

i) Clamps: They are used where requirements are less & minimum.

→ They are temporary structures.

ii) Kilns:

They are used where the requirements are more & maximum.

Methods of manufacturing of bricks:

① Clamps: first ③ stages are same but burning is diff.

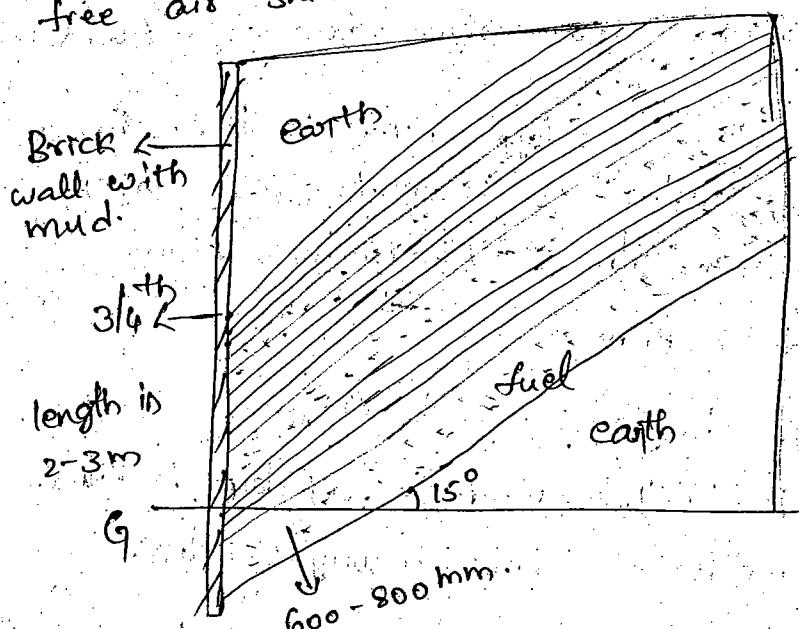
→ Clamps are made by trapezoidal form.

2 plains are same & other 2 plains are unequal in size.

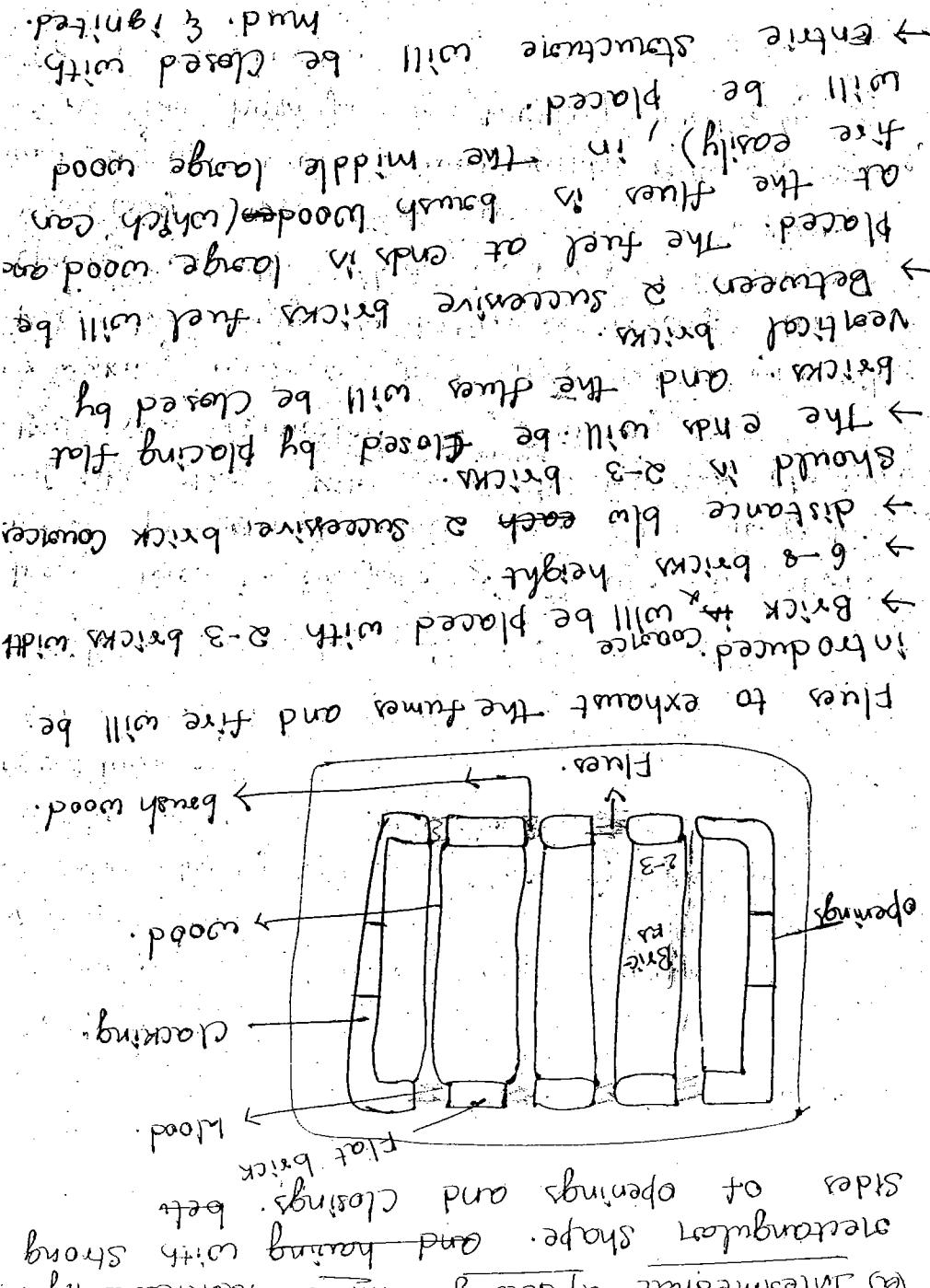
Process: Select a piece of ground level. The plain is fixed in such a way its short end is in excavation and $\frac{long\ end}{15^\circ}$ angle to ground level. Construct a brick wall with mud. The fuel is filled up on the surface of the clamp upto 600 to 800 mm size. The fuel used is prepared with mix of rice ground nut, cow dung. Now bricks will be placed 2-3 layers. Now the upper part of bricks are covered with fuel.

But the size of the fuel is gradually decreases from bottom to top. Again 3/4

layers of bricks are placed followed by fuel. Again bricks are placed. This process is continuous for various layers. Then the all the layers are filled with /Covered with a mud layer. The length of the clamp is 2-3 m. While construction of clamp is going on if $\frac{3/4}{4}$ part upto 2-3 m the fuel is ignited. After full construction it will be allowed to burn upto 1-2 months. If any sudden burns & blasts are observed by cracking of mud layer and fumes will come out. Proper precautions has to be taken and proper edgers should be laid such that to control. Free air should pass.



Then cooling is done and then extracted.



Advantages:

- If can overcome to wind & rain.
- The brick is rough, the gradual burning and cooling gives strength.
- Uneven burning i.e., the bottom bricks are burnt more than the top bricks are unburnt.
- It's adiabatic.
- Not required any skilled labour.
- The girded burning.
- The sides of openings and closings. better shape. and having with showing

Disadvantages:

- Uneven burning i.e., the bottom bricks are burnt more than the top bricks are unburnt.
- It's adiabatic.
- Not required any skilled labour.
- The girded burning.
- The sides of openings and closings. better shape. and having with showing

Bottom brick → Igneous inside the clamp.

Side of brick → Igneous below.

Bottom brick → Igneous over burnt of 4 turns.

Kilns: → This is a type oven to burn brick to 60 o.s.h.

Types of Kilns: → (i) Intermediate Kilns. (ii) Continuous Kilns.

(i) Intermediate Kilns:

- The ends will be released by placing flat should in 2-3 bricks.
- distance b/w each a successive brick course 6-8 bricks height.
- distance b/w each a successive brick course should in 2-3 bricks.
- The ends will be released by placing flat.
- Between a successive successive bricks fuel will be kept.
- The fuel at ends in large wood can place.
- At the flues in brush wood (which can easily) in the middle large wood will be placed.
- Entire structure will be closed with mud. & ignited.

(ii) Intermediate Kilns:

- They are selecting a certain shape.
- They are intermediate down strength kilns.
- They are intermediate up strength kilns.
- Alternative beginning and setting.

- Regulate the fire by taking out and keeping wood.
- First 3 days minimum temp. is applied.
- Heavy heat is applied ~~at upto its~~ when reaches 48 to 60 hrs.
- Cooling is done for 7 days.

Advantages:-

- More strong bricks than from clamps.
- Fire can be controlled.
- Disadvantages:-
- In even burning will be taken places.

(b) Intermediate down drought kiln:-

These are Rectangular & Circular in shape with permanent walls and tight roof. Roof of the these kilns are having the openings that are connected to common chimneys.

- Working mode is just like up drought kiln. But the only variation is through the opening of the flues hard gas will move vertically upto the roof then releases and again moves downwards through chimney.
- As the hard gas is moving vertically the brick burns.

→ After moving downwards the hard gas passes through the floor which is having kilns and passes through common chimneys which are connected to the floor.

Advantages:-

- stronger than the bricks from up drought kilns. as uniform heat is passing.
- More quality than up drought kiln.

Q

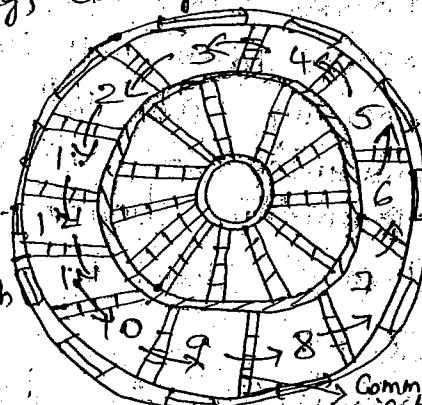
(i) Continuous Kilns:- These are oven rectangular, circular in shape and the process of brick manufacturing will be continuous i.e., loading, burning, cooling, unloading.

There are 2 types:-

(a) Half - Han Kiln :-

- Circular in shape.
- Constructed on over ground.
- Having 12 Chambers with a roof each chamber is having main opening for placing and removing bricks.
- Each Chamber also having communicable opening.

- Radial flues will be observed as they are attached to circular chimney.
- Fuel openings will be there to send fuel



Comm
unicable
main opening.

(b) Tundrel Kilns:- These are available in the flues of st., Crucible, oven made. There is a glatonegy phase where the brick is moving from this end to that end. While it is moving like this the brick will gets minimum heat also called pre-heating zone whence the brick will be. After the stationery phase, there is a heating period for heavy heat as per the desire subjected after a period of heating. Then follows a period of cooling. It is affected by convection, conduction, radiation, now the brick is used for low temperature. Here showing than half more kilns. Producers in continuous batches.

→ Through full openings → divided in 12 Chambeis → Chambei — loading → 4-5 Chambeis — softloading — heating — 6 - 7 " — 8 - 11 " — cooling — 12 " — unloading → Pavers for the above processes. → The brick will be removed by hand → The brick can be applied over → unitiles heating can be applied over → there due to this bricks are made while designing these structures → Strong durability of these structures → types of brick manufacturing we will get benefit → bricks in large scale.

Manufacturing of tiles:- 4 stages. They are

(i) Preparation of Clay:- The clay should be free from pebbles and allowed into pugmill where we get fine powdered clay. Then water is added. Kept that particular clay aside without any disturbance for a period of time. After that period all the coarse particles settle down due to gravity. And fine particles are taken and will be used for preparation of tile. The water will dry up.

(ii) Moulding:- 3 ways which will be:

(1) wooden mould:- Selected for the tile which do not have uniform projection entire its lengths. The prepared clay will be press into moulds.

(2) Machines:- adopted when tiles are having uniform projections entire its lengths. The prepared clay will be press into the pre-existing and designed moulds present in machines. Length of the tiles will be cut by a wire based on our requirements.

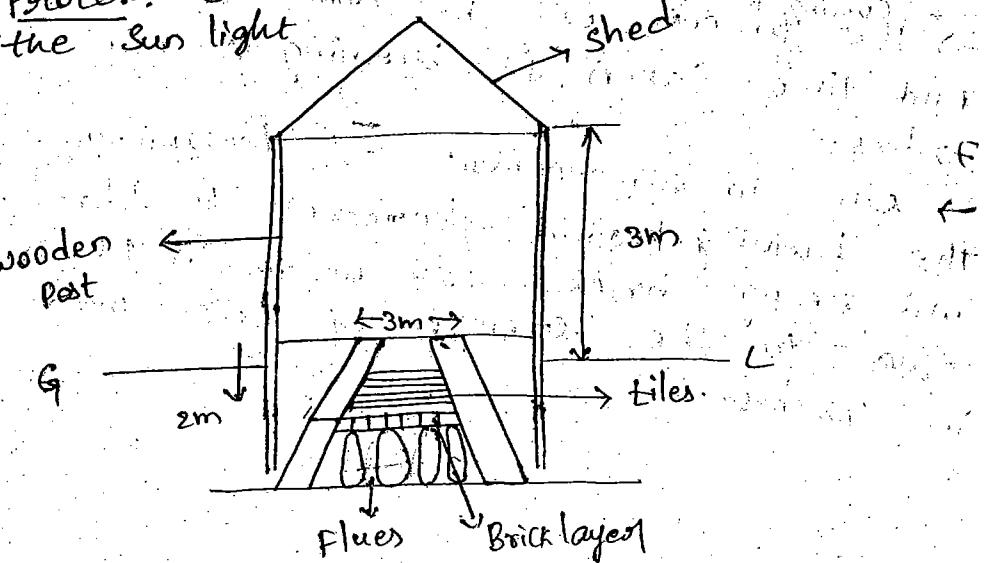
(iii) Pot wheel:- These are to observe the way they are preparing the earthen vessels. Tiles are prepared. Diameter

is of the tiles is not in uniform size.

(3) Drying:- After moulding of clay into tiles. The structure will be taken from mould and they will be kept & laid one above another to overcome cracks and wrappings. Keep it for 2 days. After 2 days by using wooden malt (\rightarrow hammer like object made up of wood) the extra soil head in the tile is removed by applying on edge of the tile. Then they will be stacked under shade. By keeping edge in shape under shade we can overcome future cracks under shade due to sun & rain.

(4) Burning:- Also called sail coke burning. Using this machines (30,000 to 40,000 tiles) are prepared per day.

Process:- shed like structure which overcome the sun light.



→ tiles should be free from pebbles and any bricks.
→ tiles are arranged one above the other.
→ they should be arranged in shape of square or other obstacles.
→ they should be bound uniformly.
→ they should pass through
→ they should be properly so placed in a
→ they should give clean striking when
→ they should have uniformity.
→ they should give right type of heat
→ they should be in position.
→ they should be stuck with
→ they should give even compact when
→ they should be broken area.
① Brick → These tiles are manufactured
to be used in doors, and while they are
manufacturing at large, cutters
will be taken in such away that
the powder surface on these top ends. Be-
cause when we use them in doors where
there is a potentiality of water
leaching. By keeping these type of tiles
the waterlogging draws them well
away from the soil due to their porous
nature and they will reduce the cost.

→ the burning period decreases to 1 hr.
→ due to arrangement of technology
and strong bricks are made in 1 hr.
→ the burning period decreases to 2 hrs.
→ the time taken for burning is min.
→ up to 6 days done in 1 hr.
→ the cooling process will be done in half time
increases upto 1300°C while heat
days up to 800°C and gain the temp
After 3 days the moisture is
absorbed due to absorption.
→ usually the heat is in which
material.
→ mud by filling tiles with wood
openings are closed with brick layers
despite moisture.
→ usually less heat will be applied to
undressed with loose tiles & old tiles
→ the end of the tiles will be
→ tiles are arranged one above the other.
→ the arrangement of the tiles will be
equal to the strength of brick made
in 2 hrs.

water spraying.

② Floor Tiles or Pave Tiles- which are moulded for floors. Thickness lies b/w 12mm - 50mm. These are square shaped tiles in the dimensions of 150mm - 300mm & they are small in size.

Advantages of floor tiles-

- available in no. of colour Compositions & no. of designs.
- They are easy to lay as they are small in size.
- They are lighter in weight than granite & marbles.
- They are anti-stiff & damp-proof.
- They do not require polishing.
- They can start using from next day onwards.

③ Roof Tiles- These tiles are exclusively prepared for roofs.

→ There are many varieties that are available in the market. And the imp varieties are as follows.

i) Allhabad tiles- these are prepared with selected clay.

- The moulding of clay is done under pressure in machine.
- The burning of these tiles is done in such away they can attain more strength.
- These tiles are provided with projection so that they interlock with each other when they are placed.
- The tiles of special shapes are made up which can be fit for ~~head~~, ridge, Valley of roof.

ii) Corrugated Tiles- (Alternative furrows & ridges).

- These are having corrugations when the are placed in position.
- A side lap of 1/2 corrugations are formed.
- The placing of such tiles on a roof gives an appearance of sheets.
- They gives good appearance but they can easily blown away by a violent wind.

iii) Flat tiles- These are ordinary roof tiles. To fix them on battens 2/3 holes are provided on their

E. Lumber		Load	Heavy
82 kg	102 kg	High average breaking	High
24	19	High water absorption	Medium
A	AA	Clos	Low
(a) Clos		S. No.	
They are divided into following types			
25 years	With 5% of damage for every		
They are very strong & can sustain up to	High, bridge & valley of foot		
These tiles are having the shapes of	mountain patterns.		
made of double channelled basal machine			
These tiles are made in column and			
when placed in position.			
that they can interlock with each other			
and provided with suitable projections so			

- (ii) English Tiles - These tiles have got the shape of S's and they are prepared with the dimensions 350 mm x 225 mm x 12 mm. These tiles do not form a good covering help of mould. The tiles do not cover like sheds. Basins they do not cover like the plain tiles & are used only as the tiles do not form a good covering help of mould.
- (iii) Gummed Tiles - These are hollow tapered 900 feet tiles. They are conical in shape having diameter at the base of 10 mm and thickness of 15 mm. They are made of gum which is a mixture of lime and thickeners of animal skin & with the base of 10 mm diameter they are conical in shape. They are made up of pottery when they placed on the soil. While they are interlocking each other 6 mm. They are made up of pottery when they are interlocking each other 6 mm. They are made up of pottery when they are interlocking each other 6 mm.
- (iv) Plain Tiles - These tiles are made of soil which is a mixture of lime and sand. They are made up of pottery when they are interlocking each other 6 mm.

→ They are less curved in section than the pot tiles. Such tiles are moulded flat first & then gives the required curvature.

→ Length of 300-330mm - 380mm & of width as 230mm-280mm.

