

unit-1 Building Components

The term building in civil Engineering is use mean a structure having various component such as foundation wall, column, floor, roof, Door, lintel etc.

* Types of building :-

→ As for the national building construction in India, there are nine groups of building.

Group (A) :- Residential Building

Group (B) :- Educational Building

Group (C) :- ~~Public~~ Institutional Building

Group (d) :- Assembly Building

Group (e) :- Business Building

Group (F) :- Mercantile Building

Group (g) :- Industrial Building

Group (h) :- Storage Building

Group (i) :- Hazardous Building

Group (A) :- Residential Building

→ A Building which provide sleeping facility such as lodging, Apartment, Hotel, family Rooms etc.

Group (B) :- Educational Building

→ Any building which are constructed for the educational purpose for limited time of Eight hours such as school, collage, university etc.

Group (c) :- Institutional Building :-

- The building which are use for the purpose are health treatment, or medical purpose for carrying a person who is suffering physical and mental.

Ex:- Hospital, Medical etc

Group (d) :- Assembly Building :-

- The building like theatre, Assembly hall, drama hall, Oditorium, dance house etc. Which are use for gathering of different people for different purpose.

Group (e) :- Buissness Building :-

- Any building which are use for the buissness purpose such as keeping of account or record are product.

Ex:- Beauty parlour etc.

At where less then 100 people included in that building.

Group (f) :- Mercantile Building :-

- The buildings which are used for the office, showroom, and for the purpose of both Holesell.

Group (g) :- Industrial Building :-

- It includes any building in which the products or materials or manufacture, Pack such as plants, factoryise, Mill etc.

Group (h) :- Storage Building :-

- The buildings which are use for the storage of product, books, manufacturing materials etc.

Group (i) :- Hazardous Building :-

→ The building which is use for the storage and manufacturing from hazardous products such as poisons, tracker, fuels, chemical, pesticides, etc.

* Load :-

Types of Load :-

① Dead Load

② Live Load

③ Wind Load

① Dead Load :-

→ This is the load which are permanently fixed upon a place. Such as building, road, Railway track, bridge etc.

② Live Load :-

→ The moveable loads upon the floor are known as live load such as furniture, vehicles, animals etc.

③ Wind Load :-

→ The effect of wind which act on a building regularly so, that building

* Different Component of Building :-

(i) Foundation

(ii) Plinth

(iii) Super-structure

} Sub-structure }

(i) Foundation :-

→ The Lower artificial Prepare Part of the any structure (building) which carry the load

of that super-structure and transmit that load to the hard-stratum. is known as Foundation.

→ It is constructed below the ground level which is directly contact with hard-stratum.

(ii) Plinth :-

→ It is the part of building about the ground level and foundation upto the floor level.

→ The built up area up measure at the plinth level is known as plinth area.

(iii) Super-Structure :-

→ It is the part of building above the plinth level which is known as super-structure.

* Basement, GF, UF :-

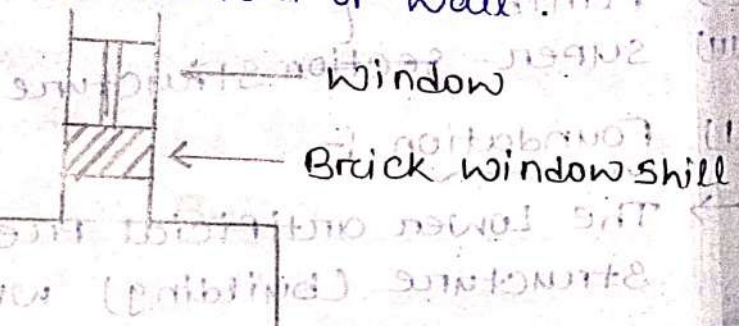
→ A floor provides support to the furniture equipments of building and all floor is known as Basement.

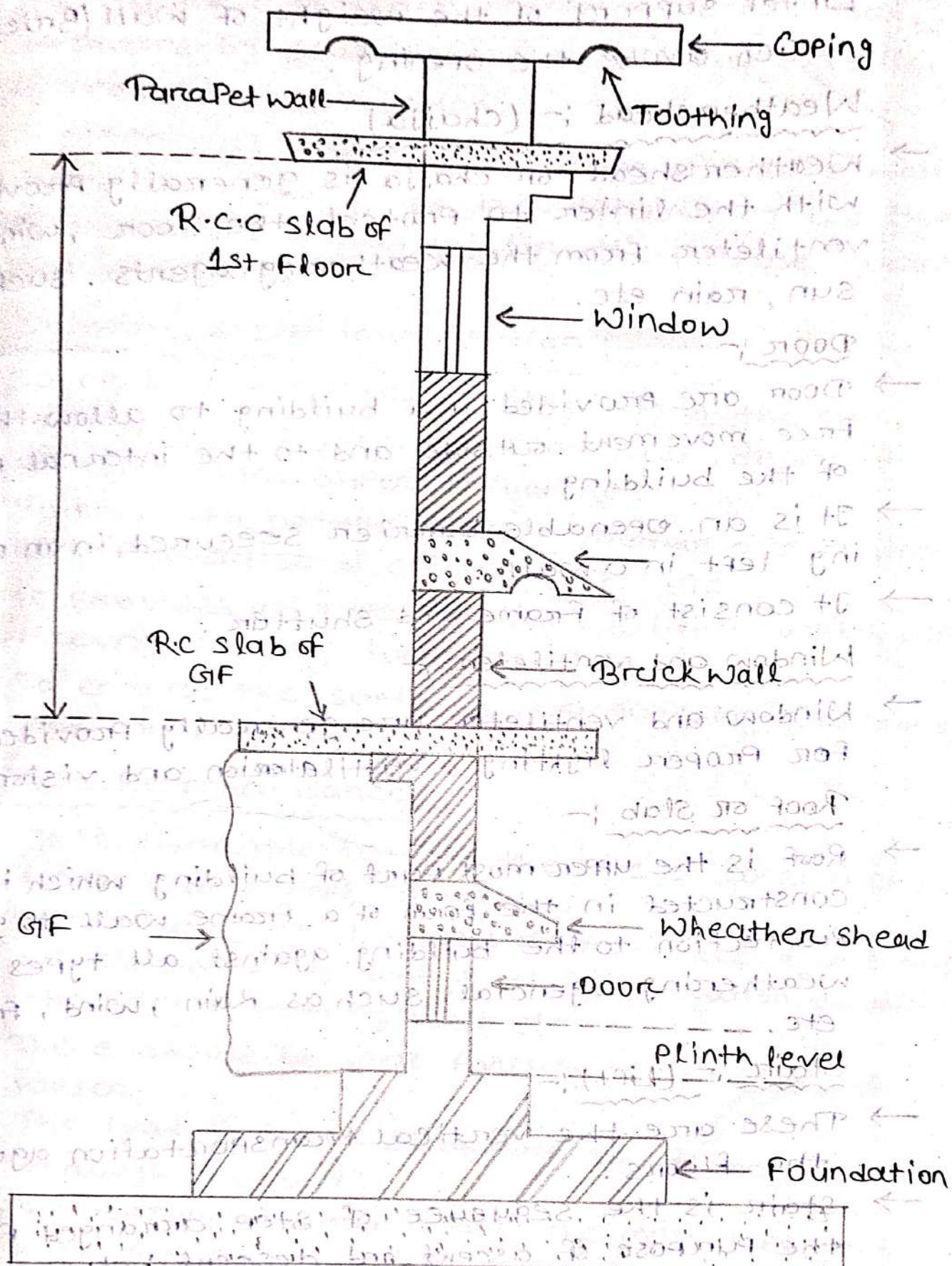
→ A floor of a building which is immediately above the ground level is known ground floor.

→ All the other floors which are above the ground floor is known as upper floor.

Sill :-

→ Sill are provided between bottom of the window frame to the bottom of wall.





Coping

Parapet wall

Toothing

R.C.C slab of 1st Floor

Window

R.C slab of GF

Brick wall

Weather shed

Door

Plinth level

Foundation

Lintel :-

- Lintel is provided above all the opening such as door, window
- Lintel support of the weight of wall (brick wall) which above the opening.

Weatherhead :- (Chajja)

- Weatherhead or chajja is generally provided with the lintel to protect the door, window, ventilator from the weathering agents. such as sun, rain etc.

Door :-

- Door are provided in a building to allow the free movement outside and to the internal part of the building.
- It is an openable barrier secured in an opening left in a wall.
- It consist of frame and shutter.

Window and ventilator :-

- Window and ventilator are generally provided for proper lighting, ventilation and vision.

Roof or Slab :-

- Roof is the upper most part of building which is constructed in the form of a frame wall to give protection to the building against all types of weathering agencies such as Rain, wind, frosts etc.

Stair :- (Lift) :-

- These are the vertical transportation agencies between the floors.
- Stair is the sequence of step, arranged for the purpose of ascent and descent between the floors. It consist of treads, ris, baluster, handrail.

site-investigation:-

- To visit, a site of work and inspect carefully from the view point of foundation.
- The nature & thickness of stratum, of soil may be estimated by studying the excavation detailed of near by construction.
- The general inspection of side of wall serve as a good guide for determining the type of foundation to adopted for the purpose to work and in addition.

Objective of site investigation :-

- To assess the general suitability of the site.
- To achieve the safe and economical, design of foundation and super structure.
- To know the nature of each stratum and engineering properties of soils, rocks etc.
- To provides all types of ~~the~~ facilities which will prevent all the local problems.
- To ensure the safety of surrounding structure and existing structure.

Site Reconnaissance :-

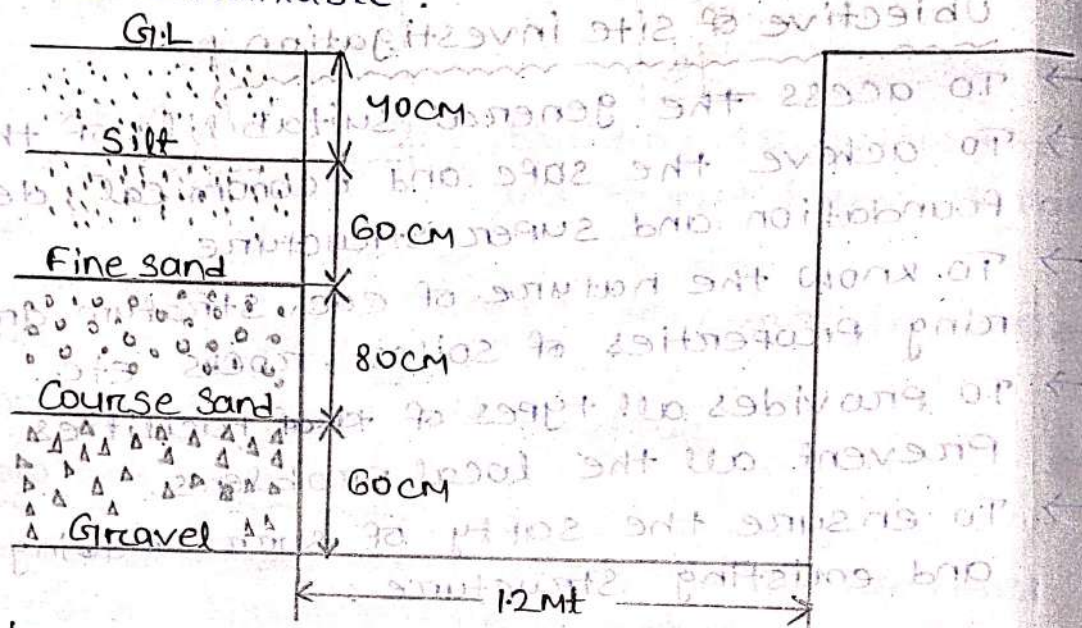
- It is desirable to visit the site of construction work and inspect carefully.
- The nature and thickness of ~~the~~ strata of soil may be estimated by studying the excavation examining the site of near by well etc.
- There should be well facility of disposed of water.
- The load of super structure should be transmitted through the soil.
- The reconnaissance forms the most important part of to find out the accurate value of perimeter and area of the site which is most necessary to design the super structure.

* Site Exploration

Methods of site Exploration:-

(1) Open Excavation:-

- In this method pit's are excavated in the site exposing the sub soil surface thoroughly.
- Soil samples are collected in various level.
- The advantages of this method is the soil ~~stand~~ can be inspected in their natural conditions.
- This method is generally consider where shallow depth is available.

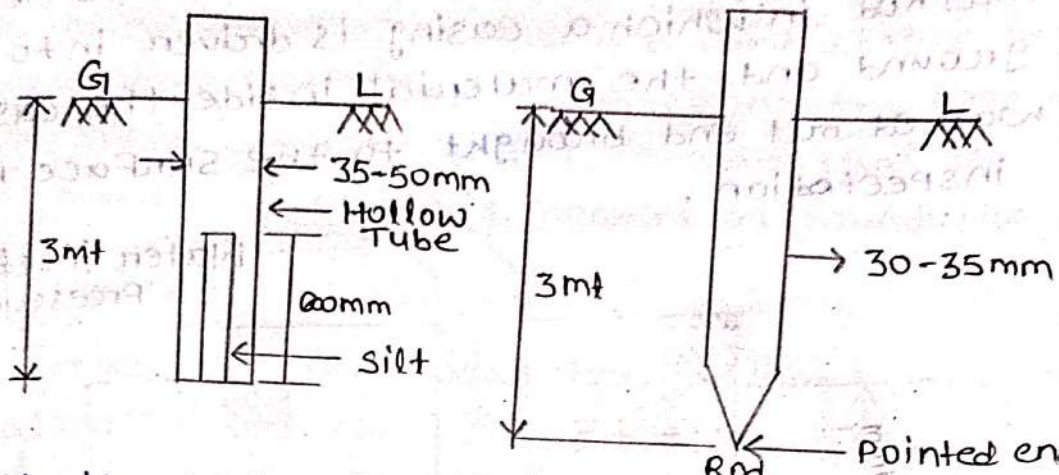


(2) Probing:-

- The Probing consists of driving either a hollow tube or a steel rod or iron rod into the ground.
- A hollow tube of diameter 35 mm to 50 mm is taken.
- It has a silt of 3 mm thickness in the bottom portions of 600 mm.
- The tube is driven in to the ground 30 mm or so at time.
- It is then with drawn and the material caught in the silt is inspected.
- In other case, a solid rod of steel or iron having a diameter of about 30 mm to 35 mm, is taken

and driven in to the ground. The rod has pointed end.

- The rod is frequently withdrawn and the material stuck up at the pointed end is examined.



- With the help of this method, it is possible to examine the ground for a maximum depth of 3m.

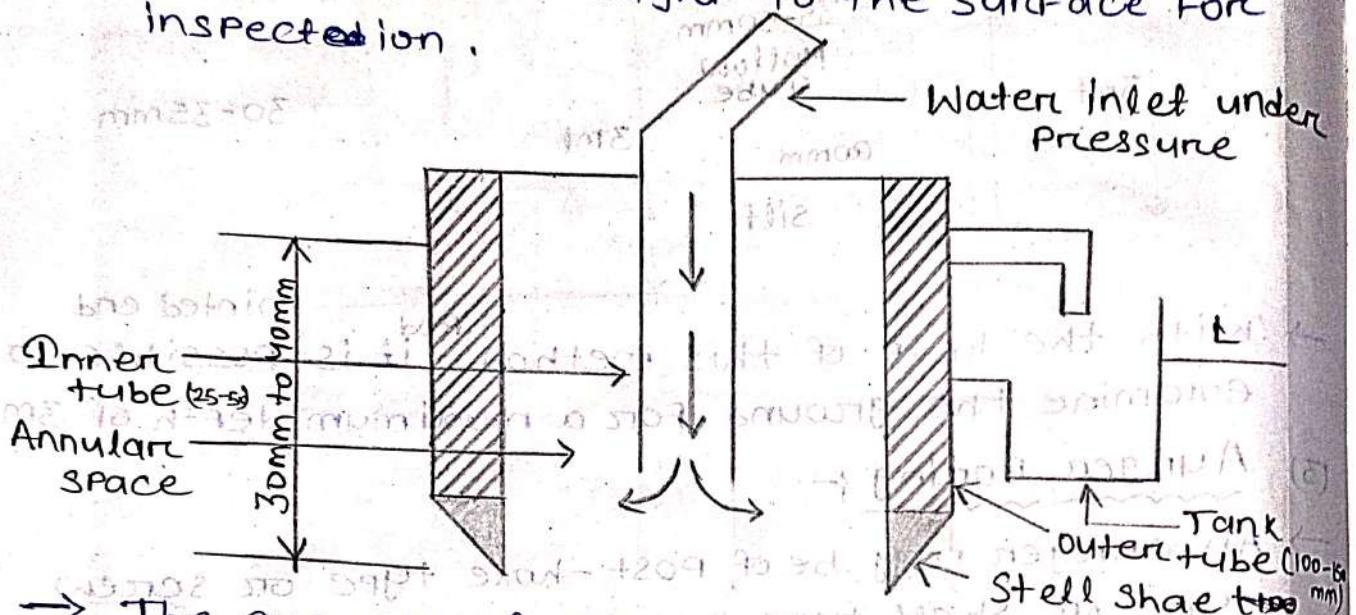
(3) Auger Boring :-

- An auger may be of post-hole type or screw type or shell type.
- They all work in the same way.
- It consists of a hollow tube of diameter 75 mm to 100 mm.
- The tube is provided with a cutting edge at the bottom.
- A slit, extending over a length of 600mm to 900mm is provided at the bottom of the tube to catch the material.
- The length of the tube is about 150mm and it is provided with a thread end so it can be suitably extended with the help of lengthening piece.
- The auger is worked by applying rotation at the top.
- The auger is driven in to ground and turned

like a screw.
→ The auger is withdrawn and the material caught in the silt is inspected.

(4) Wash Boring:-

The wash boring is the term used to denote a method in which a casing is driven into the ground and the material inside the casing is washed out and brought to the surface for inspection.



→ The process of wash boring consists in driving an inner tube of diameter 25mm to 50mm, inside an outer tube of diameter 100mm to 150mm.

→ Then water is simultaneously forced with driving to the tube under pressure through the inner tube.

