" " 1:3 / " " - 1:2
(6) Masonry in found ⁿ	" " 1:6 / " " - 1:3

Pointing work. (Good str. is req^d to prevent damage)



★ — ★ — Brick — ★ — ★ — ★ —
Constituents of Brick Earth:-

- (1) Alumina (20-30%)
- (2) Silica (50-60%)
- (3) Lime (4-5%)
- (4) Oxide of Iron (5-6%)
- (5) Magnesia (1%)

(1) Alumina (20-30%) :-

(i) It imparts plasticity to the brick earth so that it can be easily moulded. If it is in excess it causes shrinkage and warping of bricks during drying and bricks become too hard when burnt.

(2) Silica (50-60%) :- Silica prevents cracking, shrinkage warping of bricks thereby helps in providing uniform shape to the bricks.

If it is in excess it destroys the cohesion b/w the particles so the bricks become brittle.

(3) Lime (4 to 5%) :- (i) Lime also prevents the shrinkage in bricks, if it is in excess it causes the bricks to melt during the burning process hence results in its lost shape.

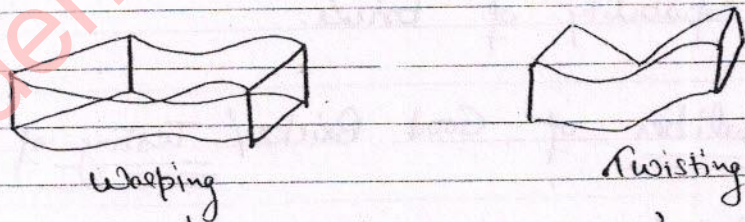
(ii) During the burning of bricks limestone gets converted into quicklime which absorbs the moisture and undergoes slaking as the result of which it leads to cracking and disintegration of the bricks.

(4) Oxide of Iron (5 to 6%) :- Iron oxide helps in Silica and lime to fuse with each other thereby it imparts strength to the bricks. It also induces reddish brown tint in the bricks.

(5.) Magnesia (1%):- Magnesia's presence also prevents the shrinkage in bricks and induces yellow tint in it,

Harmful Ingredients in Brick Earth:-

- (i) lime \rightarrow B'cos of Slaking.
- (2) Iron Pyrite:- Presence of Iron pyrite leads to crystallization and disintegration of bricks during the burning due to their oxidation.
- (3) Alkalies:- (i) Alkalies acts as a flux during the burning process if they are in excess they leads to fusing of bricks with each other thereby results in it's twisting and warping.

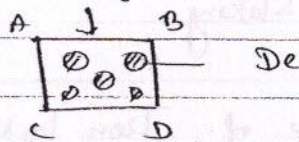


- (ii) Presence of alkalies also leads to efflorescent and staining of bricks (same as cement).

(4) Stones / Pebbles :-



Presence of stones and pebbles in earth brick leads to the formatⁿ of weak and porous brick due to reductⁿ in area through which load gets transferred



(5.) Organic / Vegetative Matter :- It helps in burning of bricks, but if left unbunt results in formatⁿ of gases during their decompositⁿ, which (Gas) when escapes out from it results in the formation of numerous cracks which intuen reduces the load-carrying capability of bricks.

→ Qualities of Good Bricks / Testing of Bricks :-

- (i) The bricks should be table moulded, well bunt and free from cracks.
- (ii) The bricks should be of uniform shape and size.

Std. Size 19cm x 9cm x 9cm

Conventional Size 23cm x 11.4cm x 7.6cm

" Weight of 1 m³ of brick → 1800 kg "

Wt. of single brick - 3.5 to 3.6 kg.

(iii) The brick should produce clear metallic ringing sound when struck with each other.

(Soundness Test)

(iv) The brick should possess uniform homogenous structure along any section.

(Structure Test)

(v) The bricks when immersed in water for 24 hours should not absorb more than 20% of water by weight in case of 1st Class bricks.

and by not more than 22% in case of 2nd Class bricks.

(Absorption Test)

(vi) The bricks should possess min^m comp^{sv} strength of 5.5 N/mm^2
(-: Comp^{sv} Strength Test: -)

(vii) The brick should not break into pieces when dropped on levelled ground from height of 1m.