④ Pot Tiles:- These are ordinary half-ground country tiles & they are known as locking tiles.

→ They are prepared on potter's wheel.

→ Polishing of inner & outer surface is done either with a wet cloth or a wetted stiff of lather.

Advantages of Pot Tiles:-

→ These tiles are less liable to be displaced by the birds.

→ These tiles may be used as a soil covering of roof.

→

25/9/14

Uses of Gypsum, Aluminium, bituminous material, Glass and their quality :-

Gypsum:- Gypsum building materials are used in all constructional types (residential & non-residential). Ranging from complex, lighter systems to easy to install products adopted for various applications by public.

Uses of Gypsum:-

pop - plaster of paris (3) Gypsum.

plaster boards:-

→ plaster board is used for partitions, lining of roofs, ceiling.

→ The properties of plaster board can be modified to meet specific requirements such as resistance, humidity resistance, shock resistance.

Decorative boards:-

→ plaster powder mixed with water manually

(3) through use of spray.

→ systems are used to create an effective and aesthetically pleasing line for brick and walls and for ceiling.

→ experience

→ light weight

→ cost of production

→ fast installation

→ they save time

→ they are fine surface

→ they are durable and hard

→ advantages :-

sound insulation, humidity resistance.

performance when it comes to shock resistance

strength good grip on floor board offers

walls, ceiling's, roof's, floors.

it is used for partitions, lining of the

ceilings, false ceilings:

partition walls are used for ceiling.

insulating blocks are used for partitions and

post and beams:-

is used for walls and ceiling.

building plaster:-

coffin to create decorative plaster mouldings.

and has been used by skilled

adhesive ends to moulding and

not stiffened.

They are not resistant to water.

disadvantages :-

→ excellent substitute for

of having a long serviceable lifetime.

same to the harmful effects

which always cause wear and tear, especially

when being handled.

disadvantages :-

surface poor

water repel

spills and drops and erosion

done starts from corners

when it comes to shock resistance

membrane and porous

bottom part and porous

durability low

embankment protection (dam sides)

erosion gullies and channels

binding agent

like protection

dam foundations and protection

heavy constructions

of permanent structures

② Design flexibility:-

→ There are more no. of designs and sections to integrate numerous functions into one profile.

→ Rolland products may be manufactured plant, curve shape, sandwich shape.

→ In addition 'Al' can be sawed, drilled, bent and welded and soldered in the workshop or in the building site.

③ Hundreds of surface shapes:-

we can prepare no. of shapes with requirements.

④ High reflectivity:-

→ This character makes 'Al' a very efficient material for light management.

→ 'Al' solar collectors can be installed to lower energy consumptions for artificial lighting and heating in winter, while 'Al' shading devices can be used to reduce the need of air conditioning in summer.

⑤ Fire Safety :-

→ 'Al' does not burn and is therefore classed as non-combustible construction material.

→ 'Al' alloys will nevertheless melt at around 650°C without releasing smoke.

→ Industrial roofs, external walls are increasingly made of thin Al cladding panels, intended to melt during a major fire allowing heat and smoke to escape thereby minimising damage.

Advantages :-

→ Light weight :-

'Al' is the one of the light weight material which is available commercially with a density approximately $\frac{1}{3}$ rd of steel & copper.

→ Excellent corrosion resistant :-

'Al' has excellent resistant to corrosion due to the thin layer of oxides that forms on the surface of 'Al' when it expose to air.

→ Strong at low temperatures :-

whereas as steel becomes brittle at low temperature Al increases tensile stress and retains.

→ Easy to work :-

'Al' is easy to fabricate into different forms such as coil, sheets, geometric shapes,

- Easy surface treatment :-
- Few many applications of paint on the surface.
- Protective and decorative uses.
- The surface supplied without further treatment.
- Thermal insulation uses among the following :-
- Wood water proofing due to unbreakable glass but the main function of glass is to be used with Na, Li, carbonate by baking on the melting point.
- To make it durable and safe.
- It can be made transparent or translucent.
- It can take different polish.
- They are excellent collector of heat.

2) potash lime glass:-

- It is made up of a mixture of potassium silicate and calcium silicate.
- And it is also known as hardglass.
- It diffuses at high temperature.
- which have to withstand high temperature.

3) potash lead glass:-

- It is a mixture of potassium silicates and lead silicate.
- It possesses bright luster and great refractive power and it is used in manufacture of electrical bulbs.

4) common glasses:-

- It is mainly a mixture of sodium silicate, calcium silicate and iron silicate.
- They are green, brown (or) yellow in colour.
- They are used in manufacture of medicine.

5) special glasses:-

- These are made up by changing basic ingredient and adding more ingredient

and alter suitably.

Applications of special glass:-

- fibre glass
- foam glass
- bullet proof glass
- wired glass
- perforated glass etc.

Summary

1. properties of building stones and relation to their structural requirements.
2. classification of stones.
3. stone quarrying
4. precautions in blasting
5. dressing of stone
6. composition of good brick earth.
7. Methods of manufacturing of bricks
8. characteristics of good tile
9. Manufacturing Method of tiles
10. Types of tiles
11. uses of materials like Gypsum, Alumina

UNIT-II

3d

glass and
bituminous and their
qualities.

Masonry

It is a process of confining building units
together in a known as Masonry.

With mortar called masonry.

Building units → stones, bricks, composite

Types of Masonry:

- (1) Brick Masonry
- (2) Stone Masonry
- (3) Hollow Concrete Block Masonry
- (4) Reinforced Brick Masonry

- Definitions:-**
 - Head brick:-**
 - Closette:-** It is a brick / cutted brick along its length.
 - Half-brick:-** Cutted brick along with breadth and the size of the brick is half.

Brick cutting:- Bricks cut along its length.
Common brick:- It is a brick which is cut along its length.

Reinforced brick:- The brick which is cut along its length and have angle with adjacent.

Brick bat:- The surface of which is cut along its length.

Common bat:- Bricks cut along its length.

King bat:- Bricks cut along its length.

Not having:- The surface of which is cut along its length.

Not having fold:- The surface of which is cut along its length.

Not having stones / bed which sustains:- The surface of which is cut along its length.

Not having folds & bed:- The surface of which is cut along its length.

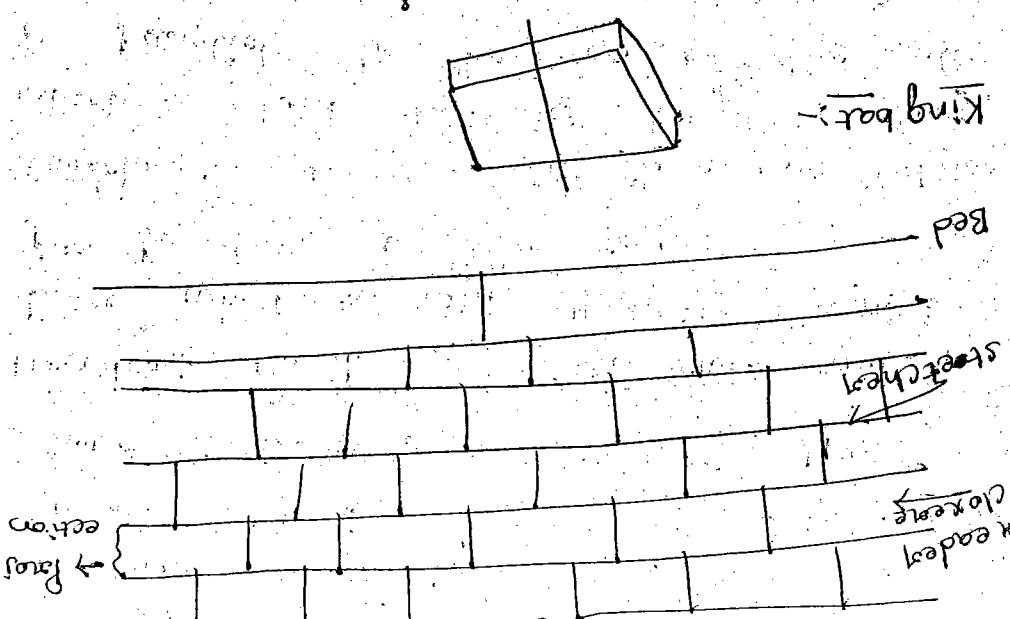
Brick can cut / break easily:- The surface of which is cut along its length.

Brick can cut / break easily 3/4th bat:- The surface of which is cut along its length.

3/4th bat:- The surface of which is cut along its length.

3/4th bat:- The surface of which is cut along its length.

is known as 3/4th bat.



Courses:- A Course of is a horizontal unit in stone masonry. The thickness of Course will be equal to the height of the stone + thickness of 1 morts Joint.

Header:- Header is a full stone unit of brick which is laid that its length is par to face of the wall.

Stretcher:- It is a full stone unit of brick which is laid that its length is along & parallel to the face of the wall.

Header Course:- A Course of brick work showing only headers on the exposed face of the wall is known as Header Course.

Stretcher Course:- It is a Course of brick work showing only stretchers on the exposed face of the wall is called stretcher Course.

Bed:- It is the lower surface of brick or stone in each course.

Natural bed:- Building stones are obtained from stocks which have definite planes through which the stones can be split easily.

Bond:- Bond is a way i.e., manner to the overlapping of bricks & stones in alternative courses so that no continuous vertical joints are formed and the individual units are tied together.

Quoin:- The exterior angle of corners of a wall is known as Quoins. Quoin. The stones of bricks forming the Quoin is known as stone Quoin & brick Quoin. If the Quoin is made in such a manner that its width is parallel to the width of the wall is Quoin header. If the length of the Quoin is laid //el towards the face of the wall Quoin stretcher.

Face:- It is the surface of the wall exposed to the weather.

Back:- The inner surface of the wall which is not exposed to weather.

Facing:- The materials that are used in facing the face of the wall is known as facing.

Hearting:- The inner portion of the wall below facing & Backing is called hearting.

Side:- It is the surface forming the boundary of bricks & stones in a direction transverse to the ~~face~~ ^{side} and ~~of bed~~ face of bed.

of fitting a key at the middle which prevents the displacement of brick above through stones:- It is a stone headed through stones which are placed across the wall at regular intervals.

The through stone:- It is a stone headed through stones which are placed across the wall at regular intervals.

Sill:- It is the bottom surface of a deep window opening in called sill.

Lintel:- It is a horizontal member of a stone arch, wood, steel, or reinforced concrete used above the opening.

Plinth:- It is a horizontal projecting course above a wall above the ground level.

Plinth course:- It is the uppermost part of a wall above the ground level.

Revels:- These are the exposed vertical surfaces left on the sides of openings of masonry.

Cable:- A cable is a projecting stone which is fixed in the position of window frame as fitted in the position of window frame as shown in figure.

Bricklaying:- It is the term used to depict the laying of bricks in a regular manner.

Surface of Sills, Sill Courses.

Thoughting:- It is a group provided on the surroundings of projecting elements such as sill courses.

Papets:- It is the portion of low height wall constructed along the edge of the roof to protect the users.

Arch:- It is a structural construction of masonry constructed by mechanical arrangement of wedge shaped stone & brick arranged in the form of a curve supporting wall of load above the opening.

Toophing:- These are the bricks left projecting in alternative poses for the purpose of bonding future masonry work.

Stooling:- These are the horizontal stones to give provision to receive filmed at the end of sills.

Column:- It is a vertical load bearing no. of masonry which is constructed in an isolation from the wall and whose width does not exceed 4 times its thickness.

Stoesh holes:- It is the arrangement of steps provided from the plinth level of the external door of veranda to ground level.

Solid Rubble Masonry:- These are part of stone masonry.

Stone Masonry

Rubble

Ashlar

Pre Cost Concrete blocks

Def:- In this type of masonry large blocks of stones which are undressed, roughly dressed having wide joints as they are irregular in shape.

Divided into 4 types:

i) Random Rubble Masonry.

ii) Square " "

iii) Miscellaneous type.

iv) Dry Rubble Masonry.

Random Rubble Masonry:- 2 types.

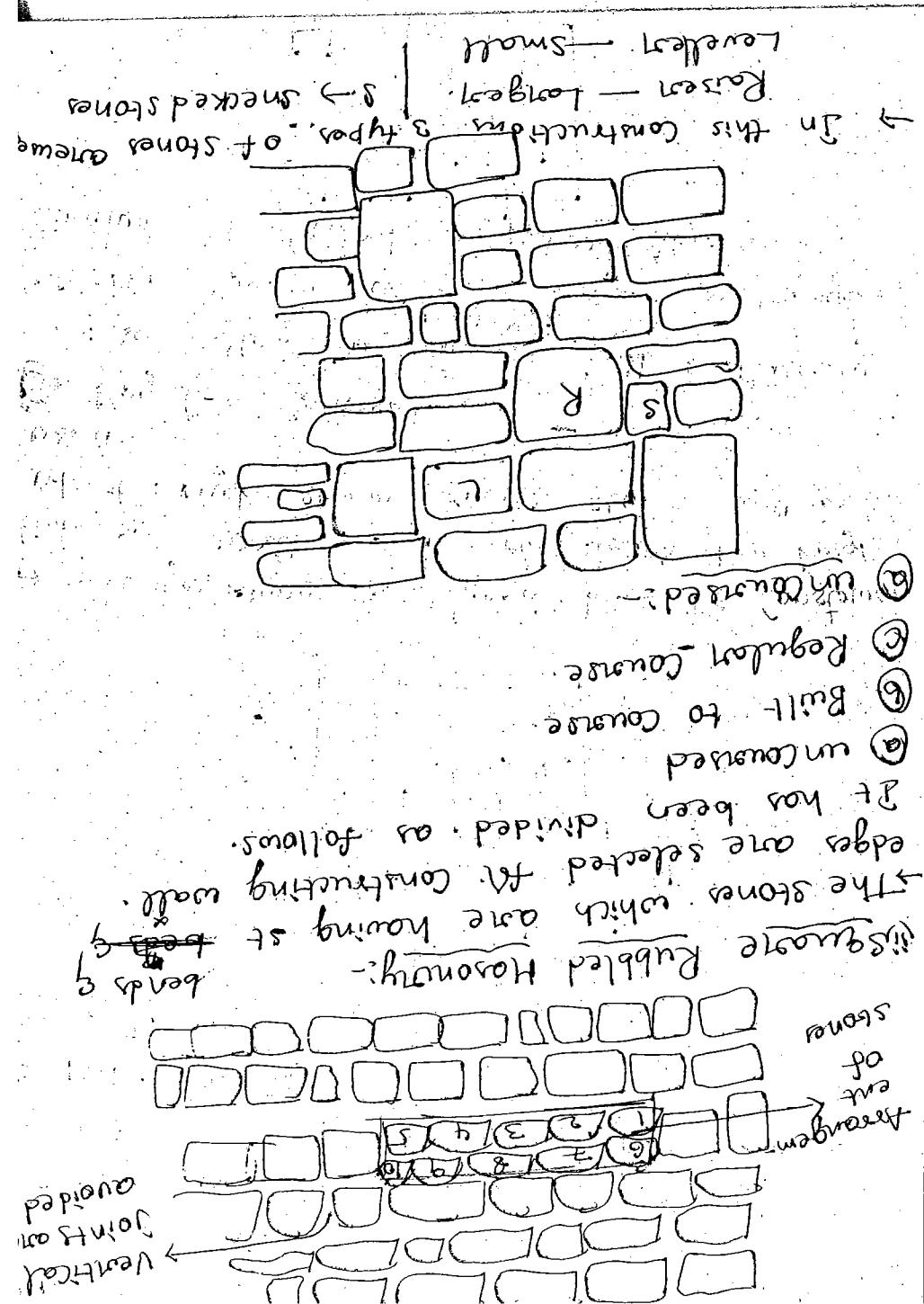
(a) un Coursed Random Rubble Masonry.

(b) Built t. to Courses " "

@ un Coursed

Large stones which are irregular in shape will be used in this type of construction.

→ while constructing wall as they are heavy in weight the pressure has to be distributed



In a much area, while constructing these type of masonry in a staggered arrangement, the bonds (transverse of longitudinal) should be strong & they can be achieved if the stones should be kept closely. And the bonds by keeping heads closely. And the longitudinal bonds large stones which have longitudinal bonds should be selected to increase the strength of the appearance.

Drawings should be selected to increase the strength of the appearance.

The bonds (transverse of longitudinal) should be avoided while vertical joints should be avoided.

→ In this type of construction, stones of different sizes are used. The arrangement of interval would be as shown in following fig.

→ In this type of construction, stones are as follows. But the height is levelled to 30-45 cm. The height is levelled to 30-45 cm. In this type of construction, stones are as follows. The arrangement of interval would be as shown in following fig.

→ The arrangement of interval would be as follows. An interlocking joint should be selected. Below the tops of stones.

→ In this construction, stones are as follows. The arrangement of interval would be as shown in following fig.

→ The process of building construction is same to course built to course is same as un coursed.

→ The process of building construction is same to course built to course is same as un coursed.

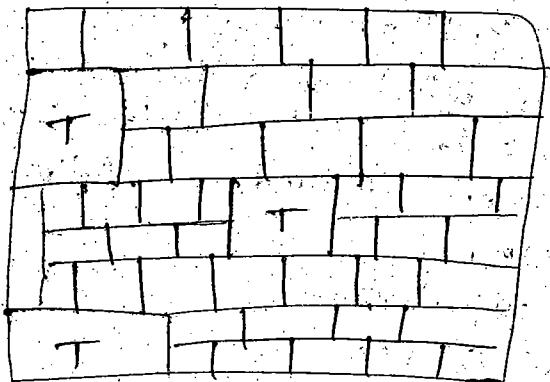
They will be constructed in the ratio of 3: 2: 1 depth.

→ edges of stones are straight.

→ Also known as Square Snected Masonry.

⑥ Built to Course:-

T → Through Stone



→ A larger stone is placed b/w the Construction in wall, and to reach the height of through stones small stones will be used.

⑦ Regular Course:-

→ Also called as Course Rubbed Masonry.

If the course of the height is varying similar is called Regular Course.



⑧ Miscellaneous Masonry:-

The stones which are not hammer dressed are used in this type of masonry.

2 types:-

(A) Polygonal walling.

(B) Flint walling.

- → Object.
- Highway

Polygon → Area.

(A) Polygonal walling:-

The undressed & hammer dressed stones are placed side by side in wall construction. and the bondings are made by avoiding vertical joints.

→ If the stones are fitted roughly then it is called Rough-fitted Polygonal walling.

→ If it is used to close projections. Glosely fitting stones and care should be taken to retain long period of time and projections are closed is called Close fitted Polygonal Masonry.

(B) Flint walling:-

↓ Hard stone of silica mineral.

