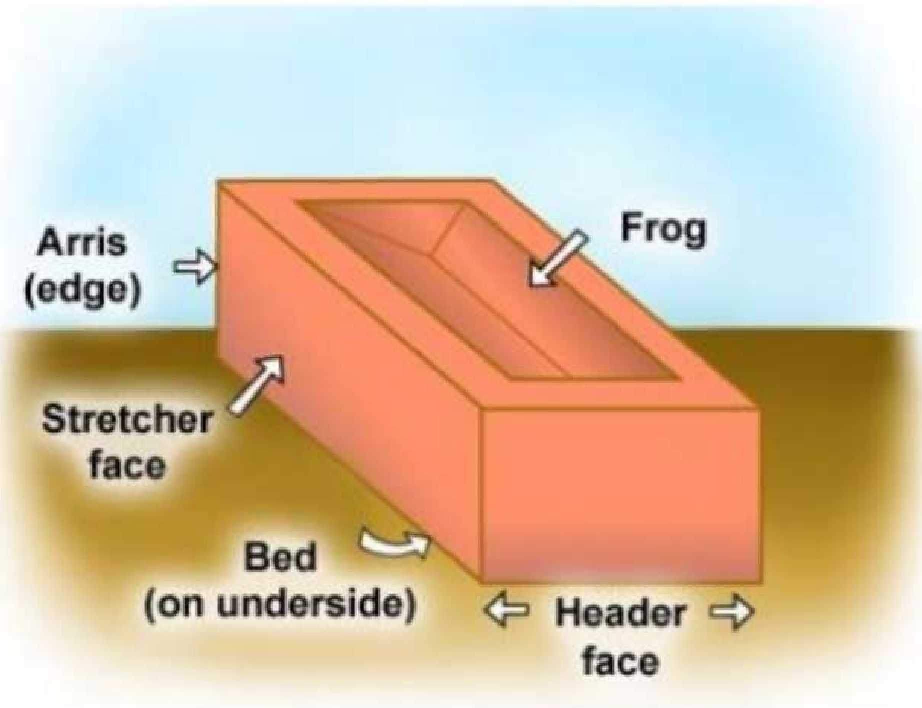
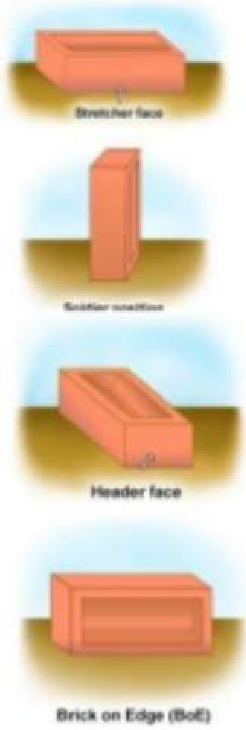
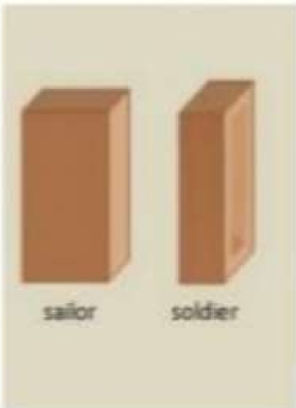
NOMENCLATURE OF BRICK



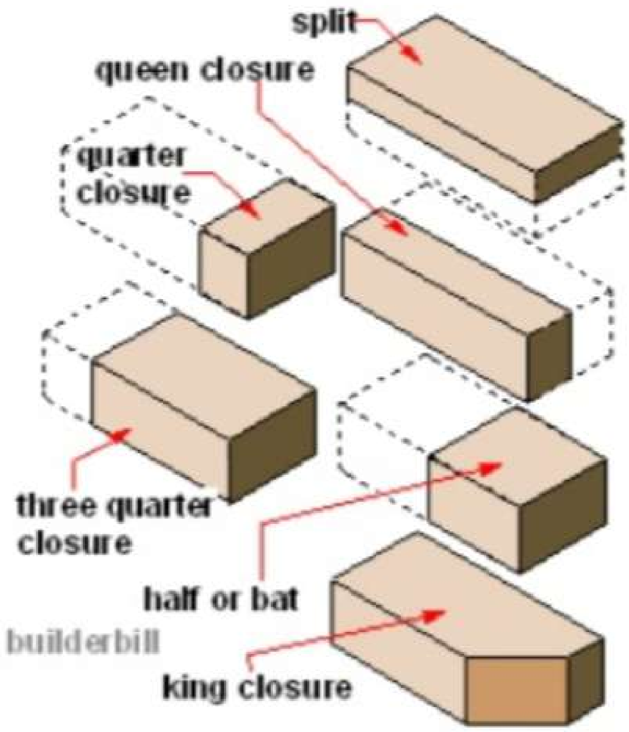


Brick Positions:

- **Stretcher:** a brick laid horizontally, flat with the long side of the brick exposed on the outer face of a wall.
- **Header:** a brick laid flat with the short end of the brick exposed.
- **Shiner:** a brick laid on the long narrow side with the broad side exposed.
- **Rowlock or Bull Header:** a brick laid on the long, narrow side with the small or "header" side exposed.
- **Sailor:** a brick laid vertically with the broad side exposed.
- **Soldier:** a brick laid vertically with the narrow ("stretcher") side exposed.