→ The facility easy driving of the tube and makes the soil loose enough to flow through the annular space.

→ The quantity of water required is usually about 100 to 300 liters per minutes under a pressure of 36.28 kN/m^2

- The process is continued till hard surface is met with.
- The washed material is collected in a tank and studied carefully.

* Foundation :-

- The lower artificial prepared part of the any structure (building) which carry the load of that super structure and transmit that load to the hard-stratum is known as foundation.

* Purpose of Foundation :-

- To distribute the total load of hard stratum.
 - It also support the super-structure.
 - It prevent the cracks of the super-structure formed due to external atmosphere pressure.
 - It give ~~the~~ purpose stability to the total structure
- again types of force become horizontal force, vertical force.

Horizontal force = wind
 Vertical force = rain, snow fall

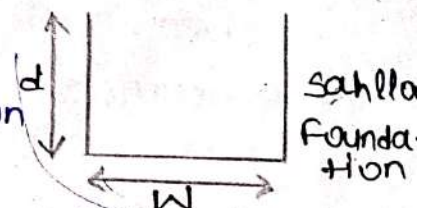
Types of Foundation :-

- There are two types of foundation for the super-structure.

- (I) Shallow Foundation
- (II) Deep Foundation

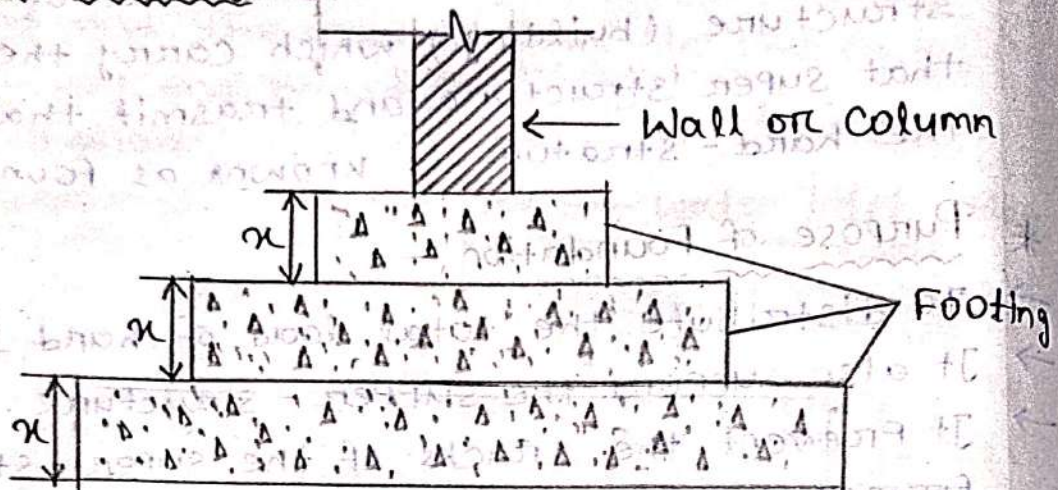
(I) Shallow Foundation :-

- Shallow foundation is the foundation which transmit the load to the hard-stratum which is very near for the top layer of the foundation.
- In shallow foundation width of the foundation is greater than depth.



- In shallow foundation width
- There are different types of shallow foundation
 - (i) spread
 - (ii) stepped footing
 - (iii) combined footing

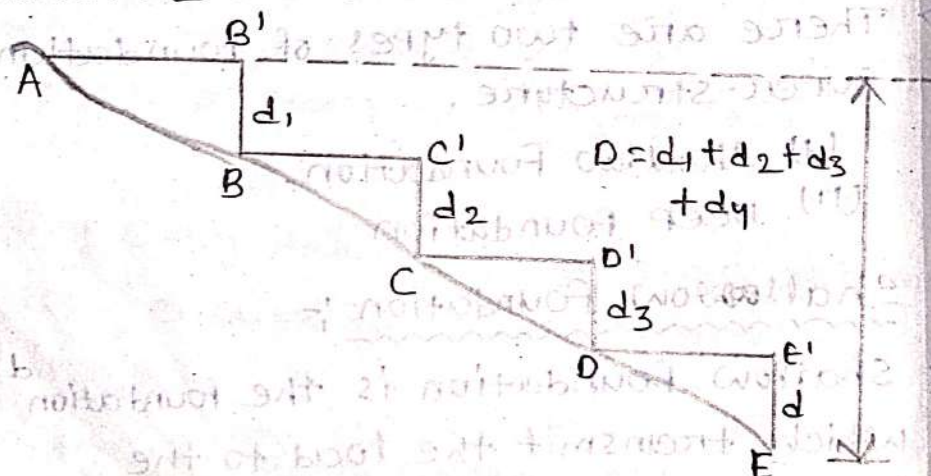
(i) Spread Footing :-



- ~~spread~~ Spread footing is in the shape of rectangular with uniform thickness.
- Width of the foundation is =
$$\frac{\text{Total Load}}{\text{Bearing capacity of soil}}$$

Bearing capacity of soil

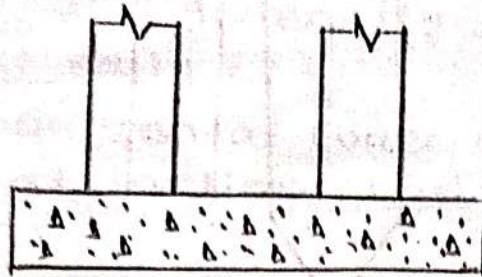
(ii) Stepped footing :-



- When the ground is ~~do~~ sloping it is not easy and ~~uneco~~ uneconomical to construction the foundation.

→ All the overlap layer of the foundation should be equal to the depth of the foundation.

(iii) Combined Footing :-



→ A combined footing provide two or more column is known as combine footing.

Deep Foundation :-

→ Deep foundation one type of foundation, which transfer the building load to the earth surface in a range of depth.

→ ~~Deep~~ The Deep foundation is the depth is equal or greater than width.

→ The Deep foundation is different types of :-

(1) Pile Foundation

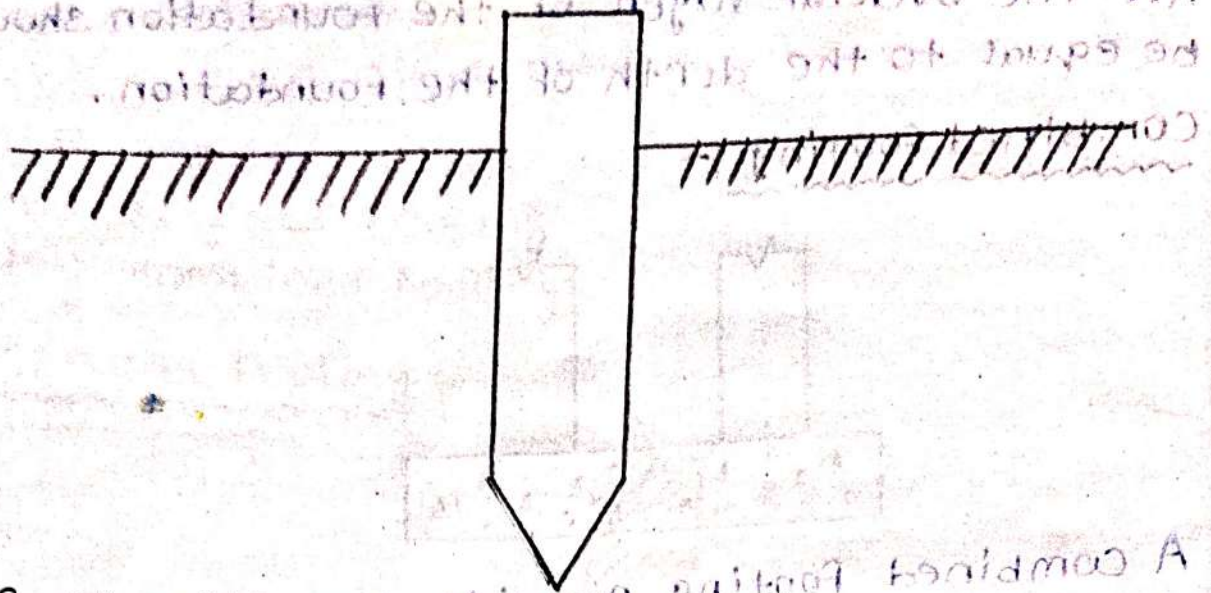
(2) Pier Foundation

(3) well Foundation

(1) Pile Foundation :-

→ A pile is basically one types of long cylined with sharp edge of the bottom side.

→ Pile is made by ~~concrete~~ with Rcc. This concrete pile is pushed into the ground to act as a steady support.



Suitability of Pile Foundation:-

- When the soil near the ground surface at a reasonable depth soil is too short.
- When the load are so high and heavy for that heavy load enough plane area is required for a foundation.
- Then after the large will get on that foundation

Classification of Pile Foundation:-

- Pile foundation are classified into two types:
 - (i) Load bearing pile
 - (ii) non-load bearing pile

(1) Load bearing pile :-

- Load bearing pile bears the total load of super structure.
- These piles are generally driven in to the ground vertically.
- When the horizontal force are applied to the piles in that inclined position is known as batter piles.
- If the batter piles are used together with vertically piles then the vertical pile automatically transfer to the batter piles.
- Classification of Pile according to the material :-

(1) Cast iron pile

(2) Cement concrete pile

(3) Sand pile

(4) Timber pile

(5) Steel pile

(6) Wrought iron pile

(1) Cast Iron pile :-

- Cast iron pile are about of 300 mm diameter and thickness of 25 mm.
- The length of pile 3-5 meter.
- Cast iron pile are not ^{brittle} generally in nature.
- For using these piles screws are provided at the bottom. So other name is Cast piles in cast iron screw pile.
- So, these piles are not generally.

(2) Cement concrete pile :-

- Cement concrete pile has more compressive strength.
- These piles is divided in to 2 types :-
 - (1) Cast - in site pile
 - (ii) Pre - cast pile

(1) Cast-in-cite pile :-

- In these pile a bore is dug into the ground by creating a casing.
- The casing protect the ^{freshly} ~~placed~~ placed concrete against the ground pressure.

Advantage :-

- Cast-in-cite concrete pile light in weight easy to handel and drive in to the ground.
- For cast-in-cites pile no extra ~~rein~~ reinforcement is required to resist the stress which develop during the driving operation.
- During the driven this pile into the ground no sound arises and these pile are not inserted during the into the ground by using hammer.
- In consturction time there is no transportation cha for the cast-in-cite pile.

Disadvantage :-

- It is difficult to maintain ~~all~~ the ^{rein} reinforcement of this pile in the construction time.
- These piles can not be used under the water.
- In dry ground also if there will be any moisture content then the effect of moisture content can also reduce the strength of the cast-in-cite pile.

(2) Pre-cast pile :-

- These piles are manufacture in factory and driven in the site.
- The stees bore is dug into the ground ~~later~~ inserting steel casing.

- The reinforcement is usually provided in allow pre-cast concrete pile to take of the stress during driven and handling.
- The main vertical reinforcement consist of steel bar of 20mm - 40mm diameter.
- The other lateral reinforcement steel consist of steel of 5-10mm diameter.
- The spacing between lateral steel bar is 100mm.

Advantage :-

- The position of reinforcement in pre-cast pile is not distribute from it's original position.
- The driving of this pile is very easy.

Disadvantage :-

- The piles are very heavy in weight. so its difficult to handle, transport, drive.
- The external reinforcement which are provided by relieve the stress, that external reinforcement is very costly.
- If sufficient care will not provide then it will be break early during transport and driving.

Sand pile :-

- This piles are found by making holes & filling the hole by the sand.
- For sand pile 300mm diameter bore is required.
- After completion of boring the borewell fill with sand, then it will hammer.
- After filling the sand in the bore the concrete will over lapped when the last layers of sand. so concrete will prevent all the sand which are provided in the bore.

→ If the sand pile constructed properly then, it can carry the load of 1000 kN/m^2 .

→ The dimension of this pile is depends upon loads.

Steel pile

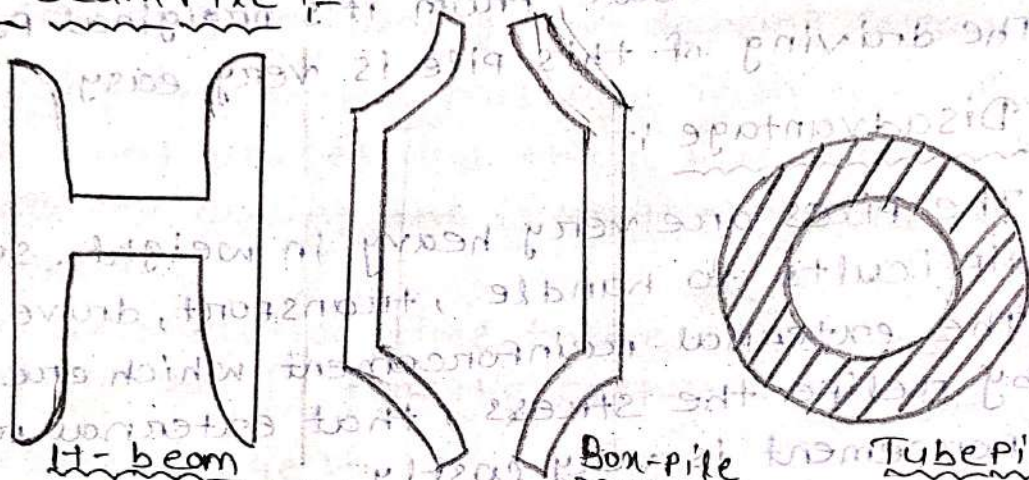
→ Steel pile are 3 types

(i) H-beam pile

(ii) Box pile

(iii) Tube pile

(i) H-beam pile



→ H-beam pile constructed in steel.

→ These pile are usually of wide flange section.

→ H-beam piles are used for the small cross-sectional area, so it is easily driven into the soil.

→ The driving of H-beam pile is very simple.

→ In this pile the energy of hammer are easily transmitted to the lower portion of the pile.

(2) Box pile

→ Box pile are in the shape of rectangular, octagonal or steel section.

→ The Box is form and the pile is drive either which close at bottom or open bottom, and always or open at top.

- After inserting the box pile ~~inside to insert~~ into the soil the box pile will be used in the place of H-beam because H-beam pile cannot insert into a hard stratum.

(3) Tube pile :-

- Tube pile are insert into ground with the open ^{top} end & closed ~~end~~ at ~~bottom~~ bottom.
- The concrete will be fill up inside the tube pile.
- The tube piles are easy to handle and easy to drive into the soil.

Advantage of steel pile :-

- Steel pile can be with stand the stress due to the driving.
- This pile can resist the lateral force.
- This pile can be handle roughly without any serious damage.
- These pile has high strength, so it will not be damage easily.

Disadvantage of steel pile :-

- The corrosion is the only disadvantage of steel pile.

Timber pile :-

- The timber pile is the shape of circular & square shape.
- The diameter of circular is 300mm - 500mm.
- The length of ~~square~~ square is 300mm - 500mm.
- The bottom of this pile a cast iron ~~shoe~~ is provided.
- At the top of this pile a steel pile is provided.
- If the group of timber pile a steel ~~phas~~ ~~phas~~ provided then all the steel should be in a same level.

→ After providing all the timber pile into the soil a concrete cap is provided upon the platform.

Advantage of Timber Pile :-

- The timber pile are easily available and is very economical.
- These piles can be handled easily without any risk.
- For inserting these piles no heavy equipment are require.
- These piles can be removed easily without any risk.

Disadvantage of Timber Pile :-

- It is difficult to get more than one timber pile same dimension.
- Timber pile can not resist heavy load.



Wrought Iron Pile :-

- This pile is very strong.
- Length of this pile is 4-6m.
- Diameter of this pile is 80-200mm.
- This piles are most suitable and used under seawater.
- This Piles are very expensive.

Non-load bearing pile :-

- Non-load bearing pile are not design for carry the vertical load.

→ This piles are designed to carry the horizontal load.

Purpose of Non-load bearing pile :-

- To prevent the under ground movement of later.
- To protect the foundation from the compression.

Types of Non-load bearing pile :-

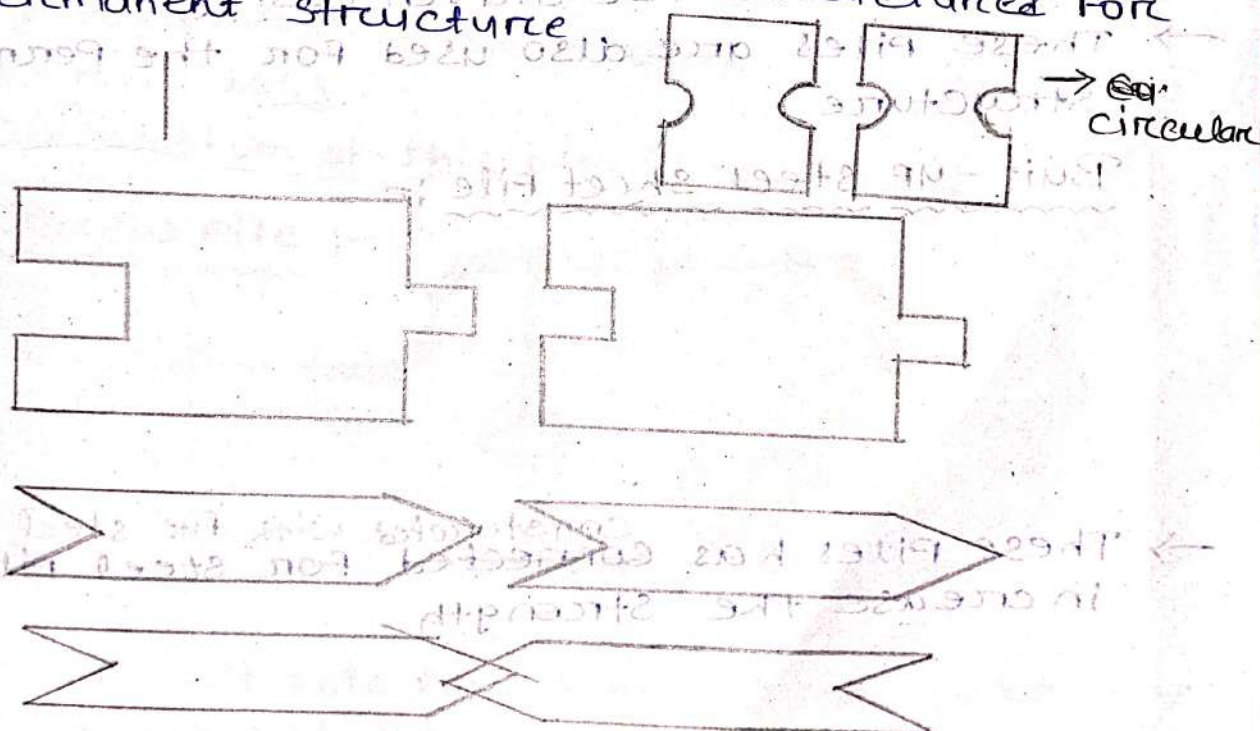
(I) concrete - sheet pile

(II) steel - sheet pile

(III) Timber - sheet pile

(I) concrete - sheet pile :-

- In concrete site pile are provided for the increase of strength.
- The size of this pile is square and rectangular in cross section.
- These piles are driven side by side to form a continuous pile.
- width of this pile is 500 - 600 mm.
- Thickness of this pile is 200 - 60 mm.
- The concrete site pile are structured for permanent structure.