(Toughness Test)

(viii) The brick should possess sufficient hardness as doesn't show any impression when scratched with finger nail.

(Hardness Test)

(ix) The bricks when immersed in water for 24 hrs should not show any sign of efflorescent and staining.

(Alkalies Test)

Manufacturing of Bricks :- (i) Manufacturing of bricks is carried out in 4 distinct operations.

(1) Preparation of clay (2) Moulding (3) Drying (4) Burning.

(1) Preparation of clay :- It is carried out in following

sequence :- (a) Unsailing :- (i) In unsailing top 200mm soil is thrown and is not used for preparation of bricks as it consists of most of the impurities.

(b) Digging :- In this process soil is dug out and thrown over the new level field for making it ready for next operation of cleaning.

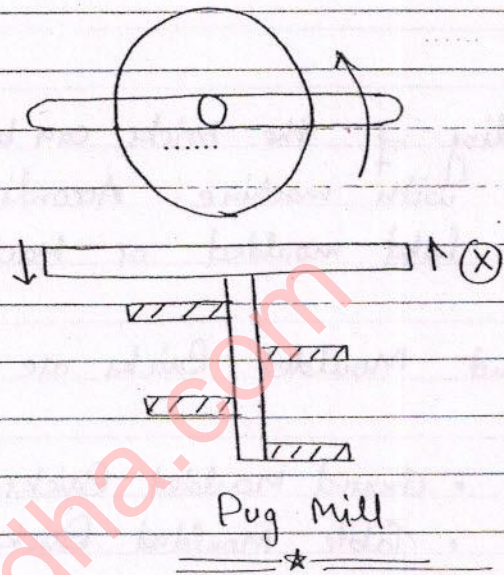
(c) Cleaning :- It is the process in which stones, pebbles, vegetation / Organic matter, or any other impurity present in brick earth is removed.

(d) Weathering :- It is the process in which cleaned clay is exposed in atmosphere for few weeks to few months in order to carry out its softening, mellowing, ripening or weathering.

(e) Blending :- It is the process in which different ingredients of brick earth are spread over the weathered clay in required proportion.

(f.) Tempering :- Tempering is the process in which 2nd plasticity is induced in Brick earth so as to make it fit for next operation of Moulding.

Tempering is generally carried out in Pug Mill.



Moulding of the bricks :- Moulding is the process of giving the desired shape and size to the bricks.

Moulding is done with the help of ~~holes~~ moulds which may either be steel or wood.

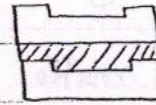
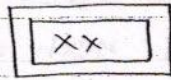
→ Size of which is kept to be 8 to 12% greater than desired size of bricks.

(In order to account for shrinkage during drying and burning)

- A mark of Approx^y depth of 10mm to 20mm is placed over the surface of the brick is termed as "flog" Mark. That serves following two purposes.

(i) It is used to indicate the plate name of manufacturer.

(ii) It act as a key during the laying of bricks one over each other

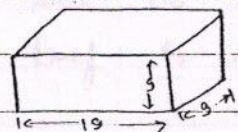


"Frog Mark"

- Moulding of the bricks can be done either with help of hand or with machine. Accordingly they are classified as hand moulded or Machine moulded Bricks.
- Hand Moulded Bricks are further of two types:-
 - Ground Moulded Bricks.
 - Table Moulded Bricks.
- Quality of table moulded Bricks is comparatively better than the quality of ground moulded bricks.
- Machine moulded bricks are also of two types:-
 - Plastic Clay moulded Bricks
 - Dry clay moulded Bricks. (Best Quality)

→ Drying of Bricks:- Moulded bricks if are directly burnt without drying it may result in it's cracking or disintegration due to excessive loss of moisture from brick.

- Hence drying is carried out before burning. In which it's moisture content is reduced upto 2%.
- Drying of the bricks can be carried out either naturally or artificially.
- During the drying of the bricks they are never placed along their face but are always placed along their edge in order to increase the rate of evaporation.



(i) $19 \times 9 \times 3$

(ii) $2 \times 9 \times 9$



$\rightarrow 19 \times 9 \times 4$

$\rightarrow 9 \times 9$

4. Burning of The Bricks:- (i) Burning of the bricks imparts strength and hardness to it and makes bricks durable and dense.