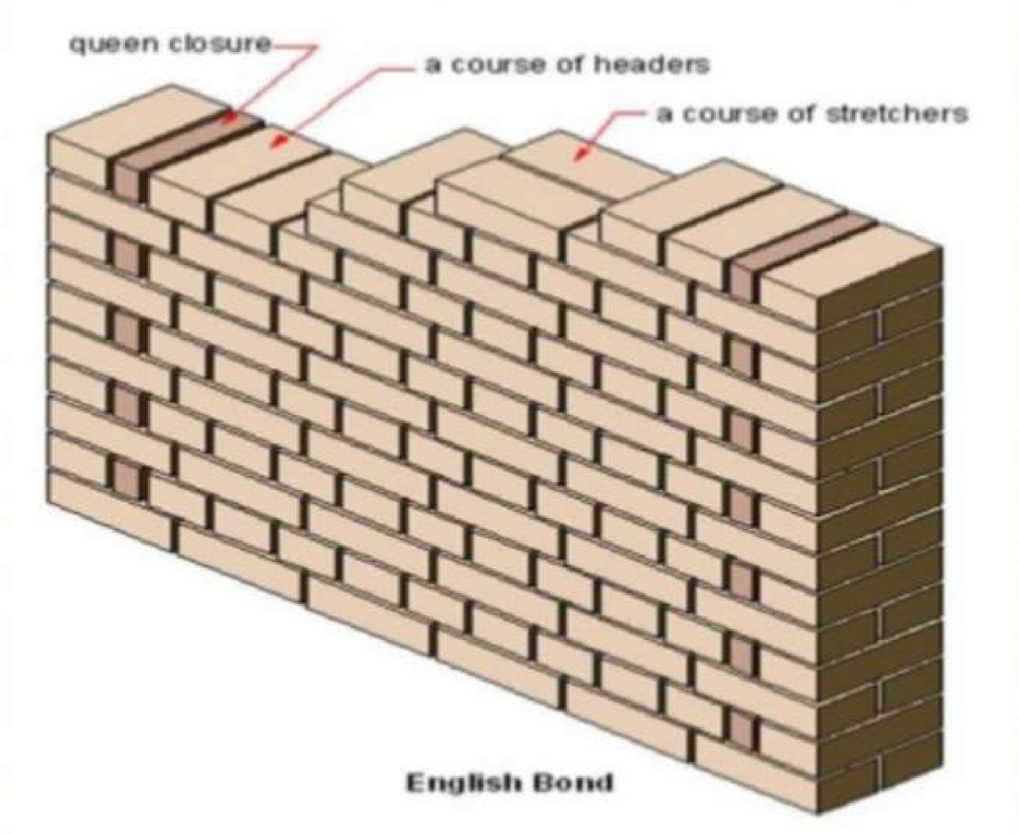
CUTS IN A BRICK



CUTS IN A BRICK

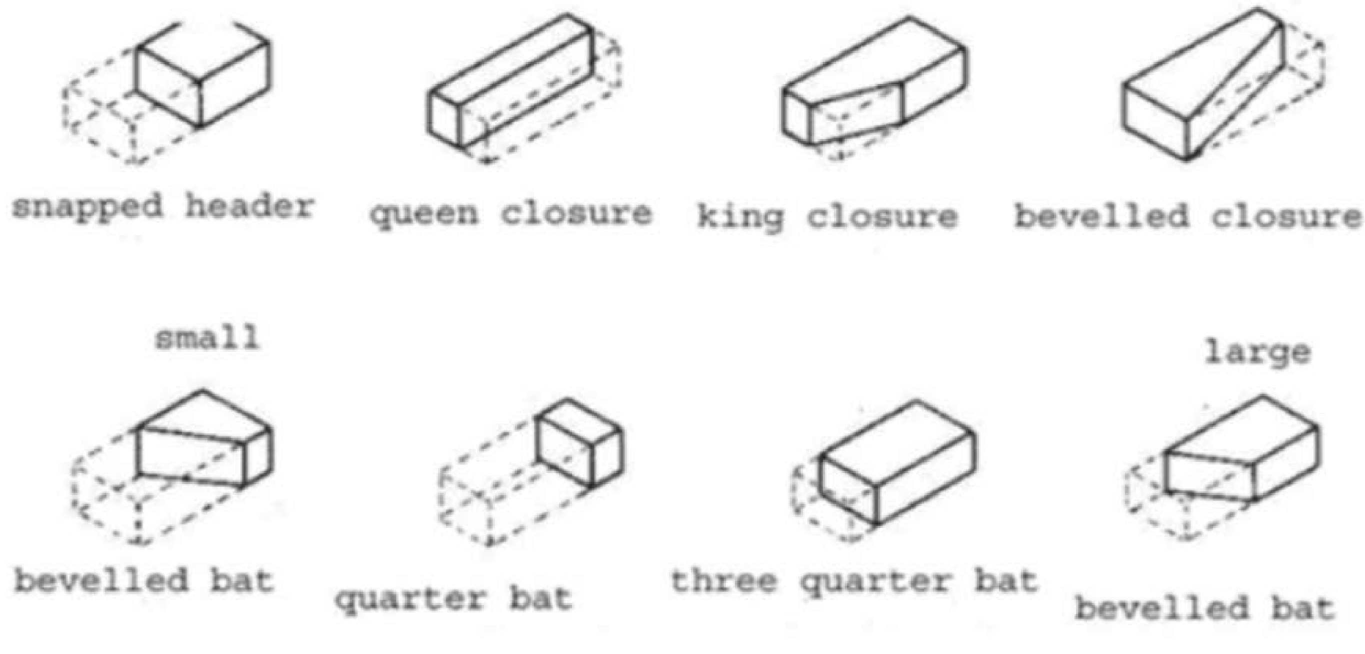
- Occasionally though a brick must be cut to fit a given space, or to be the right shape for fulfilling some particular purpose such as generating an offset—called a *lap*—at the beginning of a course.
- In some cases these special shapes or sizes are manufactured. Frequently used cuts are as follows:
- **Three-quarter bat** – stretching: A brick cut to three-quarters of its length, and laid flat with its long, narrow side exposed.
- **Three-quarter bat** – heading: A brick cut to three-quarters of its length, and laid flat with its short side exposed.
- **Half bat**: A brick cut in half across its length, and laid flat.
- **Queen closer**: A brick cut in half down its width, and laid with its smallest face exposed and standing vertically. A queen closer is often used for the purpose of creating a lap.