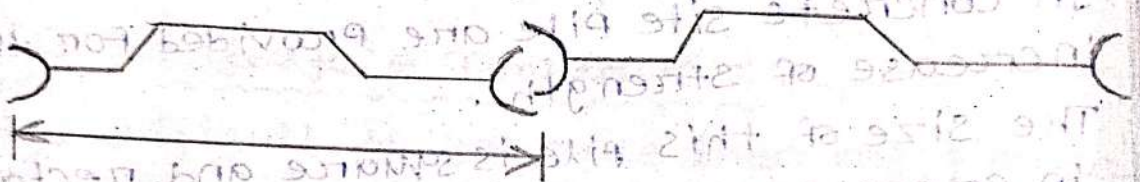


Precast RCC Sheet Pile :-

- These piles are used for the permanent structure.
- These piles are placed in such a way that the grooves are formed and those grooves will fill with cement mortar of 1:3 proportion.
- After placing the cement mortar in the grooves the long of other piles will insert into the grooves of first piles.

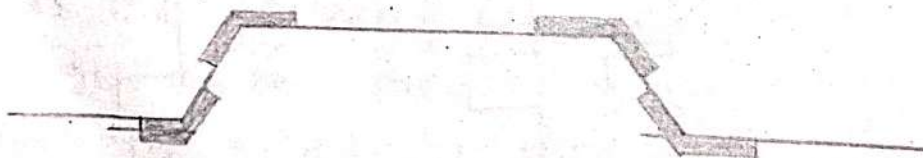
(II) ~~Sheet~~ Steel - Sheet Pile :-

- The width of steel sheet pile is 200mm - 300mm.



- The steel piles are suitable for 4-5m long with inter-locking.
- The steel sheet piles are very strong and durable.
- These piles can be driven easily.
- These piles are also used for the permanent structure.

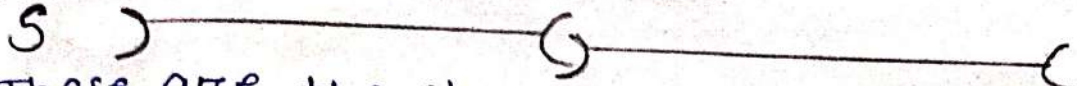
Built-up steel sheet pile :-



- These piles have been constructed with fine steel connected for steel piles to increase the strength.

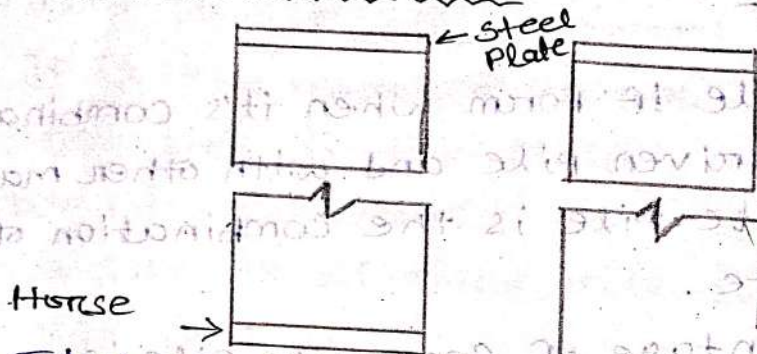
- The piles are lighted in coeigh, economical and easily hand.
- It can driven by light hammers and these are used for the light structure.

Steel web steel sheet. Pile it



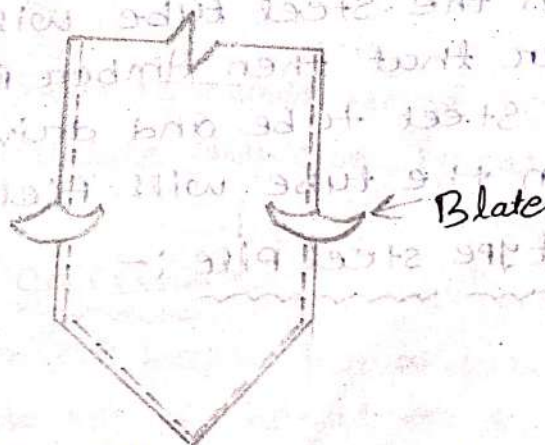
- These are the simplest form straight web steel sheet pile.
- The widness is 400mm - 500mm.
- The thickness is very strong and 12mm. This pile are very flexible.

(III) Timber Sheet pile :-



- Timber sheet piles are used for the temporary structure.
- The thickness is 80 - 150 mm.
- The wideness is 200 - 300 mm.
- 2.4 m is long.
- The bottom of this pile is champhered.

Screw Pile :-



- It is suitable for, when ground to be Penetrated consist ~~the~~ and clay of sand screw pile consist of hollow cast iron and Blade at the bottom.

- The Blade are made up of cast iron.
- The diameter of this shaft is 80-250 mm.
- The diameter of this blade is 500mm - 1500 mm.
- It is useful when ground to be Penetrated consist of gravel.

Composite pile :-

- A composite pile is formed when its combination of bored pile, driven pile and with other materials. mainly composite pile is the combination of wood & concrete.
- The main advantage of composite pile is: (concrete is good in durable) and (timber is very cheap in cost).

Process of forming Composite pile :-

- At first a hollow steel tube is driven just below of below of ground water level.
- Then the steel tube will be cleaned out.
- After that then timber pile will be inserted into the steel tube and driven into the ground.
- Then the tube will be filled with concrete.

Z-type steel pile :-

→ The steel pile is difficult to drive but it has high strength.

→ Z-types steel pile is very heavy so, it is used for the heavy of super structure.

Diagram of sand pile:-

Foundation:-

* Caisson:-

→ Caisson is a structure used for the purpose of placing a foundation in correct position under the water.

→ The word caisson is derived from the French word, caisset which means box.

→ It is the member of hollow person which is installed in the field and filled with box with concrete.

→ Caisson is divided into three groups:-

- (i) Box Caisson
- (ii) open Caisson
- (iii) Pneumatic Caisson

(i) Box Caisson:-

→ Box caisson is a strong water tight box which is open at the top and close at the bottom.

→ Generally box caisson is made up of R.C.C.

→ Box caisson is suitable where loads are not carry.

(ii) Open or well Caisson:-

→ This Caisson is open at both top and bottom.

→ This Caisson is made up of metal or R.C.C.

→ There are different type of open caisson.

Walls and Masonary Work

* Purpose of wall :-

- The purpose of wall in building are to support the roof and cellings wall support the roof & cellings as well as undlose a space as a part of building.
- The main Purpose of wall in building construction is not only to protect the building from damage but also to divide them from different rooms and space.

* Function of wall in Building construction :-

Following are the functional requirement of wall in a building construction.

- (i) Strength
- (ii) Stability
- (iii) weather & moisture resistance
- (iv) Durability
- (v) Fire safety
- (vi) Sound Resistance etc.

* Classification of wall :-

→ wall is classified in 3 types :-

- (i) Load bearing wall
- (ii) Non-load bearing wall
- (iii) Retaining wall

(i) Load bearing wall :-

- A Load bearing wall is a wall that is an active structure cement of a building which holds the weight of all the elements above it.
- It conducting its weight to the foundation below it.

- The Material which are mostly used for construction of load bearing wall are concrete & brick.
- A load bearing wall can support the structure as like a column.
- It is designed to carry and transfer the vertical load as well as their own weight.
- A load bearing wall can be used for the interior or exterior wall.

* Types of load bearing wall :-

- (i) Pre-cast concrete wall
- (ii) Retaining wall
- (iii) masonry wall

* Pre-cast concrete wall :-

- This wall is aesthetically. Placing the pre-cast wall has superior strength, so ~~the~~ its durability is high it provide excellent protection & it is easy to

* Retaining wall :-

- It provides lateral support. This installing the retaining wall. it can reduce erosion and protect the area.

* Masonry wall :-

- masonry wall is depend upon, which material is used for construction wall.
- ~~if~~ If a wall is construct a stone i.e, a wall is known a stone masonry wall.
- When the wall is construct a brick is known as brick masonry wall.

* Classification of wall as Per material construction As per material the wall construction is classified as follows :-

- (i) Brick
- (ii) Stone
- (iii) Reinforce brick
- (iv) Reinforce concrete
- (v) Pre - Cast
- (vi) Hollow
- (vii) Solid concrete block
- (viii) Composite Masonary

(i) Brick :-

- (i) Bricks are most commonly used material for building work. Bricks are made up of clays, which is easily available and easy to handle.
- (ii) Brick masonry is made up of bricks unit bonded together with mortar, so two essential components of brick masonry are brick and mortar.
- (iii) Mortar binds the bricks and increases the strength of wall.
- (iv) The strength of the brick masonry is depend upon :-

- (i) Qualities of brick
- (ii) Qualities of mortar
- (iii) Methods of bonding etc.
- (iv) Qualities construction process

Requirement for brick masonry :-

- All brick should be in uniform shape & size and they should arrange in a definite pattern.
- Brick should be light in weight so that they can easily handled.
- All ornamental work of brick can be done easily.

Stone wall :-

- Stone wall are made up of stone.
- For a good stone masonry qualities of building stone should be good. It should resist all types of weathering effect. An stones, should be moulded properly as per requirement.

Partition wall :-

- Partition wall is non-load bearing inter-wall which is designed to only support the ~~of~~ silling and divided a large area into number of areas / more than one area.

Suitability of wall :-

- (i) Divided a hole area number of rooms
- (ii) Provided privacy to Particular room from light and sound.

Classification of Partition wall :-

- (i) Brick Partition wall
- (ii) Wooden Partition wall

Brick masonry :-

- The bricks are obtained by moulding clay in rectangular blocks of uniform size and then by drying and burning these blocks.
- As Bricks are of uniform size, they can be properly arranged.
- The Mortar to be used for the brick masonry should have the same characteristics as the mortar used in the stone masonry.

Size and weight of Bricks :-

- Hence the BIS has recommended the bricks of uniform size such Bricks are known as the modular Bricks.

→ The Actual size of modular brick is $190\text{ mm} \times 90 \times 90\text{ mm}$ with mortar thickness, size of such a brick becomes $200 \times 100 \times 150\text{ mm}$ and it is known as the ~~normal~~ ^{Nominal} size of the modular brick.

Definations :-

The definitions of common terms in stone work & Brick work are already given in the previous chapter on the stone masonry. The remaining definition pertaining specially to the brick work only are ~~method~~ mentioned below

(1) Stretcher :-

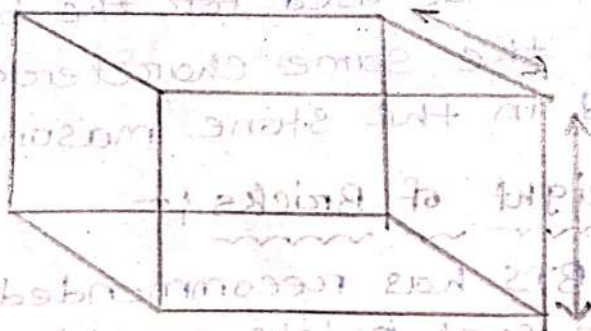
This is a brick laid with its length parallel to the face or front or direction of a wall. The course containing structure is called a ~~stretch~~ ^{stretcher} course.

(2) Arrises :-

The edges formed by the intersection of plane surface of brick are called the arrises and they should be sharp, square and free from damage.

(3) Header :-

This is brick laid with its breadth or width parallel to the face or front or direction of a wall. The course containing headers is called a header course.



(4) Bed :-

The lower surface of the brick when laid flat is known as the bed.

(5) Bed joint :-

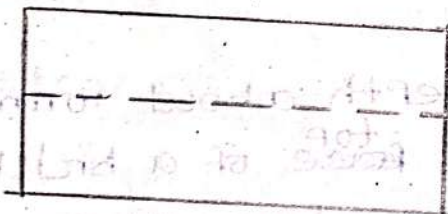
The horizontal layer of mortar upon which the bricks are laid is known as a bed joint.

(6) Closer :-

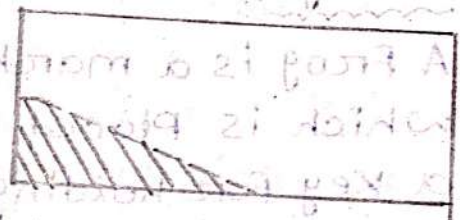
A piece of brick which is used to close up the bond end of brick courses is known as a closer and it helps in preventing the joint of successive courses to come in a vertical line.

(i) Queen closer :-

This is obtained by cutting the brick longitudinal in two equal parts. It can also be made from two quarter bricks. A queen closer is generally placed near the queen header, to obtain the necessary lap.



(queen closer)



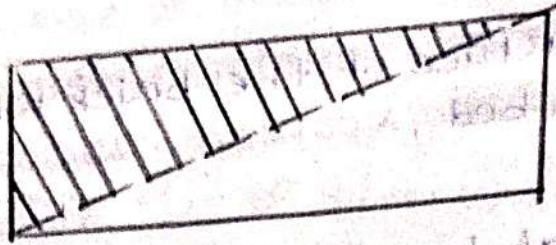
(king closer)

(ii) King closer :-

This is obtained by cutting a triangular portion of the brick such that half a header and half a stretcher are obtained on the adjoining cut faces. A king closer is used near door and window openings to get satisfactory arrangement of the mortar joints.

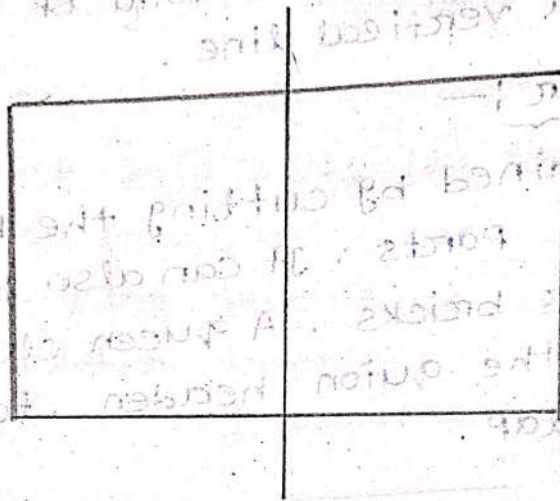
(iii) Bevelled closer :-

This is obtained by cutting a triangular portion of half the width but of full length. A bevelled closer face it is used for the splayed brick work.



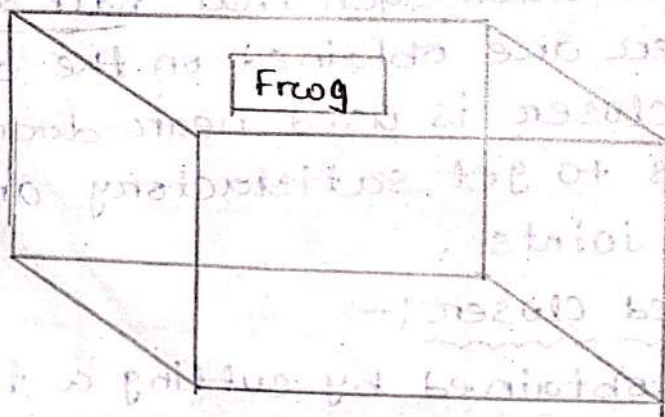
(7) Bat :-

This is a piece of brick usually considered in relation to the length of a brick and accordingly known as half bat or three-quarter bat. A Bevelled bat may be formed as shown in figure.



(8) Frog :-

A frog is a mark of depth about 10mm - 20mm which is placed on the ~~face~~^{top} of a brick to form a key for holding the mortar. The wire cut bricks are not provided with frogs. A pressed bricks ~~are~~ as a rule has frogs on both the faces. A rand made bricks has only one frog.



Bond - Meaning and necessity :-

Bonds in brick work :-

The bricks being of uniform size can be arranged conveniently in variety of forms.

- (i) The Bricks should be of uniform size to get uniform
- (ii) The stretchers should be used in the facing.

The various type of bonds with their patented names have been constructed.

