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Building construction

Building :-

Building is a structure having various component like foundation, walls, columns, floor, roof, door, windows etc.

Types of Building :-

1. Residential building :- The building which are provided with sleeping purpose, with or without cooking or dining are called residential building.
2. Educational building :- Any school, college or educational center used for educational purpose are called as educational building.
3. Institutional Building :- Any building which is used for medical treatment or care of person suffering from physical or mental illness or disease, care of infants, aged person etc.
4. Assembly building :- Any buildings like Cinema hall, Auditorium, museums, recreation places of worship, dance halls, stadium etc.

5. Business building:- Any building which is used for transaction of business for keeping of account and record are called as Business building.

6. Mercantile building:- Any building used as shop, stores, markets, showrooms are called as mercantile building.

7. Industrial building:- A building in which products or materials of all kinds are manufacture, assembled or fabricated are called as Industrial building.

8. Storage building:- Any building which is used for storage for sheltering of goods, machines, products, vehicles or animals are called as storage building.

9. Hazardous building:- A building which is used as storage, handling, manufacture, of highly explosive material.

Structural System of building

⇒ Difference between load bearing and structure and frame structure

load bearing	frame structure
1. Almost all the walls are load bearing walls	All the walls are partition walls. No load comes in the wall.
2. Almost all the walls are provided with shallow or deep foundation	All the walls rest on plinth beam and not provided with foundation
3. All load bearing walls are taken deep into the sub-soil	Only columns are taken deep into the subsoil
4. They are constructed with bricks or stones	Columns, beams and slabs are constructed of R.C.C (Reinforced cement concrete)
5. Thickness of load bearing wall in this case should not be less than 200mm	Only exterior walls are of thickness 200mm and all interior walls are of thickness 100mm or less.

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- | | |
|---|--|
| 6. A load bearing wall when once constructed shall remain in position and should never be dismantled. | The walls of frame structure can be sitted at any place. |
| 7. Too many opening for doors, windows, ventilators etc. are not allowed | There is no such restriction in frame structure. |
| 8. Plans for different floors remain same. | Planning for each floor is independent. |

Component of building's

1. Foundation.
2. Plinth
3. walls or Column
4. Basement floor, Ground floor, & upper.
5. Sill, lintel and water shed
6. Roof
7. Stair, lift and Ramp
8. plastering, pointing, painting & white washing

⇒ Foundation:- The lowest part of the structure which are in direct contact with the ground and which transfer the load of structure to the ground are called as foundation.

Object of foundation

- (i) to distribute the total load coming on the structure on a larger area so as to bring the intensity of load below the safe bearing capacity of sub soil.
- (ii) To support the structure.
- (iii) To give lateral stability to the structure.
- (iv) To prepare a level and hard surface for construction and maintenance.

(v) To transmit the super imposed load through side friction and end bearing in case of deep foundation.

(vi) To distribute the non uniform load of the super structure to the sub soil.

(vii) To provide safety against heaving due to animals, water etc.

(viii) To prevent cracks due to movement of moisture in the case of poor or weak soil.

Requirement of Good Foundation

(1) Location:-

The Foundation structure should be so located that it is able to resist any unexpected future disturbance.

2. Stability:-

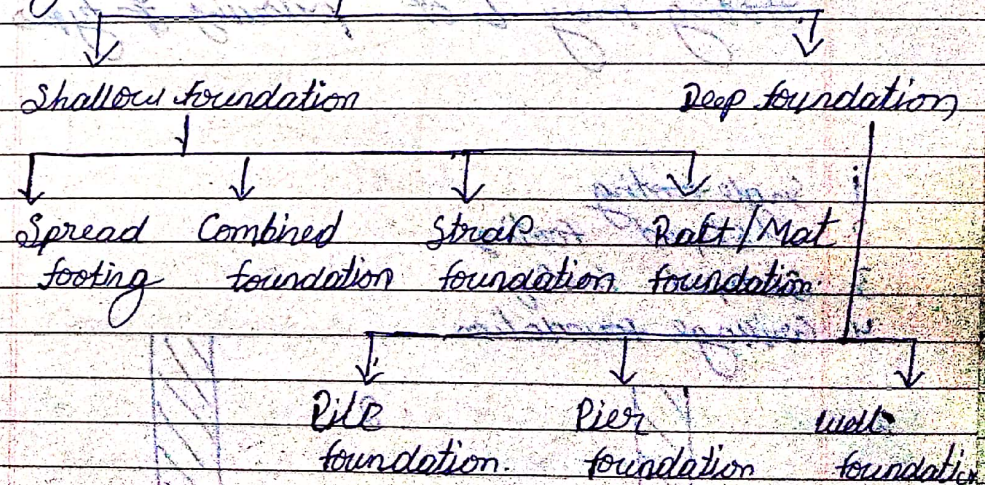
The foundation structure should be stable on site against any possible failure. The foundation base should be rigid enough

to bring down the different settlement.

3. Settlement:-

The foundation structure should not settle or deflect to such an extent so as to impair its usefulness or the stability of the building.

Types of Foundation



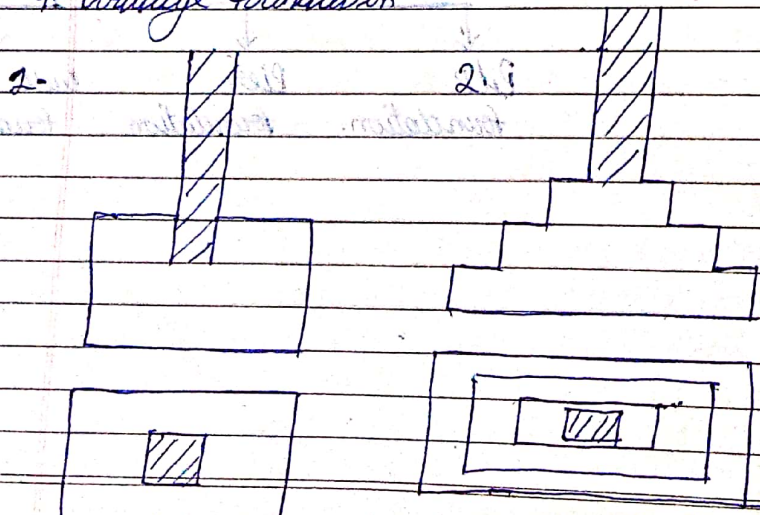
7. Shallow foundation

The foundation is called shallow foundation if its depth is equal to or less than its width.

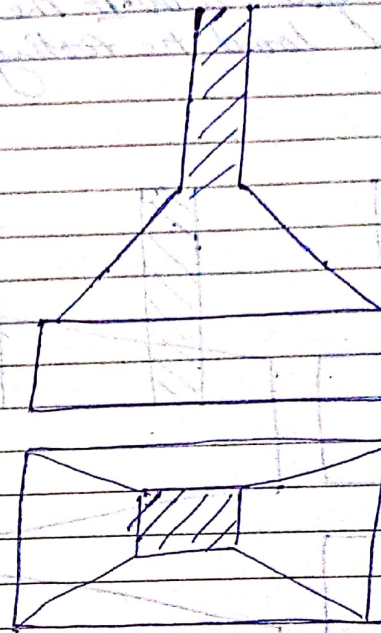
(i) spread footing :-

Spread footing are those which spread the super imposed load of column or wall over a large area. Spread footing support either a column or wall. Spread footing may be of following types

1. Single footing
2. Stepped footing
3. Sloped footing
4. Grillage foundation



3.



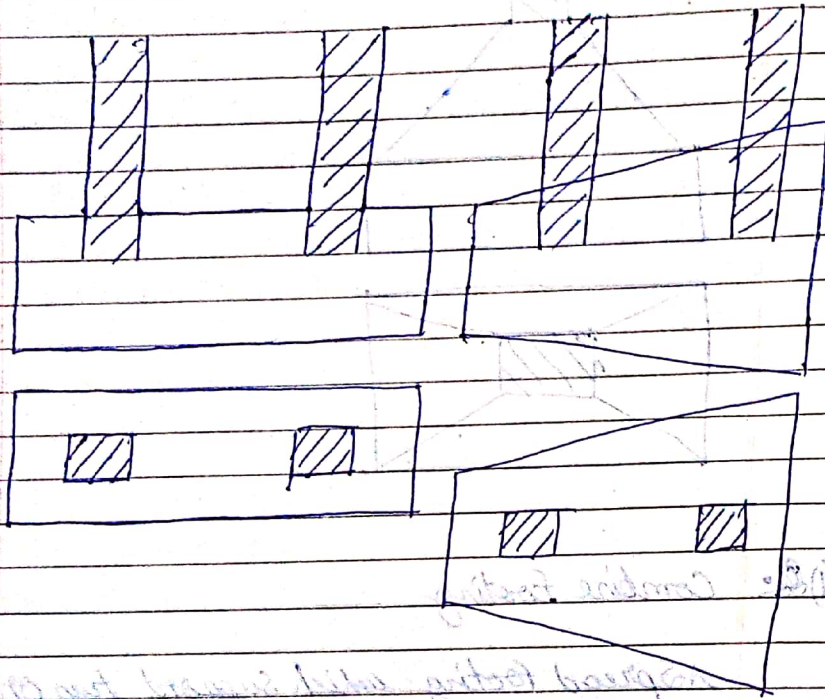
(ii) Combined footing

A spread footing which support two or more columns is called as combined footing. The combined footing may be of following type.

- (i) Rectangular
- (ii) Trapezoidal
- (iii) Combined column wall footing

The combined footing for column will be in rectangular

Shape if they carry equal load. If the column carry unequal load the footing is trapezoidal.



(ii) Strap footing :-

If the independent footing of two columns are connected by a beam it is called as strap footing. A strap footing may be used where the distance between the column is so great that

a trapezoidal footing become quite narrow. The strap beam does not remain in contact with soil and does not transfer any pressure to the soil.

(iv) Ratt on Mat foundation

A Ratt on Mat foundation covers the entire area below a structure and support all the wall and column when the allowable soil pressure is low. on the building load are too heavy then mat foundation is used.

2. Deep foundation

when the depth of foundation is more than the width of the footing they are called as deep foundation.

(i) Pile foundation.

It is that type of foundation in which the load are taken to a low level by means of vertical members which may be of timber, concrete, steel. pile

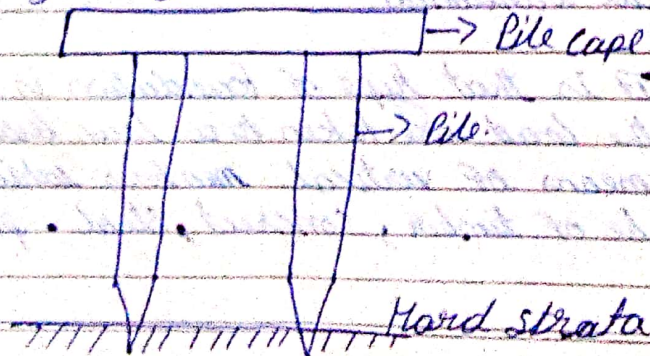
Foundation may be used

- when there is no hard strata exist at any reasonable depth.
- when the load bearing capacity of soil is low
- piles used for building may be of four types.

- end bearing pile
- friction pile
- combined end and bearing and friction pile
- compaction pile

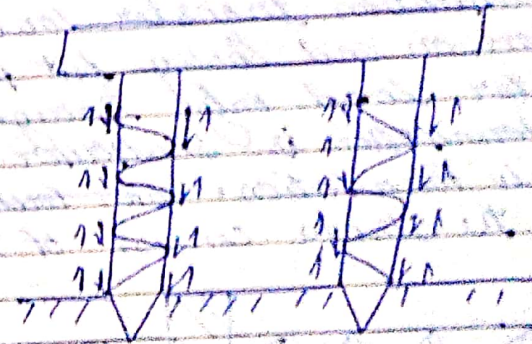
(i) end bearing pile

They are used to transfer ^{load} through water or soft soil. Such pile are used to carry heavy load safely to hard strata

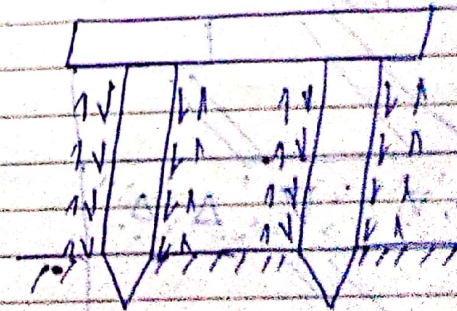


(ii) Friction pile

They are used to transfer load to a depth or a friction load carrying material by means of skin friction.