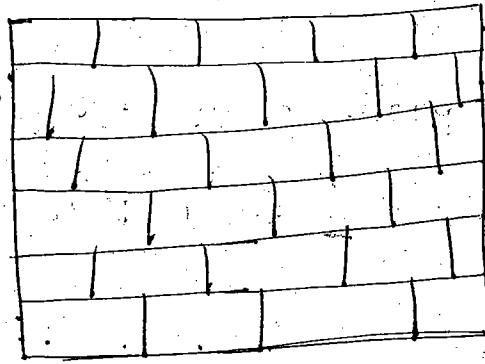
⇒ The course material for construction is of flint & Coal Coball.

⇒ Characteristic of Coball & Si is brittle in nature. so they cannot handle the weight Coball.

⇒ The height of flint & coal is 2-3m height

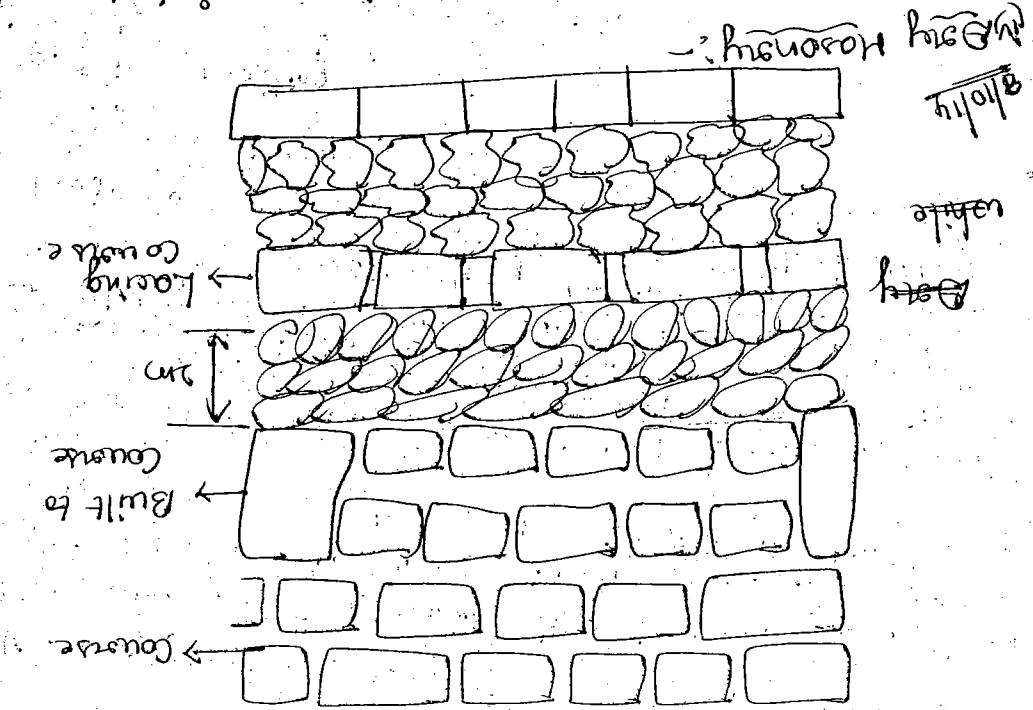
⇒ A Supporter will be given for every 2m which is called Lacing stone (hard stone)

① Ashlar fine Toled Masonry: - The stones which have square & rectangular in shape, complete
 6 Types
 edges.
 Ashlar \rightarrow permitts, multi joints.
 used in construction with perfect fit between stones.



and are picture unevenly.
 and one picture unevenly.
 These types of walls exclusively made on compound walls because they cannot
 fit in compound walls because they can not
 be used in construction which give a fast
 fit between stones.

→ also used to construct compound walls
 used in joints i.e., called cavity masonry,
 while constructing walls if the masonry is not



handle weight.
 on compound walls because they cannot
 fit in compound walls exclusively made as

→ the stone becomes very weak
they will break the vertical joints.

② Rough tool Masonry:-

The construction of this masonry is similar to fine tooled masonry.

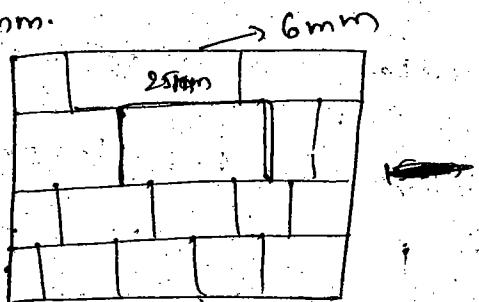
→ The front view is rough in nature & chisel hammered.

→ A bolder is placed around the course with parameter 25 mm.

→ The projections in all surfaces should not be more than 3mm.

→ The size of ~~most~~ mort joints should not be more than 6mm.

③

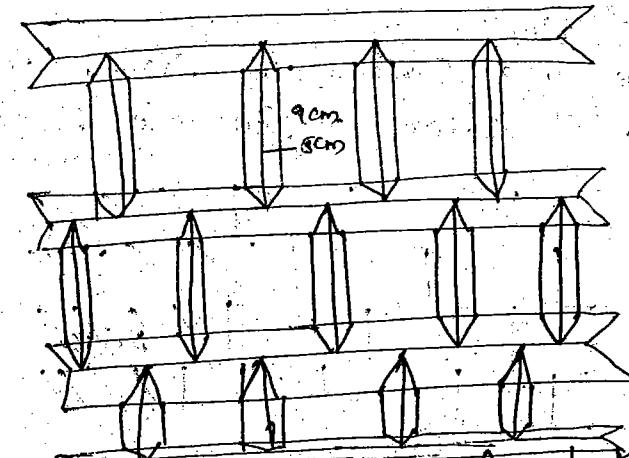


④ Ashlar Rustic, quarry faced Masonry:-

A cut in a wood or in any material made

→ A groove will be placed on the stones of at end of the stones with 45° & 25mm.

→ Set 15 cm distance b/w grooves by avoiding joints.



④ Ashlar Rock, Rustic, quarry faced Masonry:-

→ The rocks will be selected directly from the quarrying without dressing stones.

→ where the height of stones is 25-300

⑤ Ashlar Block Course Masonry:-

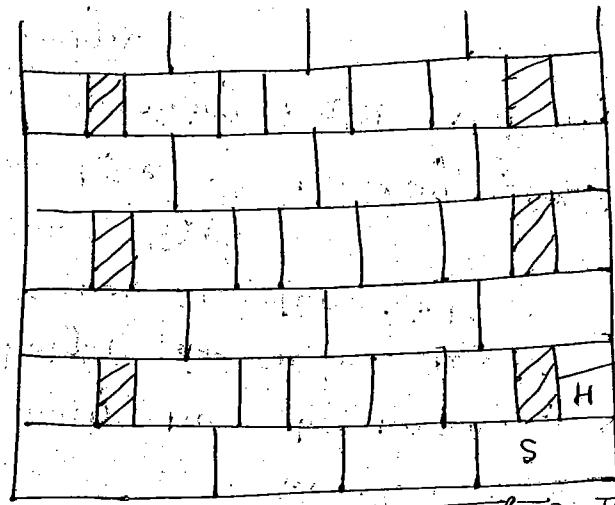
→ Here also the large stones are selected and the height of course is similar w.r.t all the courses in the wall.

→ It may not be necessary to keep the same height in entire wall.

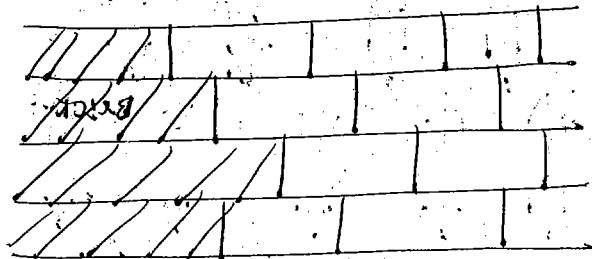
→ The stones at the joints is maintaining a 25-30 mm size.

→ This type of masonry work is exclusively used for retaining walls and in construction of bridges.

⑥ Achlear facing:
 The stones are constructed / fixed. In walls
 along with brick & concrete blocks.
 As every header a stone
 To break the vertical bond a Queen
 naturally courses in structure.
 placed.
 The header joints are come exactly centre
 to the vertical joint of the stretcher.
 So the thickness of wall is equal to the
 rear of even header brick, the appearance of
 both front and back view is similar to wall.
 i.e.) If the 1st row comes back view also comes
 the front view of even back view of stretcher
 of stretcher.
 If wall thickness is equal to the equal to
 the thickness of header brick, the appearance
 of wall is diff. w.r.t front view of
 back view i.e., if 1st row comes
 back view in front view of
 header brick.
 view comes of header.



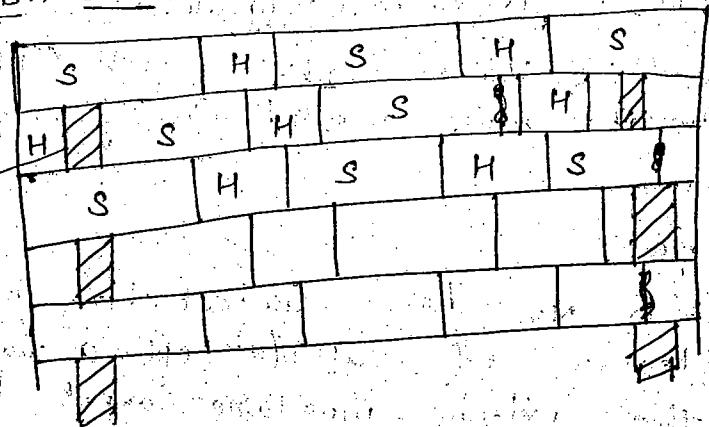
Back Header - ① English bond:-
 height of all courses.
 + may not be necessary to maintain same
 height of each course is similar.
 consequence of each course is
 back surface is filled with bricks of
 front surface is with ~~brick~~ stones.
 Both surfaces in filled with bricks of
 consequence of each course is similar.
 height of all courses.



② Header facing:
 the stones are constructed / fixed. In walls
 along with brick & concrete blocks.

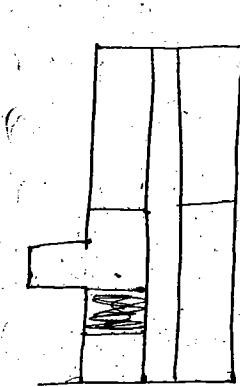
(2) Flemish bond

(2) Flemish bond



Features:-

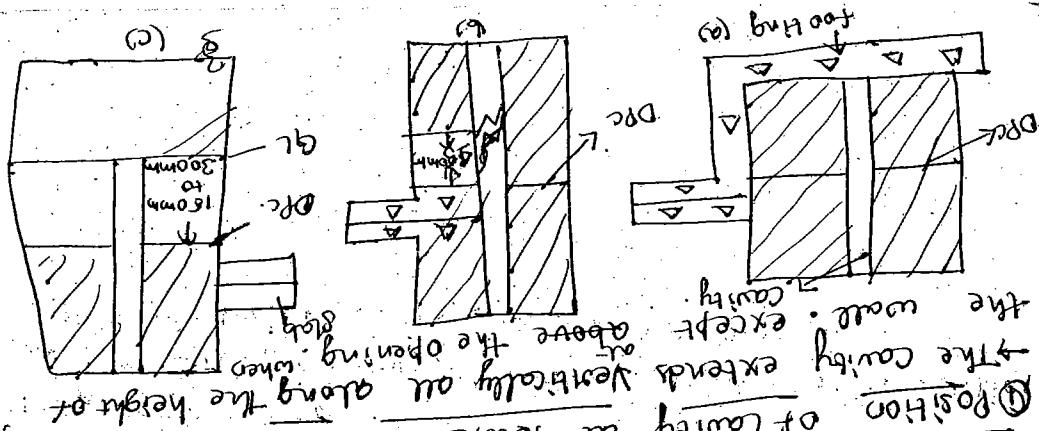
- the appearance will be good than the English bond.
- Every Course consists of headers and stretchers placed alternatively.
- The facing and backing of wall in each Course have the same appearance.
- Queen Closures are used next to Queen header.
- In walls having thickness equal to odd multiples of half bricks, half bats or $3\frac{1}{4}$ bats are required.
- For walls having thickness equal to multiple of half bricks, no bats are required.



perspective. The massive thicknesses increase the mass and therefore
up to the base of the footings just below the slab level. This is a
cavity wall; a hollow wall which consists of two opposite walls. Called cavity walls.
most common arrangement, however, is a cavity wall with damp proof
course interviews just below the slab level. This is a
below the gl if not carefully constructed particularly
in the areas where the soil is having water
content. These are called alternative.
more walls as that. These are called
action and ground level filled with 1:2:3 concrete
with top of concrete atleast 150mm below the
DPC and far from above ground level.
2. The cavity may extend only up to gl at 150-300mm
below DPC as shown in fig(c). with both (b), (c)
separate DPCs has to be provided through the out-
lets of weak walls. Water will be collected through
these cavities if the ground floor consists of wood or
concrete floating.

The ventilation of cavity can be done by use of air bricks (fig (d)). It is essential to ventilate to the
wooden floating but not by
concrete floating.

Bricklaying after wood



④ Position of cavity at foundation level:-
→ Loads on foundation are due to reduced height of
cavities.
→ Loads on foundation are due to increased height of
cavities except above the opening where the wall is thickened.

⑤ Position of cavity at foundation level:-
→ Loads on foundation are due to increased height of
cavities.

→ They are good insulation against sound.
→ They are cheap & economical.

→ The cavity below a separate wall is full of
air which is a bad conductor of heat.
so heat cannot enter from external part to
internal part of wall.

Hence the external noise from outside
cannot travel inside the building.
These is no direct contact below internal
walls of wall. (except a wall tie).

b/w them:
advantages:-
Cavity walls consist of two opposite walls. Called cavity walls.
which consists of

Wood:- The part of the tree which lies beyond the bark of tree.

→ The wood is cutten for various purposes & greaching the timber yard.
with tree — wood ; Cutten from — Timber tree

Properties:-

(1) Colour:- Should be uniform without any patches.

(2) Odour:- Should be pleasant when we use for various purposes.

(3) Sound:- Should be good grining sound when knowned on its surfaces.

(4) Texture:- Should be fine and smooth.

(5) Grain:- For good Timber grains should be closed.

(6) Density:- If the wood have good density which means strong & durable.

(7) Hardness:- It is related to hard & durability.

(8) Warping:- A good timber should not warp for external faces.

(9) Fire resistance:- It should be resist to fire up to permissible levels.

(10) Abrasion:- → Rubbing b/w 2 diff objects. The wood & timber should be resist for abrasion faces like wind, natural faces.

(11) Permeability:- wood should not give permeable through ~~wood~~ water.

→ It should give max resistance to Permeability:-

(12) Workability:- It should give the access for various purposes.

(13) Durability:- It should have long life against various external faces.

(14) Defects:- Should be free from fungal effects.

(15) Toughness:- It should be capable to resist bare sudden loads.

(16) Strength:- It should be capable of bearing more loads with good resistance for a long period of time.

Classification of wood:-

(Based on Standing Position):- If wood is in the form of living tree that is called live wood.

→ If the wood after the cutting of tree is known as felled or roughed tree

(iii) Trade: - After evaluation of all defects the construction and durability will be taken as consideration after that value will be given.

→ followed in Madhya Pradesh.

(iii) Grade: - evaluating the defects part of wood.

→ followed in International grading system to the wood and one final value will be given to the area which is not having any sound part of defects.

→ following in Number it is called as sound grading for wood.

④ Based on Hardness of wood: -

→ Based on bending moments of wood if has been divided into 3 types.

→ If these bending of wood is 12.5 KNm it is called as group A wood.

→ If the bending moment of wood is 9.8 - 12.5 Km/m it is group B wood.

→ If this "group B" is 9.8 - 6.9 Km/m it is called as group C wood.

⑤ Based on the availability: - If the wood is available up to 1415 m³ per hectare they are considered as X-wood of next class.

Common wood.

⑥ Based on Strength of wood: -

→ The wood which is converted to timber is said to be called as converted wood.

→ The wood which is converted to timber is said to be called as converted wood.

⑦ Based on Structural grading:-

→ grading will be given based on defects of wood.

→ wood contains little defects, grading will be succeeded.

→ By evaluating the defects, value will be given.

⑧ Based on Compressive grading:-

→ given to check quality.

→ Hacking grading.

⑨ Based on mechanical grading:-

→ given to be given to timber based on properties of applications of woods. It is grading will be given to timber based on properties of woods and their applications.

→ This pattern is mostly followed in grading is given.

⑩ Grade A: - By evaluating the dimensions of defects of woods and their applications

→ Divided into 4 grades.

⑪ Grade B: -

→ Karamatka

→ starts like A.P., Tamil Nadu these islands. (a) long wood (b) short wood and classified as beam grade A long (BA)

→ blw. 355 m^3 - 1415 m^3 is called common wood.

→ $< 355\text{ m}^3$ called less common or z-wood.

⑥ Based on Durability:-

By taking the ~~logs~~^{100s} of $600 \times 50 \times 50$ size and keep them in soil ~~& burying~~ upto half of its length. If the wood is in good condition upto 120 months i.e., high durable wood.

→ If wood is good condition 60-120 months called moderately durable.

→ upto 60 months - less durable.

⑦ Based on the seasoning:-

If the wood is difficult to seasoning i.e., Group A.

→ If wood is difficult to season but need some sought of external support comes under Group B.

→ The wood which can be seasoning easily comes to group C.

⑧ Based on treatability:-

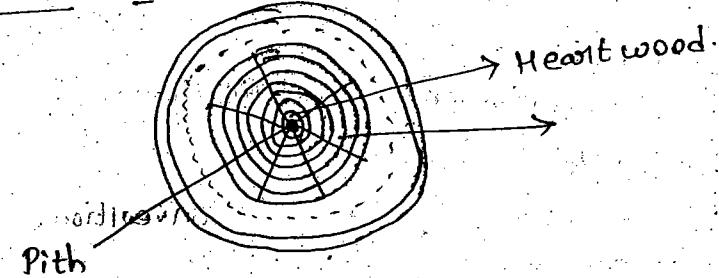
→ when the wood is exposed to heat & applying the force of 1.5 KN to find out the strength based on above 2 specifications they are as follows.

i) Easily treatable.

ii) Treatable but only a part can be treatable.

iii) Partially treatable.

Structure of wood:-



→ He. wood → A

Outer bark:- External surface / outer layer of wood. which gives resistances to external forces.

Inner bark:- The internal surface of bark. It acts as a barrier between Cambium & bark.

Cambium:- Is the live wood going to be converted as soft wood.

soft wood:- It is moisture/water content which indicates growth of live wood of tree.