POSITION OF QUEEN CLOSER



Less frequently used cuts are as follows:

- **Quarter bat**: A brick cut to a quarter of its length.
- **Three-quarter queen closer**: A queen closer cut to three-quarters of its length.
- **King closer**: A brick with one corner cut away, leaving one header face at half its standard width.



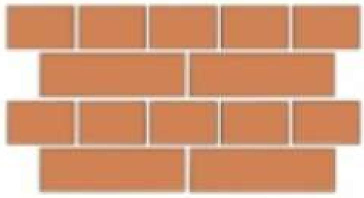
snapped header
queen closure
king closure
bevelled closure
small
large
bevelled bat
quarter bat
three quarter bat
bevelled bat

What is a Bond?

- In brick masonry, there are many techniques to stack bricks. These different arrangements are known as bricks bonds. Each bond has its own characteristics. Following are the commonly used bricks bonds. Some of the different types of brick bonds are,

1. English bond
2. Flemish bond
3. Stretching bond,
4. Heading bond,
5. Garden wall bond,
6. Facing bond,
7. Raking bond,
8. Dutch bond,
9. English cross-bond,
10. Zig-Zag bond,
11. Silverlock's bond.
12. Rat trap bond
13. Dearne's Bond

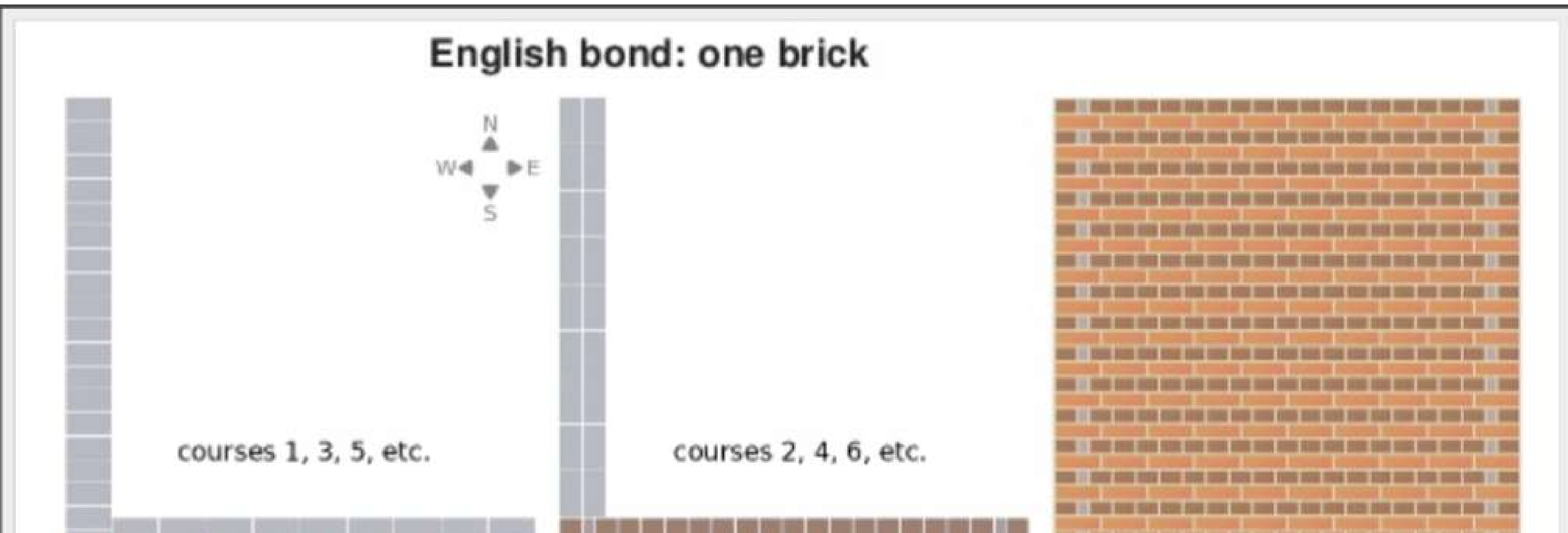
English bond

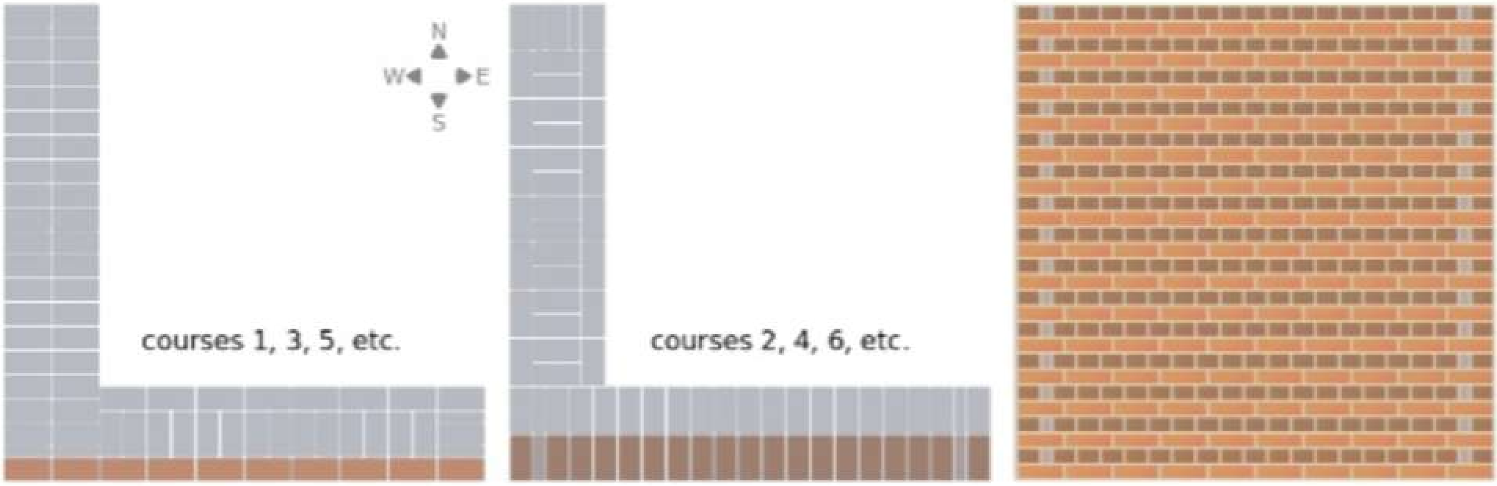


English bond:

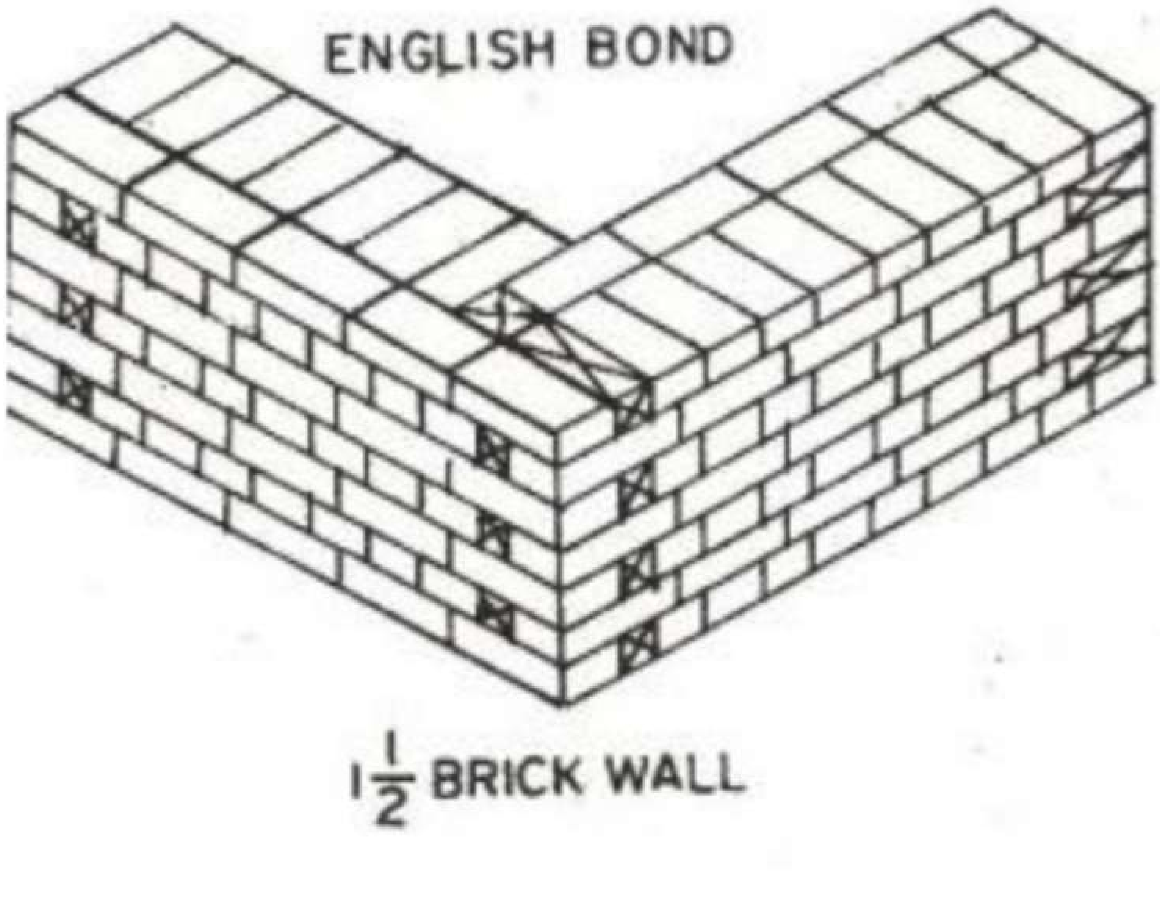
- Consists of alternate course of headers and stretches.
- In this English bond arrangement, vertical joints in the header courses come over each other and the vertical joints in the stretcher course are also in the same line.
- For the breaking of vertical joints in the successive course it is essential to place queen closer, after the first header in each heading course.
- The following additional points should be noted in English bond construction:

1. In English bond, a heading course should never start with a queen closer as it is liable to get displaced in this position.
2. In the stretcher course, the stretchers should have a minimum lap of 1/4th their length over the headers.
3. Walls having their thickness equal to an even number of half bricks, i.e., one brick thick wail, 2 brick thick wall, 3 brick thick wall and so on, present the same appearance on both the faces, i .e. a course consisting of headers on front face will show headers on the back face also.
4. In walls having their thickness equal to an odd number of half brick, i.e. 1½ brick thick walls or 2½ brick thick walls and so on, the same course will show stretchers on one face and headers on the other
5. In thick walls the middle portion is entirely filled with header to prevent the formation of vertical joints in the body of the wall.
6. Since the number of vertical joints in the header course is twice the number of joints in the stretcher course, the joints in the header course are made thinner than those in the stretcher course.