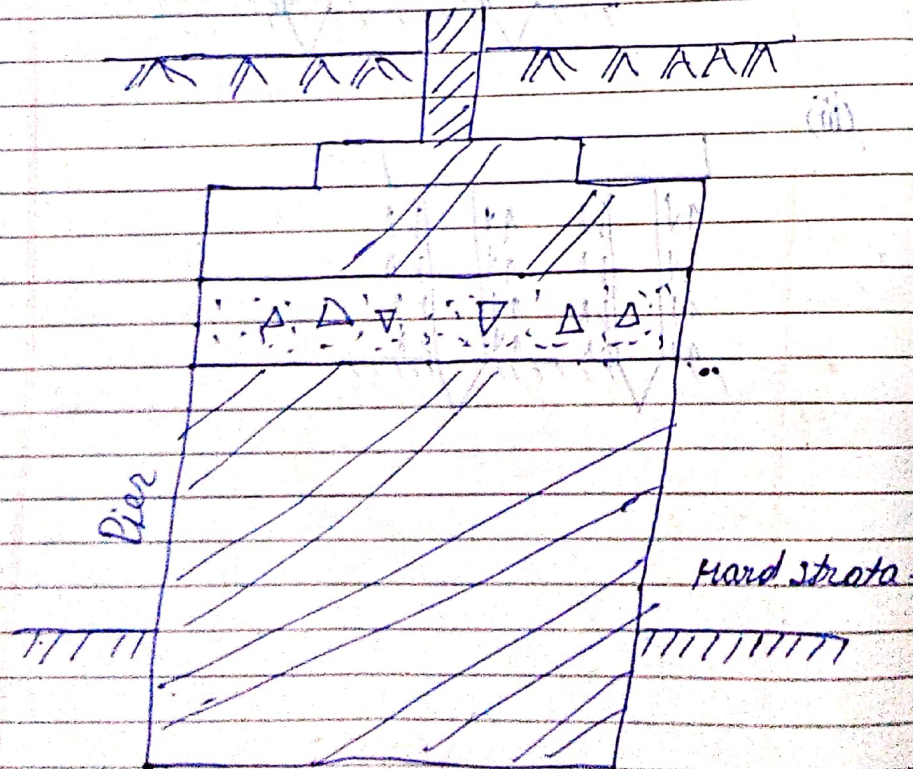


(iii)



(ii) Pier foundation.

A Pier foundation consist of a cylindrical column of large diameter to support and transfer load to the strata below. Pile foundation transfer load through friction on end bearing but pier foundation transfer load only through end bearing. pier foundation is shallower in depth than the pile foundation. pier foundation is used when the strata consist of rocks.



(iii) Well foundation.

Well foundation are box like structure which are sunk from the surface to the desired depth. They are much larger in diameter than pier foundation. They are used in bridges, docks, break water, wharves etc.

Well foundation are not used in building.

Selection of foundation:-

1. load of structure:-

loading consisting coming from the structure is one of the factors that govern foundation selection. It is in by type of building. Types of construction material and environment factors in case of low rise building shallow foundation is preferred and for high rise building deep foundation is required.

2. Soil bearing capacity:-

Soil bearing capacity is one of the most important factors in selection of the

type foundation upto a storey shallow foundation is given and for higher structure, raft foundation is provided.

3. Soil Type:-

There are different type of soil like sanding soil, low clayey soil and expansive soil. For low bearing capacity soil strong and suitable foundation shall be selected.

- (i) clay soil - Raft foundation
- (ii) Heavy soil - Strip foundation
- (iii) Silt - Reinforced concrete stoned footing
- (iv) Sand & Gravel -

(v) Rock - Any foundation.

4. Cost of construction:-

The choice of foundation should be made keeping in mind the cost with which it can be constructive at the site. The construction of different types of foundation requires labour of different skills.

5. Water Table:-

Water table is another important factor for the selection of foundation. Foundation should not be placed on soil that another got expansional and construction due to water table. If the ground water table is located below the formation level of the foundation then shallow footing like spread footing, combined footing is given for high water table mat footing should be given.

6. Adjoining structure / water bodies

7. Natural disaster

8. Economic rising

9. Stone masonry:-

Masonry may be defined as the construction of building united bonded with mortar. The building unit may be of stone, brick and pre cast concrete when stone are used as the building unit to have the masonry.

Type of Stone masonry:-

1. Rubble masonry
2. Ashlar masonry

1. Rubble masonry:-

In this type of masonry consider the stone of irregular size are used. The stone are option from quarry are taken in used in the same from or they are broken and shaped in suitable sizes by means of hammer as the work proceed.

(i) Coursed Rubble:-

In this type of Rubble masonry the height of stones varies from 150mm to 200mm this type of masonry is used for construction of public building Residential building etc.

(ii) uncoursed Rubble masonry:-

In this types of rubble masonry the stone are not rest but they are used as they are available from the quarry this

type of rubble masonry is used for construction of godown, garages etc.

(iii) Random Rubble masonry:-

In this types of masonry the stone and Rock is irregular sized and shape the stone are arranged so has to have good off appearance. If the few of stone are chised dressed and the thickness of mortar jointed to not adjust 6mm

(iv) Dry Rubble masonry:-

In this type of masonry no mortar is used in the joint. this types of masonry is the o but is required more skill it is used in bridge retaining wall.

(v) Polygon Rubble masonry:-

In this types of masonry the stone are hammered and stone selected for the work. First is polygon shape

2. Ashlar masonry -

In this type of construction the sequence of rectangular block of stone are used. The height of stone varies 25mm to 30mm the length of stone should not shift three times the height and the depth into wall should be at least equal to half of height.

Dressing of stone:-

The sequence of stone obtained from rough block are in regular shape or nonuniform size hence ^{arching} ~~design~~ ^{dressing} is important. The ~~design~~ ^{dressing} of stone is sometimes done in every other hours carry stones are soft due to the moisture contain by them.

Tools

1. Spall Hammer - used for rough design
2. Scrabbling Hammer - for removing irregular bashing
3. Mask Hammer - for rough ~~design~~ dressing

4. Grad - used to split stone

5. Drag - used for drag finish

6. Hand Saw - To cut soft stone

7. Cross cut Saw - To cut hard stone

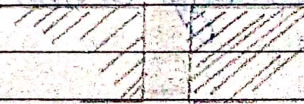
8. Frame Saw - To cut larger block

9. Rikking tool - To make stone of required size.

Tools in stone masonry

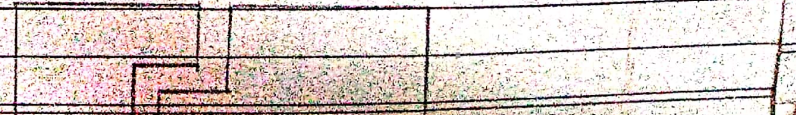
1. Built Joint:-

This is most commonly used joint in stone masonry. The dressed edges of two adjacent stones are placed side



2. Lapped Joint:-

This type of joint is provided in arches to prevent the possible movement of stone.



#

Brick masonry

Bricks

Mortar
: 1 Sukhi

Brick masonry:-

It is made of bricks units bounded together with mortar to attentional components of brick masonry are (1) Brick (2) mortar.

Types of bricks:

1. Traditional brick

 $22 \frac{1}{2} \times 11 \frac{1}{4} \times 7 \frac{1}{2} \text{ cm}$

2. Nominal size

 $20 \times 10 \times 10$

3. Actual on standard

 $19 \times 9 \times 9$

Some definitions

1. Stretcher:-

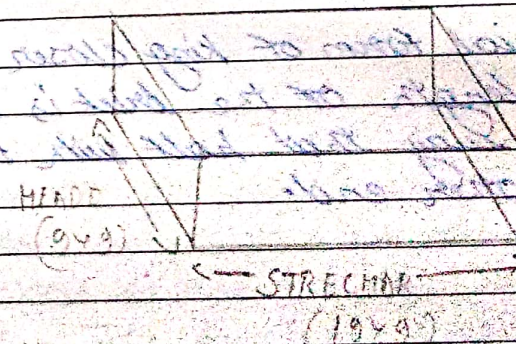
A Stretcher is the longer part of the brick as seen in the elevation of the walls.

2. Head:-

A Head is the shorter part of the brick as seen in the elevation of the walls.

3. Lap:-

It is the horizontal distance between the vertical joints of brick course.



4. Bed:- It is the lower surface of the bricks when laid flat

→ VERTICAL JOINT / LAP



Closer:-

It is the ^{portion} of brick with the cut end ~~logitudinally~~ and is used to close up bond at the end of the course.

Queen closer:- It is a portion of brick upturned by cutting a brick length by into portion.

King closer:- It is the portion of brick which is so cut that the width of one of its end is half that of full brick by the while the width at the other end is equal to the full width.

Bevelled closer:-

It is special form of king closer in which the hole length of the brick is bevelled in such a way that half width is maintain at the other end.

But:-

It is the partial of brick cut across the width.

Frog:-

Frog is an depression in the face of brick to form a key for holding the mortar.

Bonds in Brick

1. Stretcher bond:-

It is the one in which all the bricks are laid as stretcher on the face of the wall which have thickness of half brick (9cm) such as those used for as partition wall, sleeper wall, or chimney. This bond is not possible if the thickness of wall is more width.

2. Header bond:-

It is the one in which all the bricks are laid on the walls as header faces. This pattern is used only when the thickness of wall is equal to thickness of one brick. This wall is unstable to form load bearing wall this wall is use in construction of footings.

3. English bond:-

This is most commonly used for wall thickness. This bond is considered to be the strongest. The bond consists of alternate courses of header and stretcher. In this bond the vertical joint of the header face come over each other similarly the vertical joint of the stretcher ends also come over each other.

4. Flemish bond:-

In this type of bond each layer consists of alternate header and stretcher. Every alternate course starts with header at the corner. Queen closer are placed next to the header every header is centrally supported by the stretcher below it.

5. Double Flemish bond:-

In the double flemish bond each course presents the same appearance both in the front face and in the back face.

6. Single Flemish Bond:-

This is comprised of double Flemish bond in front and English bond in back. This bond uses the strength of English bond and appearance of Flemish bond.

11. Brick laying:-

- All the bricks to be used in construction are soaked in water so that they do not absorb the water of mortar.
- Mortar is spread on the top of foundation course over an area to cover by the edge of walls. The depth of spread is about 1.5 cm.
- The corner of the wall is constructed 1st for that one brick is laid 1st at the corner and pressed with hand so that the thickness of bed joint remains only about 1 cm.
- The level and the alignment is checked. If the brick is not in level they are pressed gently further.

- End headers and stretchers are then laid in the first course.
- After having laid the 1st course at the corner mortar is laid and spread over the first course.
- Other courses are then laid at the corner.
- Bricks with one frog should be laid between spread on its top face.
- In the case of thick wall mortar is 1st spread over the entire bed and the outer bricks are laid.
- All coarse material, dust and lumps of mortar should be removed with wire brush.
- After having constructed wall, joints and pointing is done.

Stone masonry

1. It is made up of stone
2. It is of any desired shape size
3. It is naturally produced
4. Stone masonry is big as compared to bricks
5. It is heavy in weight
6. It may colour
7. They are not of uniform shape of size
8. They required dressing and finishing
9. Stone are not easy available.

Brick masonry.

- It is made up of brick units
- It is set of accurate size and shape
- It is made by hand by human being
- It is as small as compared to stone.
- It is lightly
- It is only one colour
- They are of uniform shape and size
- They do not required any dressing or finishing
- Brick are easy available.

10. Stone laying is not easy.

In bricks laying is easy.

11. They are not good fire resistant than brick.

They are good fire resistant than stone.

12. The cost of construction stone of work big.

The cost of construction of brick work is less.

13. The life of stone masonry is higher.

The life of brick masonry is moderate.

14. Handling is difficult.

Handling is simple.

Supervision of brick work:-

- The bricks to be used should have proper specification. 1st class bricks should be used to brick should be soaked in water before use for a period of time.

- Bricks should be properly laid on their bed.

- The brick while laying should be pushed sideways.

- for the thickness wall the joint should be grouted.

- The brick work should be perfectly in level.

- The mortar to be used should be of specified quality.

- After construction the brick work should be kept weight for one to two week.

Concrete masonry:-

This type of masonry uses cement concrete block either hollow or solid for wall construction. A hollow unit is defined as that unit which has void and greater than 25% of gross area. The recommended size of common block are $39\text{cm} \times 19\text{cm} \times 30\text{cm}$, $39 \times 19 \times 20\text{cm}$, $39 \times 19 \times 10\text{cm}$ the aggregate used in the block manufacture consist of 60% coarse aggregate.

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Wall:-

Wall is a structure element that divides a space into two spaces or rooms and provides shelter and safety. The walls can be divided into two types: inner walls and outer walls. Inner walls are also called interior walls and outer walls are known as exterior walls.

Types of walls:-

1. Load bearing walls.

The name suggests that the entire building structure rests on walls. The walls carrying the entire structure's weight whether exterior or interior is known as load bearing wall. For load bearing wall a strip foundation is used.

2. Non-load-bearing walls.

This wall is not designed to support roof or floor load. It can therefore carry no weight from the structure above. The best

Example is the partition walls which is a building without affecting the structure of the building it is possible to remove or reduce non load bearing walls.

3. Retaining walls

A retaining wall is a wall that is designed to keep the ground at an uneven level on both its faces. Retaining walls are constructed around the plot to keep the soil at one end and the land from sliding on the other after earth work is completed you can choose to make the wall by RCC.

4. Parapet walls

This wall is built on the top floor to prevent people from falling off the roof. The parapet wall height is generally 3' 6".

5. Cavity walls

A Cavity Wall is a type of wall construction that consists of 2 parallel layers of wall separated by a cavity or gap. The two layers are made of brick or concrete

block. The cavity between them is filled with insulation material which helps to reduce dampness, thermal insulation, soundproof etc.

6. Precast wall :-

Precast walls are built by casting concrete into reusable moulds, curing them and then finally transported to the site to be installed as they are prepared strictly in controlled condition pre-cast wall have the least amount of defects.