→ It is pale coloured.

(i) Shallow carvings : - on the surface of the wood which may leave their marks as chip shape and grain shape.

→ while processing of this wood into various applications. They may leave their marks as depending upon the carvings of the wood.

(ii) Shallow carvings : - on the surface of the wood due to heat, friction, wind speed which may form film due to extreme heat of outer part of wood due to extreme heat of outer part of wood.

(iii) Wind carvings : - The shape shrinkage of outer part of wood due to extreme heat of outer part of wood due to wind blowing upon the carvings of the wood.

(iv) Upsets : - When the tree is growing during better of wind is called as wind carver.

(v) Young stage : - It undergoes excessive compression through which the growth will be arrested.

and the wood may be supported.

④ Due to improper seasons and connection the connected number may drop and tourist is in decrease If seasons is not within the connected number may drop and tourist is in decrease

⑤ Due to improper seasons and connection the connected number may drop and tourist is in decrease

⑥ In wood when the lamp is above 20°C attacks - it trigger material is present due to fan effects of fungi and insect de fees are arise arrest.

⑦ In the process of convealing time base into they are made susceptible in kiln seasons directions. And they appear as defects and thinner wood drop and tourist is in decrease

→ Common cold sizes. The following types of →

Hollow stem - which holds the angular things in deep part. Part i.e., called dead knot leaves which left on the stems are called as knots. If the knot is penetrate into the following of leaves. The uneven part of the tree cutting of leaves to the bark.

→ As the tree growing there is a terminal basic consists of knots after the cutting of leaves to the bark.

Blk notes - when the tree is cut, it is affected due to Natural forces & effects due to followi-

- ① Due to Natural forces & effects due to followi-
- ② Due to effects of fungi.
- ③ Due to Improper seasoning of timber.
- ④ Through Natural forces -
- ⑤ Classified as following specie facts:-

Pith - Centre part of wood is also called.

→ Through which earthen structure is formed of

Angular Ray - which indicates growth of wood.

Sept wood.

Heat wood → Oak in colour.
→ Hardin strength.
→ Represens dead cells.
→ Growth is absent.

the fungi reacts with moisture and damages
8) Vacating the wood.

→ But the wood like teak due to their
Chemical composition they can withstand
fungal effects.

Uses of Timber:-

- For constructions like columns, stones, piles
- Home applications like manufacturing of
windows, doors.
- As an railway sleepers.
- (Manufacturing). In ~~apply~~ Various industrial
and residential application
- For temporary construction works like
Gentrings, packing of materials.

→ Alternative materials Rather than wood
Steel:— It has been manufacturing from the
ores of iron which are available in the
deeper crushes of earth.

→ Based on the iron availability & the other
materials concentration it has been
divided in 2 parts → Ferrous & Non Ferrous.

(i) Ferrous Materials:

→ where the iron is predominant materials
along with other minerals like silica

Sulphur, Potassium, Manganese:
→ Such substances are called as ferrous
materials.

→ These ferrous materials are classified base
on the Carbon concentration and generally
Ferrous materials consists Carbon Concentra-
tion from 0.15 — 2.15 %.

Classification of Ferrous materials based on Carbon Concentration:-

low steel / mild steel	upto 0.25 %
Medium steel	0.25 — upto 0.70 %
High steel	0.70 — upto 1.5 %

Mild steel:— Mild steel has been using in various
home applications like

- ① Manufacturing of bolts, locks, Keys
- ② As an ingredient material of ACD, Freezer
- ③ During manufacturing of gloves, windows, bats,
door knobs.

High steel:— To manufacture strong objects like
chisels. and any other such type of objects
which should withstand vibrations and
external heavy loads.

High Tensile steel:— which is used in precast
Concrete block as an support to bear extra
loads.

1) Internal partition walls:- Also used as a way to internal partition walls to divided in such a way they won't the create only sound of best internal partition walls to divided in such in convenience below the divided parts.

2) Temporary sheds:- Used in building temporary in convenience below the divided parts.

3) Idiots tanks:- Various types of shapes of water tanks can be manufactured by using various tanks can be manufactured by using these following.

4) Structural section:- The available cross section profiles in these FPCs with the advantages of steel) ABS PVC can also be made up with these FPCs are having better properties strength & low weight.

5) Evolution of FRPs → These FPCs are having better properties strength & low weight.

6) Advantages of FRPs → These FPCs are having better properties strength & low weight.

7) Properties of FRPs → They can withstand heavy impact, flexible, easy to clean, easy to maintain, available in diff shape & sizes.

8) Temperature → Used in building temperature in convenience below the divided parts.

9) Temporary tanks:- Various types of shapes of sheds, storage units, such type of storage tanks can be manufactured by using these following.

10) Structural section:- They can withstand heat, load etc.

11) Advantages of FRPs → The available cross section profiles in these FPCs with the advantages of steel) ABS PVC can also be made up with these FPCs are having better properties strength & low weight.

12) Evolution of FRPs → These FPCs are having better properties strength & low weight.

Aluminum: - Manufacturing of keys, locks, knobs exclusively with absence of iron.

Non-Ferrous Metals: - Means the materials which are made up of Al, Si, S, K and exclusively.

Aluminium: - Manufacture of keys, locks, knobs as well as made up of Al, Si, S, K and exclusively.

Galvanised Iron: - This is one type of iron which has been using in door, windows and also usage, decorative purposes.

Fibreglass: - These are made up of & materials \rightarrow Fibre glass and plastic which gives more strength & ultimate they are good in strength & high durable materials which can be used in various applications.

Fibre Reinforced Plastic: -

- As made in AEs, fire etc.
- Electrical cables
- Switches
- Fibre made up of concrete & materials \rightarrow Fibre glass
- These are made up of & materials \rightarrow Fibre glass and plastic which gives more strength & ultimate they are good in strength & high durable materials which can be used in various applications.

Nano-ferrous Metals: - Means the materials which are made up of Al, Si, S, K and exclusively.

Alloy: - Can be manufactured by adding other elements to the combination of metal.

Alloys: - In a few heat right forms of

Alloys: - Applications. They are using in buildings, structures, vehicles, electrical equipments etc.

Alloys: - The can be manufactured by adding other elements to the combination of metal.

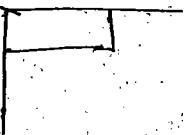
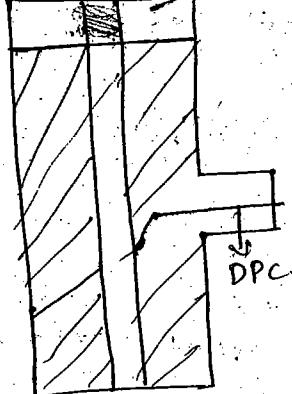
Alloys: - The can be manufactured by adding other elements to the combination of metal.

12/10/14

Baffle wood

(a) Position of Cavities at eaves & Parapet levels:

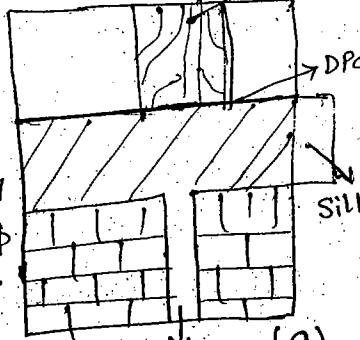
In the case of flat roofs with a parapet the cavity can be extended up to the bottom of coping or slightly above the flat roof as shown in fig(a), (b).



When the cavity is extended up to the bottom of coping it is essential to have a DPC below the bottom of coping and top cavity so that rain water does not enter the cavity. If the cavity is terminated just above the flat roof 1 DPC is provided over the top of the cavity & below the bottom of coping. In both the cases it is better if flexible DPC is provided starting from roofing & bridging over the cavity as shown.

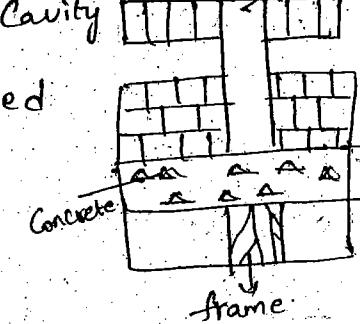
13/10/14 (b) Position of Cavities at Opening walls:- frame-

i) A cavity will be maintained from the bottom of window:-
→ DPC will be provided on the top of sill and frame will be fixed at suitable position. Collected water will be drained off through weep holes & narrow vertical joints.

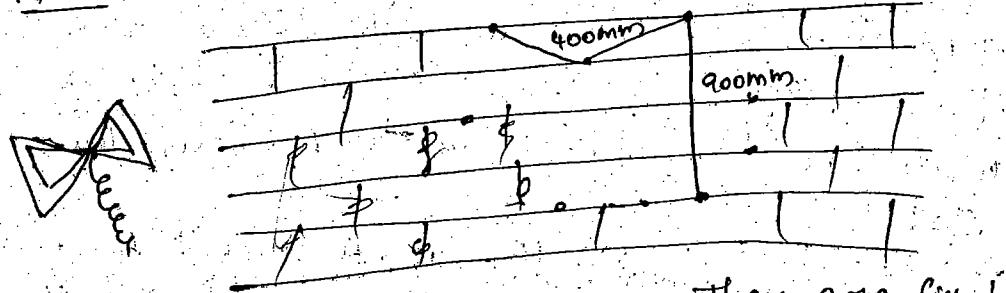


(b) Position of Cavities at lentels:-

From the roof upto lentel cavity will be maintained.
→ Collected water will be drained off through vertical joints.
→ The frame will be fixed at suitable position.



WALL TIES:-



→ To avoid closing of cavities they are fixed vertically min 900 mm in vertically & in horizontal way 400 mm.
→ Generally used to avoid corrosion.

General Characteristics of Partition walls :-
In soft soil areas bronze & Cu wall tiles has to be selected to avoid corrosion.
Leave to晴期 leave to leave to晴期 leave to晴期
to avoid passage of water from one
case should be taken while selecting water
the GL and also when C. where required.

Leave to晴期 leave to leave to晴期 leave to晴期
to avoid passage of water from one
case should be taken while selecting water
the GL and also when C. where required.

partition walls :-
When the wall which is divided to
when the walls are placed to divide they should have the following specifications.
They should be as light as possible so in the view of weight they should be as thin as possible to make them as portable as possible.

Thicknes. They should be better to best insulation against the sound especially when the area is divided into rooms.

(i) They should supply in such away to keep out the dust particles.

(ii) They should be strong in such away they can't be easily broken by fixer i.e.) wash basins.

(iii) They should be better to best insulation against the sound especially when the area is divided into rooms.

(iv) They should supply in such away to keep out the dust particles.

(v) They should be strong in such away they can't be easily broken by fixer i.e.) wash basins.

Types of Partition walls :-

① Brick walls / clay hollow walls.

② Concrete walls.

③ Reinforced concrete walls.

④ GL walls partition walls.

→ Hold → of cu of bronze. In detail areas to avoid casting.

These are many types.

→ Fig (b) shows

General features of cavity tools and
procedures to be maintained during casting

→ The cavity should be mounted in such a way not less than 4 mm & not more than : 100 mm in size.

→ used to avoid casting of cavities.

→ ~~the~~ Castle should be broken to avoid dropping of metal & swabbing of cavities.

→ At the end / top near the root when width has to be maintained below the cavity is supposed to finish 2 parts

→ weeble holes of ~~use~~ Holes joints should be glad.

→ mounted at specific intervals to draw off water periodically.

→ Project ventilation holes to be given to the cavity when the floor is made up with bricks & membranes.

→ Member through all the parts and cavities.

(6) Timber walls:

- (i) Brick walls: - Has been divided into 2 types.
- plain brick walls: - When the wall is constructed as an a partition with half brick thickness called are plain brick partition.
- (ii) Reinforced Brick Partition walls: - While constructing a brick wall to bear the loads a steel strip with diamond shape opening will be fixed in the wall to bear loads.
- (iii) Clay Brick walls: - When the partition wall is made of hollow clay bricks.
- These are available in sizes of 30cm length, 20cm height, 5-15cm thickness.
- Best insulators against sound & heat.
- (iv) Concrete walls: - Pre-Cast Concrete blocks usually with a thickness of 40mm will be used below 2 concrete parts as an a partition.
- (v) Asbestos walls: - ^{when} Asbestos sheets which are corrugated closed with 2 plain sheets at both the surface by using molts & they will be used as an partition.
- Best insulators against sound & heat.
- (vi) Glass walls: - When the partition wall is made up of with thick glass or bullet proof glass to divide the area they are called glass walls.
- Normally a ~~glass~~ wire glass, 3 ~~glass~~ layers glass.

(vii) Timber walls: - ~~wood~~ with proper moulding/ specifications we can divide the area.

14/10/14 Seasoning: - The process of reducing the water content in timber.

Objectives: -

- To make it burn immediately when we use it as a fuel.
- To bring down the weight of the log which reduce the cost of transportation.
- To make fit for converting various Engg. applications.

- To impart/impose strength, stiffness, electrical resistance above all high durability.
- To make fit to access for painting, varnishing, gluing ⇒ attaching 2 objects.
- To make it fit resistant against the fungal attacks.

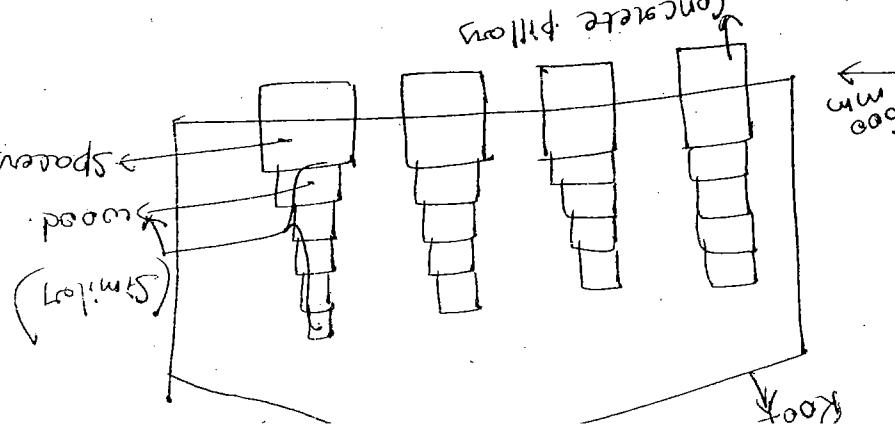
Classification of seasoning: - 2 types

- i) Natural seasoning.
- ii) Artificial seasoning.

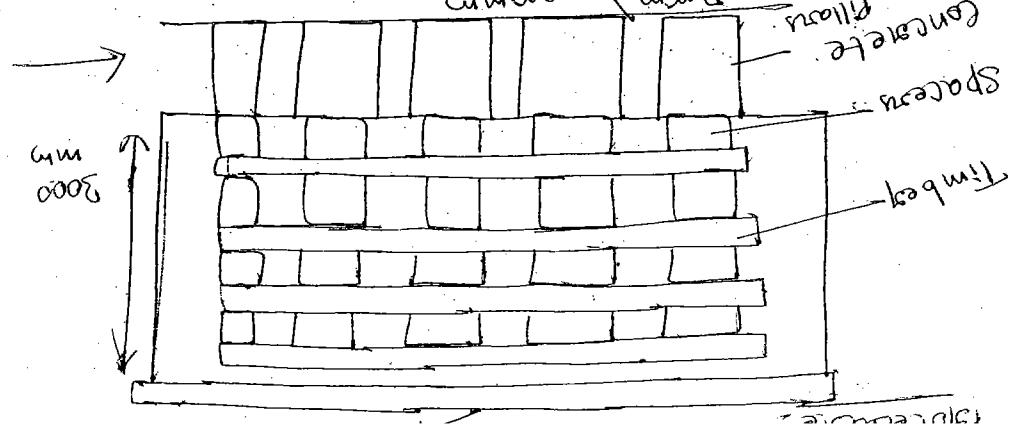
i) Natural seasoning:

- Dewatering/reducing the water content from wood naturally without applying any technique in natural atmosphere.

- Reduces large area.
- Spacing of wood
- Coarse wood as it dries immediately from the inner
- Reduction of moisture content as per the 6 yrs.
- Drying period is more as it takes minimum time.
- Drying is uneven if uniform.
- Advantages:
 - Reduces humidity
 - Reduces moisture content as it has high width
 - Relatively cheap & uneconomical.
 - Not suitable for large area.
 - Reduction of moisture content up to 20-30%.



- The distance should be 600mm b/w 2 spacers.
- Fig (b) shows the seasoning of vertical width of stack is 350cm.
- Timber is placed horizontally.
- The height of spacers is 450 - 600 mm.
- Size is the size the space is minimum.
- If the timber is thin the space between
- Roof is constructed.
- To avoid attack from atmosphere, water
- Below the timber spaces are provided.
- On concete pillars, timber is placed in and 350x85mm in dimensions.
- A leveled ground should be selected.
- And 350x85mm in dimensions.
- Made by dry wood in 35x85mm spaces — To keep the log on the spaces.



ii) Artificial seasoning:-

Reducing moisture content from wood through various applications rather than the natural process.

Objectives:-

- Drying period is minimum.
- Drying is uniform & even.
- Reducing water content as per requirement is possible.
- To make fit the wood for paints & varnishing is good.

Types of Artificial seasoning:-

- ① Boiling:- The wood is going to be boiled.
- The wood will be kept in the water & the water will be boiled. By doing so the internal part of the wood will be dried but it loses its strength & elasticity. To overcome this problem instead of boiling. By applying water vapours. the water content will be reduced. But it is highly cost effective.

② Chemical seasoning:- The wood will be immersed in the high salt concentrated water. By keeping wood like that the moisture content of wood will be reduced due to the interaction of salt but because of salt water the external surfaces are tend to crack.

③ Electrical seasoning:- Power is supplied. By applying electric power the moisture content will be reduced. cohesive as the green & fresh wood offers no resistance at beginning. After a period of time when the heat is increasing it offers high resistance. By keeping like this for a period of time due to heat inside the moisture content will be reduced.

④ Kiln seasoning:- After processing of wood i.e., the timber is grubbed) in into diff dimensions in such away to keep them in ~~high~~ ovens while keeping the wood core must be taken in such away air should be circulated freely. Saturated moistured air will be supplied into the oven. → The air \rightarrow temp at $25-30^{\circ}\text{C}$ is supplying inside. → When the heating is increasing, the evaporation is minimum. → After a period of time slowly the moisture content is reducing.