(ii) Burning of the bricks should be carried out properly as if bricks are overburnt it makes them brittle, hence it can be easily broken and if bricks are left unburned underburned bricks remains soft and are not able to carry design load.

(iii) The burning of bricks is carried out 1100°C at which lime and silica fuse with each other thereby imparting strength to the bricks.

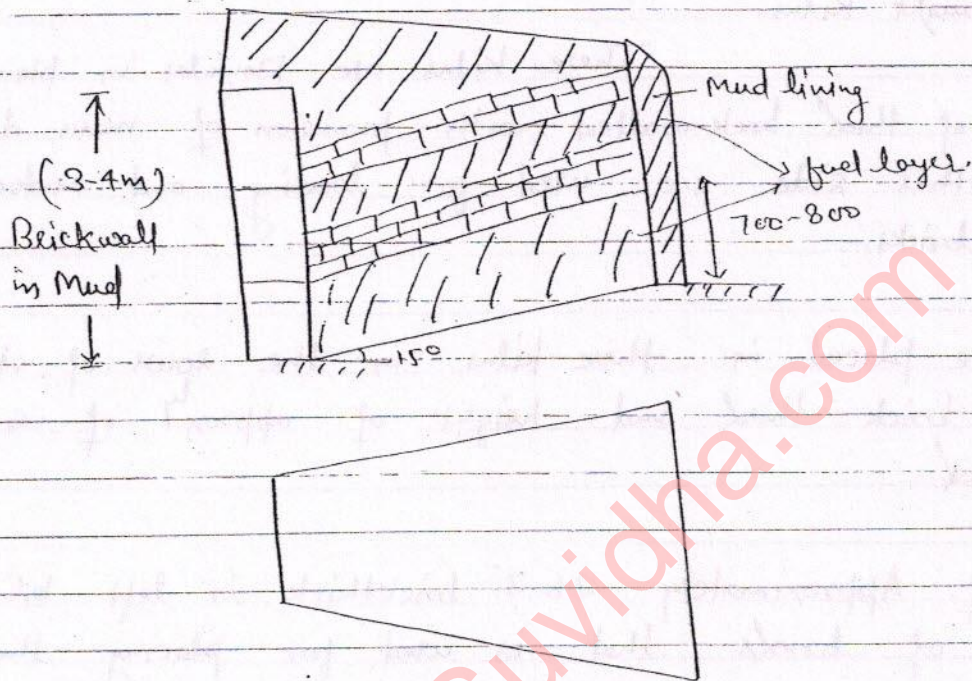
(iv) Burning of the bricks can be carried out either in clamps or in kilns.

(A) Clamps :- In order to prepare the clamp a level piece of ground is selected which is Trapezoidal in plan. Shorter side of which is constructed in excavation and longer side is raised by an angle of 15° . Brick wall in mud is constructed along the shorter side of clamp and a layer of fuel of approximately 700-800 mm is placed over the levelled ground. over which bricks in the layers of Approx^y 4 to 5 courses is laid that is further followed by another layer of fuel over it. Hence

It subsequently leads to the formatⁿ of alternate layers of fuel and bricks laid over each other.

- In clamps locally available fuel like grass, ricehusk ash, wood, cow dung or cold dust is used for burning of bricks.
- The total height of clamp is Approx^y 3 to 4 m. When $\frac{1}{3}$ rd of the height of clamp is constructed. fuel in the lower layers is ignited along with the subsequent construction of the remaining clamp.
- When the entire clamp is constructed it is covered with the layer of mud in order to avoid the escape of heat out of it.
- Burning of bricks is carried out for approximately 2-3 months. that is further followed by it's cooling for the same duration.
- No supervision is req^d in clamps moreover locally available fuel is used burning is comparatively economical in Clamps.

- Fire cannot be regulated in these clamps hence the quality of the bricks obtained from it is not regular.



(B) Kilns :- These are large size oven that are used for the burning of the bricks. Kilns are generally of two types intermittant kilns and Continuous Kilns.