Scaffolding :-

When the height above the floor level exceeds about 2.5m a temporary structure usually of timber is used to the work to provide a safe working platform for the workers and to provide a limited space for the storage of plant and building material the temporary frame work is known as scaffolding or Scaffold and it is useful in construction, maintenance or repair work.

Types of Scaffolding

1. Single Scaffolding :-

This is the most common type of scaffolding and is widely used in the construction of brick work. It consists of single row of standards placed at a distance of about 1.2 m. from the wall. The ledgers are then fixed to the standards at vertical distance of about 2 m to 2.5 m.

2. Double Scaffolding

This scaffolding is stronger than the single scaffolding and it is used in the construction of stone work. The frame work is similar to the single scaffolding and erects the two rows of standards are provided. The distance between the row of the wall and the 1st row of standard is about 1200 mm to 3000 mm and distance between the rows is about 1 m.

3. Cantilever Scaffolding

This type of scaffolding is useful under the following solution:

- The proper hard ground is not available for the standard to rest.

- It is desired to keep the road or pavement near the face of wall clear of obstruction cast by the scaffolding.

- The construction work is to carry out for upper part of a multi-story building.

4. Suspended Scaffolding -

This is a very life type of scaffolding load can be used only for the maintenance work such as painting, white washing, distemping etc. The working platform is suspended from the roof by the means of ropes, wires or chain and arrangement made such that the platforms can be raised or lowered.

5. Trussle scaffolding.

In this type of scaffolding the working platform is supported on malleable struts (bars or ladders) Tripods etc. mounted on wheels. This type of scaffolding is used for minor repairs work on painting work inside the room and maximum height is about 5 m.

6. Steel Scaffolding.

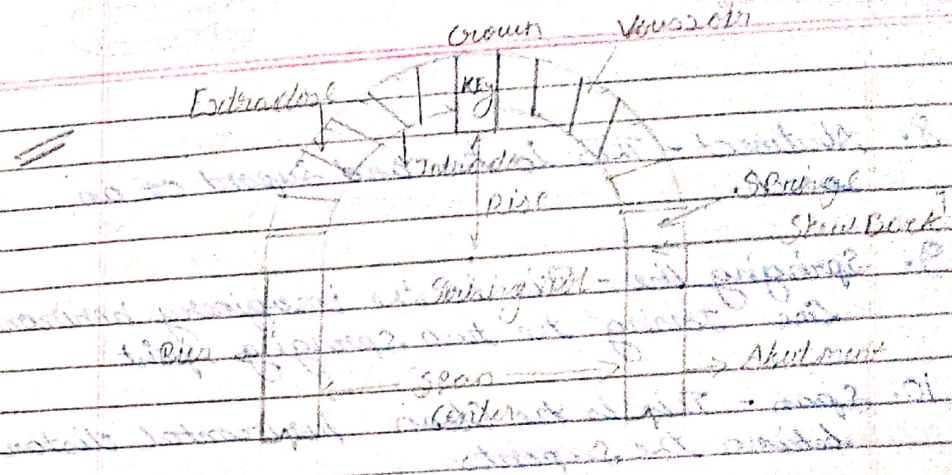
In place of timber steel tubes can be used for the scaffolding works. The diameter of the tubes is about 14mm to 15mm and the thickness is about 5mm. The tubes are available in standard length which spaced screws.

purpose of Scaffolding -

- Provide a platform to stand safely and carry on construction.
- Provide platform to keep necessary material of construction, motor, ladders etc.
- Scaffolding support the platform that has been use by the worker on their working path to transport the material.

Arches.

An arch is a structure which is ^{constructed} to span across an opening it ~~generally~~ generally consist of small edge shape units which are joint together ~~the~~ with mortar arches ~~are~~ and made of steel and R.C.C are built in single unit without the use of wedge unit ^{space}



Technical terms

1. Intrados:- This is the inner curve of the arch.
2. Extrados:- This is the external curve of the arch.
3. Voussoirs - This are the wedge shape unit forming the courses on arch ^{inside}
4. Skew back - This is the ~~intri~~ surface on the abutment
5. Springer - This is the 1st voussoirs on both the side of ~~an~~ an arch
6. Crown - This is the highest point of the arch
7. Key - This is the ^{curve} wedge shaped unit at the crown of an arch.

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8. Abutment - This is the end support of an arch.
9. Springing line - This is the imaginary horizontal line joining the two springing point.
10. Span - This is the clear horizontal distance between the supports.
11. Mutch - This is the lower half portion of the arch between the crown and the skew back.
12. Pier - foundation of arch.
13. Center - This is the Geometric Center of the curve of an arch.

Classification of arches.

1. According to shape

(i) flat arch

The apparent shape of arch is flat and usually the skew back forms an angle of 60° with horizontal. An equilateral triangle is formed with one side as intrados.

(ii) Segmental Arch

The center of their arch is situated below the spring line. This is the common type of arch used for building.

(iii) Semicircular Arch

The center of the arch lies on the springing line and the shape of curve arch is semicircular.

(iv) Pointed Arch

This type of arch consist of two curves which are meeting at the apex of a triangle. The triangle formed may be equilateral or isosceles in shape.

#2. According to material

(i) Stone Arch

This Arch can be constructed in the rubble masonry as ashlar masonry. The rubble masonry Arch is comparatively weak because it is use in interior work. The span of rubble masonry stone arch is limited.

to about 1m. In order to give strength Ashlar masonry is used.

(ii) Brick Arch:-

This Arch can be constructed from ordinary brick the ordinary bricks are not cut into in shape of voussoir hence the trough brick arch are formed for getting the arch curved the joint are made wedge shape with greater thickness at the extrados and small thickness at the intrados.

(iii) Concrete arch:-

This arch can be constructed of the pre-cast cement concrete block the block are similar to stone and are prepared by casting cement concrete in specially prepared mold. They are generally used in bridges on ~~at~~ culverts.

3. According to Number of centers

(i) one-centered arch

This type of arch has one center only the flat segmental and semicircular arches are one centered, sometimes the circular windows are used.

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(ii) Two-centered Arch

This type of arch has two centered. a pointed arch is good example of this

(iii) 3-centered Arch

This type of arch has 3-centered. It is in the form of semiellipses

(iv) 4-centered Arch

This type of arch has 4-centered. It consist of 2 different ^{curve} and has and the opposing ^{one} of different. an ellipse at the trough

Construction of Arches

The construction of arches of all the types of material is carried out in 3 steps.

1. Installation of centering on frame formwork

Centering is the temporary structure required to support brick, stone or concrete arch during its construction till it has gained sufficient strength the centering is installed

in such a way that its upper surface is in contact with inner surface of arch.

The usual centering is made of timber or steel. Timber centering is the simplest and cheapest used for construction it is easy to construct and easy to dismantled and it can be used several times.

2. Laying or casting of Actual Arch

After the installation of centering skews are first prepared. Voussoirs are then arranged in proper and required form starting from skew backs and proceeding toward the crown. Finally keystone is inserted so that all the voussoirs are locked in position. After that the center is eased by the ways so that it is lower by a height of 2 to 3 mm such a process is essential requirement in stone arches.

3. Removal of Centering

When the arch has developed sufficient strength the centering can be removed no load should be placed on the arch unless the centering has

been removed for small span the removal of centering is done by loosening the folding wedges when the span is more than 7m. Scaffolding method can be used.

Lintel

Lintel →

Door

Lintel is a horizontal member which is placed across the opening.

A lintel is short beam the width of which is equal to the width of wall and the end of which are built into the wall.

Classification of Lintel

1. Timber Lintel - they are oldest type of lintel they are not commonly used now a days except in hilly areas. The timber lintels are costly, weak and not fire resistant. They are liable to decay. If not properly ventilated.

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2. Stone lintel

They are the most common type where stone is available easily. A stone lintel consists of a simple stone slab of greater thickness. Stone lintel may be used in the form of either one piece or more than one piece. Dressed Stone lintel gives good appearance.

3. Brick lintel

Brick lintel are not strong and they are used only when the opening is small and loads are light. The depth of brick lintel varies from 10cm to 20cm depend upon the span.

Door, windows and ventilations

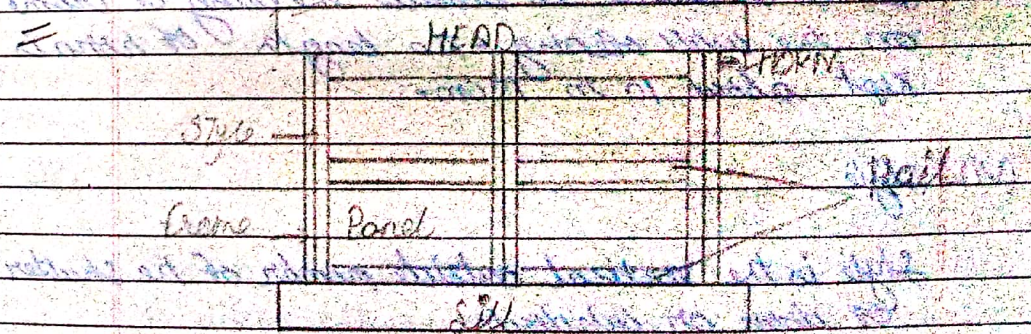
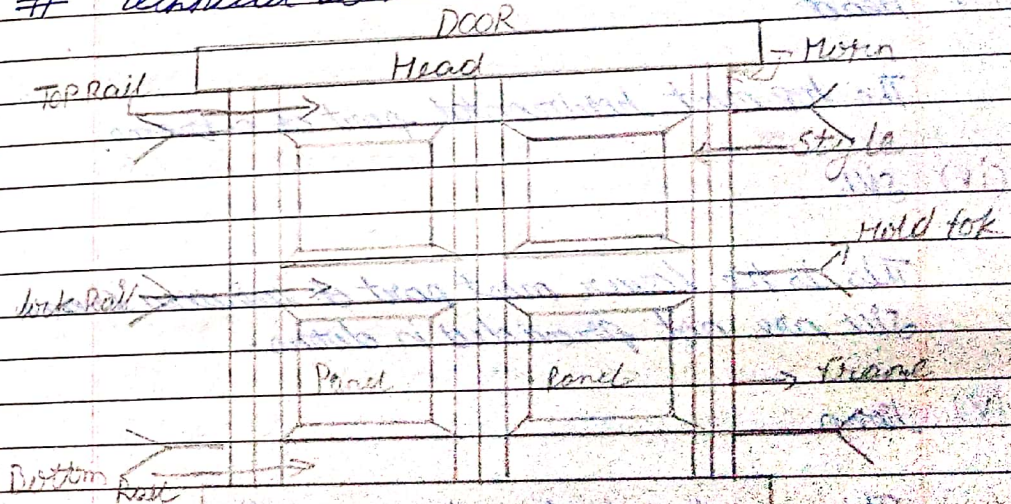
1. Door

It may be defined as an openable barrier secured in an opening left in a wall. For the purpose of providing access to the users of the structure it basically consist of two parts namely frame and shutter.

2. Window

It may be defined as opening made in a wall for the purpose of providing day light, vision and ventilation. Window may consist of two parts that is frame and shutter.

Q. Write the element of a full panel window.
Technical term. door also draw a sketch.



(i) Frame

It is an assembly of horizontal and vertical member which support the shutter.

(ii) Shutter

This are the openable parts of door or window.

(iii) Head

The top most horizontal part of a frame

(iv) Sill

This is the lower most part of subframe frame. Sill are not provided in doors.

(v) Jamb

This are the horizontal projection of head and sill of a frame to provide the fixing of frame on the wall opening. The length of jamb is kept about 10 to 15 cm.

(vi) Style

Style is the vertical outside member of the shutter or door or window.

(vii) Top Rail

This is the topmost horizontal member of shutter.

(viii) Lock Rail

This is the middle horizontal member of a door shutter to which locking arrangement are fixed.

(ix) Bottom Rail

This is the lower most horizontal member of a shutter.

(x) Cross Rail

This are addition horizontal rail fixed between the top and bottom rail of a shutter.

(xi) Panel

This is the area of shutter enclosed between the adjacent rail.

(xii) Hold fast

This are mild steel generally bent into Z shape to fixed on hold the frame to the opening.

They are horizontal member whose length is 20 cm.

Types of door based on material

1. Wooden doors

The wooden door is the most common type of door used in day today life. Wooden doors look much better than other material and they can be polished if desired. Most of the wooden doors open in a swinging system.

Advantages

- (i) wood is a material that is easy to work.
- (ii) wood panels are ecofriendly, sound proof, water proof.
- (iii) we can use it as a security door, entrance door etc.
- (iv) A wooden door has simple installation.

Disadvantage

- (i) It needs care and maintenance.
- (ii) A wooden door should be sealed before installation, otherwise it may get rotten moisture.

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- (iii) because of its heavy material a wooden door is may sag over time.

2. Metal doors

Metal doors are generally made of Steel, Aluminium etc. Its function is to bolt the entrance to a formation and components metal doors are barricade type which can with stand stone and earthquake.

Advantage

- (i) It is easy to install
- (ii) It is high fire resistance
- (iii) It is good in chemical resistance
- (iv) It can be used for longer time

Disadvantage

- (i) It has a rusting problem
- (ii) It cannot give architectural view
- (iii) This might be heavy in weight.