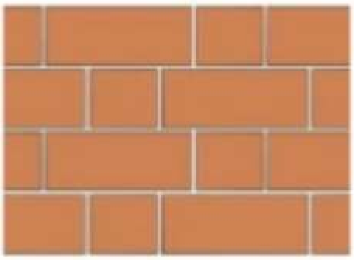

English bond: one brick
N
W
E
S
courses 1, 3, 5, etc.
courses 2, 4, 6, etc.
English bond: one and a half brick
N
W
E
S
courses 1, 3, 5, etc.
courses 2, 4, 6, etc.



English bond: two brick


ENGLISH BOND
$1\frac{1}{2}$ BRICK WALL

Flemish Bond

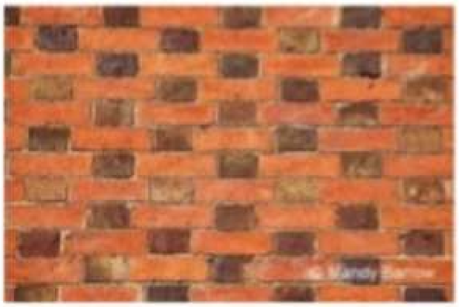


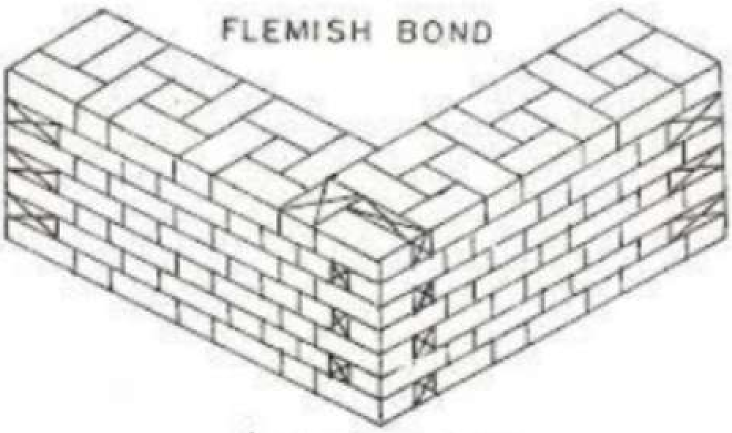
Flemish bond:

- Each course consists of alternate headers and stretchers.
- The alternate headers of each course are centered over the stretchers in the course below.
- Every alternate course starts with a header at the corner.
- For the breaking of vertical joints in the successive courses, closers are inserted in alternate courses next to the quoin header.
- In walls having their thickness equal to odd number of half bricks, bats are essentially used to achieve the bond.
- Flemish bond is further divided into two different types namely,

  1. Single Flemish bond,

  2. Double Flemish bond.



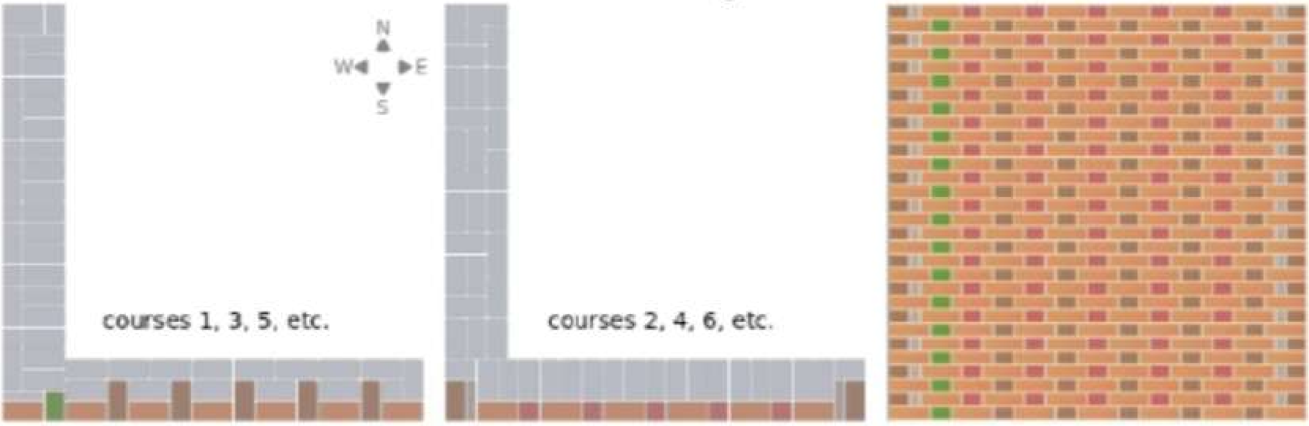


$1\frac{1}{2}$ BRICK WALL

Types of Flemish Bonds

Single Flemish Bond.