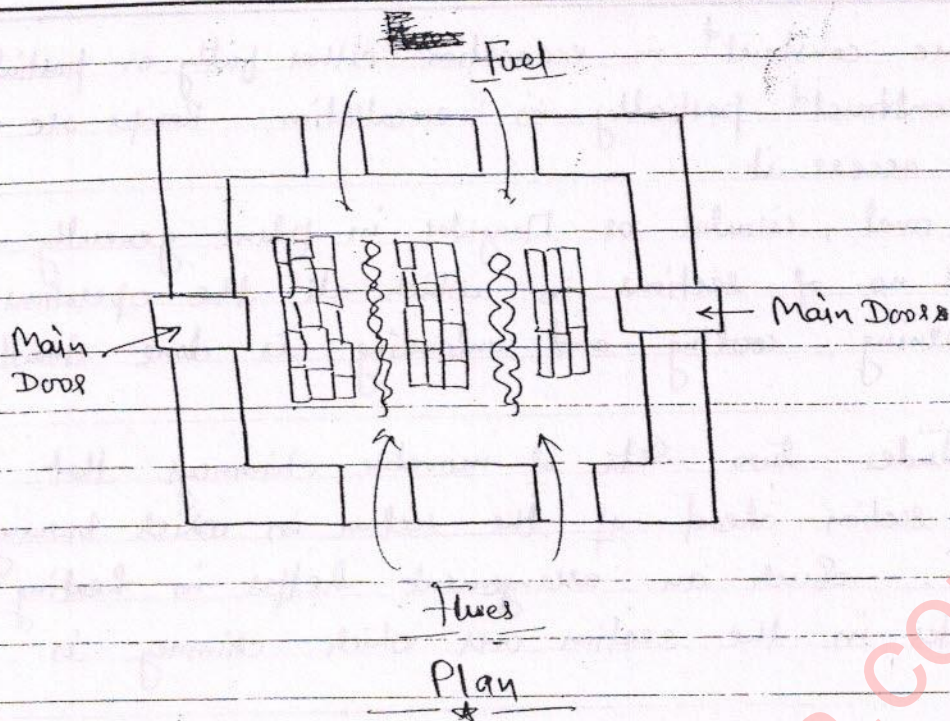
- If the supply of the bricks is not continuous from these kilns are referred as intermittant kilns, ^{And} if the supply is maintained to be continuous is referred as Continuous type kilns.
- In intermittant kilns, all the operations of loading, burning, cooling and unloading is carried out seperately. Hence the supply of the bricks is not insured to be Continuous.

Intermittant Kilns are further of two types:-

- Up draught Kilns
- Down draught Kilns.

These Kilns are Rectangular in plan and consist of thick brick walled with provision of main doors on either side i.e. used for loading and unloading of bricks.

- Bricks are placed in these kilns in the rows of approx^y 3 to 4 brick thick and height of approx^y of 6 to 8 brick thick.
- Space of Approximately 2 to 3 brickthick is left b/w two rows of bricks that is used for placing the fuel in kilns.
- If the movement of gases is allowed to take place in vertically upward directⁿ it is termed as "Up-draught" kilns. But if the movement of the gases is allowed to take place in vertically downward directⁿ is termed as down draught Kilns.
- Downward movement of gases in these kilns is insured by provision of permanent roof and central fixed chimney.
- Quality of bricks obtained from down draught Kilns is comparatively better than that of obtained from up draught Kilns.



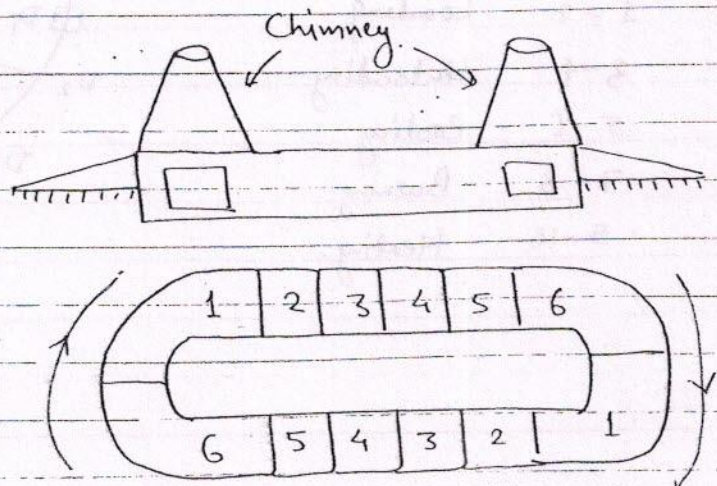
→ In Continuous Type Kilns, the supply of the bricks is maintained to be continuous as all the operations of loading, burning, cooling and unloading is done simultaneously.