3. Plastic door

This door are replacement for a wooden door. It is made of fully recycle material it is mainly used in interior bathroom and garden.

advantage

- (i) It never warp, rot, discolour
- (ii) It comes in different colour and sizes
- (iii) It is durable and water resistant
- (iv) It is long lasting and maintenance free
- (v) It is light in weight

disadvantage

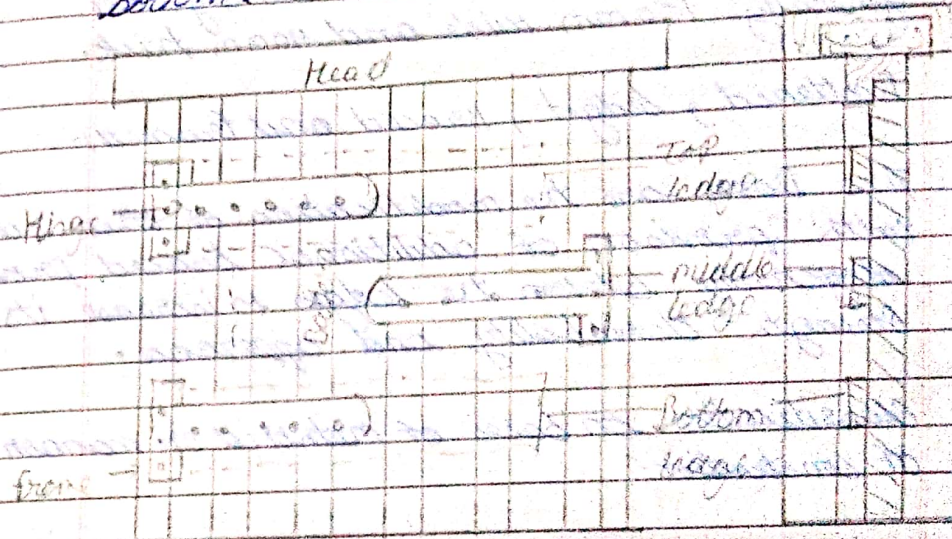
- (i) It is not suitable for front door due to its light weight

Classification on the basis of arrangement of component.

1. Battened and ledged doors

This is the simplest type of door specially suitable for narrow opening. The vertical board are known as battens and the horizontal support

are known as ledges. Battens are 100 to 150mm wide and 20 to 30mm thick ledge as 100 to 200mm wide and 25 to 30mm thick. 3 ledges are generally provided Top, middle bottom.



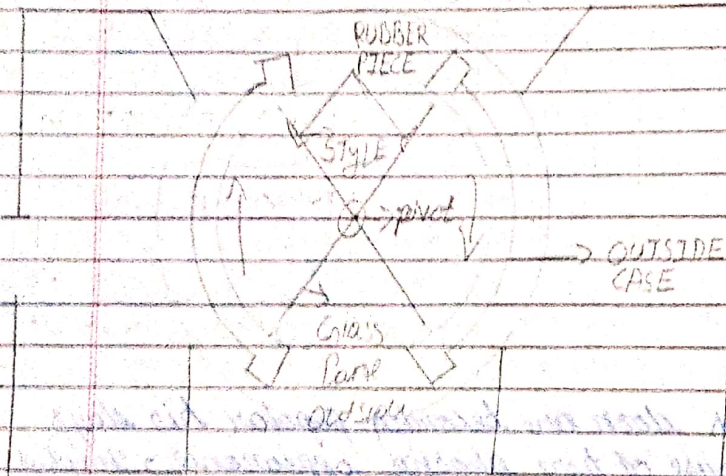
2. Battened, ledged and Braced door:-

This doors are improve version of battened and ledged doors in which additional curved member called braces are provided. This door can be used for wider opening. The braces are 100 to 150mm wide and have thickness of 25 to 30mm.

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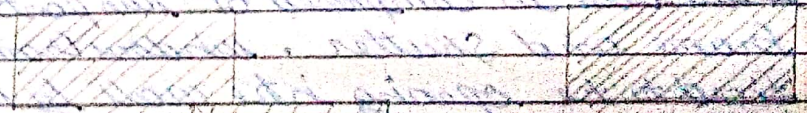
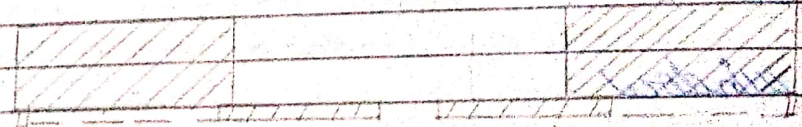
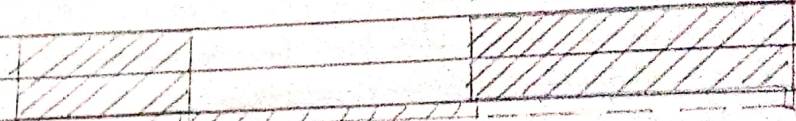
3. Revolving Doors

Such doors are provided only in public building such as libraries, museum, banks etc. where there are constant visitors. Such a door provides entrance to 1 and exit to the other person alternately and closes automatically when not in use. This door is also suitable for air-condition building or for building situated at a place where breeze blows throughout the year.



4. Sliding Door

In such a door the shutter slides on the sides with the help of runners and guide rail. The door may have one's sliding shutter, two shutters or even three shutters depending upon the size on opening and the space available on the sides for sliding.



#1 Rolling Shutter door

This door is commonly used for garages, godowns, shop etc. Since they are quite strong and offer proper safety to the property, door consists of a frame, a drum and a shutter of thin steel plate.

1. Size of the room
2. Location of the room
3. Utility of the room
4. direction of wind
5. climatic condition such as humidity, temperature
6. Requirement of exterior view.
7. Architectural ~~view~~ treatment to the exterior of the building.

Types of windows.

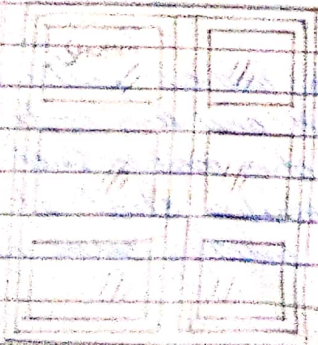
1. fixed window
2. Caset window
3. ~~lean~~ louvered window
4. Sash window
5. metal window
6. sliding window
7. Sky light
8. Ventilator

Popular in private as well as public building because of their strength and less cost. windows made of other metals such as aluminium, bronze, stainless steel etc are also used for more building where high

work of finishing is required. ruled steel windows are the cheapest and are therefore mostly used in all types of building.

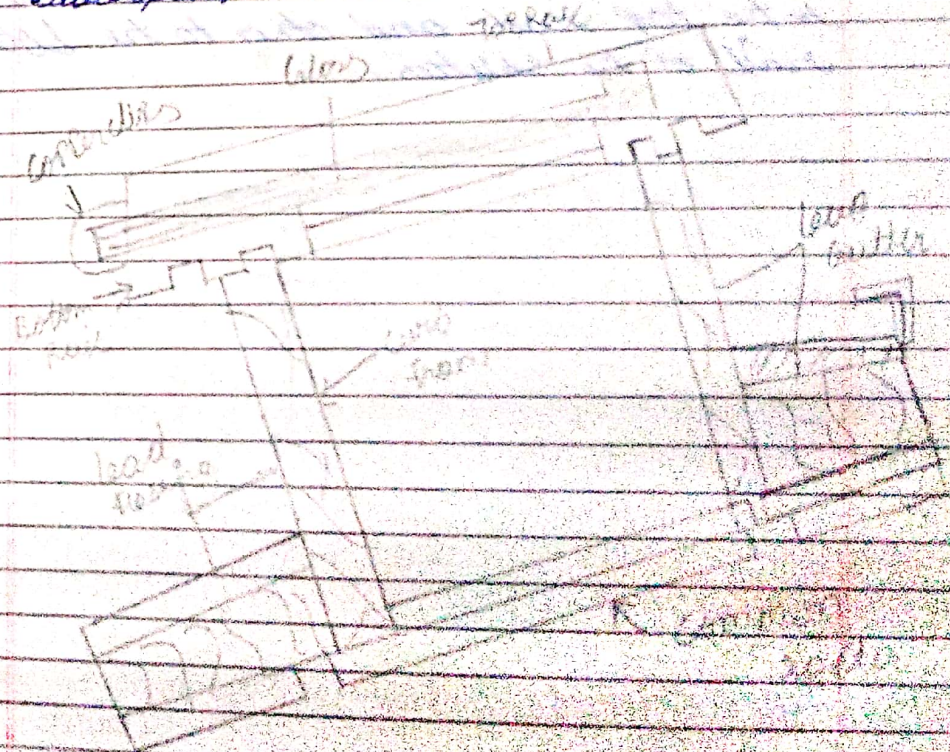
advantages:

1. Steel windows are generally manufactured in factories with greater precision and better quality control.
2. They exhibit elegant appearance.
3. Steel windows are stronger and more durable than wooden windows.
4. There is no contraction and expansion due to weather effects in the steel window.
5. They are highly fire resistant.
6. They are rot proof and termite proof.



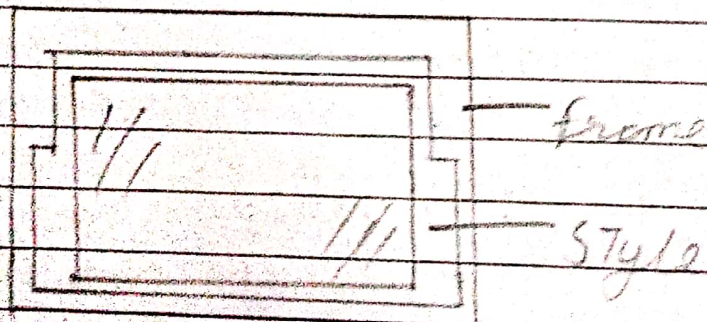
Sky light

A sky light is provided on a sloping roof to admit light. The window projects above the top sloping surface. The run is parallel to the sloping surface. The opening is made in properly treated by lead like flashing to the roof, surrounding the opening, waterproof.



Ventilator

Ventilators are small windows fixed at a greater height than the windows, generally about 30 to 50 cm below roof level. The ventilators has a frame and a shutter generally glazed which is horizontally pivoted. The shutter can be opened or closed by two means of two cords one attached to the top rail and other to the bottom rail of the shutter.



UNIT-3 (Floor, Roof and stairs)

Floors :-

The purpose of floor is to provide a level surface capable of supporting the occupants of a building, furniture, equipments and sometimes internal partition wall. To perform this function and in addition may vary according to the situation of the floor in the building and the nature of the building itself. A floor must satisfy the following requirement.

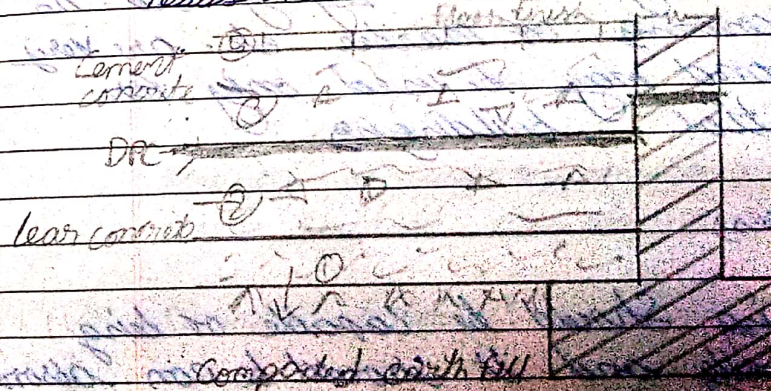
- (i) Adequate strength and stability
- (ii) Adequate fire resistance, sound insulation
- (iii) Sound insulation
- (iv) Damp resistance
- (v) Thermal insulation

Component of a Floor

A floor is composed of two essential component.

- (i) Sub floor base course or floor base.
- (ii) Floor covering or simply flooring

The floor base is a structural component which support the floor covering. On the ground floor the object of floor base is give proper support to the covering so that it does not settle and to provide damp resistance and thermal insulation.



Ground floor may be constructed on the ground or may be supported a little distance above the ground. The floor supported directly on the ground are known as solid floors while the floor

Supports above the ground level are called suspended floor. Suspended floor are generally made of timber.

II Selection of flooring material

Following factors affect the choice of flooring material.

(i) Initial cost

The cost of material should be low with the type of building and its likely use. The floor covering of marble etc. are very costly and may be used only for residential buildings.

(ii) Cleanliness

The flooring should be capable of being clean easily and it should be non-absorbent.

(iii) Appearance

Covering should be of pleasing appearance. It should produce a desired colour and aesthetic beauty. Flooring Terrazzo

mosaic, tiles and marble gives good appearance.

(iv) Durability :-

The flooring should have sufficient resistance to wear, temperature changes, disintegration with time and decay so that long life is obtained.

(v) Dampresistance

The flooring should offer sufficient resistance against dampness so that healthy environment is obtained in the building. Flooring of concrete, terrazzo, mosaic etc. are preferred for this purpose while flooring of wood, rubber, brick etc. are not suitable for damp condition.

(vi) Sound insulation

Flooring should insulate the noise also. It should not be such that noise is produced when heavy walk on it.

(VII) Thermal insulation

The flooring should offer reasonable good thermal insulation that comfort is improved to the residents of the building.

(VIII) Fire resistance

It is more important for upper floors flooring material should offer sufficient fire resistance so that fire doesn't or catch between different level.