- This bond is a combination of English bond and Flemish bond.
- In this work the facing of the wall consists of Flemish bond and the backing consists of English bond in each course.
- This type of bonding cannot be adopted in walls less than one and a half brick in thickness.
- This bond is adopted to present the attractive appearance of Flemish bond with an effort to ensure full strength in the brick work.



Single Flemish bond: one and half brick

Double Flemish bond.

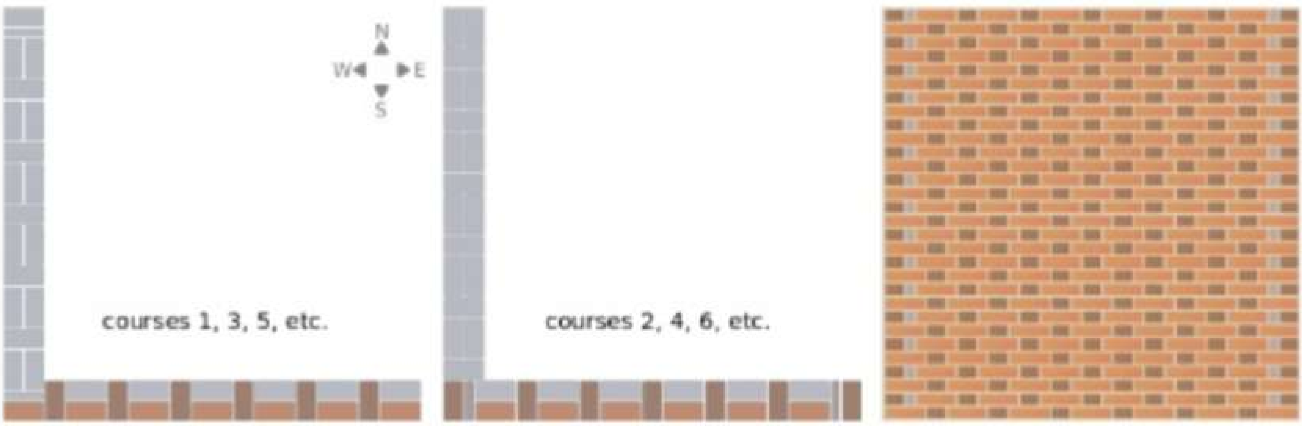
•In Double Flemish Bond, each course presents the same appearance both in the front and back elevations.

• Every course consists of headers and stretchers laid alternately.

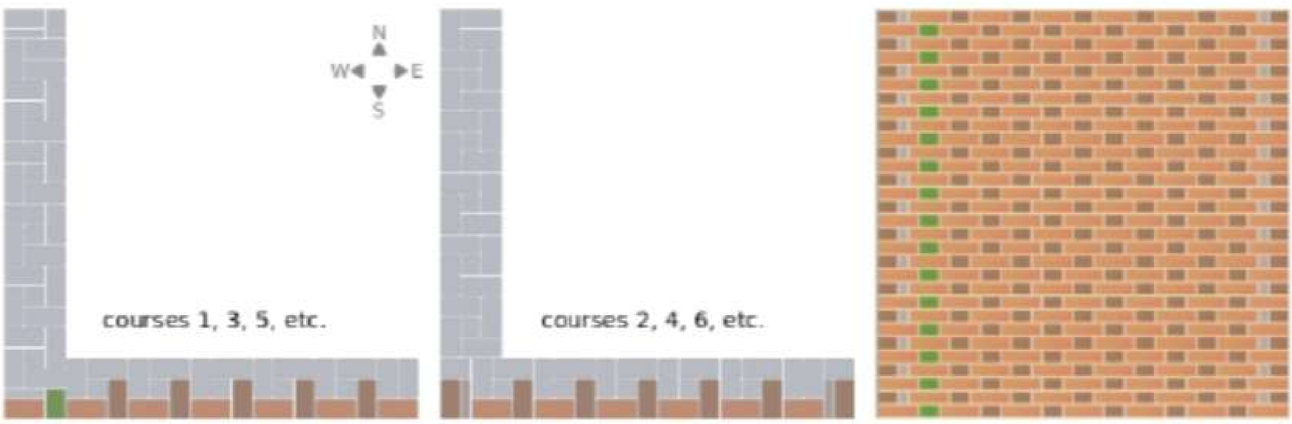
•This type of bond is best suited from considerations of economy and appearance.

•It enables the one brick wall to have flush and uniform faces on both the sides.

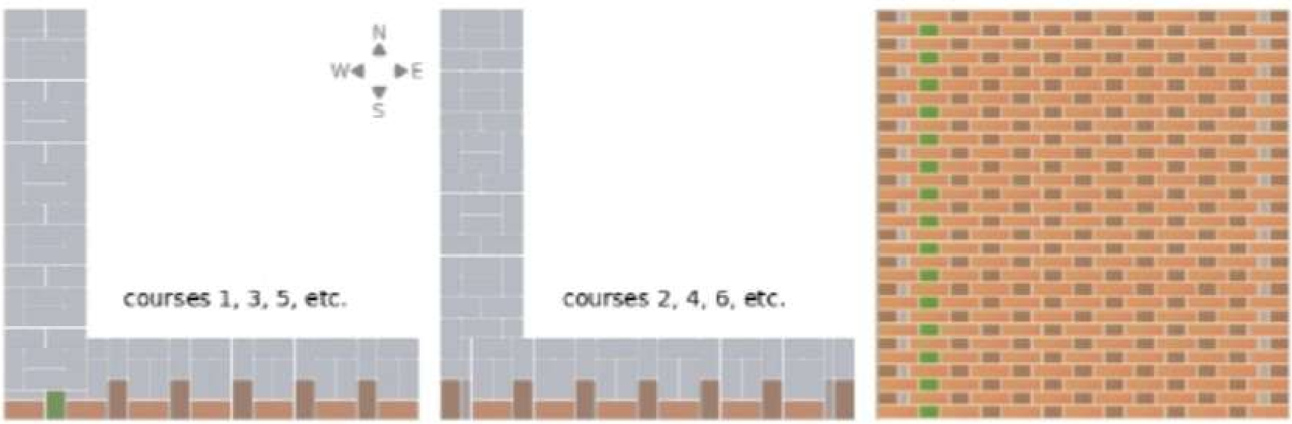
•This type of bonding is comparatively weaker than English bond.