LIME:- Host impotent ingredient in the construction. When the lime is mixed with sand & water it is used as a mortar in masonry work. It is used as a method in masonry work. + when the lime is used with aggregate to another end. But at the discharging end heat will be supplied. Initially heat is minimum. After the period of time the heat reaches the required heat. → The wood is passing from one end of kiln to another end. But at the discharging end heat will be supplied. Initially heat is minimum. After the period of time the heat reaches the required heat. → Lime never available in a free form. → Always available in association of other minerals. Sources of lime:- Sand if acts as a concrete for foundation. Lime never available in a free form. → Sources arise as follows:-

- (i) Lime stone Hill
- (ii) Bedded limestone of silver & bottom of gulf bed.
- (iii) Shells of sea animals.
- (iv) Consistuent of lime stone:-
- (v) Clay - It is one of the major constituents of soil lime stone in lime. If it is excess it creates slaking in lime. It leads to powdering.
- (vi) Bisulication of solid lime stone in lime. It is due to presence of calcium carbonate in lime.
- (vii) Good lime is concentrated in the soil.
- (viii) Slaking
- (ix) It is due to presence of water in building.
- (x) Fumes
- (xi) 8-30%

(a) Selective seasoning:→ Types of kiln seasoning? → The process of removing moisture from in a separate compartment. → The kiln in a separate compartment.

(b) Polymeritive seasoning:→ The wood in passing from one end of kiln through kiln.

Summary:- Types of Horosity:- English Brick, Stone, Hollow concrete block Horosity, Reinficed brick Horosity, Rubble Horosity, Randomly laid Horosity.

Stone Horosity:- English walls, Partition walls, English and Flemish bonds.

Cavity walls,季节性 of wood - Cladding - Effects in timber - Effects in building - Effects in aluminum.

Wood:- Structure - Properties - Seasoning of cavity walls, Partition walls.

Clay:- It is one of the major constituents of soil lime stone in lime. If it is excess it creates slaking in lime. It leads to powdering.

Fires - Reinforced plastics, steel, aluminum.

(ii) Soluble Silica:- One of the Constituent of lime stone.

→ It imparts / creates hydrolic action.

hydrolic action the way of becoming hard & stiff.

→ It will be in inactive stage at low temp. & active at high temp by making bonds with lime.

(iii) Magnesium Carbonate:- It is one of the Constituent of lime.

→ Imparts strength.

→ Creates less heat & less expansion.

→ If it is present more than 30% no need of Clay.

→ Also imparts hydrolic action.

(iv) Alkali and metallic oxides:- If its Concentration is upto 5% they causes hydrolic action due to the formation of soluble silica at low temp.

(v) Sulphate:- When these are minimum it accelerates setting and retards slaking setting → making hard.

(vi) Titan:- One of Constituent in lime.

→ If it is in min. Concentration forms Composite silicate.

→ If it is objectionable when it is max.

(vii) Pyrolytes:- The presence of pyrolytes in lime is ~~at all~~ objectionable & not recommandable.

Classification of Lime:- Lime can be further classified into following.

i) Fat

ii) Hydrolic

iii) Poor

i) Fat Lime:

→ High 'Ca' Concentration of which extracted from Calcium Carbonate.

→ Also called as Rich lime / Pure lime / white lime / higher lime.

Properties of fat lime:

→ Hardness slowly.

→ Having high plasticity.

→ Soluble in water.

→ Changes into different are detectable.

→ Vigorously slaking (highly)

→ Setting is slow in rain

→ appears in pure white colour.

Usage:

→ When mixed with sand it will be used as mortar for thin joints.

→ It will be used in white wash.

(iii) Rock lime: Clay concentration is middle. Hydrolytic action is less. Apparatus for hydrolytic action consists of lime. Hard facuturing process of lime. Highly available 3 steps: 1. Majuli 2. earth 3. Heating. Coal is evaporated by lime. Available in the form of lime from the earth. Coal is available in the form of lime from the earth. Lime stones can be collected from the limestone but it is not preferable. Calcination: Burning of lime stone to extract the lime upto bright red colour. is called calcination. Will be done in 3 flats. Clamming: Limestone collected from sources will be mixed with fuel (wood, charcoal) to wood has to be fixed in alternate rows. If it is due to coal then lime stone of coal). They are mixed with lime stone if bounded in clamps.

(i) <u>Hydrolic Lime</u>	\leftrightarrow Apppearas white & not much consists of clay & ferricous oxide.	\leftrightarrow Reacts with water, (← forms thin joint)	\leftrightarrow Also known as water lime.	\rightarrow Based on the clay concentration it has been divided into 3 types.	(a) Feeble hydrolic lime.	<u>Speckleation</u>	\leftrightarrow clay concentration 5-10% Few mins 1-2 hrs difficult	\rightarrow Slaking	\rightarrow setting	<u>use</u>
					(b) Moderate	<u>Feeble</u>	\rightarrow Few mins 1-2 hrs difficult	\rightarrow clay concentration 5-10% Few mins 1-2 hrs difficult	\rightarrow setting	
						<u>Emulsion</u>	\rightarrow Few mins 1-2 hrs difficult	\rightarrow clay concentration 5-10% Few mins 1-2 hrs difficult	\rightarrow setting	
						<u>Setting</u>	\rightarrow Few mins 1-2 hrs difficult	\rightarrow clay concentration 5-10% Few mins 1-2 hrs difficult	\rightarrow setting	
							\rightarrow Few mins 1-2 hrs difficult	\rightarrow clay concentration 5-10% Few mins 1-2 hrs difficult	\rightarrow setting	

→ To ignite fire dry cowdung chips are used as an initiator.

→ width of clamp is 4m & 380m length

→ once the fire catches fuel it burns

vigorously.

→ At the top of clamp blue flames are observed ⇒ CaO is evaporated.

→ After a period of time blue flames are not observed that means the process is over.

→ Hence the fat limestone are collected.
Advantage:- Can't handle large amount of limestone & white burning mud may give cracks.
Identification of fat lime:- Not burning 3.60m → wall

→ If limestone has no impurities & white in colour then it gives fat lime.

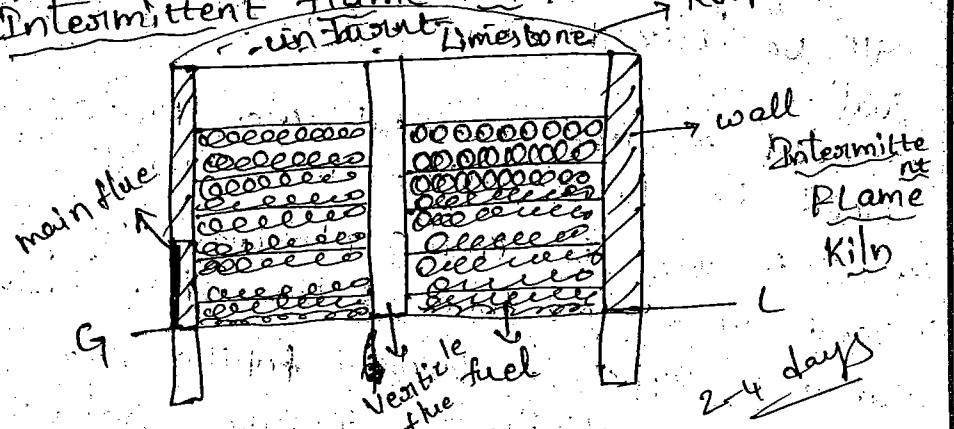
Obtained after burning.

(ii) Intermittent kiln:

→ Batch mode burning stone.

& types:-

a) Intermittent flame kiln:



Intermittent → continuous starting & stopping.
In closed chamber fuel & limestones are placed vertically in heap form (one-on-other) as a layer. Alternatively, vertical structure is called flue in a chamber.
Once the burning is completed the lime is collected.
There may be chance of mixing ash with lime stone.
Unburnt limestone is collected at the root.

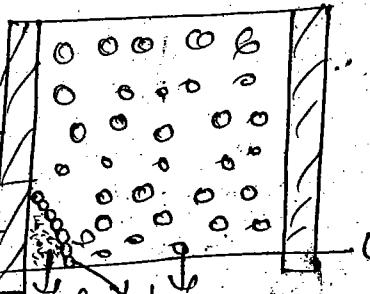
b) Interrmittent flue Kilns:

Flue → unsteady.

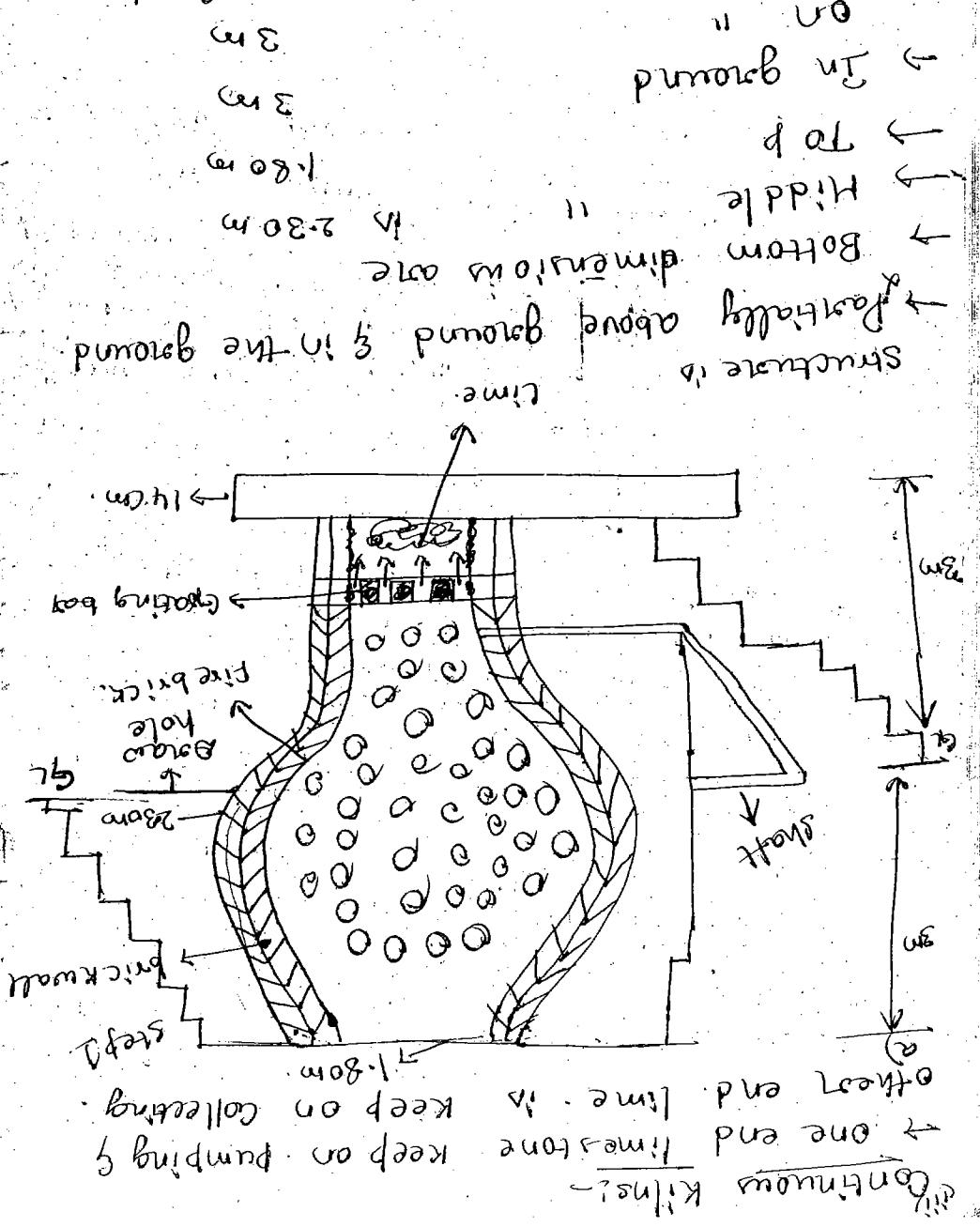
Lime stone & fuel are fixed separately.
Taking large limestone a bridge is made.
As fuel is burning the limestone is burnt.
The limestone burns slowly & lime is obtained.
Pure lime is obtained when compared with

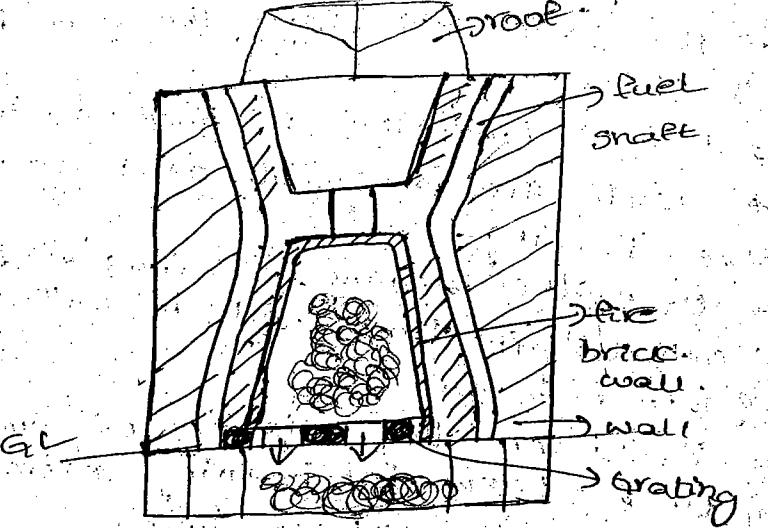
flame kiln.
Limestone is placed & lime is drawn from the draw hole kiln through draw hole. & Disadvantage:-

→ Everytime Loading, cooling, time taking process.



→ ~~less~~ day 4th of limestone can be calculated.





Following steps has to be remembered in the Manufacturing process of burning,

Limestone: → The bright red colour of stone indicates the burning is complete. The burnt limestone should be withdrawn from the kilns as soon as CO_2 is driven off.

→ The dark red colour of stones indicates the presence of CO_2 in stones. But when CO_2 passes off completely the colour changes to brilliant white without flame or blaze.

→ The heating should be such that it does not ^{overshoot} into overburnt & under burnt.

- While the process is going the reg temp. is 800°C .
- The quantity of fuel i.e., size to burn 60N of fuel lime stone is 1KGN.
- The lime stone should be broken into suitable sizes before they are burnt.
- For proper burning the fat limestones, the sizes should be 200mm - 250mm.
- Hydrolic lime sizes should be 75 - 100 mm.
- Heating process should be gradual. Because sudden heating results the blowing of stones to pieces due to quick release of moisture & CO_2 .

(i) Slaking of burnt lime:-

The lime which is left after calcination is called quick lime.

When water is added to quick lime it swells immediately & cracks into powder.

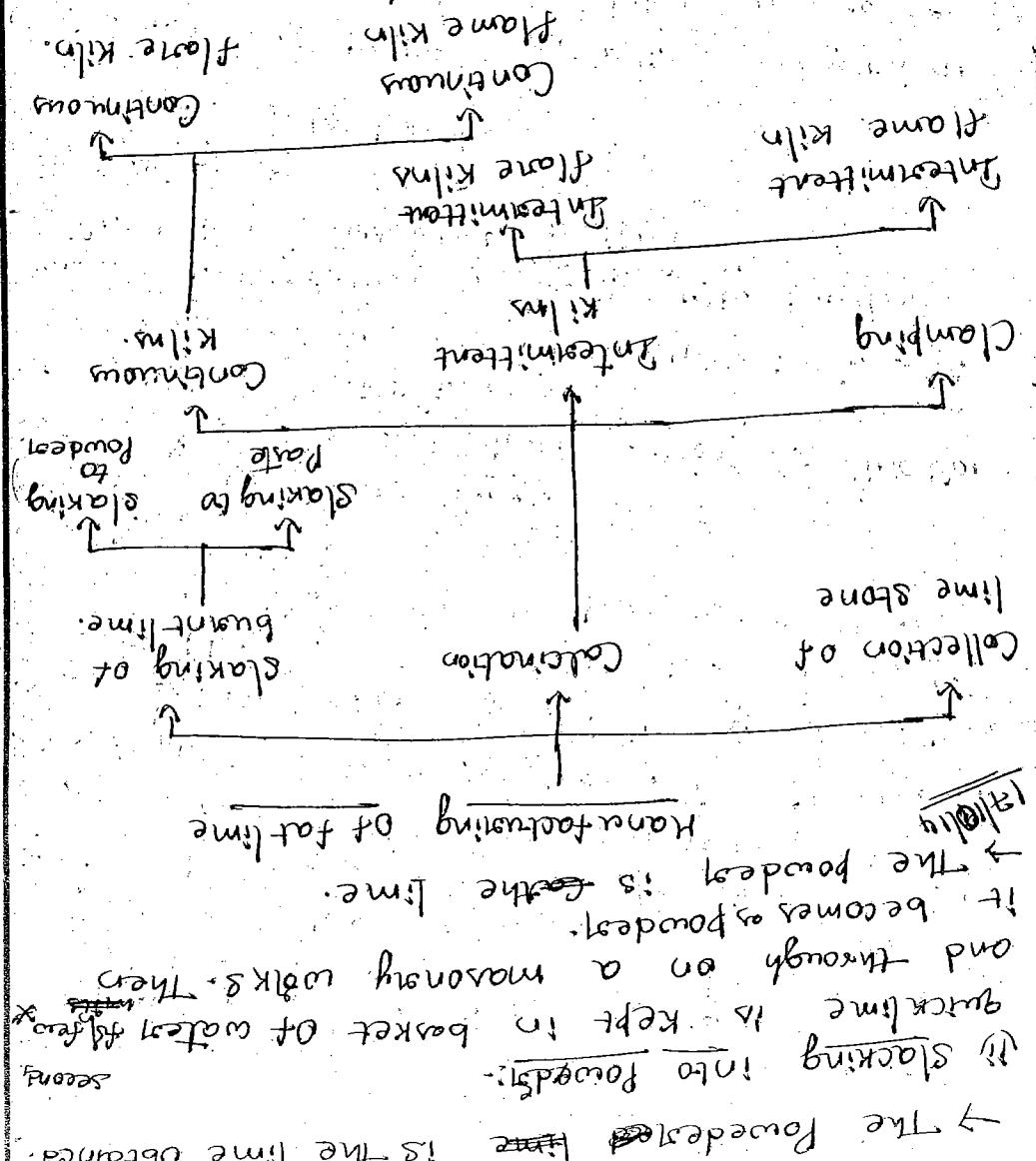
Quick lime is converted into lime in slaking into paste.

Slaking into powder

(ii) Slaking into paste:- quick lime is placed at wooden planks at 150mm depth and water is poured. $\frac{2}{3}$ times more water is maintained then it swells.

The swelled lime is taken and then ground ^{volume = 2.4 times more} in a ^{mixer} & then it becomes a paste.

Then it becomes a powder.