(IX) Smoothness

The flooring material should be smooth and should have even surface. It should not be slippery.

(X) Hardness

It should be sufficient hard so as to have resistance to marks, impacts etc. likely to be caused by sitting of furniture, equipment etc.

(XI) maintenance.

The flooring material should require least

maintenance. Hard wear, broken even repairs are required. It should be such that repairs can be done easily with least possible expenditure.

4# Types of flooring

(1) mud or wet process

(2) Brick

3. flag stone

4. concrete

5. Terrazzo

6. mosaic

7. Tiles

8. Marble

9. Granite

10. wood on timber

11. Asphalt

12. Rubber

13. Lithum floor

14. latex flooring

15. PVC or plastic

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20th 1. Mud or mudum flooring

They are used only in low cost building. Generally in village. Such flooring is cheap, hard, fairly impervious, easy to construct and easy to maintain. It does not retain heat properly due to which it remains cool in summer and warm in winter. The method of construction is very easy. Over a well prepared ground a 2.5 cm thick moist earth is spread and is then rammed well to get a compact richness of 15 cm. In order to protect cracks, straw is mixed with it. Before ramming some times cow dung is mixed with soil and as this layer of this mixed is spread over a the compacted layer.

Advantage

1. Low cost
2. Good fire resistant
3. Good thermal insulation
4. Good sound proofing
5. Being a natural resource it is easily available.

Disadvantage

As they can be easily destroyed by wind, rain and standing. It is not protected well.

(i) They required more care and maintenance and they may even be affected by dampness or by weather.

(ii) It may also have a small water proofing construction.

2. Brick flooring

- Such flooring is used in cheap construction specially where good bricks are available.

- This flooring is suited for warehouses, stores, godowns, etc.

- Well burnt bricks of good colour and uniform shape are used.

- The method of preparing the base course for brick work is as follows:

Preparation of base course for brick work

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- In one method the subgrade is compacted properly to the desired level and a 3.5 cm thick layer of sand is spread.

- Over this a course of bricks laid flat in mortar is built.

- This forms the base course over which the brick flooring is laid in jointed pattern. Cannot mention in revised pattern.

- In the second method 10 to 15 cm thick layer of compact concrete is laid which forms the base course.

- Over the base course a thick dry layer of brick mortar and the mortar is properly trowled.

Advantages

- Durable and long lasting

- Low cost

- Good thermal insulation is provided.

- It can be used both internally and externally.

- Easy and quiet to maintain.

Disadvantage-

- Lack of comfort because it is too hard.

- Stains and fungal growth due to porosity of bricks.

3. Flag stone flooring:-

- Flag stone is any laminated sand stone available in 2 cm to 4 cm thickness in the form of stone slabs or square or rectangular.

- This type of work is also called paving.

- The stone slabs are laid on concrete base.

- The sub soil is properly compacted over which 10 to 15 cm thick lime concrete or lean cement concrete is laid.

- This forms the base course of the floor. The flag stone are then laid over it.

is the mortar layer of thickness 20 mm to 25 mm.

- When the stone slab are properly set mortar in the joint is filled out to a depth of 15 to 20 mm and then filled with 1:3 cement mortar.

Advantages

- It is durable.
 - It is easy to install.
 - It is eco friendly.
 - It provides good drainage.
- ### Disadvantages
- It gets hot easily.
 - It might crack under heavy load.

Q.4. Cement concrete flooring

- This is commonly used for residential, commercial and even industrial building.
- It is moderately cheap, durable and easy to construct.
- The floor consist of two component base concrete and wearing surface.
- The two component can be constructed monolithically or non monolithically.
- The base concrete may be 7.5 cm to 10 cm thick. There is such cement concrete on thin concrete is laid.
- The base course laid over well compacted soil, compacted properly and damped.
- When the base concrete has been finished its surface is finished with stiff beams and cleaned.
- It is treated to prevent night and wear with painted.

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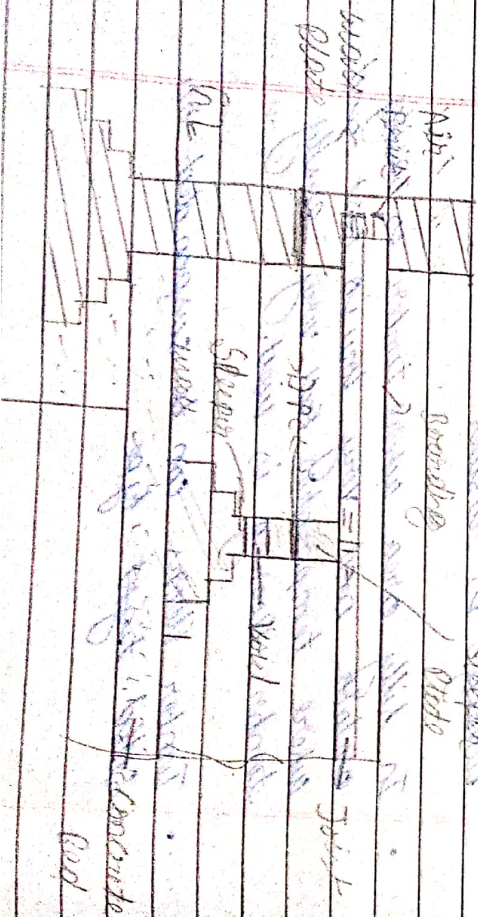
Advantage

- The topping is then laid in square or rectangular panels by the use of either glass or asbestos slip. The topping plate of 1:2:4 concrete concrete laid to the desired thickness.
 - Alternate panels are laid first, prior to laying the concrete in the panel a portland and cement slurry is applied.
 - When alternate layers are then laid after 22 hours so that initial shrinkage of all ready panel take place it eliminate the cracks.
 - The surface is then properly cured for about 7 to 14.
- ### Advantage
- Concrete floors are durable.
 - Concrete floors are low maintenance.
 - Concrete floors have built-in aggregate option.
 - It has high strength.

Disadvantage

- Concrete floors are hard.
 - Concrete floors can collect moisture.
 - Concrete floors can have cracks.
 - They are environmental suspect.
- ### Timber flooring
- Timber flooring is used for carpentry, hall, drawing hall, auditorium etc.
 - They are not commonly used in residential building in India because timber flooring is costlier.
 - In hilly areas where timber is easily available and very low cost and where temperature fall very easily timber flooring is used.
 - Timber floors can be suspended or solid tight type.

- The flooring consist of boarding supported on bridging or their gird at timber.
- Where the position of dampers is not acute timber may be supported on the ground
- This type of construction first base concrete is layed in 15 to 20 cm thickness over which asphalt is apply. Then wooden board flooring is laid
- In order to find the wooden floor on concrete railing is done



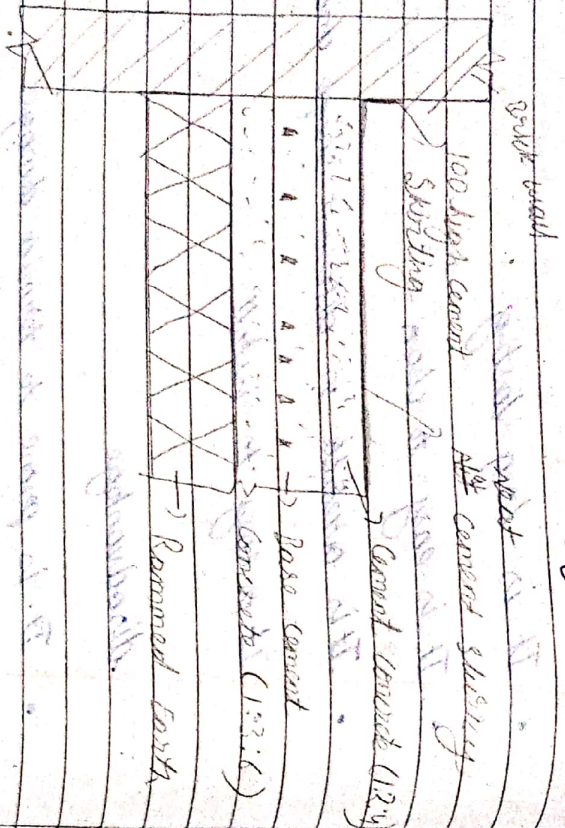
advantages

- It is long lasting
- It is easy to clean
- It is available in different shape and pattern
- It is easy to install

disadvantage

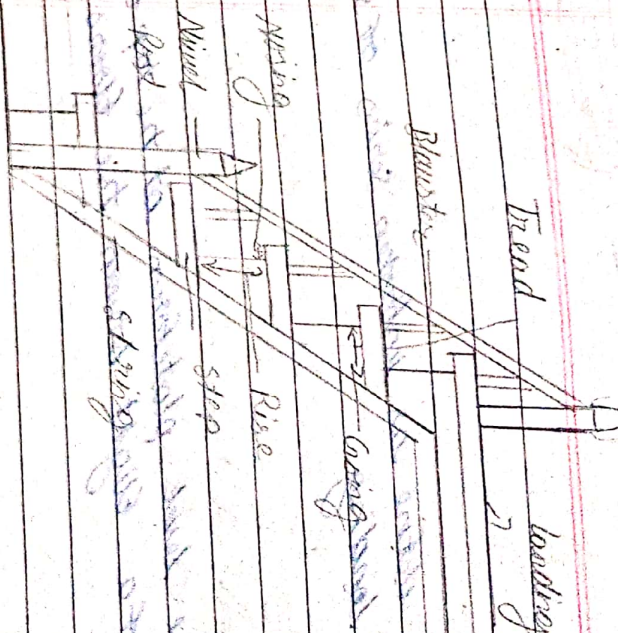
- It is prone to termit damage
- It is expensive
- It is not fire and water resistance
- It has high maintenance

Dissection of cement concrete flooring



11 Stair

A Stair is a set of steps leading from one floor to the other it is provided to give access to go up and down in various floor of a building. The Room and enclosure of the building in which the stair is located is known as stair case and the opening or space occupied by the stair is known as stair way.



Top # Technical Terms

1. Step
2. Thread
3. River

It is a portion of stone which parent about on descent

It is the upper horizontal portion of a slope on which the foot is placed

3. Risen

It is the vertical position of a step providing a support to a thread.

4. Flight

This is after an unknown level of sleep
without waking.

5. Landing

This is the last phase of the step on
bottom or a flight above the ground.

6. Rise

This is the vertical distance between two
successive steps & forward movement.

7. Swing

This is the horizontal distance between two
successive steps & from "swing".

8. Swing

This is the projecting part of the head.

9. Rotation

This is a rotating provided under the moving to
improve the direction of the step.

10. Soffit

This is the under side of the stairs.

11. Pitch on step

This is the angle between the line of rising
of the step, measured with the horizontal.

12. String

This are the sloping member which support
the step in stairs.

13. Nosing part

Nosing part is a vertical member which is
placed at the end of the flight to prevent
the end of string and hand rail.

14. Baluster

This is the vertical member of wood or metal
supporting the hand rail.

15. Head room

This is the minimum clear vertical distance
between the track and ceiling.

Requirement of good stair

1. Location

It should be so located so as provide easy access to the occupants of the building. It should be so located that it is well lighted and ventilated.

2. Width of stair

It should be wide enough to carry the user without much crowd or inconvenience. It depend upon it's location in building and the type of building itself. In a domestic building 200 wide stair is sufficient in public building 1.5 to 1.8 wide may be required.

3. Length of flight

There comfort point of view the number of step should not be more than 12 and not less than 3.

4. Pitch of stair

The slope or pitch of stair is limited to 30° to 45°.

5. head room

The clear distance between the track and the ceiling should not be less than 2.1 to 2.3 m.

6. Balustrade

Open wall stair should always be provided with balustrade to provide safety to the user. Wide stair should have hand rail to both the sides.

7. material of construction

The material used for construction of stair should be such as to provide sufficient strength and fire resistance.

Classification of stair

Stair can be classified in two broad head

Stair

Straight stair

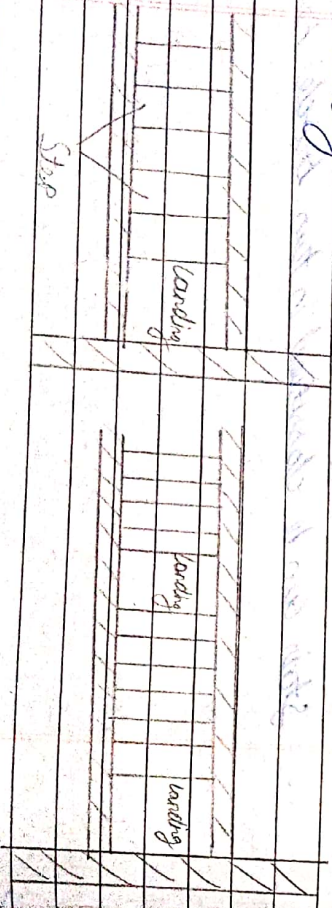
Turning stair

Quarter turn stair
continues stair
Half turn stair

Three Quarter
Turn stairs
Bifurcated
Stairs

1. Straight stair

In this type this stair runs straight between the two floors. It is used for small houses where their are restriction in available height or rather than one flight with a landing



2. Turning stair

(i) Quarter turn stair

It is the one which changes its direction either to the left or to the right the turn being effected either by introducing a quarter space landing or by providing winders



Quarter Turn Stairs



Geometrical Quarter Turn Stairs

11) Half turn stairs

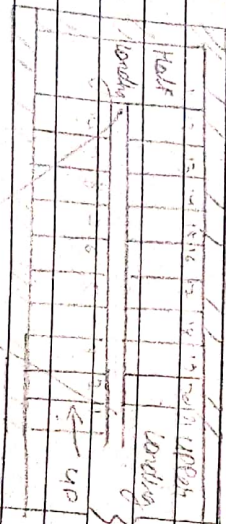
Half turn stairs is the one which has its direction reversed or change for 180°. Such stairs are quite common. This are of 3 types.