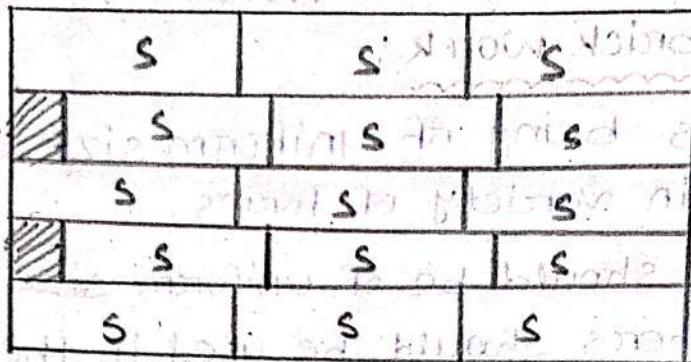
* Following are the types of bond, ~~all~~ ⁱⁿ the bricks are arranged in the ~~stretcher~~ courses work :-

- | | |
|-------------------------|---------------------------|
| (i) Stretcher Bond | (VIII) Brick-on-edge Bond |
| (ii) Header Bond | (IX) English cross Bond |
| (iii) English Bond | (X) Facing Bond |
| (iv) Garden - wall Bond | |
| (v) Flemish Bond | |
| (vi) Raking Bond | |
| (vii) Dutch Bond | |

(i) Stretcher Bond :-

- (i) In this type of bond, all the bricks are arranged in the stretcher courses.
- (ii) The stretcher bond is useful for one-brick partition walls as there are no headers in such walls.
- (iii) As this bond does not develop proper internal bond.
- (iv) It should not be used for walls having thickness greater than that of one-brick wall.

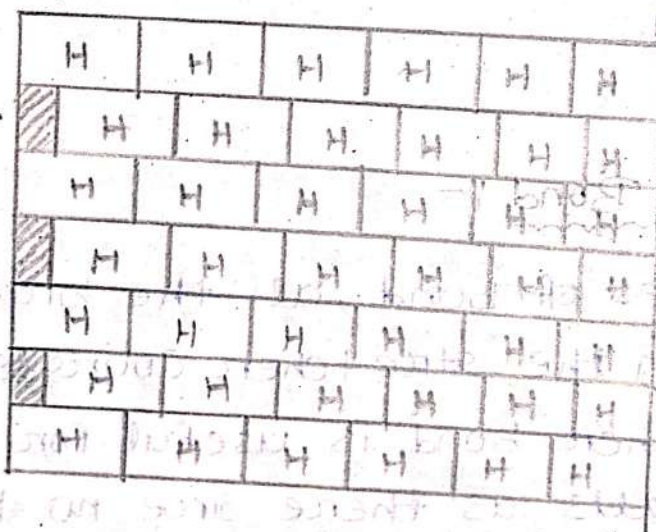
Closer →



(ii) Header Bond :-

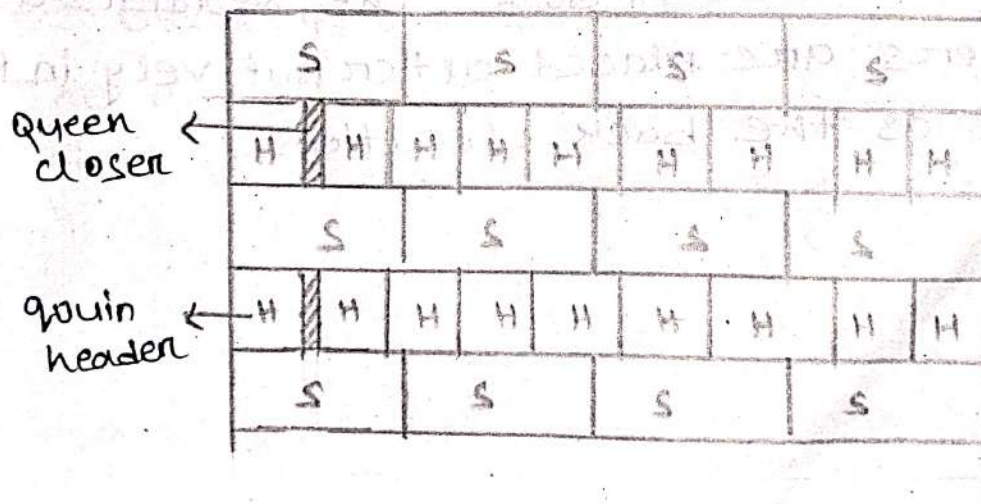
- In this type of bond, as the bricks are arranged in header course.
- This bond does not have strength to transmit pressure in the direction of the length of the wall.
- Hence it is not suitable for load bearing walls.

Closer →



✓ 3ms (3) English Bond :-

- It is considered as the strongest bond in brick work.
- The alternate courses consist of stretchers and header.
- The queen closer is put next to the quoin header to develop the face lap.
- Each alternate header is centrally supported over a stretchers.
- The no. of mortar joints in the header courses is nearly double than that in the stretchers courses.
- A header course should never start with a queen closer as it is ~~probable~~ liable to get displaced in this position.
- The queen closer are not require in the stretchers course.

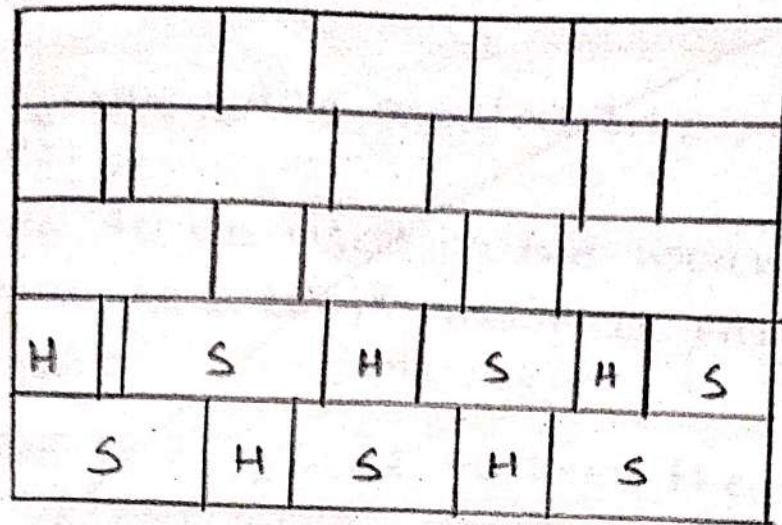


14) Flemish Bond :-

In this type of bond, the headers are distributed evenly and hence, it creates a better appearance than the English bond.

Following are the peculiarities of a Flemish bond.

- In every course, the headers and stretchers are placed alternatively.
- The queen closer is put next to the quoin header in alternate course to develop the face lap.
- Every header is centrally supported over a stretcher below it.
- The Flemish bond may be divided into two groups :-
 - (i) Double Flemish Bond
 - (ii) Single Flemish Bond
- In double Flemish bond, the headers and stretchers are placed alternatively in front as well as the back elevations.



- This bond gives better appearance than the English bond. But it is not so strong as the English bond as it contains more number of stretchers. In this type of bond an attempt is made to combine the strength of the English bond with the appearance of the Flemish bond.
- This type of bond is used when expensive bricks are used for the face work, but in order to construct this bond, a wall of minimum thickness $1\frac{1}{2}$ Bricks is required.
- The Bricks in the same course do not break joints with each other. The joints are straight.

English & Flemish bond Difference :-

- The english bond is found to posses more strength than the flemish bond for walls having thickness greater than $1\frac{1}{2}$ Bricks.
- The flemish bond grants more pleasing appearance than the english bond.
- The construction with the flemish bond requires greater skill as compared to the english bond.

Stone Massonary :-

- In a very strict sense, the term massonary is used to indicate the art of building, the structures in stones, But broadly spealling the term massonary is used to indicate the art of building the structures in either stones or bricks. The former type is called brick masonary.

Material Required for stone Masonary :-
For Stone Masonary, the following two material are required :-

(1) stones

(ii) Mortar

(1) Stones :-

- (i) Depending upon the availability, the stones are selected.
- (ii) The stones to be used in the work should be hard, durable, tough and free from any defect.

(ii) Mortar :-

- The Mortar is required to keep the stones in position.
- It is Prepared by mixing "lime or cement with sand and after adding water.
- It is Placed in the joints. The type of Mortar to be used will depend on the strength required load coming on the structure, resistance desired for weathering agencies etc.

* Stone Definition :-

(1) Natural Bed :-

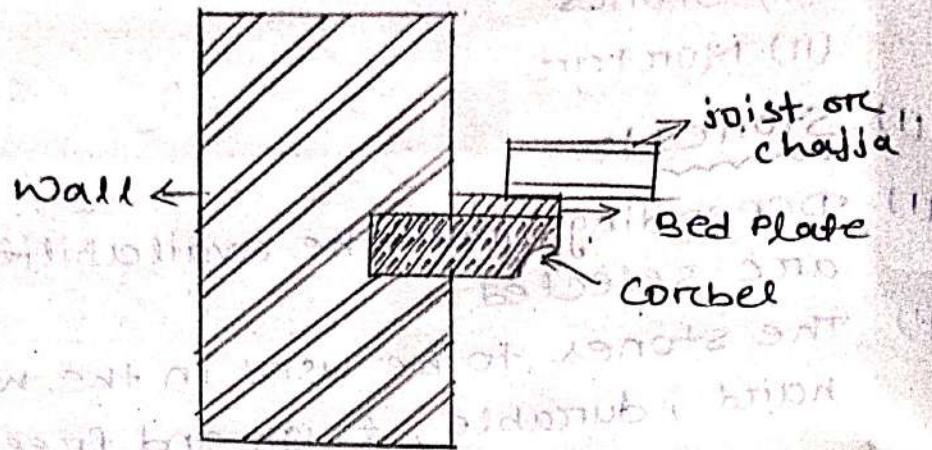
- The building stones are obtained from rocks.
- These rocks have a distinct plane of division along which the stones can easily be split.

(2) Sills :-

- The bottom surface of a door or a window opening is known as a sill.
- The sill stones are so dressed that they prevent the entry of water to the interior of the building.

(3) Corbel :-

- A Corbel is a projecting stone which is usually provided to serve as support for roof stress, beam, weathershead etc.
- The Corbels are generally moulded and given



(4) Course :-

A layer of stone or brick's is known as a Course and its thickness is generally equal to the thickness of a stone or a brick. The thickness of one mortar joint.

(5) Cornice :-

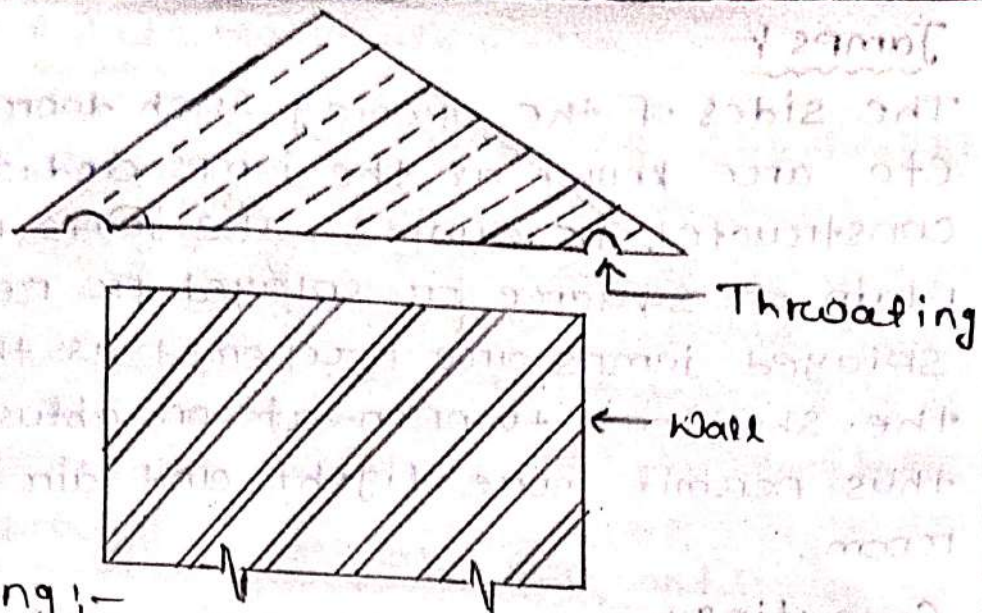
- A cornice is a course of stone which is laid at the top of wall (the top brick layers of the wall which is directly connect with the slab).
- It is generally moulded and given ornamental treatment.
- It is weathered and throated to dispose of rain water.

(6) Coping :-

- ~~A Cornice is a course of stone provided at the~~
- A coping is a course of stone which is laid at the top wall so as to protect the wall from rain water.
- This course is generally provided at the top of a compound wall or a parapet wall.

(7) Weathering :-

- The upper surface used for sill, cornice and coping is dressed in a sloping way so that the water may flow off easily.
- This is termed as the weathering.



(8) Throating :-

- A Groove is provided on the underside of sill, cornice and coping so that the rain water, can be discharged clear of the wall surface.
- This is known as the throating.

(9) Plinth :-

- The projecting at ground floor level is known as the Plinth.
- It is also used to indicate the height of ground floor level from ground level.
- The Plinth course protects the interior of a building from rain, water, frost etc.
- It is sometimes moulded and given ornamental treatment.

(10) String course :-

- The horizontal course provided at suitable levels between the Plinth and the cornice is termed as a string course.

(11) Through stone :-

- In stone work, some stones at regular intervals are placed right across the wall, such stones are known as the through stones or throughs or bond stones.

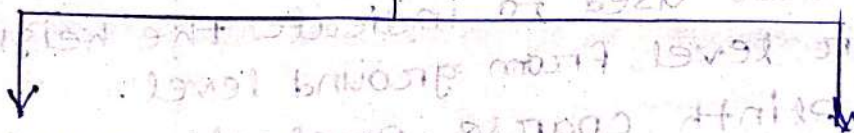
(12) Jamps :-

→ The sides of the opening such doors, window etc are known as the jamps and they are constructed to quoins. The jamps may be either plain or square or splayed or rebated. The splayed jamps are preferred as they allow the shutters to open at an obtuse angle and thus permit more light and air into the room.

(13) Grouting :-

The bore holes in sufficient number are driven in the ground. The cement grout is then forced under pressure through these bore holes. The cracks of pressure of the rocks are thus filled up, resulting in the increase of bearing power of soil.

Stone Masonry



Rubble Masonry

- (i) coursed rubble
- (ii) uncoursed rubble
- (iii) Random rubble
- (iv) Dry rubble
- (v) Polygonal rubble
- (vi) flint rubble

Ashlar Masonry

- (i) Ashlar fine
- (ii) Ashlar rough-tooled
- (iii) Ashlar rock or quarry faced
- (iv) Ashlar chamfered
- (v) Ashlar block-in-course

(i) Rubble Masonry :-

In this type of construction, the stones of irregular sizes are used. The stones as obtained from quarry are taken in use size by means of ~~runner~~ hammer.

(i) Coursed Rubble Masonry I:-

- In this type of rubble masonry, the heights of stone varies from 50mm to 250mm.
- The masonry work is then carried out in courses such that the stones in a particular course are of equal heights. This type of masonry is used for the construction of public buildings, residential building etc.

(a) Coursed Rubble Masonry @ I sort:-

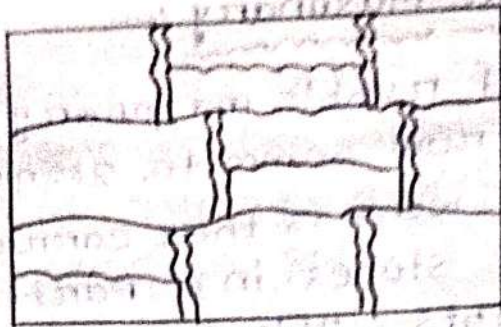
- (i) In this type, the stones of the same heights are used and the courses are also of the same heights.
- (ii) The face stones are dressed by means of a hammer and the bushings do not project by more than 40mm.
- (iii) The thickness of mortar joint does not exceed 10mm.



(b) Coursed Rubble Masonry II sort:-

It is similar to @ I sort except the following.

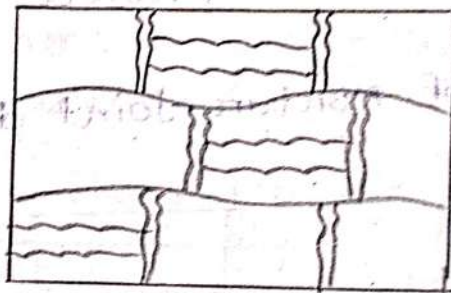
- (i) The stones to be used are of different heights.
- (ii) The courses need not be of equal heights.
- (iii) Only two stones are to be used to make up the height of one course.
- (iv) The thickness of the mortar joints is 12mm.



LC) Coursed Rubble masonry III sort :-

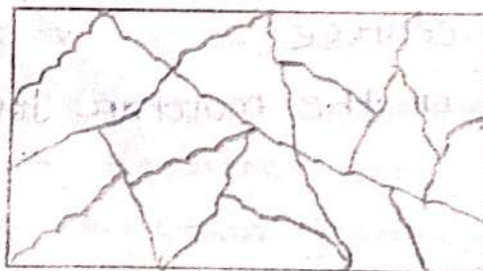
This type is similar to I sort except the following

- i) The stones to be used are of different heights, the minimum being 50mm.
- ii) The courses need not be of equal heights.
- iii) only three stones are to be used to make up the height of one course.
- iv) The thickness of the mortar joints is 10mm.



ii) uncoursed Rubble Masonry :-

- In this type of rubble masonry, the stones are not dressed.
- But they are used as they are available from the quarry.
- The courses are not maintained regularly.
- This type of rubble masonry being cheaper is used for the construction of compound walls, grounds, garages, labour quarters etc.



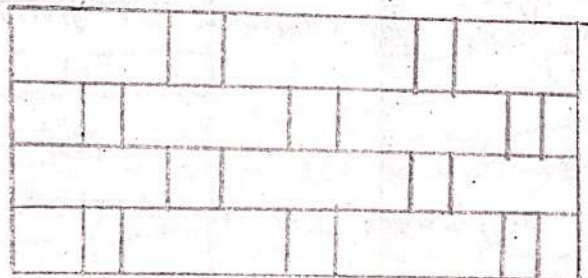
(uncoursed Rubble) (Random Rubble Masonry)

(1) Random Rubble Masonry :-

- In this type of rubble masonry, the stones of irregular size and shapes are used.
- The stones are arranged so as to have a good appearance.
- It is to be noted that more skill is required to make this masonry structurally stable.
- If the face stones are chisel dressed and the thickness of mortar joints does not exceed 6mm.
- It is known as the random rubble masonry I sort.
- If the face stones are hammer-dressed and the thickness of mortar joints does not exceed 12mm, it is known as the random rubble masonry II sort.