- a) By using modern machines and steam.
- b) specially highly sophisticated machines to make Quick lime into powder form.
- c) By using any strong objects that will be converted into powder.

→ In hydraulic lime the volume of water is added then lime increases to 1-1½ times.

Manufacture of Artificial Hydraulic lime

When lime stone is not available to manufacture hydraulic lime by utilizing the available limestone, hydraulic lime can be prepared.

This entire process is known as preparation of artificial hydraulic lime.

It can be achieved through following:-

Conversion of soft lime stone:-

The lime content on the surface of soil which is available in smooth form (i.e., charcoal) is available in suitable amount of chalk by adding suitable amount of clay.

Conversion of Hard lime:-

When the limestone is in the form of hard that will be subjected to calcination and slaking. After slaking suitable amount of

clay has to be mixed with slaking clay they should mould as balls. → The moulded balls again should be calcined after that slaking also follow. In this process slaking and calcination was done twice so that it is also named as Twice kiln lime.

Various Ingredients of lime:-

1. Quick lime calcium Dolomite:-

	High CaO	CaO + MgO 2-3, 3-4	55-60 0.21 55°
i) Primary Constituents			
ii) Specific gravity			
iii) Bulk density			
iv) Specific heat at 100°F			
v) Angle of repose			

Hydraulic Lime:-

specification High(Ca) Normal Dolomite Precious Dolomite

	High(Ca) $\text{Ca}(\text{OH})_2$	Normal Dolomite $\text{Ca}(\text{OH})_2$	Precious Dolomite $\text{Mg}(\text{OH})_2$ $\text{Ca}(\text{OH})_2$
1. Primary Continents			
2. Specific gravity	2-3, 3-4	2-7, 2-9	2-4, 2-6
3. Bulk density	25-35	25-35	30-40

Refrigerate

4. Specific heat 0.29 0.29 0.29

5. Range of 70° 70° 70°

Uses of lime

When lime is mixed with sand & water it

is used as a mortar.

When lime is used as a chemical slow material

in the purification of water, to treat water

water by sewage treatment.

It is used as flux in metallurgical

and concrete.

Used in the production of glass

Used in the production of cellulose

Used for the soil stabilization and for

improving soil for agricultural purposes.

When it is mixed with Portland Cement and that mortar will be used in place

of cast iron.

CEMENT

→ obtains / Manufacture by burning and crushing of stones containing clay, carbonates of silica and carbonates of Mg.

→ The common variety of artificial cement is known as normal setting cement or ordinary cement.

→ This cement was invented by Joseph Aspdin of Leeds in England in 1824.
→ He took named it as a portland cement & he has taken patents on its name and the reason why he called it as portland cement is:-

when the cement is settled the colour resembles sandstones which are present abundantly in portland area of England.

so he named it as portland cement.

Chemical Composition of Cement:-

Ingredients	Percentage	Range
Lime (CaO)	62%	62-67.
Silica	(SiO_2) --- 22%	17-25.
Alumina	(Al_2O_3) --- 5%	3-8
Calcium sulphate	(CaSO_4) --- 4%	3-4
Bron oxide	(Fe_2O_3) --- 3%	3-4

Magnesia

Sulphur

Alkali

Varieties of cement
Properties:-

① Acid Resistance Cement:-

→ Made up of by adding acid resistance aggregates like quartz, magnetite and additives of sodium fluo silicate and sodium silicates and the solutions of glass wares.

Properties:-

- Strong resistant against acids.
- But not resistant with water.
- To achieve water resistant 0.50 laudine will be added to make it water resistor.

② Blast furnace Cement:-

→ In this type of Cements the biproducts of blast furnace such as lime, alumina, silica will be added as an ingredients.

→ For this type of Cement the initial setting time is less. But it is more stronger once it is settled.

(MgO) --- 2%

S --- 1%

- - - 1%

1-3

1-3

0.2-1

⑧ Coloured Cement:

- To bind cement 5-10% of Colours will be added to achieve desirable colours. and it is achieved as follows.
- Chromium Compounds — Green colour
- Cobalt Impurity Blue colour
- Iron Oxide — Red, Brown, yellow
- This type of cement will be used especially at floors, external surfaces etc.
- To the Bindinary Cement Sta. Bi. (Expanding) agent will be added. And these are especially sulphuric acid (Expanding) agent.
- Used at water retarding substances and will be added.
- The properties of Concrete surfaces.
- ⑨ High Alumina Cement-Chincrete
This cement is produced by grinding of Chincrete of Calcining boxite and lime and the boxite predominately consists of Aluminium Chincrete.
- It should not be less than 35% and the heat should be released by weight of Alumina to the cement.

- The main cement is also found in England, Other names like cement fundo in Brazil, America and Duranlagers.
- The initial setting time of this cement is about three $\frac{1}{2}$ hrs and final setting time is about three hours.
- Alloys make time for mixing & placing operations.
- If can resist high temperature.
- It never loses great heat during setting.
- It is therefore not effected by frost.
- It is the best way to use acids in a better way.
- It is quickly and attains highest ultimate strength in a short period.
- Its strength after 3 day is about 40 N/mm²
- After 3 days 50 N/mm²
- Its setting action mostly depends on chemical reaction hence it is not necessary to add water to fine powder.
- It is a durable cement to be taken to see that extreme case has to be taken with even dense contact comping.
- It is highly cast effective.
- Traces of lime & Bindinary cement.
- It cannot be used in most construction as it evolue great heat & sets soon.

(6) Hydrophobic cement:-

This Cement Contains add mixtures which decreases the wetting ability of Cement grains & the usual hydrophobic add mixtures are acidolne, oxidised petroalatum etc. And these mixtures film a thin film around Cement grains.

→ when water is added to this Cement the absorption films are torn off. At the surface does not prevent the normal hardening of Cement.

However in initial stage the graining strength is less for this hydrophobic Cement and Cement grains prevents the interaction with water & its strength after 28 days is equal to ordinary portland cement.

(7) Low heat Cement:-

Considerable heat is produced during the setting actions of Cement.

→ In order to reduce the amount of heat this type of Cement will be used. It consists lower % of tricalcium aluminate (C_3A) of about 5% and high % of dicalcium aluminate (C_2A) about 46%.

This Cement Posses less compressive strength. Initial setting time is about 1hr & final setting time is about 10 hrs. Mainly used for mass concrete works.

(8) Pozzuolona Cement:-

The word Pozzuolona means a volcanic powder. It is formed in the few areas of Italy.

→ It resembles 'Sarkhi' (product made by burn brick powder with ordinary soils)

→ Also be procured by shales & certain types of clays.

→ The % of Pozzuolona material should be b/w 10 - 13%.

Advantages:-

→ Attains compressive strength with age.

→ It withstands against the actions of sulphur.

→ It evolves less heat during setting.

→ It imparts higher degree of water tightness.

→ It imparts plasticity & workability to the mortar.

→ It posses highest tensile strength.

→ It is cheap.

Disadvantages:-

→ In early days the compressive strength is less.

→ It posses less resistance against to weathering & erosion.

(7) Alumina ceramic cement -
This is prepared by adding a small % of aluminum sulphate and by finely grinding
aluminum sulphate in cement
precipitation has to be follow.
addition of gypsum for setting action is
also greatly reduced.
The % of gypsum for setting action is
the cement.
As it sets rapidly the construction work
may be carried out easily.
The frame work of concrete will be removed
easily can be used frequently.
Light in weight.
No damage easily.
Cement starts earlier than period of curing.
① Extra Rapid Hardening cement-
This type of cement accelerates the
setting of hardening process.
It impacts the strength of above 35%
than the rapid hardening cement.
Days about 96% and 90% higher in 2 days.
The gain of strength disappears with the
age at the span of 90 days.
At the strength of this cement is
not exactly same as that of ordinary
Portland cement.

(8) The extent of about 56%.
It contains high % of tricalcium silicate
but attains highest strength in early days
of ordinary cement.
These cement are the same as these
The initial of final setting times of
⑩ Rapid (setting) cement-
slowing water
Used to lay concrete under traffic
be placed in a short period.
When mixing of cement of concrete to
The extreme case has to be
when mixing of cement of concrete to
in the span of 30 mins.
after adding water it becomes stone
The setting action starts within 5 min.
accelerating the setting action of cement.
fineness of standardizing rate responsible for
the addition of aluminum sulphate and
also greatly reduced.
The % of gypsum for setting action is
the cement.
Precipitation at high temp.
In case lime composition in cement content
very fine grinding.
Additional -

→ The normal addition of CaCl_2 should not exceed 2% by weight of rapid hardening cement.

(2) Sulphate Resisting Cement:

→ Ordinary Portland Cement is susceptible to the attack of sulphate.
→ Free Calcium hydroxide & hydrates of Calcium aluminium present in the set cement reacts with sulphate and forms Calcium Sulphate and Calcium Aluminate respectively.
→ The product forms with the reaction with in the frame work of hydrated cement results in the expansion and subsequently disruption of
→ The remedy of sulphate attack is Sulphate resisting cement. It is a cement with low tricalcium aluminate (C_3A) & comparatively low (C_4AF) Content. The % of C_3A is kept less than 5% & it results in increasing resistant power against the sulphate attack.

This cement will be used for following

→ For the structures which are likely to attack by severe alkali such as Canal lining, culverts etc.

→ In case of sewage treatment plants.

→ Marine constructions.

→ Foundations & basements where sulphur concentration is mole.

(3) White Cement: (IS 8042-1989)

→ The first white cement factory was established at Kottayam of Kerala by Travencore Cement Ltd (TCL) in 1956.
→ And sold under the brand name Vembanad Cement and few more plants also established & are going to establish in & around the India.

This is just a variety of ordinary cement and it is prepared from raw materials which are practically free from colouring oxides of Iron, manganese, Chromium. For burning of this cement the oil fuel is used instead of coal & it is white in colour & it is used for floor finish, plaster work, ornamental work etc. It should not set earlier than 30 mins & it should be carefully transported & stored in closed containers only. More costly than the ordinary cement due to specific ingredients & requirements imposed on raw materials and manufacturing.

Increasing the cement by considering only cement - the environment rules by regulation by maintaining quality by adapting highly advanced technology to competition most of the industries are increasing due to the following reasons.

→ Due to the adoption of modern technology following ways.

and it can be achieved through the process of slow materials like limestone & dolomite and shale day in a good combustion and it can be achieved through the quality of cement is kept on the following ways.

→ Increasing due to the following reasons.

→ Increase quality of cement by government to overcome the competition. Industrialization all environment rules and manufacturers.

Manufacturing Process:- In earlier days the cement was manufactured with present manufacturing processes for building construction.

→ In the construction industry cement / building material is used for fixing mortars of glazed precast concrete blocks.

→ Also for already mix concrete structures etc.

→ If can be used for moulding structures shades, walls, under water.

It replaces glazed tiles with colour cement like swimming pools where

→ The miscellaneous applications of white cement like appearing other values.

→ Pages have high strength.

→ It has quick drying.

in industry.

→ In dispensable for housing and construction of quickly establish itself as absolutely solid of the cement. If has the qualities in dispensable for housing and construction in industry.

→ The construction industry uses mainly mineral raw materials to produce the cement by considering the central role of the qualities of the cement.

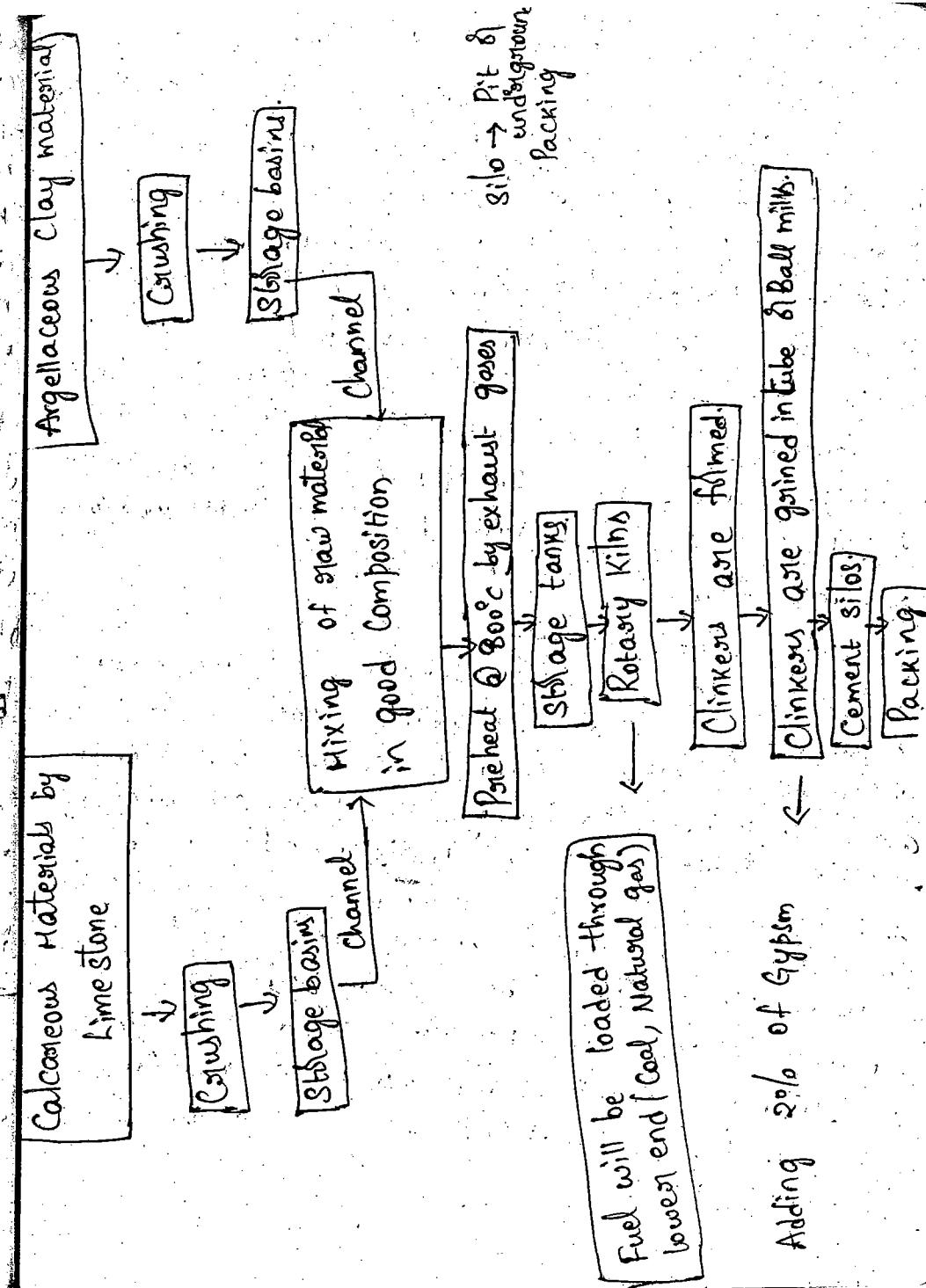
→ Power:— In order to bring down the power consumption modern technology helps with respect to electricity and with respect to human power.

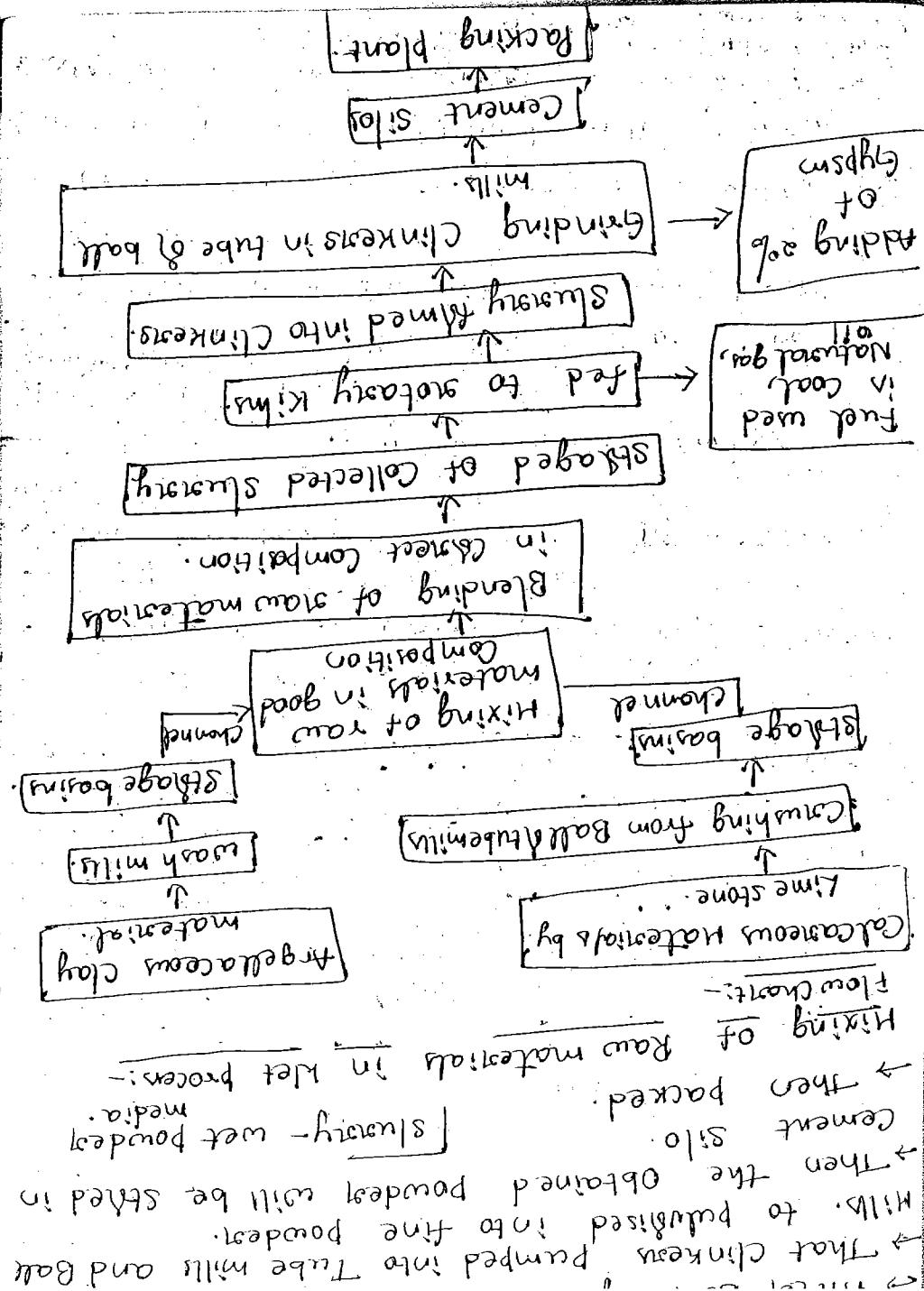
→ Quality of Cement:— By increasing research in cement industry with the help of modern technology we are able to increase the quality of cement.