- 1) Dog legged stairs
- 2) Open wound stair
- 3) Geometrical half turn stair

1) Dog legged stair:-

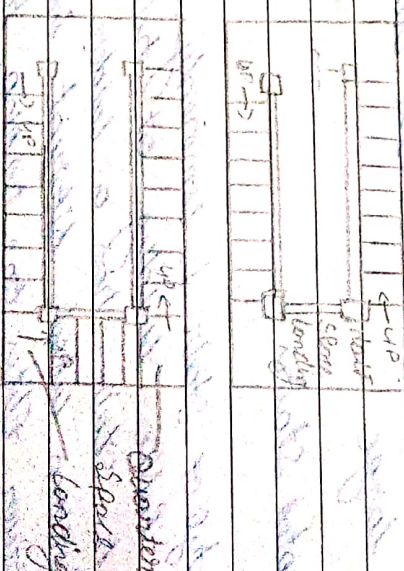
This name is given because of its appearance is sectional elevation it come in category of wound stair in which wound part are provided.

In this stairs the flight runs in opposite direction and there is no space between them in plan. In this stairs are useful where total width of space available for the stair case is equal to twice the width of one steps.



2) Open Wound Stair

Open wound stairs has a space or void between the outer strings. This is the only aspect in which it differs from dog legged stairs. No additional width is required between the two flights. The space between the two strings may vary from 1500 to 1000 mm. When the space left is more, a small flight connecting 2 to 4 steps may be introduced at the turn between the two quarter space



3) Geometrical half turn stairs

The essential feature of such stairs are that the strings and the hand rail are continuous. This may be shown with

half space landing or without landing.

(iii) Three Quarter Turn Stairs

A Three Quarter Turn Stair has its direction changed 3 $\frac{1}{4}$ times with upper flight crossing the bottom one. It may be of open novel type. Such type of stair is used when the length of stair room is limited and when the vertical distance between the two floors is quite large.

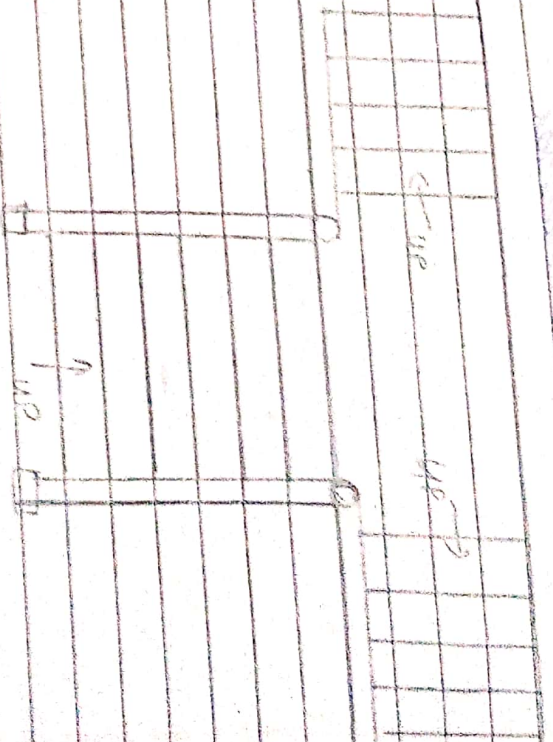
(iv) Biscuit Stairs

This type of Stair is commonly used in small public building at their entrance hall. The stair has a curved flight at the bottom which, distant into the narrowness, takes one turning to the left and the other to the right at the landing.

(v) Continuous Stair

Continuous Stair are those which do not have any landing. In fact they are geometrical in shape. Continuous Stair may be of the following types:

- 1) Circular Stair
- 2) Spiral Stair
- 3) Helical Stair



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Stairs of different material

1. Timber

- Timber stair are light in weight and easy to construct but they are very poor in fire resistance they are used only for small-rise residential building.
- They are unsuitable for high rise residential building and for public building.
- The timber used for construction should be free from fungal decay and insect attack.
- In timber stair the string are the support for the stair and act as inclined beams.
- for a 90 cm wide stair case and addition width of 40 cm is given.

2. Stone stair

- They are widely ^{used} ~~to~~ at places where stone is easily available.
- They are quite strong and rigid, though they are very heavy.

- Stone used for construction of stair should be hard, strong and resistance to wear.

- Stone are fire resistance.

- The simplest form of stone stair are those supported on both the ends, and open well stair case can be built.

3. Built stair

- Built stair are not very common except at the entrance.

- Built stair of single straight flight are often made in village house.

- The stair consist of either solid wall on either opening may be left for storage space.

- The built stairs need frequent maintenance.

- This stairs may be cement plastered at the top or inside and side of riser.

4. metal stair

- Stair of pulished or cast iron are used only as emergency stair.

- They are not common in residential and public building.

- They are strong and fire resistant.

- They are not used frequently because of their expensive and they make lot of noise when used by users.

- They are commonly used in factory, godown, workshop etc.

- A metal stair consist of welded steel stringer

- metal stairs are commonly of spayed steel

5. R.C.C stair

- R.C.C stair are the one which are widely used used for residential, public and industrial building.

- They are strong, hard and fire resistance.

This are mainly cost - in-situ and a
Masonry or bricks work used on this

4. Roof

Roof may be defined as the upper most
part of the building provided as
a structural covering to protect
the building from weather (rain, sun,
wind etc.)

A roof is constructed in some way as on
upper floor. The roof covering may be
of A.C. sheet, G.I. sheet, tiles, slate
or steel etc.

4. Requirement of roof

1. It should have adequate strength
and stability to carry the super imposed
load and its load.
2. It should effectively protect the building
against rain, sun, wind etc. and. It
should be durable against the adverse
effect of the agency.

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3. It should be water proof and should have
efficient drainage arrangement.

4. It should provide good thermal insulation

5. It should be fire resistance.

6. It should provide good insulation against
acid, sound.

4. Types of roof

Roof are classified into three categories

1. Sloping roof

2. Flat roof

3. Curved roof

The choice of type of roof will depend
on the climatic condition, slope of
building availability of material, important
or building. The sloping roof has
sloping top surface and rain are
useful at places where rainfall or
snow fall is very heavy. The flat roof

are built at places where there is moderate rainfall. The curved roof have rain top surface curved in the form of salt and domes. They are more suitable for public building.

Ind 1. that roof / Terraced roof

A flat roof which is nearly flat. It should be noted that a flat roof can be laid perfectly level. The roof must have slope in one direction or the other to cause rain water to flow off rapidly and easily. The two types of flat roof are: (i) one commonly used in modern and (ii) one as follows.

Advantages of flat roof

1. The roof can be used as terrace for playing, gardening and for cultivating flowers.
2. Construction and maintenance is easier.

3. They can be easily raised the roof is comparison to fixed roof.

4. They avoid the enclosure of irregular space.

5. Flat roof have better insulating property.

6. They are more stable against high winds.

7. Flat roof are more economical.

8. In multi story building flat roof is the only type.

Disadvantages of flat roof

1. The span of flat roof is restricted unless intermediate columns are introduced.

2. The self weight of flat roof is very high. due to the size of the heavy columns and other structural members.

3. They are not suitable at places of heavy rainfall or snow fall.

4. It is difficult to locate and verify
date in that roof.

5. The speed of that roof construction
is much slower than the shop roof.

Life of that Terrace Roofs

1. mud mortar roofing.

2. Brick-Jelly on mud mortar roofing.

3. ~~the~~ lime concrete flooring

4. Bangor Terrace Roofs

5. Light weight terrace roofing

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Lime concrete flooring

This type of flooring is commonly used
over the stone roofing. It can also be
used over the slab.

- The longitudinal joint between the stone
slabs are first pointed in cement
mortar. The joint should be "V" shaped
this joint is filled with cement mortar.

- The slope to the roof is provided by
laying ~~the~~ 1" lime mortar over the surface
of the slab in the required thickness

- Laying of lime slab is done in four
considerable days. The 1" day is plastered
kashmir lime 10cm in thickness & is spread
over the roof slab.

- on the 2" day the lime is plastered
rated up and again the plaster of
first day is reapplied.

- on 3" day 250gm of finely chopped hemp
with Janti finely powdered is
added in the mix.

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7. durability
8. Availability of material It self.
9. climate of the locality

Imp =

Asbestos cement sheet :- OR (A.C sheet)

This sheet are now becoming popular for industrial building, factory, sheds, cinema hall, Auditorium etc. They are very cheap, light weight, tough, durable, fire resistant etc. The biggest advantage is that they are available in biger unit and hence supporting frame work is also cheaper and easier. This sheet donot required any protective paint and maintenance its construction is very fast. This sheet are manufacture from Asbestos, fiber, Portland cement

Procedure of laying

1. They are laid either from left to right or from right to left.

2 They should laid at the end opposite to the direction of wind and Rain. The joints spacing are adjusted to provide Specified overlap at intended plate joint.

3. The sheet are fixed to the purlins with the help of bolts. The commonly used screw for wood purlins are coach. The spacing is done from left to right the first sheet is laid intact while the other sheet have to be lapped from left hand corner.

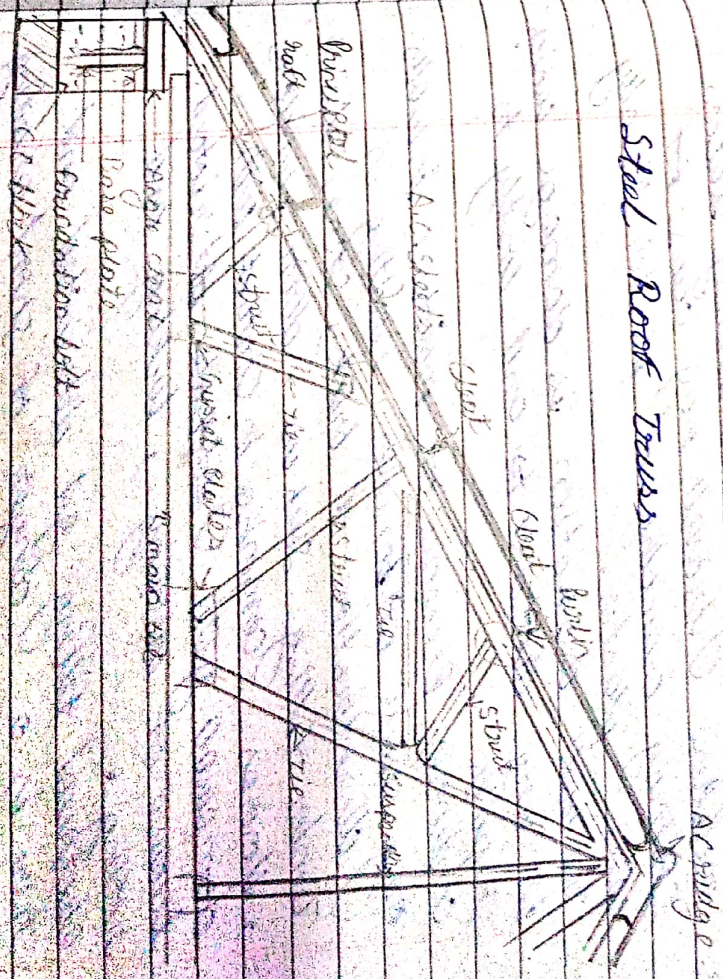
The sheet in second from should have both left and right corners cutted except the 1st sheet which should have only top left corner cutted.

Galvanised Iron corrugated sheet

G.I Sheet are widely used. They are stronger than AC sheet. However because of their higher cost they are now replaced by AC sheet. They are not used for slop flooring.

1 in 4
1:4
From ~~1 in 4~~ G.I Sheet are manufacture with corrugating running from one end to other. G.I Sheet are made of Iron sheet which is galvanised with zinc to protect them from rusting action of water and wet weather.

Steel Roof Truss



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UNIT 4

Effect of Dampness:-

1. Dampness give rise to breeding of mosquitoes.
2. Travell of moisture through wall and Sealing may cause unsightly patches.
3. moisture travell may cause ~~for~~ softening crumbling of plaster specially lime plaster.
4. The wall decoration is damage which is very difficult to and costly to repair.
5. continuous presence of moisture in walls may cause efflorescence resulting in disintegration of brick, stone, tiles etc.
6. Timber fitting such as door, windows, frames coming in contact with dampness gets ~~deteriorate~~ deteriorated because of warping, buckling and rotting.
7. electrical fitting get deteriorated and there is a danger of short circuiting.
8. moisture causes rusting and corrosion of metal fitting attached to the walls, floor and ceiling.