(2) Ashlar Fine Masonry :-

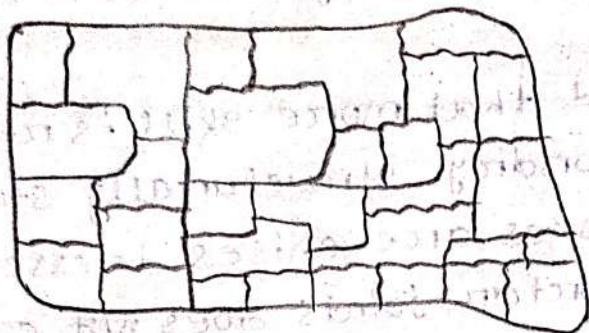
- In this type of masonry, the beds, sides and faces are finely chisel-dressed. The stones are arranged in proper bond and the thickness of the mortar joints does not exceed 3mm. This type of construction gives perfectly smooth appearance but it is costly in construction.



* Polygonal Rubble Masonry :-

- In this type of rubble masonry the stones are hammer dressed and the stones selected for face work are dressed in a irregular polygonal shape.
- It is to be noted that more skill is required

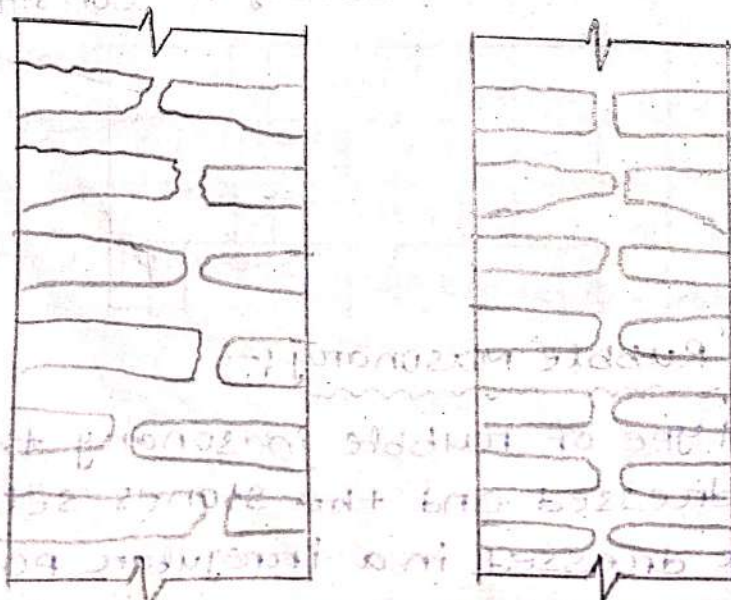
- the construction of this type of masonry.
- As the stones are of irregular shape, it is difficult to adjust them with regard to stability and appearance of the work as a whole.



Flint Rubble Masonry :-

- In this type of rubble masonry the stones used are flints which are irregularly shaped nodules of silica.
- The width and thickness vary from 80mm to 150mm and the length varies from 150mm to 300mm.
- The stones are extremely hard, but they are brittle and therefore they break easily.
- The face arrangement may be either coursed or uncoursed.

Rubble Masonry :-



(ii) Ashlar rough-tooled masonry :-

- In this type of masonry, the bed and sides are dressed in chisel.
- But the face is made rough by means of tools.
- A strip about 25mm wide and made by means of chisel.
- The thickness of mortar joint does not exceed 6mm.
- This type of work is also known as the baslar ashlar.

Heating :-

- The material which is lie in between face and back that is known as Heating.

Facing :-

- The Material which is use to cover the face that is known as facing.

Buttress :-

- Buttress is a sloping or stepped support of a wall, which is provided at the outside of the wall.

Pilaster :-

- A right angle column or projection of a wall, pierce, column is known as Pilaster.

Face :-

- The surface of the wall which is exposed to the weathering is known as face.

Back :-

- The surface of the wall which is not exposed to the weathering is known as Back.

Backing :-

- The material which is used in the back of the wall is know as backing.

Building communication and ventilation

Door, Window, Lintel :-

* Door :-

→ Door is defined as an openable barrier secured in an opening left in a wall for the purpose of providing access to the users of structure.

→ It is basically of two part :-

(I) Frame

(II) Shutter

→ The door shutter is held in position by door frame which is fixed in the opening of wall.

* Window :-

→ Window is defined as the opening made in a wall for the purpose of providing day light, vision & ventilation also.

→ It is consist of two part :-

(I) shutter

(II) frame

→ window frame is fixed in the opening of wall and shutter is held in position by frame.

* Technical terms :-

(1) Frame :-

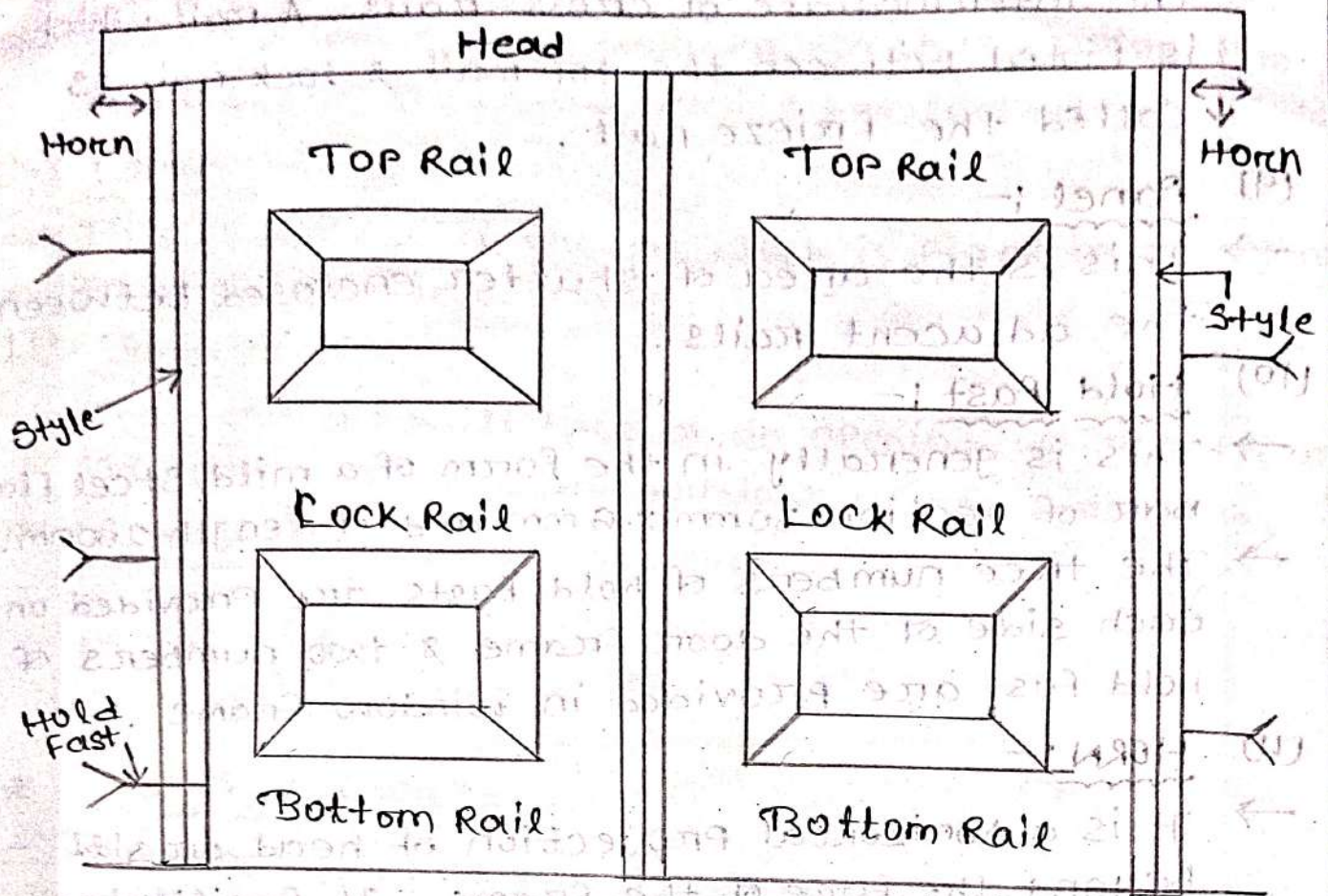
→ This consist of a group members which form a support for a door or a window.

(2) style :-

→ This is the out side vertical member of the shutter of a door or a window.

(3) Head :-

→ The top of uppermost horizontal part to frame is known as head.



(4) Sill :-

→ The ~~top~~ lowermost or bottom horizontal part of window frame is known as the sill. The door frames are usually not provided with sill's.

(5) Top Rail :-

→ This is the top most horizontal member of the shutter.

(6) Lock Rail :-

→ This is the middle horizontal member of the shutter where the locking arrangement is provided.

(7) Bottom Rail :-

→ This is the lower most horizontal member of the shutter.

(8) Inter Mediate or cross Rail :-

→ The additional horizontal rails fixed between the

top and bottom rails of shutter are known as the intermediate or cross-rails. A rail which is fixed between the top rail & lock rail is called the frieze rail.

(9) Panel :-

→ This is the area of shutter enclosed between the adjacent rails.

(10) Hold Fast :-

→ This is generally in the form of a mild steel flat bar of section 30mm x 6mm and of length 200mm.

→ The three numbers of hold fasts are provided on each side of the door frame & two numbers of hold fast are provided in window frame.

(11) HORN :-

→ It is a horizontal projection of head or sill beyond the face of the frame. It facilitates the fixing of the frame on the wall opening and its length is about 100 mm to 150 mm.

(12) Shutter :-

→ The entire assembly of style, panels and rails is known as the shutter.

(13) Sash :-

→ This is special type of frame, made of light sections and designed to carry glass. A sash consists of two vertical styles, a top rail and a bottom rail. A sash can be divided vertically or horizontally by providing bars. These bars are known as the sash bars or glazing bars.

(14) Mullion :-

→ This is a vertical member which is employed to sub-divide a window or a door opening vertically.

(15) Transoms :-

→ This is a horizontal member which is employed to sub-divide a window opening horizontally.

(16) Louver :-

→ This is a piece of timber which is fixed in an ~~angled~~ inclined position within a frame.



(17) Jamb :-

→ The vertical wall face of an opening which supports the frame of door and window is known as Jamb.

(18) Reveal :-

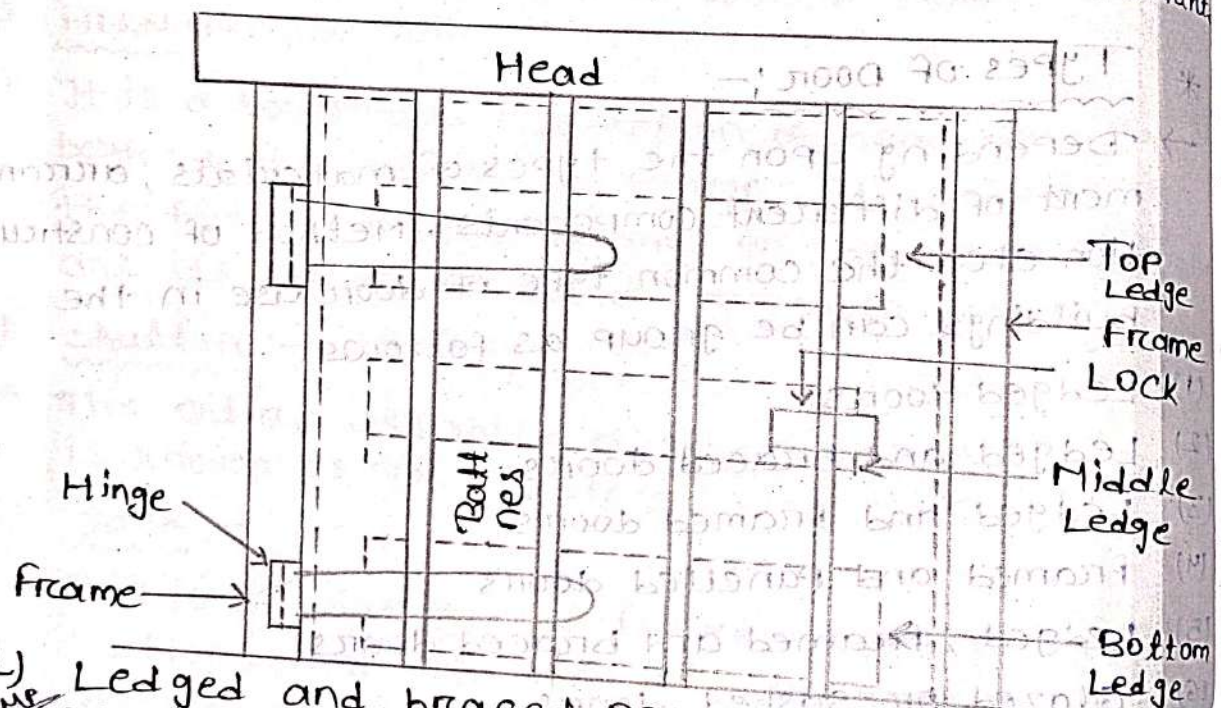
* Types of Door :-

→ Depending upon the types of materials, arrangement of different components, Method of construction etc. the common type of door use in the buildings can be group as follows.

- (1) Ledged doors
- (2) Ledged and braced doors
- (3) Ledged and framed doors
- (4) Framed and Panelled doors
- (5) Ledged, framed and braced doors
- (6) Glazed or sashed doors
- (7) Flush doors
- (8) Louvered doors
- (9) collapsible steel doors
- (10) Revolving doors
- (11) Rolling steel doors
- (12) sliding doors
- (13) swing doors

(1) Ledged Doors:-

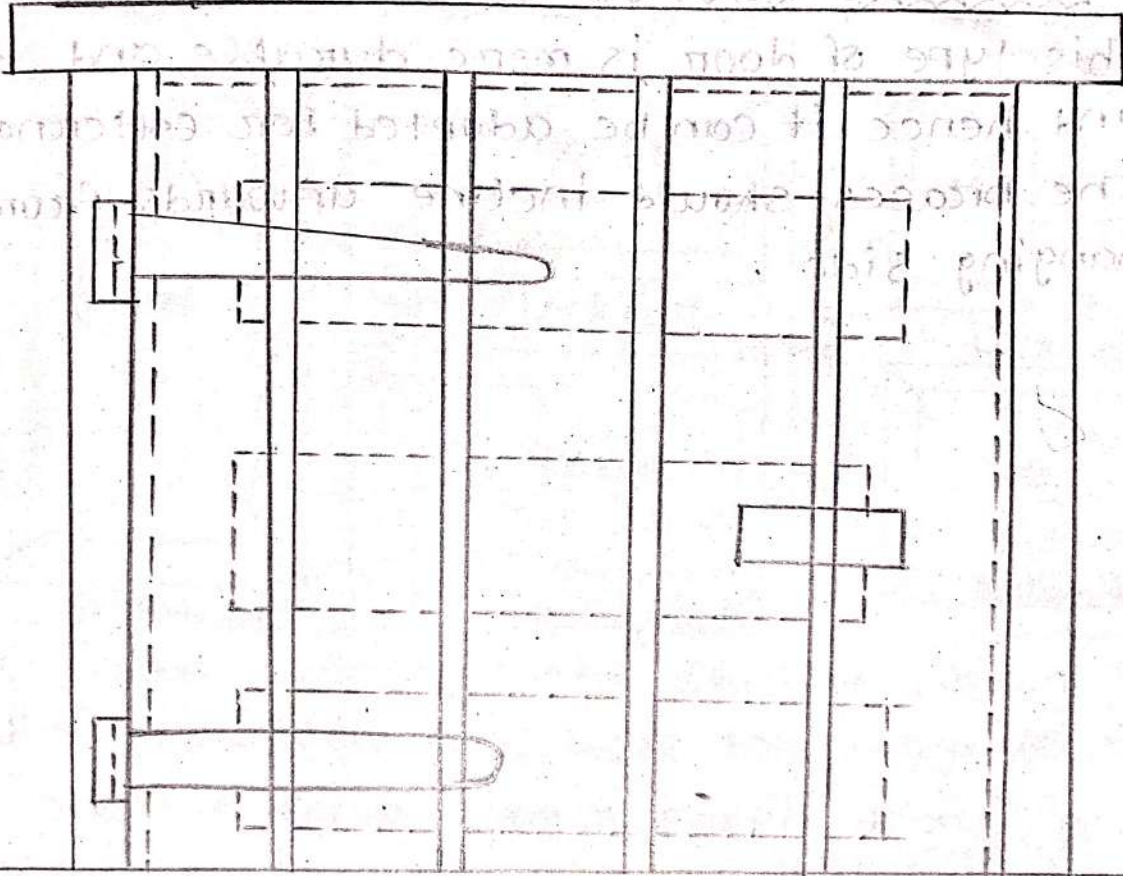
- A ledged door is formed of the vertical boards known as the battens, which are secured by horizontal supports, known as Ledge.
- The battens are 100mm to 150mm wide and 20mm to 30mm thick the ledges are generally 100mm to 20mm wide and 30mm thick.
- The three ledges are generally employed top middle and bottom the battens are secured by means of suitable joints and the shutter is hung and T-Hinges which are fixed on Ledge.
- This is simplest form of door and it is used where strength and appearance are not important.



(2) Ledged and braced Doors:-

- These are similar to the ledge doors except that the diagonal members, known as the braces.
- The braces are generally 100mm - 150mm wide and 30mm thick.
- The braces give rigidity to the doors hence the doors of this type are useful for wide openings, they have to work in compression.

and not in tension. & horizontal, edge (M)

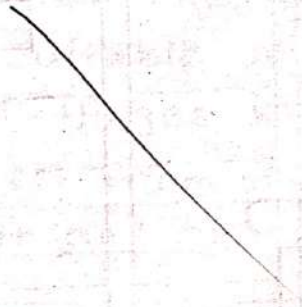


3) Ledged and Framed doors :-

→ In this type of doors, a frame work is provided to make the doors stronger and better in appearance, the style are generally 100 mm wide and 40 mm thick.