→ Technology:— By obtaining technology step by step with respect to manufacturing of cement we are able to produce good quality cement.

→ Mixing of raw materials can be achieved as follows:-

Flowchart:





→ Generation of limestone will be established by machines by using proper technology.

→ Before dumping limestone into the hopper up to 25mm - 35mm size and this can be achieved by using ball mills and tube mills.

→ High temp will be passed through the substance into

→ substance will be pulvified film.

→ Then that will be passed in storage basin

→ After making powder.

→ The channels there are made of

→ + Through mixing at 60°C.

→ That will be supplied in storage tanks.

→ Then that will be subjected to take subsequent amount of substance.

→ The temp will be maintained at 60°C.

→ Properties as best storage element

→ + The channels there are made of

→ + Through mixing

→ Then that will be passed in storage tanks.

→ After mixing powder.

→ The channels there are made of

→ + Through mixing

→ Then that will be subjected to take subsequent amount of substance.

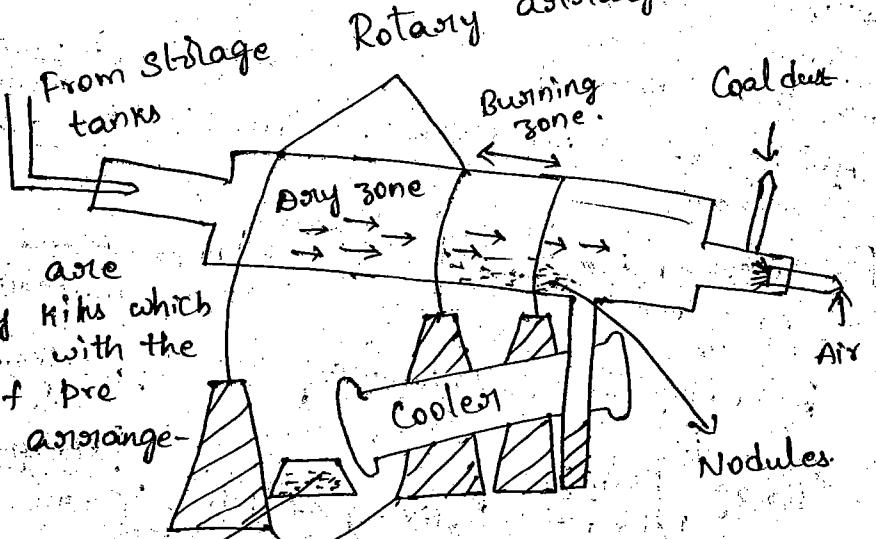
→ The temp will be supplied in storage tanks.

→ That will be supplied from the lower end to rotary kilns.

→ which will be used at the kiln.

Procedure:-

(ii) Burning:- Burning will be done in Rotary Kiln.



→ These are rotatory kilns which rotates with the help of pre existed arrangement.

Clinkers support

→ Diameter is 0.25m - 3m. & length is 90-120m

→ They are vary in size.

→ when the powder is entering into the kilns

→ Dry zone:- slowly the water content is drying by using the fuel

Burning zone:- The temp in the Kiln is $1400 - 1500^{\circ}\text{C}$

and the inner surfaces are coated with refracting materials.

→ Once the water content is evaporated the powder was turned into gritted

materials called nodules → the immediate small or medium mass content formed after water evaporated

cooling then the nodules are enters into coolers. the temp is 95°C . → separate basin is there to collect the nodules from coolers. to called as clinkers.

(iii) Grinding:- Slagage tanks

↓
Rotary kiln

↓
Clinkers are fined.

↓
Grinding in tube mills & ball mill

↓
weighing & packing

↓
Distribution

The clinkers which are obtained through ball mills will be dumped into ball mills where Chromium steel balls are placed.

Abbression → Rubbing blw to diff 2 objects

→ while the drum rotates due to the abbrasion blw ^{steel} balls and materials clinkers fine powder will be fm

→ per min the whole mill will be rotate 1-3 revolutions.

→ The powder will be Collected through hooter.

→ By using electronic equipment Weighing &

time at which it gives a comprehensive strength around 500 kg/cm² after 195 minutes.

5 No. Grade O.P.C. Cement
 Used for general
 construction under normal
 environmental conditions
 even conditions
 The compressive strength after 28 days
 is 33 N/mm²
 If cannot be used
 where highest grade concrete above H-20
 The use of this
 cement has problems
 very decreased by
 water soluble facets out
 in 28 days
 compressive strength
 in 43 N/mm²
 half widely used
 cement of general
 use cost/k.
 Compressive strength of individual
 building blocks, bridges
 etc.

33-grade O.P.C. (IS 269 - 1989)
 Grade O.P.C. (IS 8112 - 1989)

3

53 grade O.P.C.
(IS 1269 - 1987)

- and other general Civil Construction works.
- Suitable for all types of applications, RCC plastering, Masonry.
- Min. 28 days.
- Comprehensive strength is 53 N/mm²
- Introduced in 1991 by Grasim Birla Super.
- Gives 10-15% saving in Cement Consumption.
- 5-8% saving in steel Consumption.
- Provides highest grades of Concrete above M-30 are used.
- Useful for high rise buildings, bridges, flyovers, chimneys & pre stressed structures where high grade Concrete is required.

Hydration:-

when the water is added to cement chemical reactions are taking place b/w water & cement by releasing heat. The process of releasing heat is called as hydration. And the heat is called as hydration heat.

The release of heat is up to 80-90% in 1st one month & the process goes on ~~upto~~ on upto 1 yr. This hydration is influenced by following facts:

- ~~exist~~ existed heat while the
- fine ness of powder
- Ingredients of Cement

Hydration Heats- The heat which is released due to the actions of cement & water. The heat is made in 1st 28 days by imparting strength to the cement. And it goes on upto 2 yrs & till max strength attains to cement.

Setting and fitness of cement- When the water is added to cement, The ingredients of cement react chemically with water & forms various complicated chemical compounds. The formation of these compound is not simultaneous. But setting action of cement continuous for a long time. The mixing of cement & water results in a sticky cement paste and its goes on gradually thickening till it achieves till 1 yr.

Following are the compounds formed during the sett-

→ ~~Tri~~ ^{Calcium} Aluminate ($\text{Ca}_3\text{Al}_2\text{O}_9$) ^(3\text{CaO}\cdot\text{Al}_2\text{O}_3) :-
This Compound is formed with in 24 hrs

After adding water to cement
 the gain in strength of C_2S is small
 is about 15% of that of C_3S in the
 extra Calcium Aluminoferrite ($4CaO \cdot Al_2O_3 \cdot Fe_2O_3$)
 This compound is formed with in 24 hrs.
 after adding water to cement
 3) Tri calcium silicate ($3CaO \cdot SiO_2$)
 This compound is formed with in a week a
 after addition of water if it affects
 the most susceptible to impact strength
 to the cement in early period of setting
 4) Di calcium silicate ($2CaO \cdot SiO_2$)
 This compound is formed very slowly and
 hence it is responsible for progressive setting
 the property of C_3A is utilized in quick
 be in high concentration. The hardening of
 a hydrolic substances. The hardening
 concrete required long setting time as
 high concentration of C_3S . When high strength
 passed off time the cement is made with
 high strength concrete is strengthened in a short
 hydration of C_3S begins. Hence when a high
 C_3S comes partially to end and the
 span of about 28 days. The hydration of
 is about 15% of that of C_3S in the
 the gain in strength of C_2S is small

after adding water to cement
 5) Tetra calcium Aluminoferrite ($4CaO \cdot Al_2O_3 \cdot Fe_2O_3$)
 This compound is formed with in 24 hrs.
 after adding water to cement
 6) Calcium silicate ($3CaO \cdot SiO_2$)
 This compound is formed very slowly and
 hence it is responsible for progressive setting
 to the cement in early period of setting
 7) Tetra calcium silicate ($4CaO \cdot Al_2O_3 \cdot Fe_2O_3$)
 This compound is formed with in a week a
 after addition of water if it affects
 the most susceptible to impact strength
 to the cement in early period of setting
 8) O.P.C designated as C_3A , C_4AF , C_3S
 C_2S and these proportion is $C_3A:4:14$
 The above 4 principle minerals go
 to cement
 hence it is responsible for progressive setting
 to the cement in early period of setting
 9) Tetra calcium silicate ($4CaO \cdot Al_2O_3 \cdot Fe_2O_3$)
 This compound is formed very slowly and
 hence it is responsible for progressive setting
 to the cement in early period of setting
 10) Calcium ferrite ($3CaO \cdot Al_2O_3 \cdot Fe_2O_3$)
 This compound is formed with in a week a
 after addition of water if it affects
 the most susceptible to impact strength
 to the cement in early period of setting
 11) Aluminium - containing C_3A " " less " 20%
 As follows
 Hardening Portland cement
 depending upon % of mineralogical composition
 of Portland and cement can be classified
 as follows.

11) Aluminium - containing C_3A " " less " 12%
 C_3A and the water is added to cement
 the quicker to react with water is
 when the water is added to cement
 12) $C_3S \leftrightarrow C_4AF$, C_3S/C_2S
 C_3A and 10% due to decreasing rate

Various field tests and Laboratory tests for cement:-

① Field test:-

Colour:- The colour of cement also one of the properties to define the quality of cement. For instance, gray coloured greenish shade cement.

→ This test indicates to find out the % of lime, silica, clay.

→ But it is not accurate.

Physical properties:- When cement is taken b/w 2 fingers while rubbing in b/w them ~~it~~ it should be smooth.

→ If it is rough it indicates adulteration of sand.

adulteration → Mixture of improper & cheap element.

→ If we throw that cement on the surface of water body if it flows that is unfit & not good.

→ If the cement paste is taken b/w the finger if it is rough it means adulteration of cement with silica & lime.

Presence of Lumps:- Lumps → Mass of moisture content.

→ Lumps are formed in the cement due to

the action of atmosphere which defines the cement is unfit.

Strength:- When the briquette is made of ratio of cement & sand which 1% cement, 6% sand. 1:6 Cement & sand with dimensions of $75 \times 25 \times 12$ and allowed to keep it in water for 24 hrs it should not break easily & should not convert into powder.

Laboratory Test:- These tests are most imp & quality oriented while the defining cement quality. Extreme care has to be taken while collecting the samples at various places with right proportions every where and it can be taken as follows.

→ when the cement is loose approximately in samples with equal proportions has to be taken from the heap of cement.

heap → Arranging 1 on another.

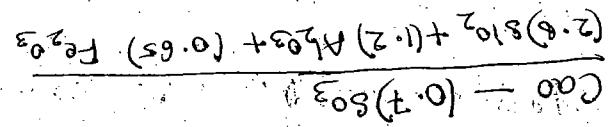
→ If it is in bags 12 samples has to be taken from diff bags and Collected sample either from loose samples or from cement bags should not be greater than 50N.

Re Need of the test / uses:-

→ To find out the quality of cement

→ To regulate the production of cement

while it comes from various steps.



done through the following steps:

- The % of lime should be less than 1.02 if it can be silica.
- The % of lime should be less than 0.66 and should be greater than 1.02 if it can be cement particles.
- If 0% of lime to that of alumina, iron oxide and silicon should not be less than 0.66.

The % of alumina to that of iron oxide to that of alumina shows the following results.

① Chemical composition → This can be done/derived through

② Soundness of cement → " "

③ Final " "

④ Tensile strength " "

⑤ Compressive strength " "

⑥ Consistency test " "

⑦ Initial setting of cement. " "

⑧ Soundness of cement. " "

⑨ Chemical composition. " "

Types of laboratory tests:-

1. Consistency.

When it is used at various working

To find out the behaviour of cement

- (i) Total weight of sulphuric acid should not be greater than 4%.
- (ii) Weightage of sulphuric acid should not be greater than 0.5%.
- (iii) Weightage of insoluble residue should not be greater than 0.5%.
- (iv) Weightage of magnesium should not be greater than 0.5%.
- (v) Weightage of manganese should not be greater than 5%.
- (vi) Fineness:-

 - This test is meant to find out the concentration of cement particles.
 - Grinding of cement particles by 2 ways.
 - It can be done by 2 ways.
 - When the cement is sieved by using sieve number 9 size of which is 10% in left should not be more than 10% in
 - Its number 9 size the size due to which is 10% in left value.
 - To prime ability test the surface area of cement particles will be calculated.
 - It gives better result that the sieve analysis.
 - If a good quality particle size should not be 2.50 mm.
 - Cement particle size should not be 2.50 mm.

③ Compressive Strength:-

To find out the compressive strength of the cement the procedure is as follows:

→ The (amalg) m₁ of cement & sand is prepared in 1:3 proportion i.e., 1g of cement, 3g of sand, then water is added to m₁ in the ratio of 0.4.

→ This m₁ is placed in moulds. The test specimen is in the form of cube with dimensions of 70.6mm & 76mm. These moulds are made up with metal & they are cast in such away that they can be easily taken without being damage.

→ The m₁ after been placed in moulds is compacted in vibrating machines.

→ The mould is kept in damp cabin for 24 hrs.

→ The specimens are removed from the mould & they are submerged in the clean water for curing.

→ The cubes are tested in compressive testing machines. At the end of 3 days & 7 days.

→ The force is applied during 3 days test is 250 kg/cm² or 35 N/mm².

→ The compressive strength at the end 3 days should be less than 115 kg/cm² or 11.5 N/mm².

for 7 days should not be less than 175 kg/cm² or 17.5 N/mm².

④ Tensile strength:-

This test was formerly used to find out the tensile strength & the procedure is as follows. The m₁ & sand is added in the 1:3 ratio proportion.

→ water is added to m₁. The quantity of water is 8% in the weight of cement, sand.

→ The m₁ is placed in briquette moulds. The mould is filled with m₁ & a small heap is placed at the top of briquette.

→ The m₁ will be adjusted with a standard spatchula & the amount of cement is $\frac{600}{1000}$ g for 12 briquettes.

→ The briquette is kept at damp area for 24 hrs.

→ The briquettes are carefully removed from the moulds & are submerged in clean water for Curing.

→ The briquettes are tested by testing machine at the end of 3 days & 7 days.

→ 6 briquettes are tested in each test,

average is findout, during the test the force is applied 35 kg/cm² or 3.5 N/mm² And it may be noted the Colets sectional

By applying formula to the tensile strength
 of cement will be calculated out
 An indirect scale is attached to the "mould".
 And it shows the level of penetration.
 The Vi-Cat mould is in the cylinder form.
 And it has 3 attachment — square needle
 plunger & and needle with annular slings.
 The square needle is used for initial setting
 time.
 The plunger " " " cannot be used
 The needle with cylinder " " " cannot be used
 The needle with cylinder " " " cannot be used
 The plunger is attached to the mould.
 And the plunger is attached to the mould by weight (90g) is added to it
 Mix water & cement on a non-plastic
 surface (glass). While mixing the mixing
 time of 3-4 minutes (8/4 min) - 4/4 min
 to filling the mould is known as
 the initial addition of water
 → Fill the mould of Vi-Cat Operated
 to filling the mould should be 3-4
 minutes (8/4 min) - 4/4 min
 → The test is used to detect the setting
 period of cement
 procedure for initial setting time
 → The cement weighing 300g is taken &
 mixed with permissible amount of water
 to determine the consistency.

old weighing 300g & having a claim to
 a frame to which an attached movable
 → The ~~test~~ Vi-Cat Operated consists of
 mins (8/4) 3 8/4 min - 4 4/4 min
 time of ongoing & it should be 3-4
 to the initial addition of water
 → The initial addition of water
 should be properly
 → Take 300g of cement & 30% of water
 by volume
 → Take 300g of cement & 30% of water
 by weight (90g) is added to it
 → Mix water & cement on a non-plastic
 surface (glass). While mixing the mixing
 time of 3-4 minutes (8/4 min) - 4/4 min
 to filling the mould should be 3-4
 minutes (8/4 min) - 4/4 min
 → The purpose of this test is to determine
 the use of water required for preparing
 cement paste to other test
 → The purpose of this test is to determine
 the tensile strength = $\frac{f_{ai} \text{ in load}}{f_{ai} \text{ in load}}$
 Ultimate tensile strength = f_{ai}

→ The Cement paste is fixed in the Ni-Cat mould & square needle of 1mmx1mm is fixed to the Operad.

→ The needle is quickly released to allow to penetrate the Cement paste. In the starting the needle penetrates completely & it is taken out ~~as~~ it is dropped fresh place. The procedure is repeated as regular intervals till the needle does not penetrate completely.

→ The needle shows penetration upto about 5mm measure from bottom.

→ The initial setting time in interval b/w the time is 30 mins for good Cement

Final setting Cement:-

Procedure:-

→ The Cement is prepared same as above.

→ The needle with annular Collar attached to the moving rod of Ni-Cat Operad. And the needle is released gently.

→ The time at which the needle

makes no impression on test blocks & cement to do so is noted.

→ Generally the final setting time is 10 hrs.

(B) Soundness of Cement:-

→ The purpose of this test to detect the presence of uncombined lime with Cement.

→ Perfomed with the help of Lechatelier's Operad.

→ Consists a brass mould of diameter 30mm

& height 30mm. There is a split in mould it does not exist 0.50 mm on either side of split.

→ There are 2 indicators with point ends.