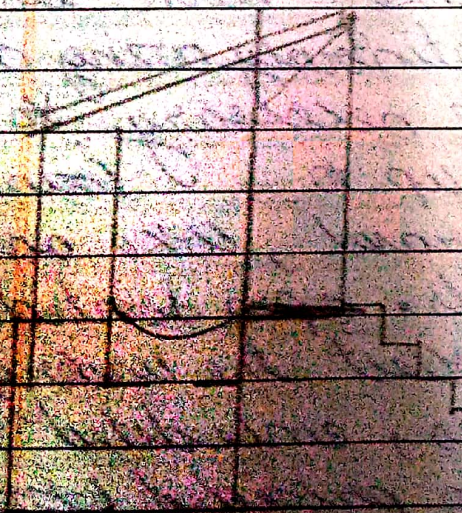
D.P.C Treatment in building.

1. Treatment to foundations against gravitational water.

Foundation may receive water percolating from adjacent ground, and this moisture may rise in the wall.

This can be checked by providing air drain parallel to the exterior wall. The width of air drain may be about 20 to 30 cm. The outer wall of the drain is kept above the ground to check the entry of surface water.

A.R.C.C. roof slab is provided.



2. Treatment to basements:-

When basement is deep soil are cant constructed. Three method may be adopted.

- (a) Provision of foundation and D.P.C.
- (b) Provision of R.C. raft and ~~total~~ wall
- (c) Pappall. piling

(a) ~~Provision of foundation and~~ Provision of foundation and

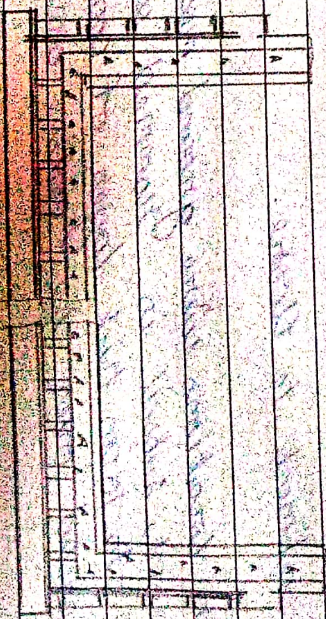
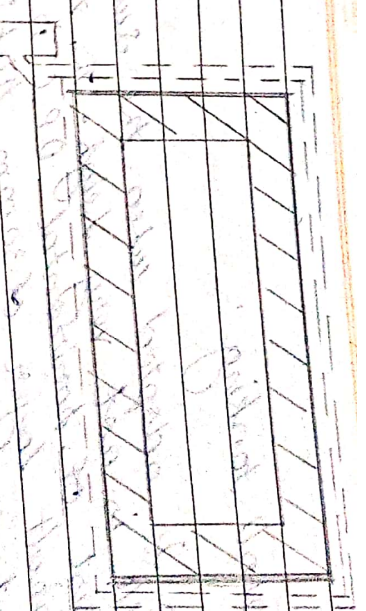
(b) Provision of foundation drains and D.P.C.:-

When basement rests on soils which are not properly drained. Great hydrostatic pressure is exerted and the floor as well as wall receive water continuously rising up. In such case it become necessary to make a trench all round, up to foundation level and fill it with gravel, coke and other porous materials. Open jointed drains may be provided to collect the water in drains. Drains pipes, embedded in gravel bed, may also provided below foundation concrete.

(b) provision of R.C.C. raft and wall slab:-

where underground water pressure is severe the drainage system may not solve the problem effectively. They construct pumping out water may be costly.

In such a case, when slab as well as walls may be constructed in rigid R.C. structure. Horizontal and vertical D.P.C. treatment is also provided. At least 3 layers of bituminous felt are used as D.P.C. raft - base with outer protecting wall is provided at the outer face of R.C. wall.



(c) Asphalt tanking:

This is adopted when the subsoil water table is not very high. The treatment consist of horizontal D.P.C in the form of asphalt layer of 30 mm thick in three coat over the entire area of basement floor and then extending it in the form of vertical D.P.C on the external faces of the basement walls. The thickness of vertical asphalt layer may be 80 mm, applied in three coats. The D.P.C has function like a water proof tank on the external faces of the basement walls keeping it dry. A $\frac{1}{2}$ brick thick outer protective wall is constructed. The vertical D.P.C is taken at least 15 cm above ground level. A protective flooring of 1:1.3:6 is provided to protect the D.P.C from damage during the construction of floor slab.

3. Treatment to floors.

For locations where ground moisture is not present, subsoil is rammed well and a 7.5 to 10 cm thick layer of coarse sand is spread over the entire area under

flooring. Alternatively stone setting may first be provided and then 7.5 cm to 10 cm thick layer of lean cement concrete (1:1.3:6 to 1:4:8) may be provided under it.

The membrane may be in the form of mastic asphalt or bituminous asphalt felt. A layer of flat brick is laid on a cushion of fine sand over D.P.C to protect it from damage during the construction of floor slab. Below laying bituminous felt, a coat of hot bitumen, at the rate of 1.5 kg/m² is applied over the foundation concrete, to serve as primer coat.

4. Treatment to walls

For basement wall, a vertical D.P.C. is laid over the external face of wall. This vertical layer of D.P.C. is laid over the base of mortar - cement plaster provided on the external face to the wall. The vertical D.P.C. is further protected by external protective wall of half-brick thickness. The vertical D.P.C. should be carried at least up to level 15 cm above G.L. Similarly, horizontal D.P.C. in external wall, extending from the floor is provided at least 15 cm above G.L. In the internal wall, D.P.C. is provided in level with the upper surface of concrete floor.

5. Treatment of roofs

The methods of providing D.P.C. for flat roofs, parapets coping and pitched roofs have been illustrated.

• method of damp proofing

1. membrane damp proofing:-

This consist of introducing a water repellent membrane or damp proof course (DPC) between the source of dampness and the part of the building adjacent to it. DPC may consist of flexible materials such as bitumin, asphalt, plastic, metal sheet etc.

2. Integral damp proofing

This consist of adding certain water proofing compound or material to the concrete so that it becomes impermeable. This water proofing compound may be in 3 form.

- (i) compounds made from chalk, talk which may fill voids of concrete under the mechanical action.
- (ii) compound like aluminium sulphate, calcium chloride etc. which react chemically with concrete to produce water proof concrete.

(iii) Compound like soap, petroleum, oil, fatty acids work on water repulsion principle.

3. Surface treatment.

The surface treatment consist of application of layer of water repellent substance on compound on this surface through which moisture enter. The use of water repellent material like soap, salt or calcium and aluminium are more effective against water proofing.

4. cavity wall construction.

This is an effective method of damp proofing in which the main wall of a building is shielded by an outer skin wall leaving a cavity between the two walls.

5. Guniteing

This consist of depositing under pressure and impervious layer of rich cement mortar over the exposed surface for water proofing on over pipes for resisting

the water pressure. Cement mortar consist of 1:3 cement sand mix which is short on the cleaned surface with the help of cement gun under a pressure of 2 to 3 kg/cm^2 .

material used for damp proofing course

The characteristice of ideal damp proofing material are as follows:-

(i) The material should be perfectly impervious and should not permit any any moisture penetration.

(ii) The material should be durable.

(iii) The material should be strong, capable of resisting superimposed load.

(iv) It should be flexible.

(v) It should not be costly.

Plaster or plastering

It is the process of covering rough surface of wall, column, ceiling and other building component with thin coat of mortar to form a smooth durable surface the coating of plastic material is term as plaster. Plastering and external exposed surface is known as rendering.

Object of plastering

- (i) To protect the external surface against penetration of rain water and other atmospheric agency.
- (ii) To give smooth surface in which dust and dirt cannot stick
- (iii) To give decorative effect.
- (iv) To protect surface against vermin
- (v) To conceal inferior material or defect in workman ship.

// # Requirement of good plaster.

- (i) It should adhere to the background and should remain attach during all variation in season.
- (ii) It should be hard and durable.
- (iii) It should possess good workability.
- (iv) It should be possible to apply it in all weather condition.
- (v) It should be cheap.

// # Selection of type of mortar.

- (i) availability of binding material
- (ii) durability requirement
- (iii) finishing requirement
- (iv) atmospheric condition and variation in weather
- (v) location in surface

Types of plastering.

1. Lime mortar
2. Cement mortar
3. Lime cement mortar

1. Lime mortar :-

Lime mortar used for plastering are flat lime or hydraulic lime. Flat lime is preferred since it has good yielding property after slaking. Hydraulic lime contain particles which slake very slowly as it comes in contact with atmospheric moisture such as slaking may even continue 6 to 8 month. If unslake particles remain in such a plaster blisters are formed during the process of slow slaking. If hydraulic lime is used for plastering it should be ground dry with sand. Then it is left for 2 to 3 week and then it is used. The mixed proportion varies from 1:3 to 1:4.

2. Cement mortar.

Cement mortar is the best mortar for external plastering work since it is practically non absorbent. It is also preferred better than lime plaster both in rooms, bathroom, kitchen etc. In damp climate, cement mortar is much stronger than lime mortar. The mixed proportion may vary from 1:4 to 1:6. Sand used for plastering should be clean, coarse and angular. Better mixing with dry mixing is done when water is mixed. The mortar should be used within 30 min of mixing.

3. Lime cement mortar :-

This mortar contains property of both the lime mortar as well as cement mortar. Cement mortar as such does not possess sufficient plasticity. Addition of lime to it imparts plasticity resulting in smooth plastered surface. Mixed proportion generally used are 1:1:6, 1:1:8, 1:2:8 generally flatlime is used.

Defects in plastering

1. Blistering of plaster surface :-

This is the formation of small patches of plaster swelling out beyond the plastered surface.

2. Cracking.

Cracking consist of formation of crack due to following reason.

- (i) imperfect preparation of background.
- (ii) Structural defect in building.
- (iii) movement in back ground due to its thermal expansion (or) excessive shrinkage due to application of thick coat.

(iv) faulty workmanship

3. Efflorescence.

It is the whitish crystalline substance which appear on the surface due to presence of salt in plaster making material and wall as building material like bricks, sand,

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Point

Paints are liquid composition of pigment and binders which when apply to the surface is in coats. any to form a solid film to impart the surface a decorative finish apart from gives protection to the base material from weathering, corrosion and other chemical and biological attack paint provides timber structure against warping and decay.

Characteristics of an ideal paint

- (i) Paint should form hard and durable surface.
- (ii) It should give attractive appearance
- (iii) It should be cheap and readily available
- (iv) It should be such that it can be applied easily to the surface
- (v) It should have good spreading quality so as to cover maximum area in minimum quantity.
- (vi) It should dry in reasonable time.
- (vii) It should not show hair crack on drying
- (viii) It should be stable for long period.

Composition/constituents of paint

1. Base.

A Base is a solid substance in a form of fine particles. It is generally metallic oxide various bases commonly used are white lead, red lead, oxide of zinc, oxide of iron, Aluminium powder etc.

2. Vehicle or carrier or binder

This is liquid substance which hold the different pigment of a paint in liquid suspension. The carrier or vehicle makes it possible to spread the paint evenly on the surface. The commonly used vehicle are linseed oil, poppy oil and nut oil. Refined oil is this but it takes long time to dry.

3. Extender.

Extender is a finely ground substance that added to the paint to alter its property such as texture, drying time, transparency and cost of paint. Some of the commonly extenders are Barium sulphate, calcium carbonate, Aluminium silicate etc.

4. Filler.

Fillers are used to moderate the process of drying and hardening. By either that extend from the atmosphere and thereby up to the surface. However, fillers reduce the elasticity of the paint. They should not be used to find out the

consuming used filler are calcium manganese, lead etc. It reduces the cost of paint improves durability and mostly the weight of paint.

5. Colouring pigment

Colouring pigment are added to the base to have different desired colour. Pigment can be of different types i.e. stable, dirt and they can be similar as required.

The common types of colouring pigment are iron iron oxide, red lead, cadmium or aluminium, chrome, copper, zinc etc.

6. Solvents or thinner

Solvents are added to the paint to make it thin so that it can be easily applied on surfaces. It also help the paint in penetrating

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through the porous surface of the background. The thinning agent commonly used is the spirit or thinners kerosene oil.

1. False ceiling

False ceiling is a secondary ceiling that hangs below the main ceiling. False ceiling features are modern, handy and ceiling commercial building. False ceiling is quite an economical feature that is easy to install.

Procedure on installing false ceiling.

① finally all required measurement of ceiling and ceiling to wall is taken for cut. Room where false ceiling is to be install.

(ii) material requirement is calculated. depending on sizes that is area of room. Here it leads to be installed.

The ceiling level is done with the water because most of the time the slabs are not level. The ceiling has to be in level for correct installation false ceiling.

(iii) After building, structure is completely marking. No done marking is done on ceiling at a distance of 4 feet each. Marking is also done in the side wall at the height where the false ceiling will be suspended below the original ceiling.

(iv) Joists are metal ceiling angle ~~straps~~ straps are fixed to the ceiling. This ceiling become the steel support. Joist for false ceiling. Joists & brackets are fitted. Framing is done. For framing, powerdrill channels are fitted on the wall at a height. These false ceiling will be suspended.

(v) Ceiling section are then fitted to the main foundation framing. Joists to attach plaster boards. On any other material. Once the framing is complete ceiling for light, fans and other electrical work is completed.

of
(vi) Plaster board is ~~over~~ required thickness is then attach to the frame with the help of dry wall screws.

(vii) The joints and edges are covered and finished using jointing compound and paper tape. The false ceiling is given a smooth finish with plaster.

(viii) Once the process is over all electrical appliances are fitted and final covering is done and ceiling is painted.