• Continuous kilns are further of 3-types

- Bull Trench
- Hoff Man Kiln.
- Tunnel type

(A) Bull Trench Kiln :-

Today	Tomorrow
1 - Loading	1 - Heating
2 - Empty	2 - loading
3 - Unloading	3 - Empty
4 - Cooling	4 Unloading
5 - Burning	5 Cooling
6 - Heating	6. Burning

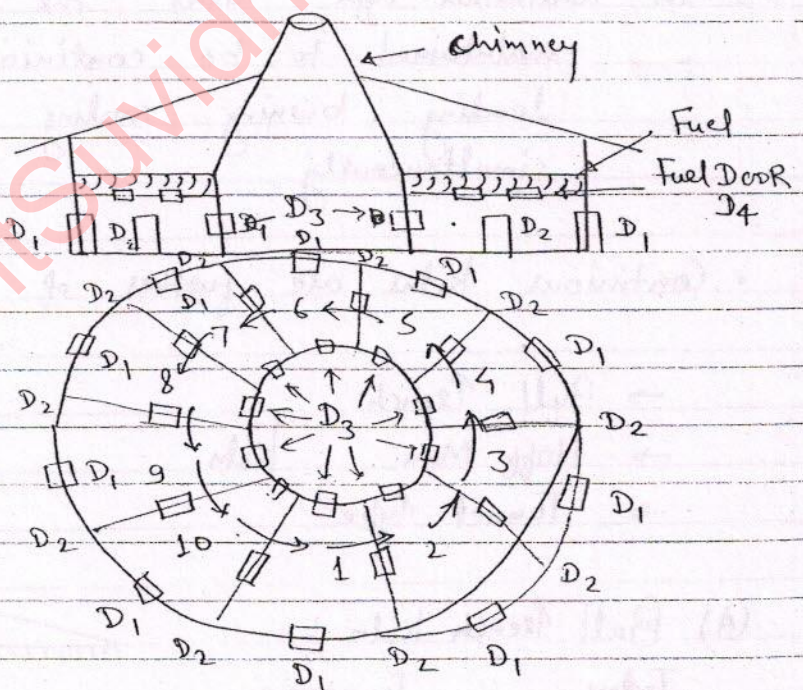


- This kilns are construct^d in excavation either fully or partially.
- If they are construct^d partially in excavation, Ramps are provided to access it.
- This kilns are oval, circular or Dangular in plane generally and consist of no. of sections in which all the operations of loading, burning, cooling and unloading is done simultaneously.
- It also includes two sets of movable chimneys that are placed a section ahead of the section in which burning is to be done. Such an arrangement helps in heating of the bricks in the section over which chimney is placed.

(B) Hoffman Kiln :-

- D₁ - Main Door
 D₂ - Communicatⁿ Door
 D₃ - Radial flue door
 D₄ - Fuel Door
 ...

- 1-2 Loading
 3-4 Unloading
 5-6 Cooling
 7-8 Burning
 9-10 Heating



- (i) Hoffman's Kiln is circular in plan and consist of no. of chambers in which all the operations of loading, burning, cooling and unloading is done simultaneously.

This kiln consist of central fixed chimney unlike "Bull Trench" Kiln in which movable chimneys were used.

- (ii) Continuous supply of bricks is ensure in this kilns by sequentially opening and closing of different sets of doors.
- (iii) Initial cost of Hoffman Kiln is compairitively more than that of "Bull Trench" kilns but lesser maintainance cost.
- (iv) Capacity of it is compairitively more than that of Bull Trench Klin.
- (v) As fire can be easily regulated in these type of Kilns quality of brick obtained is also compairitively Better.

(c) Tunnel Kiln :- (i) These Kilns are in the form of tunnels which may either be circular, oval or Dangular in plan.

- (ii) It consist of stationery zones in which loading, burning and cooling of the bricks is carried out continiuesly.

- (iii) Bricks are placed either on trolleys or on conveyers beds & passed through the different stationaly are zones in tunnel.

- (iv) Reqmnt of land in this type of kiln is more.