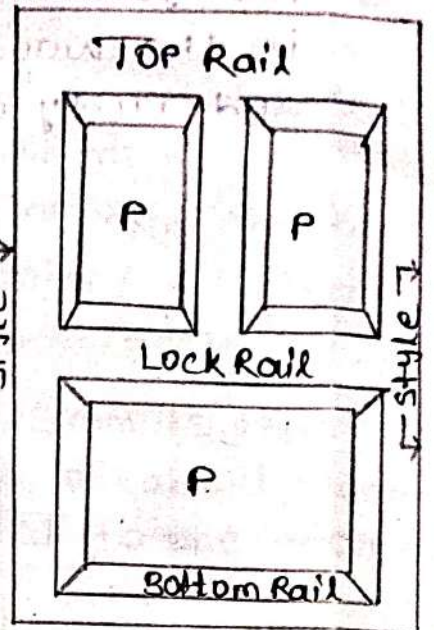
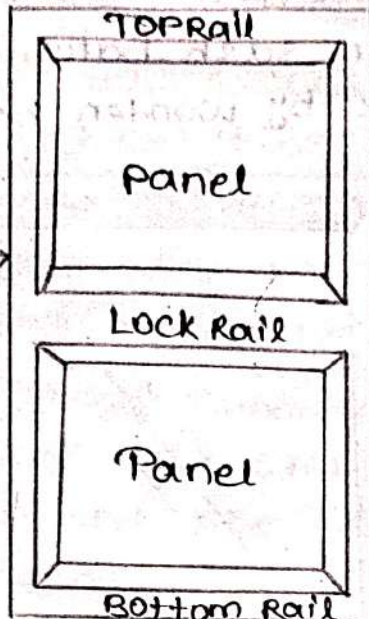
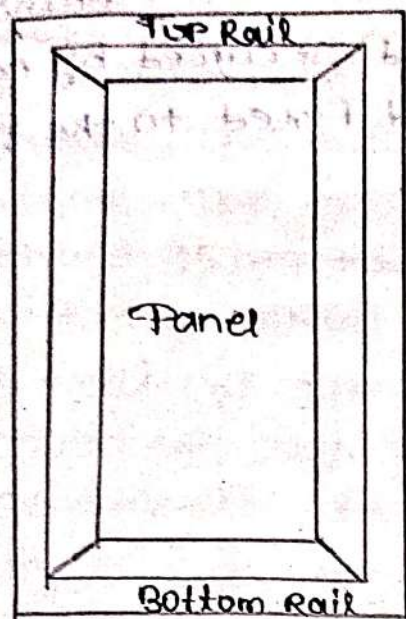
(4) Ledged, Framed & Braced Doors:-

- This type of door is more durable and stronger and hence it can be adopted for external use.
- The braces should incline upwards from the hanging side.



(5) Framed and Panelled Doors:-

- A double-leafed, framed and panelled door with four panels. This type of door reduces the tendency of shrinkage. Presents a decent appearance.
- The styles are continuous from top to bottom and rails are joined to the styles.
- The thickness of shutter depends on various factors such as type of work, situation of door, number of panels etc. But thickness of shutter is about 30mm to 40mm.
- The thickness of panels is about 20mm. The number and size of panels depend upon the architect's design or owner's desire.



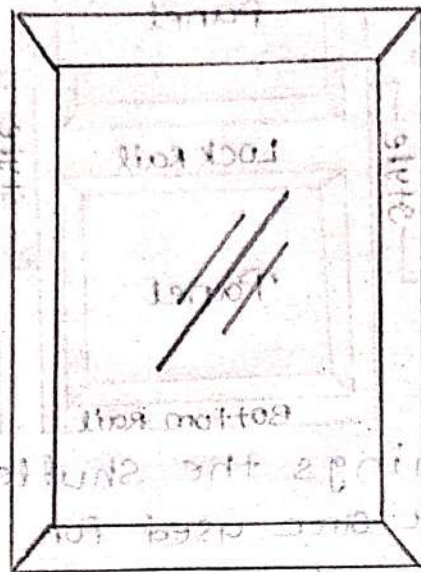
- For small openings the Shutter are of single leafed shutter are used for large openings.
- The shutter for a single panels doors, a door with two panel, and a door with three panels, a door with six panels and a double leafed door with six panels.

with horizontal vision is obstructed. The forward may be movable or fixed.

(6) Glazed or sash doors:-

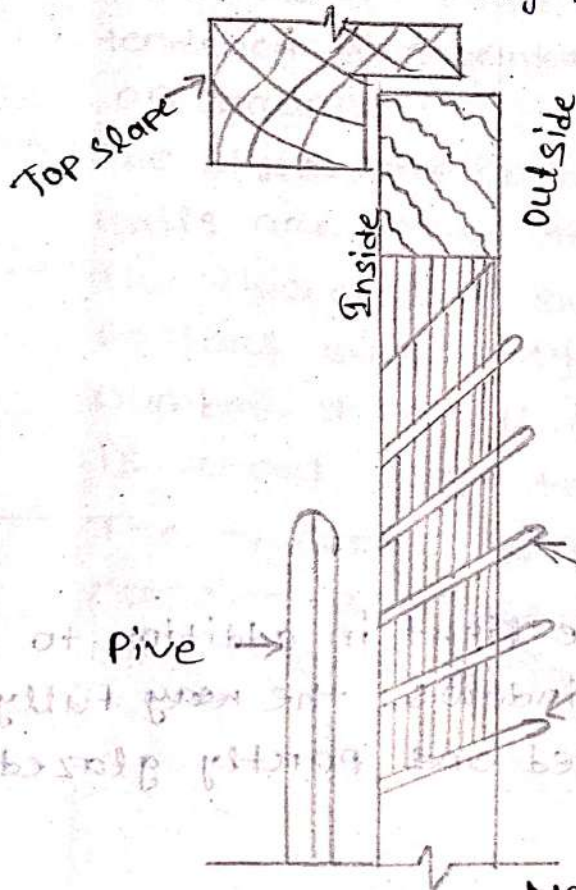
- In order to admit more light in addition to that coming from the windows, the ~~very~~ Fully glazed or partly panelled and partly glazed doors are used.

→ The glass received into the rebates provided in the wooden sash bars and secured by nails and putty or by wooden bead fixed to the frame.



(8) Louvered doors:-

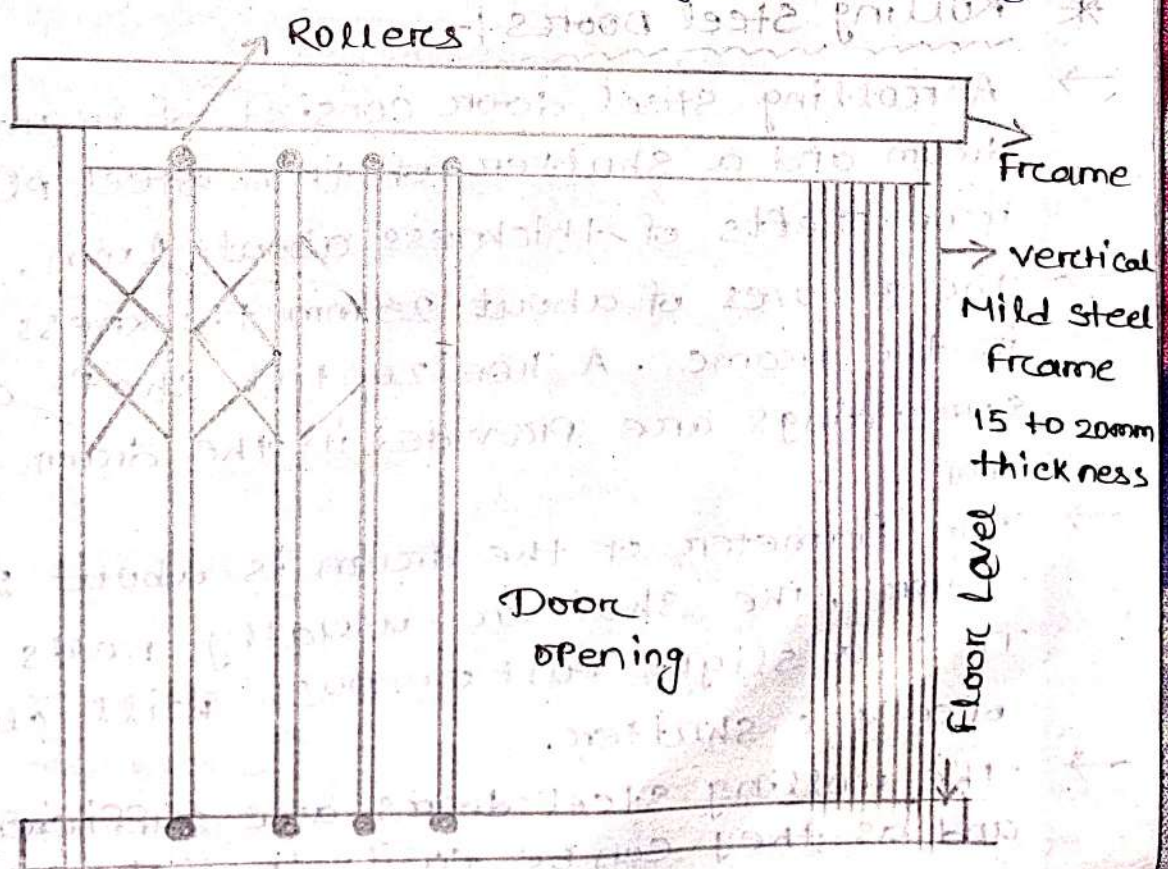
- In this type of doors, the shutters are provided with Louver either fully or partly. The louvers are arranged at such an inclination that horizontal vision is obstructed.
- The louvers may be movable or fixed.



Movable Louvers

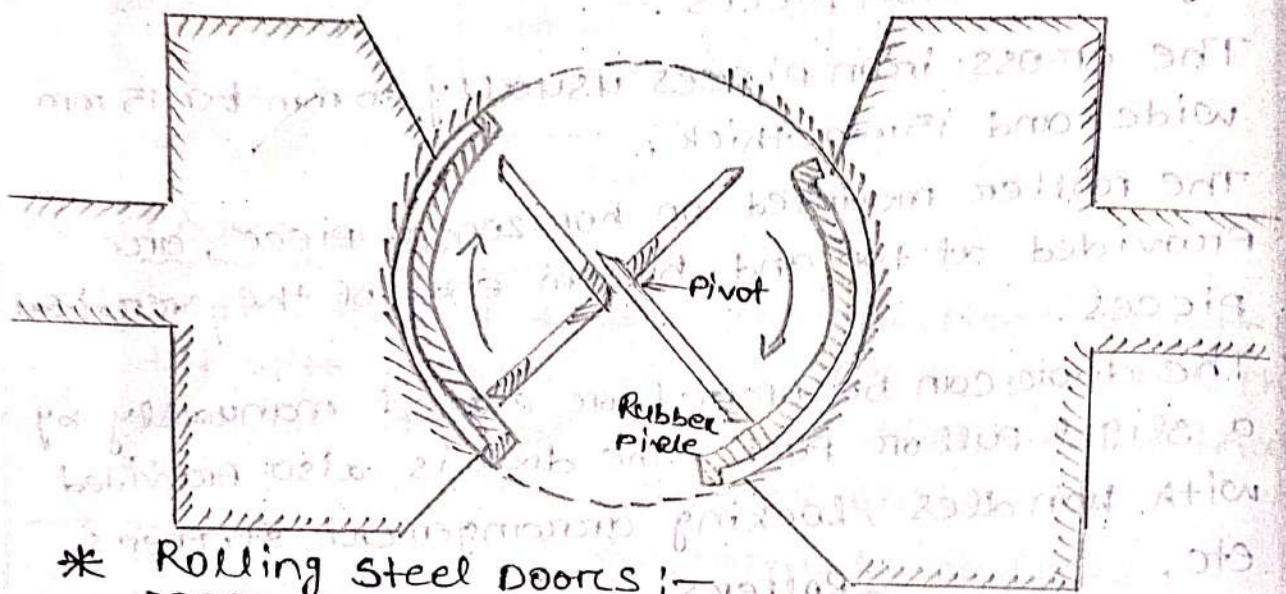
(a) Collapsible steel doors:-

- A collapsible steel door consists of mild steel frame. The two vertical pieces of mild steel about 15mm to 20mm wide are joined together with the hollow portion of the channel inside.
- A vertical gap of about 12mm to 15mm is thus created. Such pieces are spaced of about 120mm centre to centre and are joined to one another by cross iron pieces.
- The cross iron pieces usually 10mm to 15mm wide and 15mm thick.
- The roller mounted on horizontal piece, are provided at top and bottom ends of the vertical pieces.
- The door can be opened or closed manually by a slight pull or push. The door is also provided with handles, locking arrangement stoppers, etc.



* Revolving Doors :-

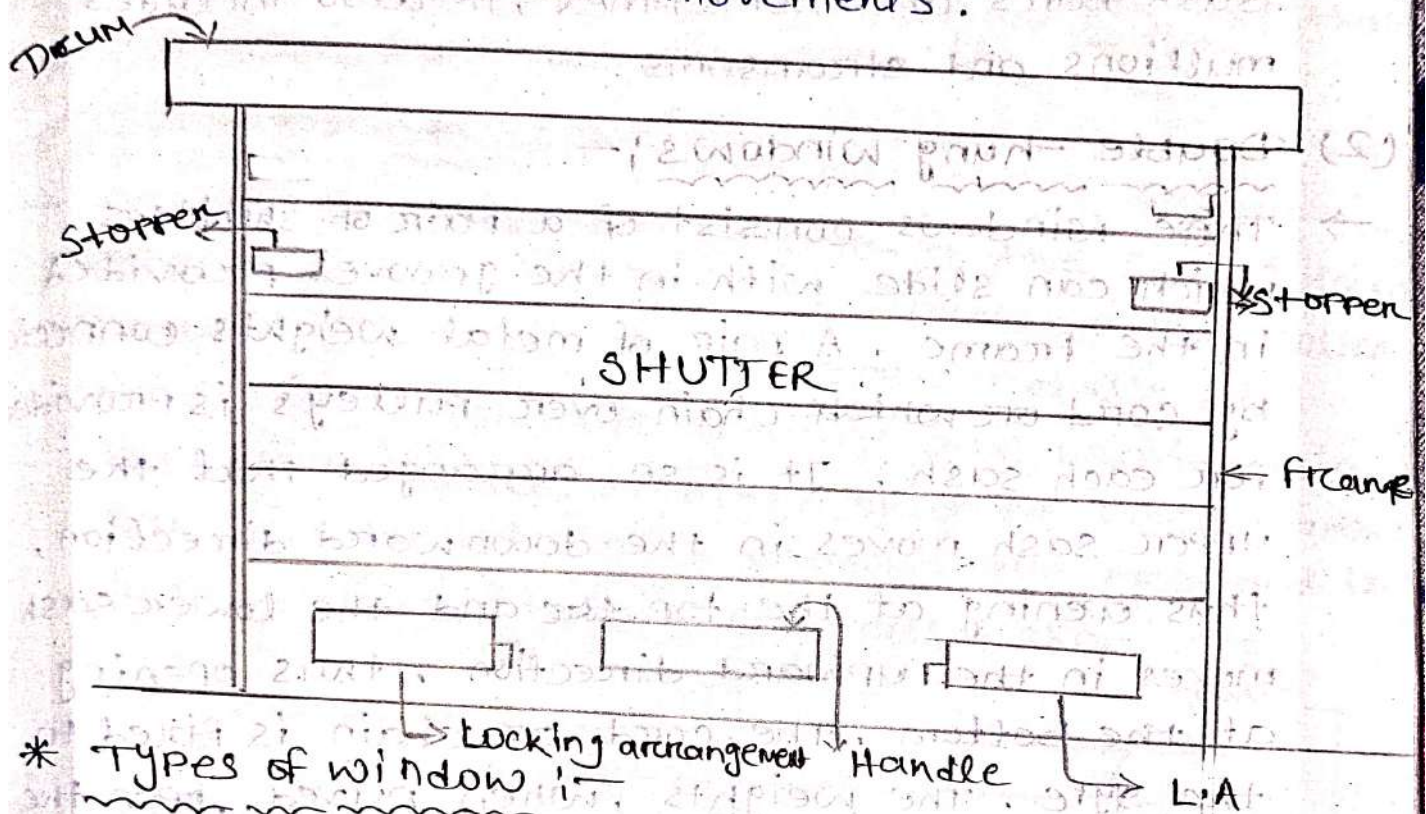
- A revolving door essentially consists of 'centrally placed mullion in a circular opening'.
- The reopening shutter or leaves which are four in number are radially attached to the pivot.
- The shutters may be fully glazed, fully panelled, or partly panelled and partly glazed.



* Rolling Steel Doors :-

- A rolling steel door consists of a frame, a drum, and a shutter of thin steel plates or iron sheets of thickness about 1mm.
- The grooves of about 25mm thickness are left in the frame. A horizontal shaft and ~~but~~ springs are provided in the drum at the top.
- The diameter of the drum is about 200mm to 300mm. The shutter usually rolls in turns. Thus a slight pull or push will close or open the shutter.
- The rolling steel doors are sufficiently strong and as they can be easily rolled up at the top.

- they cause no obstruction to the floor as well as the opening the rolling steel doors are (1) usually provided for garages, showrooms, shops, godowns, factory buildings etc.
- They provide security against fire and ~~burglary~~ they are however not good in appearance and they cause noise in movements.



* Types of window

Depending upon the manner of fixing, material used for construction, nature of operational movements of shutter etc. the common varieties of windows used in the buildings can be grouped as follows.