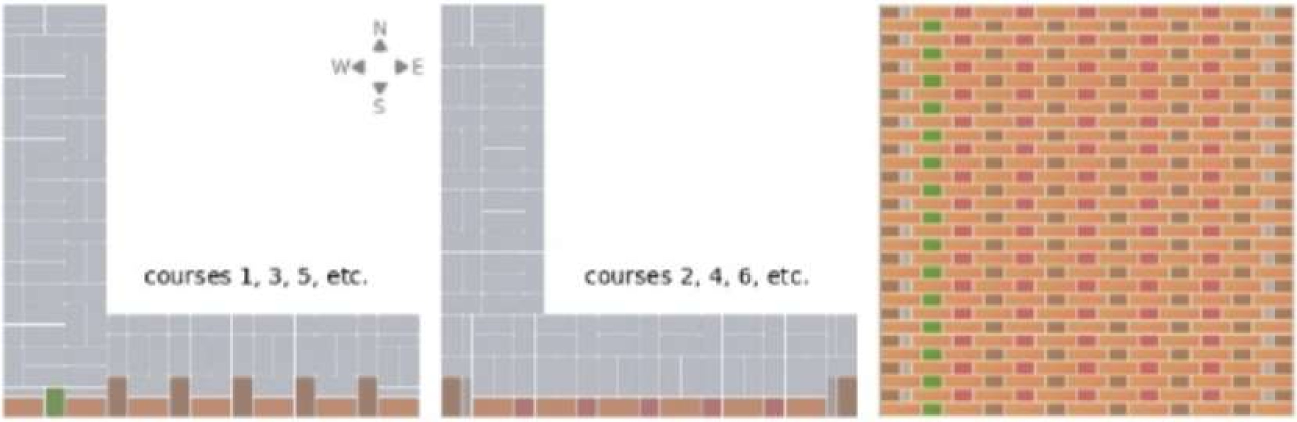
Double Flemish bond: one brick



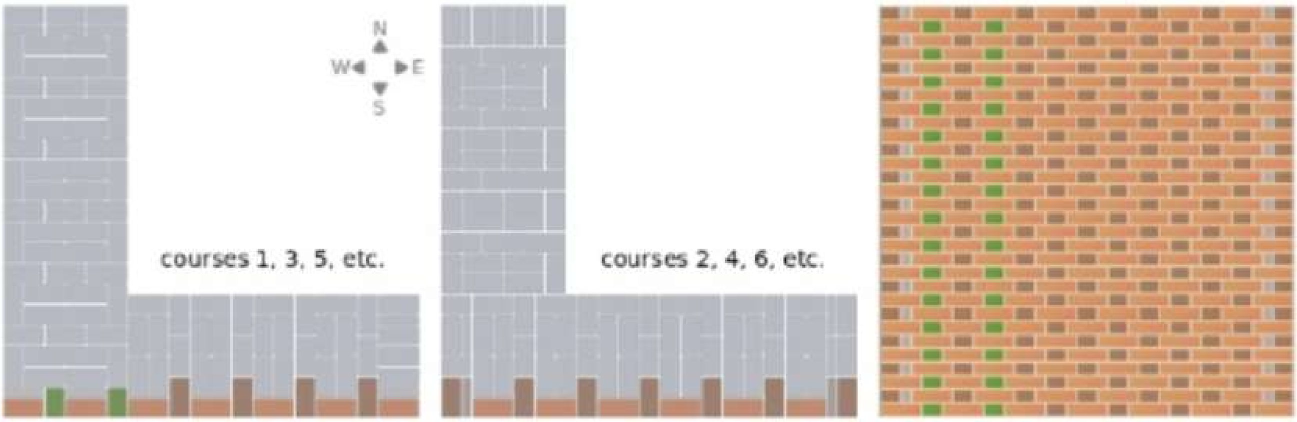
Double Flemish bond: one and a half brick



Double Flemish bond: two brick



Double Flemish bond: two and a half brick



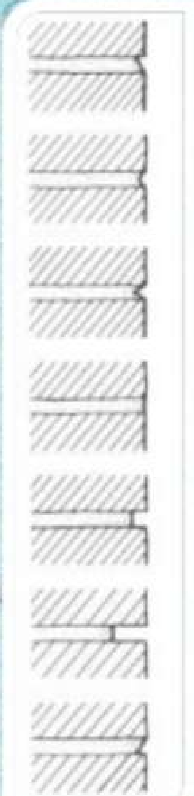
Double Flemish bond: three brick

ADVANTAGES OF BRICK MASONRY

- The Brick masonry is cheaper than compared to stone masonry.
- Bricks are of uniform size.
- Bricks are very workable .
- Brick blocks don't need any dressing.
- Bricks are very light in weight.
- No complicated lifting devices are necessary in brick work.
- There is no problem to its availability.
- They do not require transportation from long distances.
- Brick work can be done by the less skilled labours also.
- Bonding strength is very good and brick work is more durable.

