* HISTORY
  - Buildings : huts with the help of leaves
  - Bridge : Swing

* Constructs :- Building, Road, Bridge, Dams, Canals, monuments, Railways, Chimney, retaining wall, metro, Water tank

* Role of Civil Engineer
(1) Verify the design whether it is correctly according to stimulus. (PLANNING PHASE)
(2) Estimates the materials required. (CONTROLLING PHASE)
(3) Supervise smoothness of execution (EXECUTION PHASE)

* **Area of Civil Engineering:**
- Building Construction Engineering
- Structural Engineering (Design & Analysis)
- Earthquake Engineering
- Geotechical & foundation (Deals with soil)
  ↳ lowest part of any structure
- Irrigation Engineering
- Transportation Engineering (Highway, railway, airport, port & Harbour, metro)
- Remote sensing
- Urban planning
- Environmental Engineering
- Infrastructure development
- Project Management
- Fluid Mechanics

Survey - Study of Map, how to create a

BASIC CIVIL ENGINEERING MATERIAL

- Cement
- Brick
- concrete (sand [fine aggregate, coarse aggregate, cement, water])
- Steel
- Stone
- Glass
- Timber
- Mortar [cement, sand, water]

CEMENT:

Limestone + (Calcareous material) [illegible]

(1) Wet process:

Step 1 Limestone (calcareous material) + Bauxite, clay (Argelaceous material) stone (silica amount more)

Step 2 Add water, make slurry

Step 3 Give temperature of 1450°C to the mixture. (Rotary kiln)