- | | |
|----------------------------|----------------------------------|
| (1) Casement window | (8) Circular windows |
| (2) Double hung window | (9) corner windows |
| (3) Pivoted window | (10) Garble windows |
| (4) Sliding window | (11) dormer windows |
| (5) Louvered window | (12) Bay windows |
| (6) sash or glazed windows | (13) clerestorey windows |
| (7) Metal window | (14) lanterns or lantern window. |

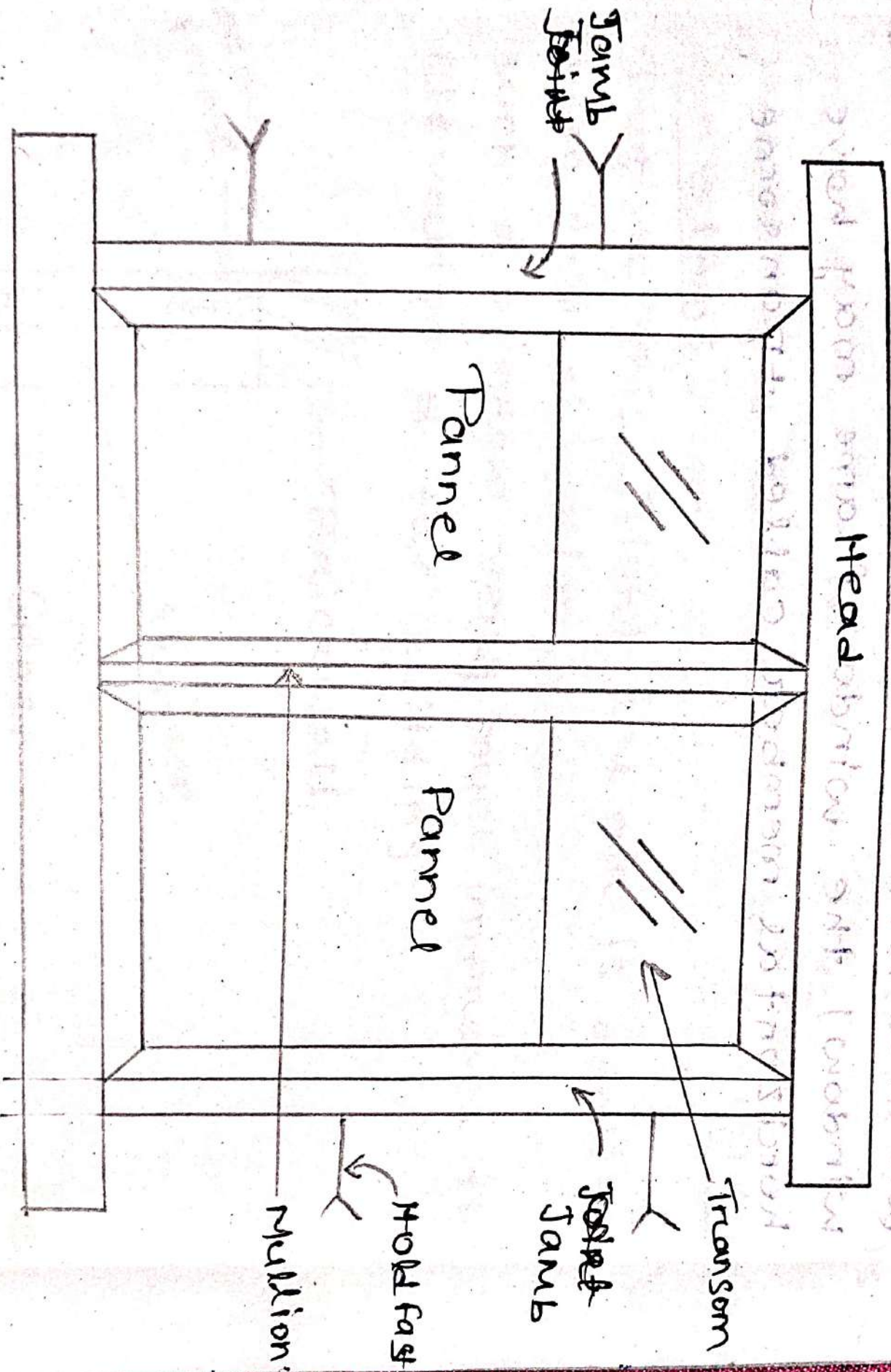
(15) Sky lights

(1) Casement windows :-

→ These are the windows, the shutter of which open like doors.

→ The construction of a casement window is similar to the door construction and it consists of frame, styles, rails, vertical and horizontal sash bars and sometimes, it also includes mullions and transoms.

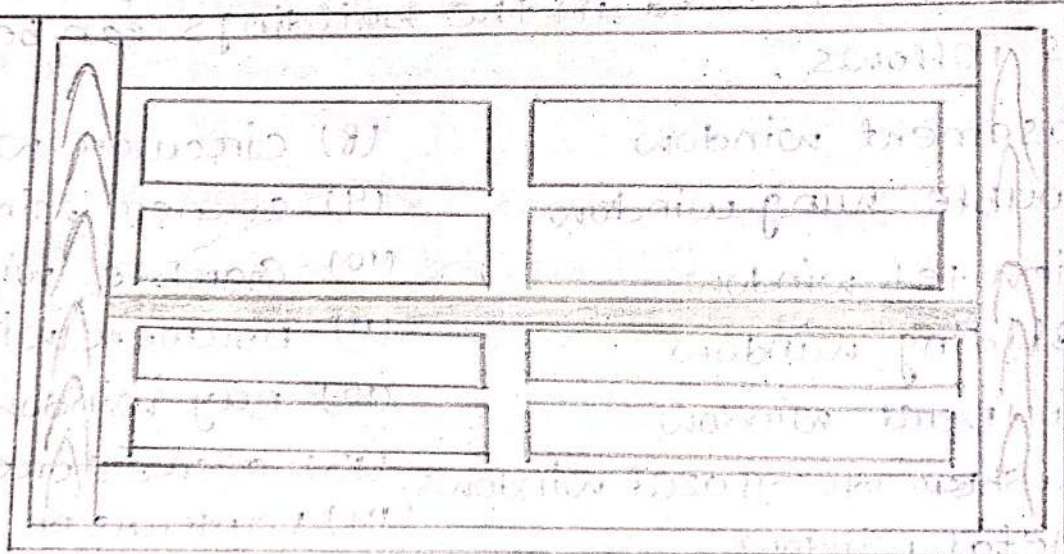
(1) Case ment : Window : Figure :-



(2) Double-hung windows:-

→ These windows consist of a pair of shutters which can slide with in the grooves provided in the frame. A pair of metal weights connected by cord or chain over pulleys is provided for each sash. It is so, arranged that the upper sash moves in the downward direction, thus opening at the top and the lower sash moves in the upward direction, thus opening at the bottom. The cord or chain is fixed to the stile. The weights, when pulled, open the shutter to the required level. Thus the ventilation can be controlled and cleaning of shutter can be carried out easily.

Chain

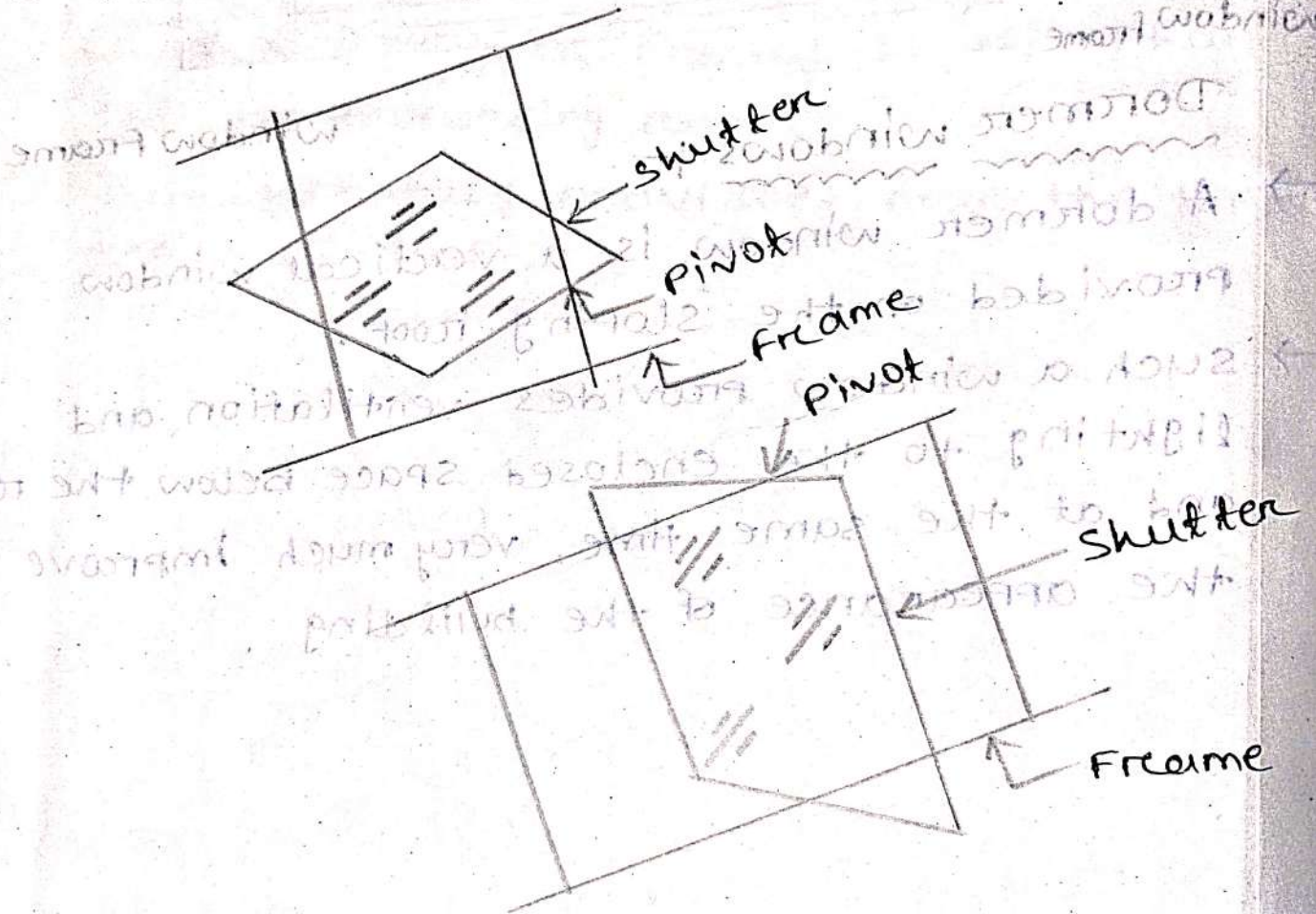


Metal weight

A

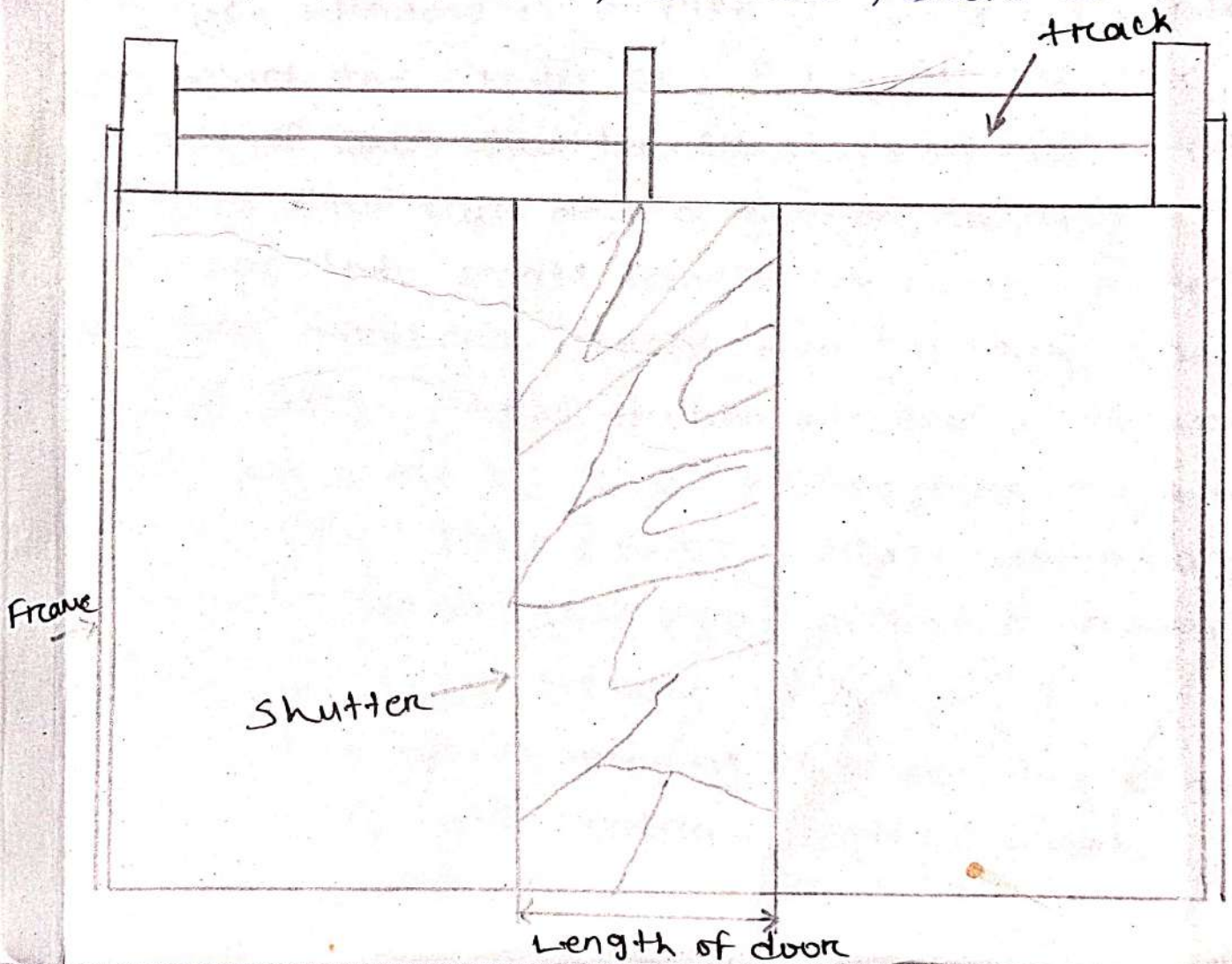
(3) Pivoted windows :-
→ In this type of windows, the shutters are allowed to swing round the pivots. The frame of a pivoted window is just similar to casement window ~~except~~ except that no rebates are provided. The windows may be vertically pivoted or horizontally pivoted respectively. The pivoted windows are easy to clean and they admit more light than the side-hung windows.

(3) Pivoted window figure:-



(4) Sliding windows :-

→ These windows are similar to the sliding doors ~~are doors~~ and the shutters move on the roller ~~bearings~~ bearings, either horizontally or vertically. Suitable openings are provided in the walls to receive the shutter when windows are opened out. Such windows are provided in trains, buses, bank, counters, shops etc.



(5) Louvered windows :-

- In this type of window, the louvers are provided as in case of louvered doors. They allow free passage of air when closed and at the same time they maintain sufficient privacy.
- The shutter consists of top rail and two styles which are grooved to receive the louvers. The economical angle of inclination of the louvers is 45° and they are generally fixed in position. If however they are to be raised or lowered, some mechanical operating device will have to be provided.

Sash or Glazed window

- A sash window is a type of casement window in which the panels are fully glazed. The frame of each shutter consists of two vertical styles, top rail and a bottom rail, is divided into small panels by means of small timber members placed horizontally and vertically. These timber members, known as sash bars or glazing bars are rebated to receive glass panels. Glass-panes are fixed to these sash bars either by means of putty or by timber.
- If the window opening is wide, the window frame may have central vertical member known as mullion.

→ If the height of window opening is more (or if a ventilator is combined with the window) the window frame may have horizontal member called transome.



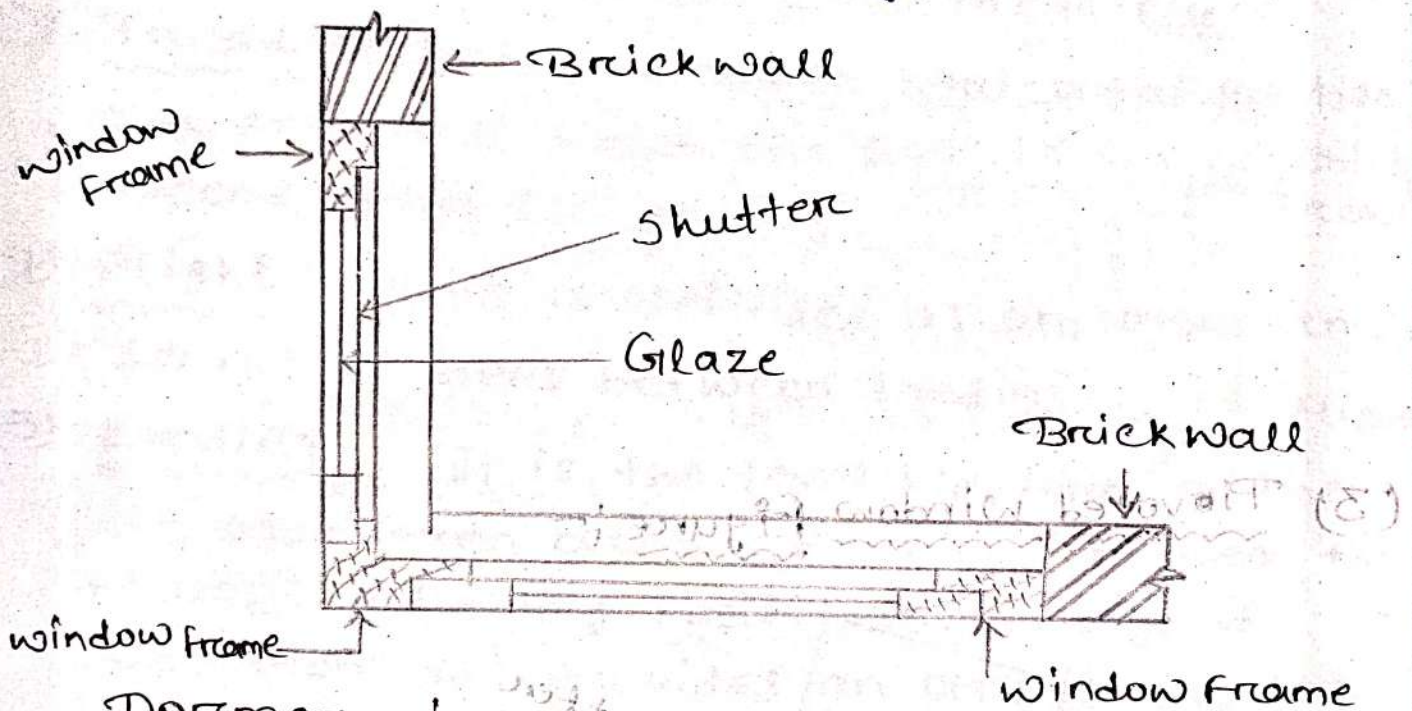
Clear - storey window

→ These windows are provided in a room which has greater ceiling height than the surrounding rooms.