Painting on new wood work.

1. Preparation of surface:- for good result wood must should be well second and should not contain more than 15% moisture.

The surface is cut thoroughly to remove dust, foreign matter etc.

Heads of nails are purchased to a depth of 3mm below the surface to be painted.

2. Knocking:- It is process of removing all knots in the wood work. With a substance which resin content come out.

knitting can be done by three methods.

In the first method (two coats are applied) the first coat consists of sand and treated. This coat dries in 10 min and then the second coat is applied. The second coat consists of sand and bind with linseed oil.

3) Priming - after knitting the surface is rubbed smooth with a abrasive paper. priming consists of applying first coat of paint to fill all the pores. priming coat creates a layer on film which prevents adhesion of the paint with the surface.

4) Stopping - It is the process of rubbing down of treated wood by means of stone after prime coat is applied and then filling the all cracks, not holes, dents, open joint with putty.

5) Under coating - after stopping second and successive coating are applied the first coat is a prime coat, the under coating should be of the same shape as that

of finished ceiling and under the coating may necessary depend upon the quality of various material. For superior work each coat is allow the dry through kept stone and glass paper.

6) Finishing coat - Finishing coat is apply after the under coat is perfectly dry. The coat is applied ~~then~~ really carefully by a skilled painter.

painting old wood work -

Before repainting old work the old paint having cracks should be removed by applying any one of the following solvent and paint removers.

1. applying solution containing 1kg of caustic soda in 5 liter of water.

(ii) Applying mixture containing one part of strong shape, two part of potash and one part of quick lime in the hot state.

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Imp #

(i) Applying mixture of equal part of washing soda and quick lime to the masonry masonry.

After removing the old paint the surface is properly cleaned and then rubbed with stone and glass paper. The final surface is given 2 to 3 coats of paint to upto of desired finish.

Painting Iron or steel work:-

- The surface is clad off by stripping or brushing with steel wire brushes till, greis etc. is removed & washing the surface with petrol to remove lime dust.
- The final surface is treated with a film of zinc oxide. This film protect the surface from rusting and provides a better adhesive surface.

- The prime coat or first coat is then apply with the brush.

- After the prime coat has dry two or more under coats are applying either with a brush or with a spray gun.

- After the under coat has dry the final coat of the desired type paint is applied.

UNIT-5

Building services and equipment.

Imp

Anti Termite:-

Termite propulerly known as white ant causes damage to wood work, furniture etc. of the building. anti termite treatment is ther is necessary so that damages can be reduce or stop.

Termite are off two types :-

Dry wood termite and sub terran termite

Anti termite treatment

The Preconstruction soil treatment has to be applied to the plinth of the Substructure in construction and in the post construction treatment are done for those building which are already attack by termites.

(1) Pre construction Treatment :-

This treatment is started white at the initial stage of construction of building. pre construction treatment can be divided into 3 operation

(a) Site preparation:-

This operation consist of removal of roots, weeds and other fibrous matter from the soil at the construction site. This is essential because the termites may be present in this material. If the termites are detected they should be destroyed by the use of insecticide solution.

Imp solution of consisting of any one of the following chemical.

- i.) DDT
- ii.) BHC
- iii.) Aladin
- iv.) heptachlor
- v.) chlordane

(b) Soil treatment

The best and the only reliable method to protect building against termites is to apply a chemical treatment to the soil at the time of construction of the building. This should be done in such a way that a complete chemical barrier is created between the ground from where the termites come and damage the wood within the building.

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The emulsion should be applied evenly with a watering can or sprayer at the following stages

- (i) In the foundation pit
- (ii) The refill of cast in both the sides of all built up walls.
- (iii) Before laying the floor.

(c) Physical structure barriers.

Continuous impermeable physical structural barriers may be provided continuously at plinth level to prevent entry of termites through wall. This barrier may be of concrete layer or metal layer. Metal barriers such as non corrosible sheets of copper or galvanized iron

2. Post construction treatment:-

- It is a maintenance treatment for those building which are already under attack of termites.
- The termites even after entering the building

maintain their contact with their rest on column in the ground through stability tubes on tunnels lined with soil.

- It is essential to carry out inspection to estimate the magnitude of spread or terrace in the building and to detect the points to entry of terrace in the building.

- This point may be near to column, doorway, bathroom, flanking pipes etc and the places where wood work is embedded in the ground.

- In the case of multi story building, fire, electrical wiring, tunneling, survey line etc. may be the entry points then the terrace.

- Where ever this stability tubes are detected this should be destroyed after injecting anti-termite solution.

- This treatment may be apply upto a depth of 30cm below the ground.

Fire protection.

No building material is perfectly fire proof every building contain some material which can either catch fire or which are vulnerable to fire. The technical interpretation of fire safety of building is to convey the fire resistance of building due to any reason which subjected to fire in term of hours is known as intensity. A wider interpretation of safety may be governed by the falling apart.

(i) fire prevention and reduction of number of out breaks of fire

(ii) spread of fire both internally and externally

(iii) safe exit of any out and all occupants in the event of an out break of fire.

(iv) fire extinguishing apparatus

Characteristic of fire resistant material

An ideal fire resistance material should possess the following characteristics

(i) No material should not disintegrate under the effect of gradual heat.

The material should not disintegrate

- The exposure of material due to heat should not be liable to instability or the stability of which it forms a part.
 - The contraction of material due to sudden cooling with water after it has been heated to a high temperature should not be regarded as a defect.
- # fire resisting property of common building material.

1. Stone

Stone is a non combustible building material and also of good conductor of heat and does not contribute to the spread of fire. It is a bad fire resisting material since it is liable to disintegrate into small pieces when heated and suddenly cool giving rise to failure of structure. In general the use of stone in fire resisting construction should be restricted to a minimum.

2. Brick

Brick is a poor conductor of heat. 1st class brick protected from a good

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clay can stand exposed to fire for a considerable length of time up to a temperature of about 1200°C . Brick masonry construction with good mortar and better workman ship is the most suitable for the structure.

Concrete

The behaviour of concrete during exposure to heat varies with the nature of coarse aggregate. As its density and the quality of cement is also depend upon the position of steel in the concrete. Concrete covers a much more fire resistance than any other building material. Reinforced concrete structure can withstand fire testing for several hours with a temperature of 1000°C without serious damage.

Steel

Steel is non combustible material which may lose fire resistance. It is a good conductor of heat during fire it gets heated very soon its modulus of elasticity decreases

and hence its tensile strength is greatly reduced. This kind of steel is known as mild steel and its tensile strength is about half of its value at normal temperature. Hence reinforced steel bars (sags) and reinforcement bars or rebars built-in building is called as Reinforced concrete.

Reinforced concrete steel

This is formed by cementing together concrete with steel. It has low coefficient of expansion and contraction. It is very strong and hard. It is used for construction of the various partition walls, roof and floor slabs.

General fire safety requirement for building.

There is great danger of fire and its thermal expansion is also very high. It is heated and then suddenly cold cracks are formed. This is called as thermal cracking. It is caused by the uneven expansion and contraction of concrete. It is caused by the uneven expansion and contraction of concrete.

Timber

Timber is a combustible material. It burns and gets rapidly destroyed during fire. The section is small. If timber is used in thick section it possesses the property of self insulation and slow burning.

3. Escape routes shall be well ventilated

4. Fire proof doors shall be used as a fire safety requirement

5. When fire resisting doors are employed the doors shall be maintained in good working condition.

6. Electrical and mechanical lifts should not be used under fire condition.

7. Joke ceiling, sound proofing, air conditioning and other similar should be so constructed as to prevent easily collapse in the event of fire so that people underneath are not trapped before they have the time to reach the exit.

8. Doors are required to which stand the effect of fire for the full period for particular grading.

9. roof for the various fire grade of building should change and construction to which stand the effect of fire for maximum period.

10. Basement are necessary for high rise building and when such basement are used for storage purposes should be made for the escape of any heat arising due to fire.

Fire resistance Construction.

1. Wall and Columns:-

(i) masonry walls and columns should be made of thicker section so that this can resist fire for longer time.

(ii) In the case of solid load bearing walls brick should be used.

(ii) walls should not be made of stones, granite and lime stone.

(iv) In the case of building with frame structure R.C.C. should be preferred.

2. ~~For~~ Floors and roof

(i) for better fire resistance slab roof is preferred to sloping or pitched roof.

(ii) If it is essential to provide sloping roof trusses should be either of Cast iron or protected rigid steel.

(iii) for better fire resistance the floor should be either of R.C.C. or of tiles.

(iv) If fire is made of timber good spacing should be used and fire barriers should be provided.

3. Wall opening

(i) From the spread point of view opening in the wall should be minimum.

(ii) Opening suite means of escape

(iii) Doors and windows should be made of steel

(iv) Rolling shutters doors should be used for garages, showrooms, shops etc.

Fire alarm

Fire alarm are installed to give an alarm and to call for assist in event of fire. Fire alarm can be either of manual or automatic type

1. Manual alarm :-

This one is a hand bell type or similar other

Sounding device this are sounded by watch men and the occupants are alerted to how safe exit is shortest possible time.

2. Automatic alarm :-

This alarm start sounding automatically in the event of fire it is used in large industrial building which may become unoccupied during night. The automatic fire alarm sends alarm to nearest control point.

Ventilation and air conditioning

Ventilation may be defined as supply of fresh air into an enclosed space or the removal of stale air from the enclosed space. Ventilation may be achieved either by natural or by artificial mean.

Ventilation is necessary for following reasons :-

(i) Creation of air movement

(ii) Prevention of undue accumulation of carbon dioxide

(iii) Prevention of flammable gas vapours

(iv) Prevention from dust and bacteria carrying materials.

(v) Prevention of odours caused by decomposition of building material

- (vi) removal of smoke, steam or foul smell generated by the occupants.
- (vii) Removal of body heat generated by the occupants.
- (viii) Provision of satisfactory condition in conference room, cinema hall etc.

Types of ventilation:

System of ventilation may be divided into two parts:-

- (i) Natural ventilation
- (ii) Mechanical or artificial ventilation.

1. Natural ventilation:-

It is the one in which ventilation is effected by the alternate use of doors, windows, ventilation and sky lights. It is usually considered suitable for residential building and small houses. It is not useful for big building, offices, conference halls, auditorium, large factories etc. In natural ventilation, even ventilation is normally useful. It is economical since no equipment is required for supplying the room ventilated. In this system ventilation is effected by

doors, windows, ventilation, sky light and other opening and enclosed space. The rate of ventilation depends on the stated.

- (i) wind
- (ii) stacks

(i) wind effect:-

In this the rate of ventilation depends upon the direction and the wind velocity or wind cut side and size of opening. Such an effect is known as ventilation due to wind action.

(ii) Stacks effect:-

In these the rate of ventilation is effected by the convection arising from temperature or vapour pressure difference between inside and outside of the rooms and the difference in the height between the outlet on that inlet opening.

When air temperature inside is higher than the outside temperature, warm air rises and passes through opening located in the upper part of the room, where

(vi) As incoming cool air enters from the lower opening.

(vii) 2. Artificial ventilation

Mechanical ventilation is useful for the use of some mechanical equipment for effective air circulation. It is provided in some close circumstances where satisfactory standard of ventilation is required or air quantity, quality cannot be obtained by natural means. These systems is called by it results in considerable increasing in the efficiency of person under the command of system.

(i) Exhaust system:- These system is based on circulation of vacuum in the room by creating the inside air by the means of exhaust fan, air is drawn and formed at a height of 1.2 to 1.8 m.

(ii) Plenum system:- In these system fresh air is introduced into the room and air is

allowed through ventilation to feel. The air inlet is located on back side of building where pressure form of air is mechanically available for incoming air is mechanically forced into the room is pushed through a of fans or filter.

(iii) Induction and pressure system:- This is an extraction or plenum system in which extraction fans are used for the exit of air from the room. This system is actually here the delivery of fresh air is not possible. It is generally used in kitchen, bathroom or various industrial area.

(iv) Air conditioning (AC):- This is the best system of artificial ventilation in which provision is made for filtration, heating or cooling does creating most comfortable working condition.

(vi)

7. Excavating equipment:-

(vii)

(i) Tractor

(viii)

This equipment is self propelled machine which is used mainly to erect a powered tractor. Some falling other machine, when the tractor is not required for hauling other machine it can be easily converted to serve as bulldozer. The tractor are used for agriculture operations such as ploughing, harrowing, etc.

(ii) Bulldozer and angle dozer

(i) Bulldozer

A Bulldozer is very useful equipment and can be used on the construction work for the filling purpose.

(a) To clear the site of work

(b) To make the land level

(c) To prepare flyash waste through mountains and hard ground.

(d) To excavate the material and haul for a distance of 1000

4. Excavating equipment:-

(i) Scraper

This equipment consist of a large wheel called the scraper and it is attached to a tractor. Its capacity varies from $3m^3$ to $9m^3$. The scrapers have a cutting edge or blade at the bottom and it is possible to dig earth to depth of about 250 mm.

(ii) Excavator

An excavator is the latest type of machine which remove earth. It perform work of moving the earth while the main unit is stationary. The little effort is required to move the dead weight of earth in a vertical plane. The lateral motion is in the horizontal plane and the effort required is primary factor in excavation.

The excavator is of following type

(a) Back truck hoe excavator

(b) Claw shell excavator

(c) Power shovel excavator