Step 4 Formation of clinker

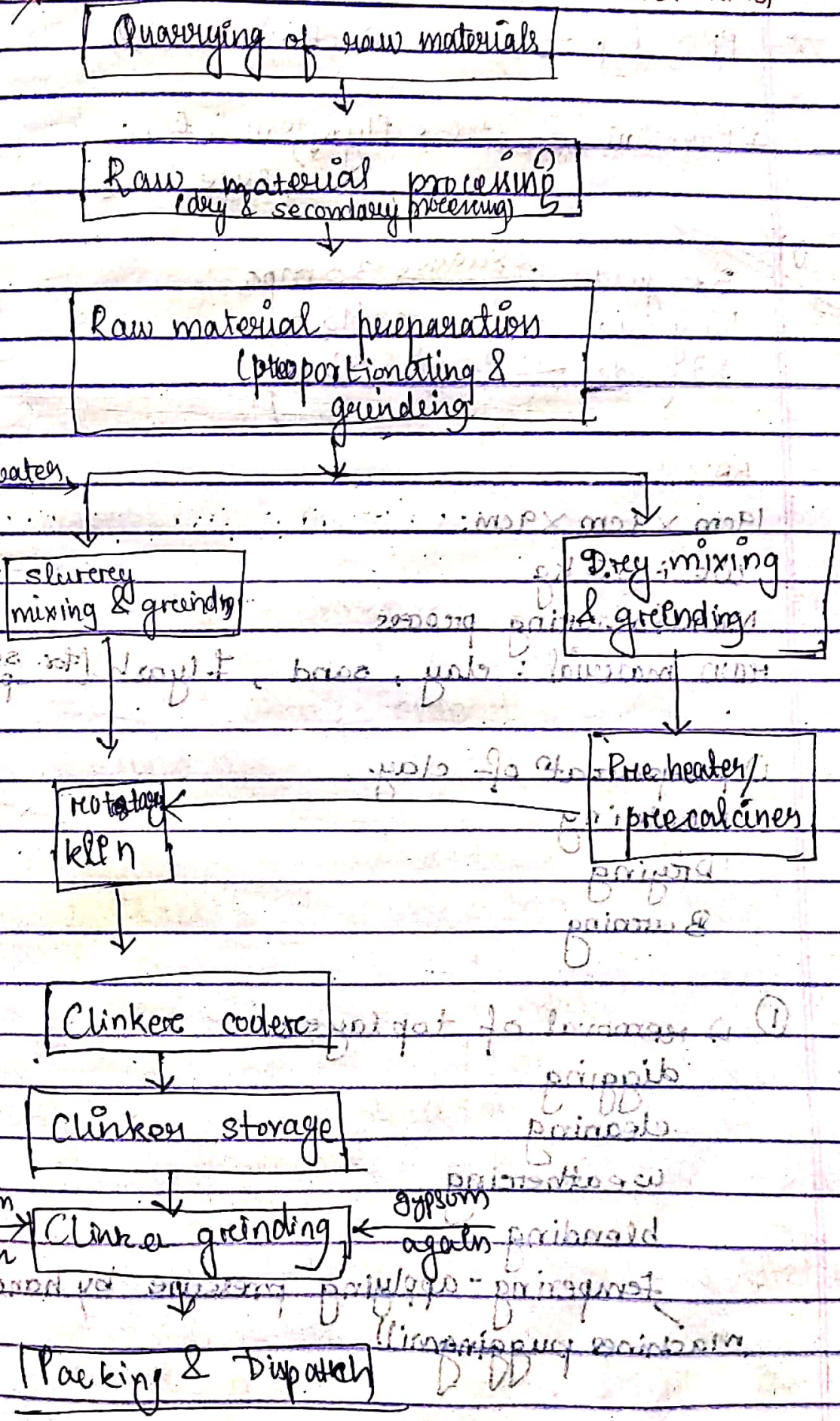
Step 5 Add gypsum

Step 6 Grind the mixture

Step 7 Collect the cement at the storage tank.

② Dry process :- pre heater is needed & then same process as wet process.

FLOW CHART OF CEMENT MANUFACTURING



Types of Cement:

→ OPC (Ordinary Portland Cement)

→ PPC (Pozzolanic Portland Cement)

* Pozzolinic material : flyash, silica fume, rice husk

OPC

33 grade — 28 days → 33 mpa
43 grade — " → 43 mpa
53 grade — " → 53 Mpa

BRICK

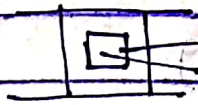
19cm x 9cm x 9cm
wt : 3.5 kg
Manufacturing process
raw material : clay, sand, flyash (for some specific)

1) preparation of clay
Moulding
Drying
Burning

① i) removal of top layer
digging
cleaning
weathering
blending
tempering - applying pressure by hand/machine
machines puggingmill

Pugging

Moulder (20cm x 10cm x 10cm)



funct^n: It shows the manufacturer trade name
It acts as a shear key for machinery working

Ground moulding - rough surface
since the bottom part of brick was in contact with ground so it was rough.
Table moulding - smooth surface
Ground moulding - rough

Machine moulding
- Plastic clay machine (add water)
- Dry " "
  - compress & make standard size
  - no need of drying
  - strength is less

Plastic - strength more (used more for manufacturing)

rough surface - slub moulded brick (by adding water)
Sand moulded brick (by flyash or by sand make the bottom surface smooth.

Drying

1) to reduce the moisture content & save fuel.
2) to avoid chances of crack.
3) to get sufficient strength (raw bricks) so that it can be stacked

Burning

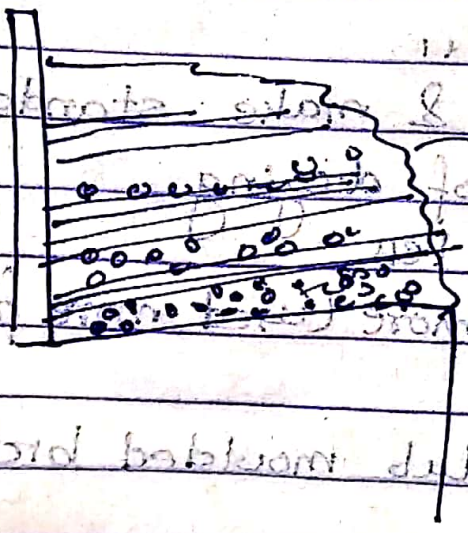
1. Clamp burning (Pazawan)
2. Kiln " (Bhatta)
3. High quality brick

STEPS OF CLAMP BURNING

1) Construct a vertical wall.
2) Adjacent to it, make a sloping floor.
3) Add fuel like coal, charcoal in the slopping floor.
4) Alternate layers of fuel & brick.
5) Cover it with mud.

brick will burn.