→ It is generally provided near the top of the main roof.

corner window :-

- This is a ~~specimen~~ ^{special} type of window which is provided in the corner of a room.
- This window has two faces in two perpendicular directions.
- Due to this, light and air is admitted from two directions.
- Such a window very much improves the elevation of the building.



Dormer windows :-

- A dormer window is a vertical window provided on the sloping roof.
- Such a window provides ventilation and lighting to the enclosed space below the roof, and at the same time, very much improve the appearance of the building.

* Stair Case

Technical Terms :-

Nosing



(1) Step :- It is a portion of stair which permits ascent or descent. It is comprised of a tread and riser. A stair is composed of a set of steps.

(2) Riser :- It is the vertical portion of a step providing a support to the tread.

(3) Tread :- It is the upper horizontal portion of a step upon which the foot is placed while ascending or descending.

(4) Flight :- This is defined as an unbroken series of steps between landings.

(5) Landing :- It is the level platform at the top or broken bottom of a flight between the floors. A landing facilitates change of direction and provides an opportunity for taking rest during the use of the stair.

(6) Riser :- It is the vertical distance between two successive tread faces. Distance - Riser

(7) Going :- It is the horizontal distance between two successive riser faces. Going

(8) Nosing :- It is the projecting part of the tread beyond the face of the riser. It is usually rounded off from architectural considerations.

(9) Scotia :- It is a moulding provided under the nosing to improve the elevation of the step, and to provide strength to nosing. Scotia

(10) Soffit :- It is the underside of a stair.

(11) Line of nosings :- It is an imaginary line parallel to the strings, and tangential to the nosings. It is useful in the construction of hand rails, giving the line coincide with which the under-surface of the hand rail should coincide.

(12) Pitch or slope :- It is the angle which the line of nosing of the stair makes with the horizontal.

(13) Strings or stringers :- These are the sloping members which support the steps in a stair. They run along the slope of the stair.

(14) Newel post :- Newel post is a vertical member which is placed at the ends of flights to connect the ends of strings and hand rail.

(15) Baluster :- It is vertical member of wood or metal, supporting the hand rail.

(16) Balustrade :- It consists of a row of balusters surmounted by a hand rail, to provide protection for the users of the stair.

(17) Hand Rail :- It is a rounded or moulded member of wood or metal following generally the contour of the nosing line, and fixed on the top of balusters.

(18) Head Room :- It is the minimum clear vertical distance between the tread and overhead structure (i.e. ceiling, etc.).

(19) Run :- It is the total length of stairs in a horizontal plane, including landings.

(20) Header - It is the horizontal structural member supporting stair stringers, or landings.

* Classification of Stairs -

Stairs can be classified in two broad heads :-

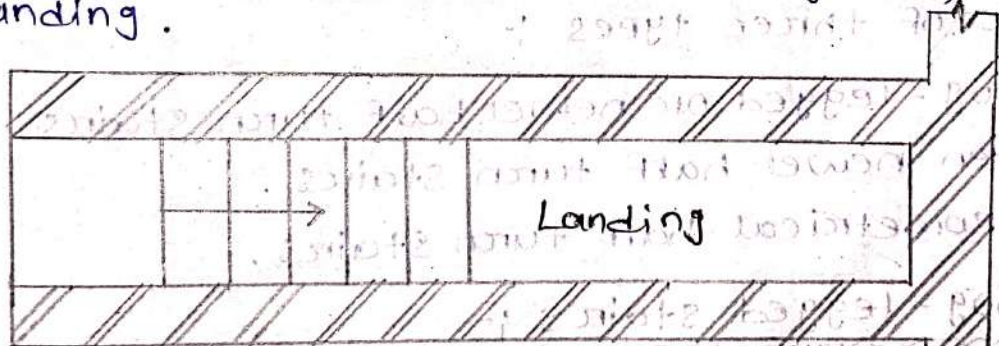
- (1) Straight stairs
- (2) Turning stairs
 - (i) Quarter turn stairs
 - (ii) Half turn stairs (dog-legged and open well stairs)
 - (iii) Three-quarter turn stairs
 - (iv) Bifurcated stairs.

Each of the turning stairs are of three types :-

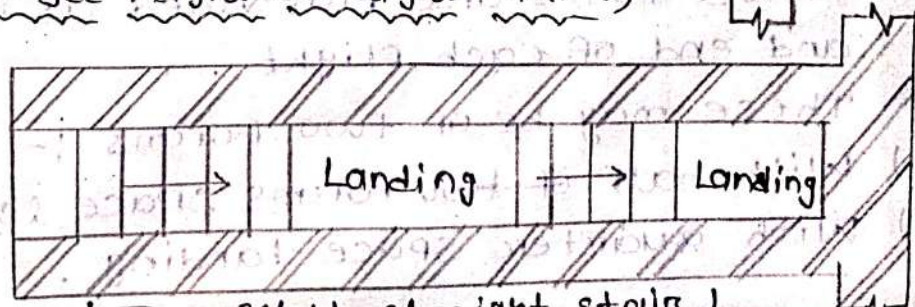
- (a) Newel stairs
- (b) well or open-newel stairs, and
- (c) geometrical stairs

(1) Straight Stairs -

→ In this type, this stairs runs straight between the two floors. It is used for small ^{areas} houses where there are restrictions in available width. The stair may consist of either single flight or more than one flight (usually two) with a landing.



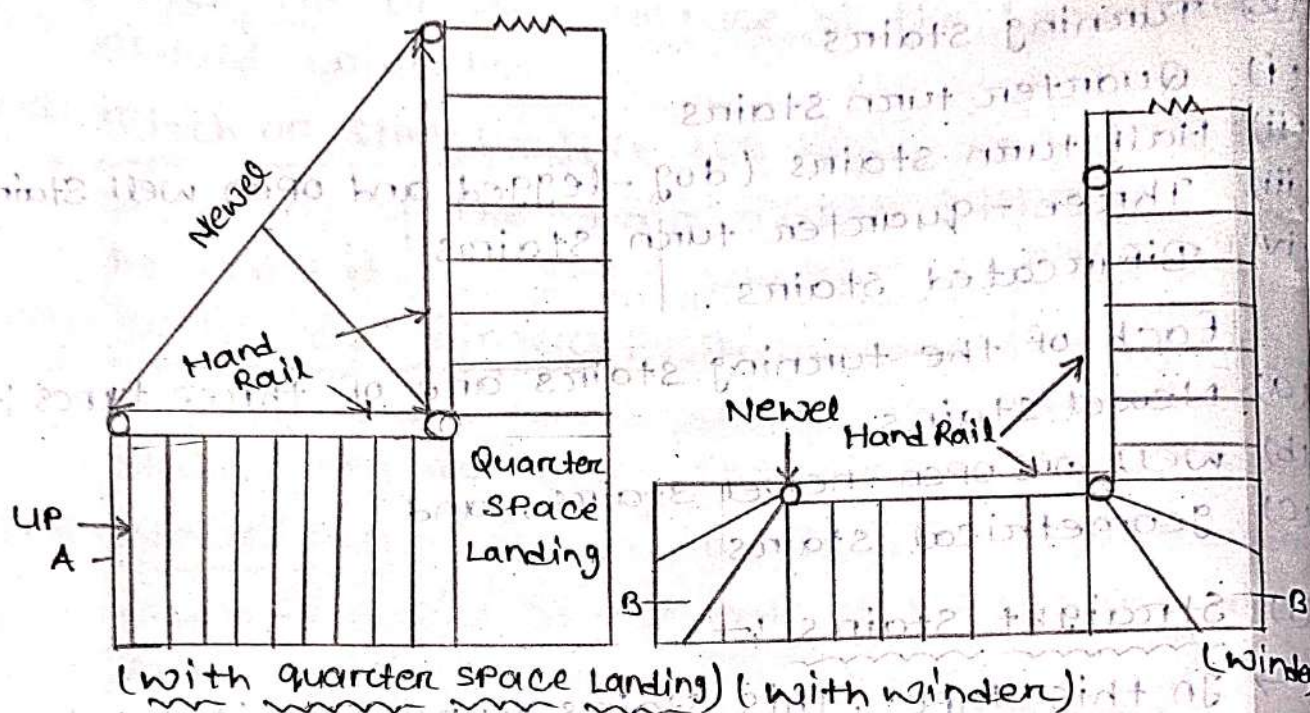
(single flight straight stair)



(Two flight straight stair)

(2) Quarter Turn Stairs :-

→ A quarter turn stair is the one which changes its direction either to the left or to the right, the turn being affected either by introducing a quarter space landing.



(3) Half Turn Stairs :-

→ Half turn stair is the one which has its direction reversed, or changed for 180°. Such stairs are quite common. These may be of three types :-

- (a) Dog-legged or newel half turn stairs.
- (b) open newel half turn stairs.
- (c) Geometrical half turn stairs.

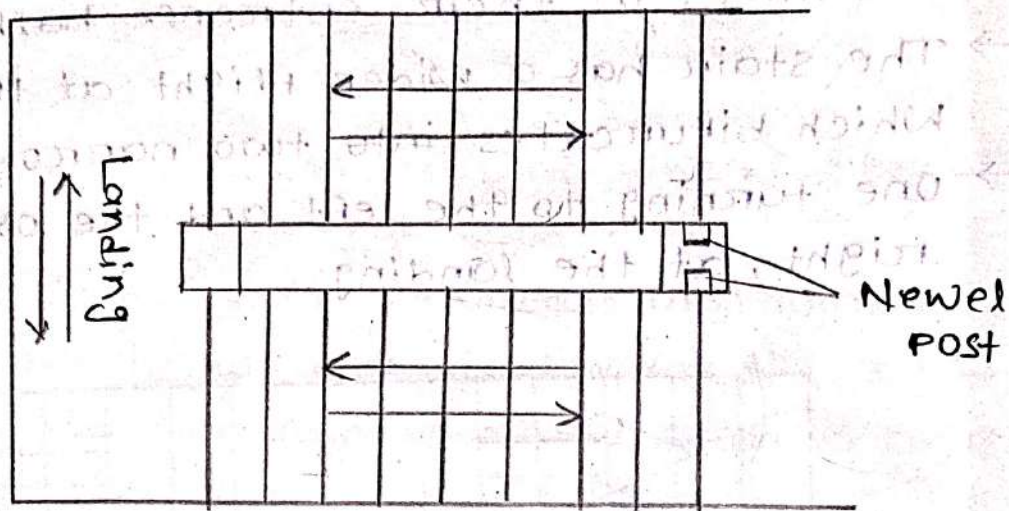
(a) Dog-legged stairs :-

→ Newel posts are provided at the beginning and end of each flight.

→ These may be of two forms :-

- (i) With half of ~~two forms~~ space landing, and
- (ii) With quarter space landing.

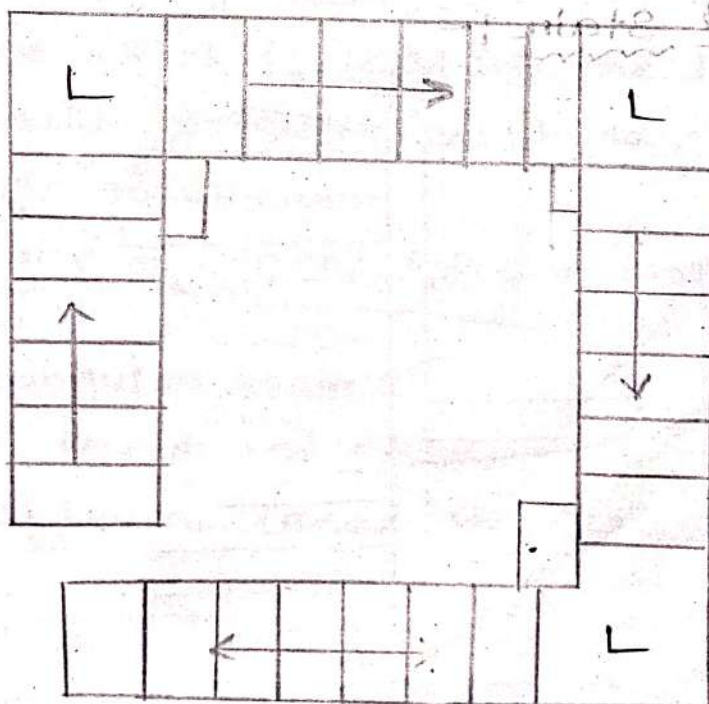
→ There is no space between the outer strings of the two flights.



(DOG LEGGED HALF TURN)

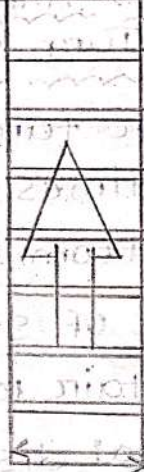
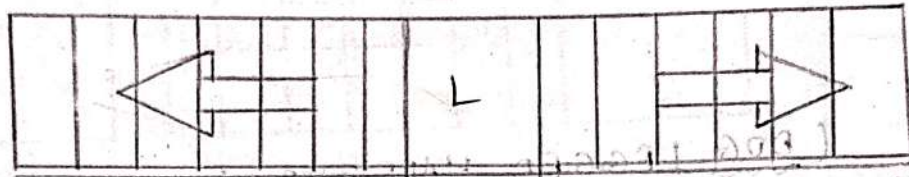
(4) Three Quarter Turn Stairs :-

- A three quarter turn stairs has its direction changed three times with its upper flight crossing the bottom one.
- Such ~~newel~~ type of stair is used when the length of the stair room is limited.
- When the vertical distance between the two floors is quite large.



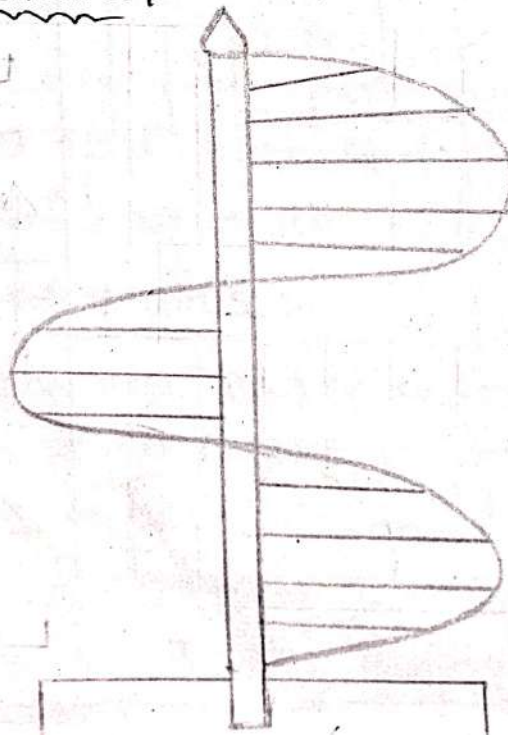
(5) Bifurcated stairs :-

- This type of stair is commonly used in Public buildings at their entrance hall.
- The stair has a wider flight at the bottom, which bifurcates into two narrower flights.
- One turning to the left and the other to the right, at the landing.



(6) Half turn stairs figure :-

(6) Spiral Stair :-



→ This stairs don't have any landing and any newel post.

→ This stairs are made up of either RCC or any metal.

→ This stairs are constructed where the space or area are limited.

→ All the steps of the staircase are winder.

→ This stair is not comfortable for the users.

→ Design and construction of the stair is complicated.

* Classification of stair as per Material:- (11)

(I) Timber stair

(II) Stone stair

(III) Brick stair

(IV) Metal stair

(V) R.C.C stair

(I) Stone stair:-

→ Stone stair is very strong and rigid, so these are very heavy.

→ The stone which is used for the stone stair that should be sufficient hard, strong, and resistance to wear.

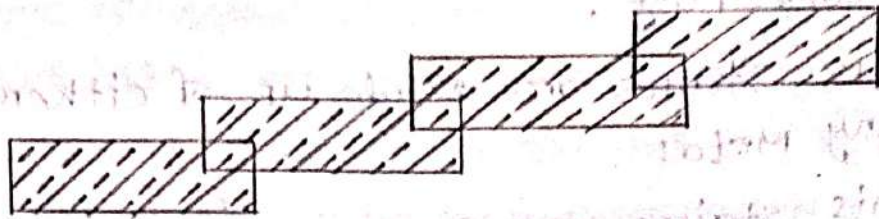
→ There are different types of stone stair such as:-

(I) Rectangular stair

(II) Slab, tread and Riser

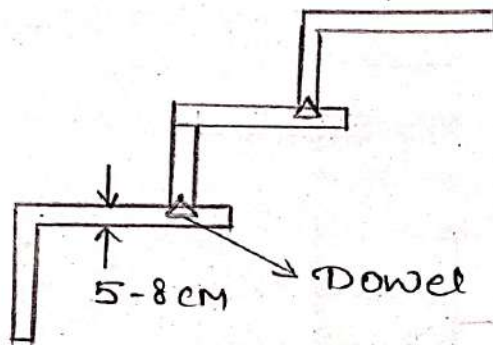
(III) Cantilever tread and slab stair

(I) Rectangular stair :-



- In this stair the steps are prepared in the form of Rectangular.
- The steps are arranged in such a way that lower edge of one step should rest on upper edge of below step.

(II) Slab, tread, or Riser :-



- These steps are connected two Dowel.
- Thickness of the stone slab is very strong 5-8 cm.

(III) Cantilever tread and slab stair :-



- This stair is formed with tread only no rise is there in the stair.
- Tread slabs are fixed at one end into the wall so, it act as cantilever.