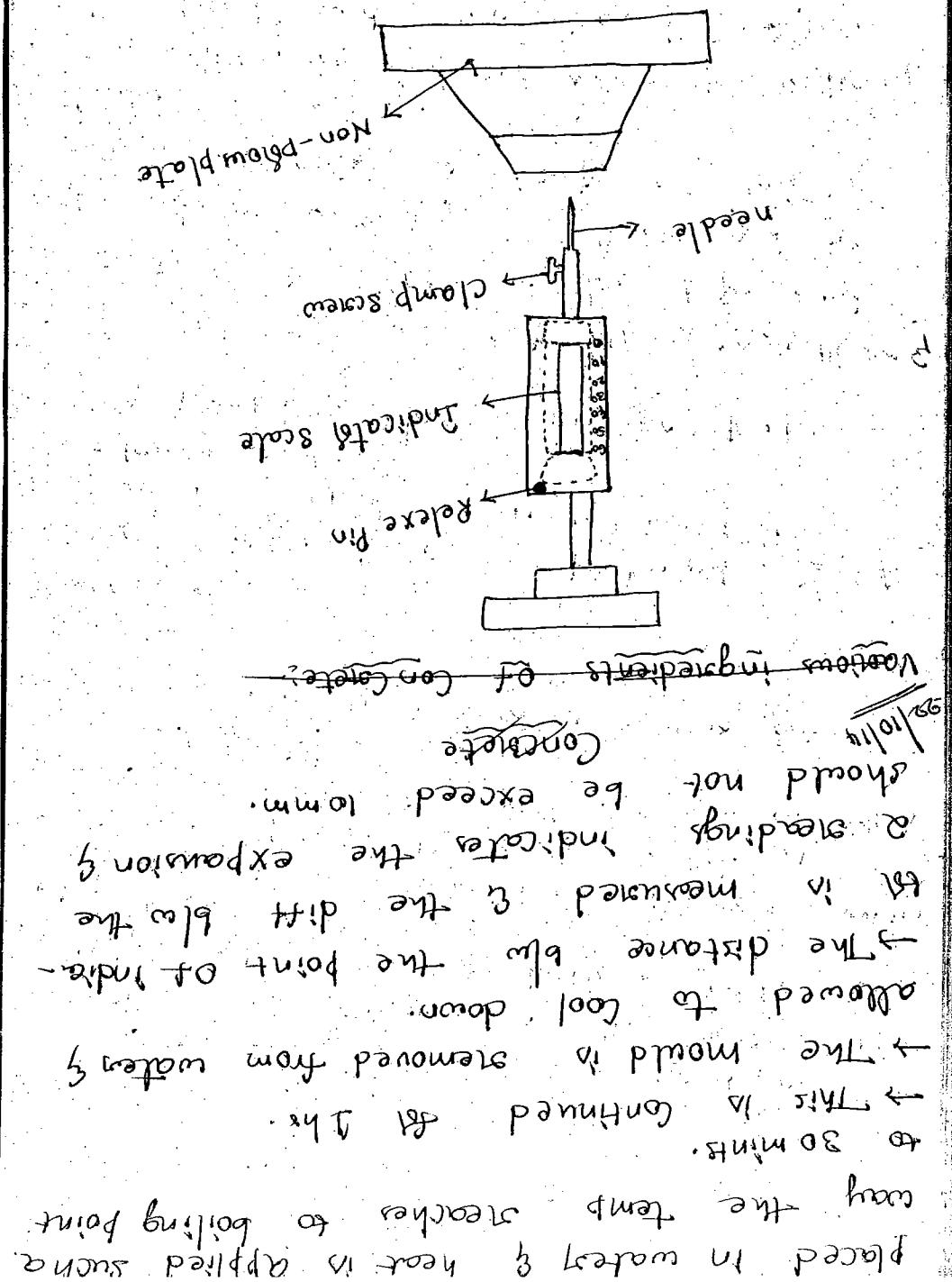
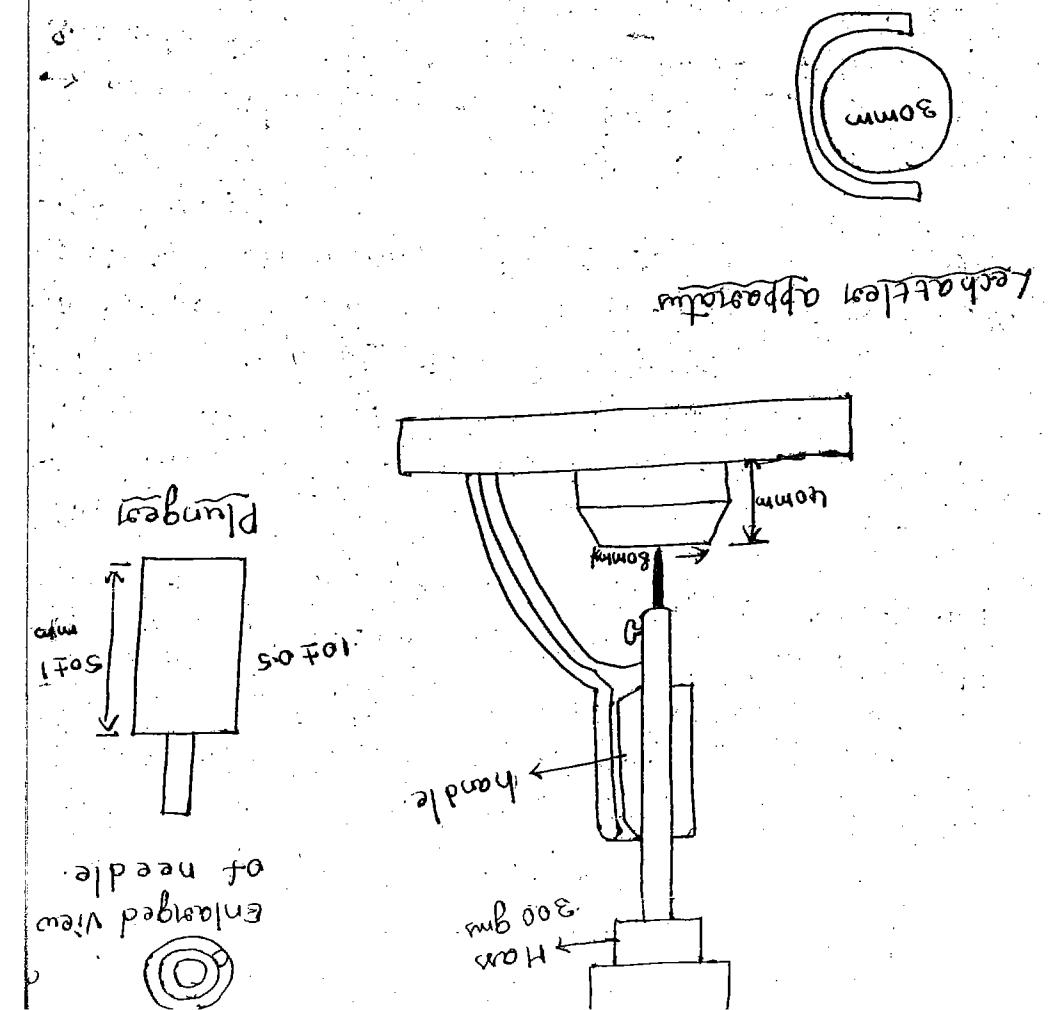
Procedure:-

→ The Cement paste is prepared, % of water is added as determined in Consistency test.

→ The mould is placed on glass plate

→ It is covered top by glass plate & a weight is kept on the top. And the whole assembly is submerged in water for 24 hrs & temp of water should be $24^{\circ}\text{C} - 35^{\circ}\text{C}$.

→ The distance b/w the points of indicator is noted and the mould is again



Cement Concrete

- It is a mixture of binding material, fine aggregate, Coarse aggregate, water.
- This is strong in Compressive strength, weak in tensile strength.
- To get tensile strength, diff fibres are used with the names of Rcc, Psc (Pre-tensioned Concrete), FRC (Fiber Reinforced Concrete).
- Plain Concrete should be used before it loses its plasticity and hardness.

Various ingredients of Concrete:-

① Cement: - It acts as a binding material after addition of sand, water & gets hard after the hydration.

- ↓
Librating heat
→ After it hydrates it binds aggregate & surrounding surfaces like stone & bricks.
- Generally richer mix (more cement) gives more strength & setting time starts after 20 mins & ends after 6 hrs.

② Fine aggregate: - It can pass through the sieve when sewed. The material which passes through the sieve is 0.45 when we sewed it that material is called fine aggregate.

- Generally its construction is given sand.
- It mixes with cement and close the voids in the aggregate & the binding of ingredients takes place.

3) Coarse aggregate: - Consists of crushed stones.

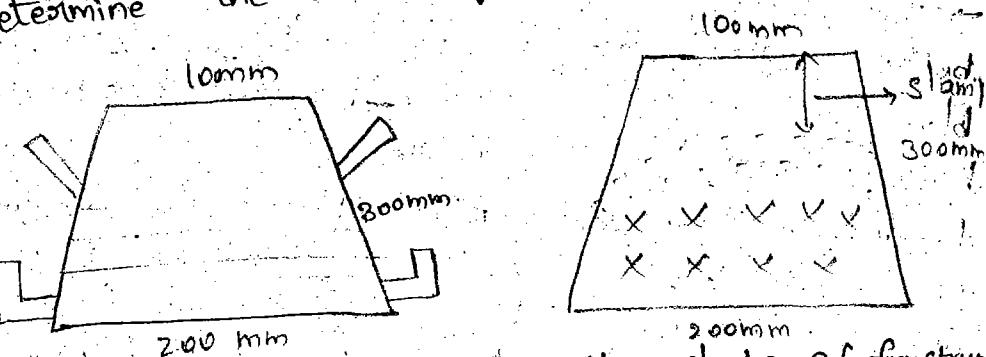
- Well graded stones generally igneous rocks
- They should be clean, sharp, angular & hard
- They give mass to the concrete and prevents shrinkage of cement.

4) Water: - Used for making concrete mixture.

- It activates the hydration of cement.
- As it settles completely, concrete becomes hard mass.
- The water gives workability to concrete which means to be mixed properly with all ingredients.

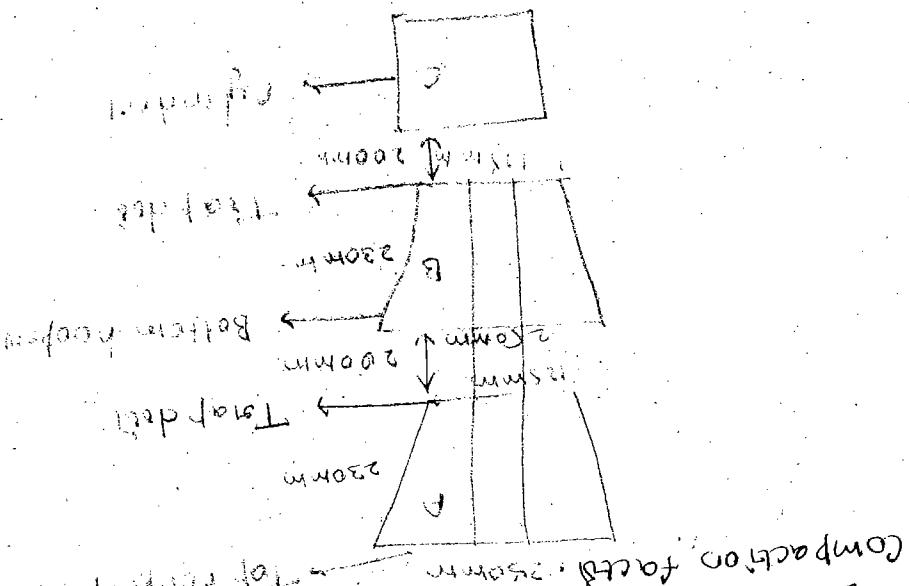
Concrete Tests:-

① Stamp Cone test: - → This test is aimed to determine the workability of concrete.



- Stamp Cone is a vessel in the shape of frustum (half cone) of a cone with diameter at bottom 200 mm & 100mm at top & 300mm height.

③ Glazing Strength test:- cement, fine aggregate
cement aggregate to be used in making
concrete by roughly into 500m temp prefereable
(27F-37oC). After commencing the preparation
of concrete which is mixed thoroughly at
uniform state.ould be taken and
they will be filled up with mixture (concrete
with a layer of 50 mm. Each layer is mixed
and compacted with tamper rod after



Concrete with 50mm concrete layer which is tampered by tamperer tool with 16mm dia, 60mm dia and bullet end. The weight of tampered concrete is weight and let it be tampered concrete in weight and let it be 1/2. The ratio of w_2/w_1 is termed as compacton factor. Summary - ratio of weight

of Concrete. This test is conducted in Laboratory, the test equipment consists of a hoop eccentricity of a cylinder fixed to a stand. The dimensions and distances are specified. The upper vessel named it as "A" with length of 250mm at top bottom of 125mm, 280mm height. Distance between vessel is 230mm, 125mm at bottom, 280mm height. The vessel and vessel is 230mm, bottom length is 125mm, 280mm height. Distance between vessel is 230mm, and each vessel below 3 vessels is 200mm. And each vessel A/B having track deal at bottom.

Having track deal with concrete to be tested. As soon as it is filled the trap door is opened and concrete is collected in cylinder vessel by. Then the track deal of B is opened to collect concrete in cylinder vessel. Now the vessel B.

Concrete is weighed and let it be 21. To collect concrete in cylinder vessel. Now the vessel B.

Concrete is weighed and let it be 21.

This cone is made out of impervious materials.
 It is filled with concrete in 4 layers.
 Each layer is 16 mm dia with a tangent side of
 600 mm in length, 16 mm dia with bullet end for
 25-35 times. After filling completely the cone
 is gently pulled up and the decelerate in the
 height of the concrete is called as slump.
 At the slump should be sum of otherwise
 it is unfit for construction.

finishing of filling allowed to leave them for 4 days. After that moulds should be removed and the test specimens will be kept in the water for curing for 28 days. After 28 days they will be brought to compressive strength machine by applying load of 14N/mm² wise 3 specimens will be tested from 3 batches and the average will be taken. By applying the following formula

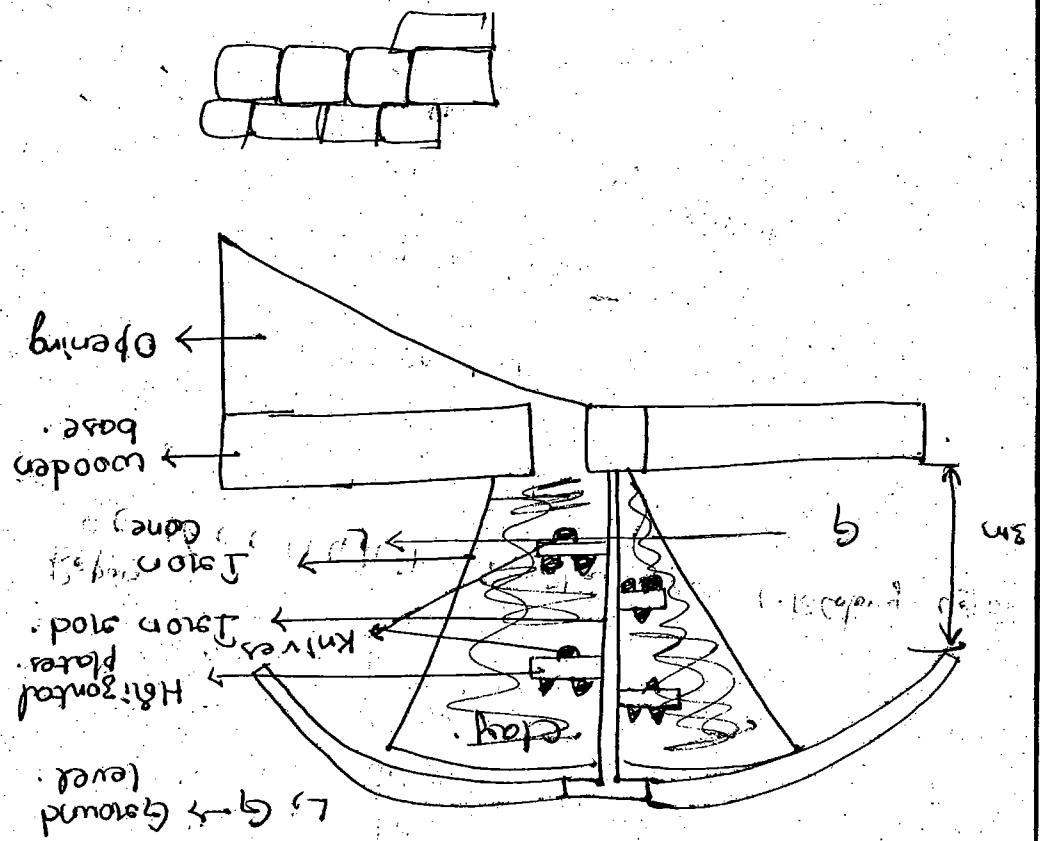
$$\text{Compressive Strength} = \frac{\text{Max Load}}{\text{Cross sectional area}}$$

Mixes of Concrete

<u>Proportion of concrete mix</u>	<u>Max size of Aggregate</u>	<u>Nature of work</u>
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$\rightarrow 1: 1: 2$	$\rightarrow 12 - 20\text{mm}$	\rightarrow Heavy Loaded RCC Column, RCC arches of long span.
$\rightarrow 1: 2: 2$	$\rightarrow 12 - 20\text{mm}$	\rightarrow Small Pre Cast members of concrete such as poles, fencing, telegraphs etc, long piles, water pipe const and heavily stressed members of structures.
$\rightarrow 1: 1\frac{1}{2}: 3$	$\rightarrow 20\text{mm}$	\rightarrow Water retaining struct, piles, pre cast products.
$\rightarrow 1: 2: 3$ (Q)	$\rightarrow 20\text{mm}$	\rightarrow Water tanks, Concrete deposited under water, bridges, sewers, Construction of all general RCC works.
$\rightarrow 1: 2\frac{1}{2}: 3\frac{1}{4}$	$\rightarrow 25\text{mm}$	\rightarrow Footpaths, pavement works such as Slabs, Columns, tentals etc.
$\rightarrow 1: 2: 4$ (Q)	$\rightarrow 25\text{mm}$	\rightarrow Hand Concrete works such as culverts, Retaining walls
$\rightarrow 1: 2\frac{1}{2}: 3\frac{1}{2}$	$\rightarrow 38\text{mm}$	\rightarrow Hand Concrete works for heavy walls, foundation footings etc.
$\rightarrow 1: 3: 6$	$\rightarrow 50\text{mm}$	
$\rightarrow 1: 4: 8$	$\rightarrow 60\text{mm}$	
$1: 5: 10$		
$1: 6: 12$		

The concrete as per BIS-456/978 is designated in 7 grades namely M10, M15, M20, M25, M30, M35, M40. The letter 'M' refers to the mix and the number



Assignment:

- Uses and Implications of Concrete →
 - As a bed concrete over the piers of walls or walls on support at beams.
 - As a wall footings, on walls on support at beams.
 - As a sill concrete over the piers of walls or walls on support at beams.
 - As floating, the area around the buildings coping concrete.
 - P & P movements for marking pre-cut blocks etc.
 - However may use of concrete is as a load bearing of reinforcement and stressed concrete, many structural elements like footings, columns, beams,恋etal etc.
 - Lime: Variation in quality of lime - Consistency of lime - Various methods of lime - Classification of lime - Various methods of lime stone - Various methods of lime.
 - Cement: Portland cement - Chemical composition of cement - Hydration, setting and thermal of cement. Various types of cement and their properties. Various fields and laboratory tests for cement.
 - Concrete: Various in quality of cement - Various tests for concrete and their importance - Various tests for concrete and their applications in field.

Indicates the specified compressive strength of concrete at 28 days expressed in N/mm²