After 3- 4 months, remove mud



CLAMP BURNING ADVANTAGES

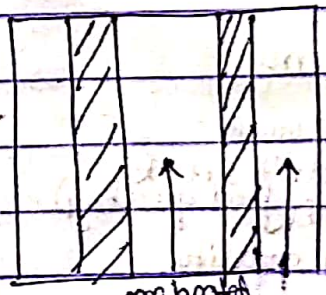
- ★ Bricks are tough & hard.
- ★ Cheap & economical
- ★ no skilled labour
- ★ lot of saving in fuel

DISADVANTAGES

- ★ Slow process
- ★ fuel regulation is not possible
- ★ Irregular shape of brick
- ★ bottom brick - more compressed so irregular
- ★ Quality of brick not uniform (bottom excess burned)

Klin Burning

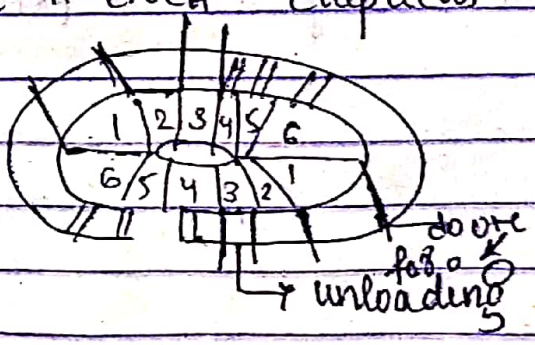
- Intermittant klin
  - upward (bottom to top)
  - downward
  - (according to direction of flow of gas)
- countinous klin
  - Bool trench
  - Hoffman
  - loading, preheating, heating, burning, cooling, unloading



Intermittant klin

COUNTINUOUS KLIN

BOOL TRENCH - Elliptical



①	Loading	disadvantages
2	Empty	It will standstill in
3	unloading	the rainy season
4	Cooling	
5	Heating (slow)	
6	heating (slow)	

In countinous klin process, 25000 - 40 lakhs of bricks can be burned in 1 day.

HOFFMAN (Circular type)

Test on brick

- ★ Physical Test
- ★ Laboratory Test

PHYSICAL JEST

- Colour - It should be uniform
- Shape & Size curve: not of good quality
- Strength (1 m free fall, if didn't break it is of good quality)
- Hardness - "no impression" if scratched, good quality
- Soundness - clear & metallic sound - good quality
- Texture - if no vegetative part or texture is hard
- Durability
- Inner structure - if soluble salt or void or gravel is not present.

Laboratory Test :-

- ~~Testing~~ crushing strength
- Water absorption
- Efflorescence

Crushing strength

(1) The brick specimen are immersed in water for 24 hours.
(2) The frog of brick is filled with 1:3 cement mortar (cement 1 part & 3 parts sand) & the specimen is stored in damp jute bag for 24 hours.
(3) Immerse it in clean water for 3 days.
(4) The specimen is placed in compression testing machine with 6mm plywood on top & bottom surface of the specimen (to get uniform load on the specimen
(5) The load is applied axially at uniform rate of $14 N/mm^2$.
(6) The crushing load is noted.
(7) The crushing strength is calculated the ratio crushing load to the area of brick surface
(8) Avg 5 specimen value is taken as crushing strength.

Water Absorption

(1) Take brick specimen & weighed in dry condition.
(2) Then they are immerse in water for 24 hrs.
(3) The specimen is taken out & wiped out through a cloth. Again weighed in wet condition.
(4) The difference in weight indicates the water absorbed.

The percentage of water absorption is ratio of

water absorbed to dry weight & multiply with 100
% of water absorptn.

$$\frac{W_2 - W_1}{W_1} \times 100$$

for good quality, it should not exceed 20%.

Efflorences

1. Place the brick specimen in a glass dish containing water upto a depth of 25mm. in a well ventilated room.
2. Again after all the water is absorbed, again add water upto depth of 25mm.
3. Then after 2nd absorption, observe the bricks for white/grey patches.

- ~~No patches~~ : no efflrences
- slight - upto 10% of area is covered with patch
- moderate - 10% - 50% " " "
- heavy - more than 50% but unaccompanied serious with flaky surface.
- serious - more than 50% but accompanied with flaky surface

TYPES OF BRICK

A/c to strength of brick, there are 4 types of bricks

1st class
2nd class
3rd class
4th class

1st class	2nd class	3rd class	4th class
- These are well standard shape & size, of uniform colour. - burnt in klin & table moulded. - crushing strength min - 10.5 N/mm² - water absorption (15 - 18 %) Uses - road, building, arches, stadium etc.	- round edges - burnt in klin (faded colour) & ground moulded - crushing strength ∓ N/mm² or ∓0 kg/cm (min) - water absorption :- 22 % - Uses: masonary wall whose face are plastered, load bearing wall with single storage.	Irregular shape & size - clamp burning & ground moulded - faded - Crushing 3.5 N/mm² - water →25 % Uses: inferior & temporary wall i bound any wall	Irregulary brittle & hard - over burnt (may be clamp or klin) dark colour - max crushing 8 ∓ :- 3.5 - water more than 25 Uses: used as aggregate in floor & foundation work

→ Cement mortar

Cementious material — Sand

★ Mortar is the combinat^{n} of cementious material & sand.

★ Cementious material in cement mortar is cement.

★ **Preparation of Cement mortar:**

Take 1 part of cement & mix with 3 parts of sand. Then, the mixture is mixed thoroughly in dry condition.

After proper mixing, add water of amount half of weight of cement.

Again the mixture is mixed thoroughly so that no water will be flow off.

★ **Uses:**

(i) In masonary structure
(ii) In flooring surface
(iii) Plastering
(iv) Repair work

Concrete mortars

It includes

Cementi cementi ous material	fine agrem ent (sand)	Coarse aggregate	Water	Admixtures (optional)	enhance the quality of concrete
					Chemical / mine

★ Types

(i) PCC (Plain Cement Concrete)

(ii) RCC (Reinforce Cement Concrete)

★ Reinforcement bars (steel rod)

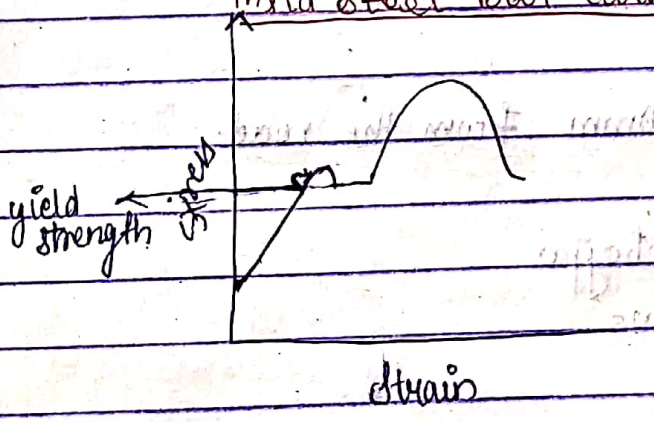
Types : (a) Mild steel bars - more ductility — Yield Stress 250 N/mm²

High Yield Strength Deformed Bar (HYSD)

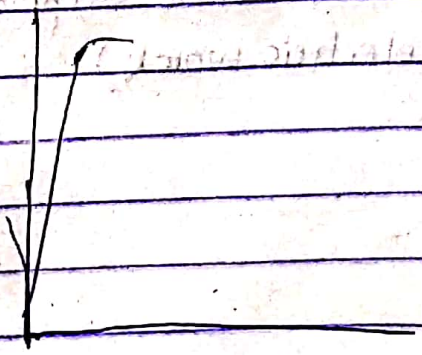
↓

TMT Bars (Thermo mechanical Treated bars) — Yield stress 450 N/mm² / 500 N/mm²

Mild Steel Bar Curve



HYSD Curve



Midsem : mod ① & ②

★Building Planning :

→ Requirements
→ Elements
→ Orientation Planning
→ Environmental suitability Planning
→ Utility
→ Economic & feasibility planning

→ Requirements of Building :-

- to take shelter
- to store the materials
- to maintain the privacy
- to solve various purpose

→ Elements

- foundation
- plinth = min 150mm from the road.
- wall & column
- Sill, lintels & chajjas
- Doors & windows
- Floor
- Roof
- stairs & ramp
- finishing work (like plastering, painting, white washing
- Building services (like water supply, sanitation & drainage work, electric work).

* plinth: It is the portion of wall b/w the ground level & ground floor level.