MASONRY JOINT

- **Weathered joint** :-Mortar joint has sloped (downwards) edge.
- **Concave joint** :-Joint concave inwards.
- **Vee joint** :-Mortar joint is the form of V.
- **Flush joint** :-Mortar joint is flush with the brick surface.
- **Raked joint** :-A large portion of the mortar joint is raked out not a safe ,impermeable joint.
- **Stripped joint** :- A medium large portion of the morta joint is a safe permeable joint.
- **Struck joint** :-Mortar joint has aslope (upwards) edge.

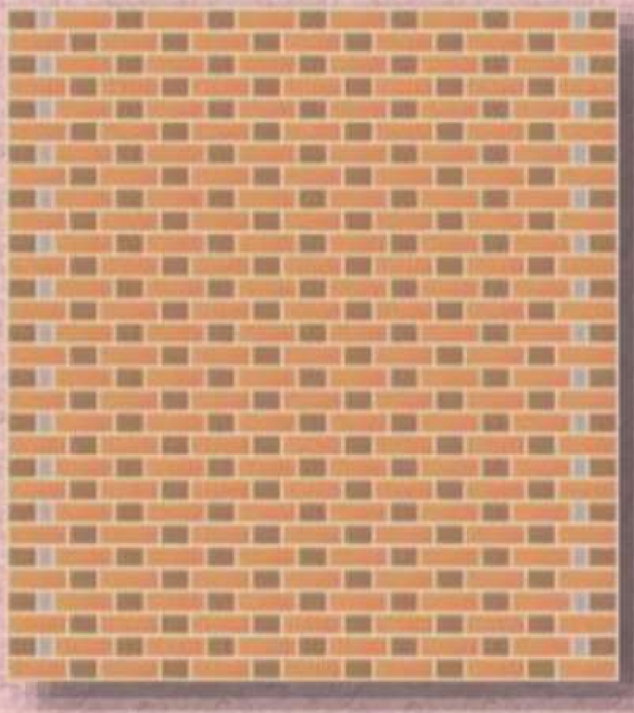


TOOLS USED IN BRICK MASONRY

- Trowel
- Plumb bob
- Hammer
- Spirit level
- Mason square
- Steel tape

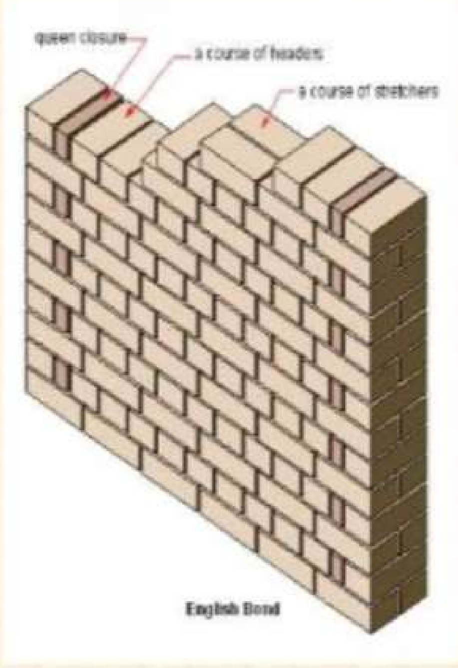
FLEMISH-BOND

- This bond has **one** stretcher between headers, with the headers centered over the stretchers in the course below.
- When a course begins with a stretcher, the course will ordinarily terminate with a stretcher at the other end.
- Brickwork that appears as Flemish bond from both the front and rear is Doubl*e* Flemish bond.



ENGLISH BOND

- Bricks are laid in alternate courses of headers and stretchers.
- There is a chance of penetration of damp through transverse joints.
- Queen closures are inserted next to headers to produce overlap.
- English bonds are the strongest but it is to be noted that the continuous vertical joints are to be avoided.
- Appearance is not as good as Flemish bonds.



DEFECTS IN BRICK MASONRY

- **Sulphate attack** :- Sulphate salts present in bricks work react with alumina content of cement .It occur in boundary walls.
- **Crystallization of salts from bricks** :- Occur in masonry made out of brick which contain excessive soluble salts.This phenomenon is also known as efflorescence.
- **Corrosion of embedded iron or steel** :- Iron or steel embedded in brick work gets corroded in the presence of dampness .On corrosion the metal expands in volume and tends to crack the brick work.

Frog

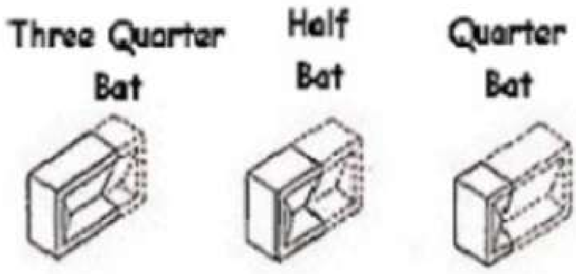
- The depression provided in the face of a brick during its manufacturing.
- Depth of frog in a brick 10 to 20mm
- Frog should be upward. Why?

Course

Each horizontal layer of bricks laid in mortor in any brick work is called coarse.

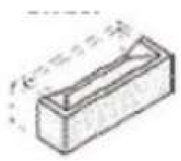
Bats

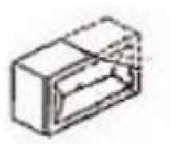
- The portions mad by cutting standard bricks across their width are known as brick bats.
- These are named according their fraction of full length of a standard brick.



Closers

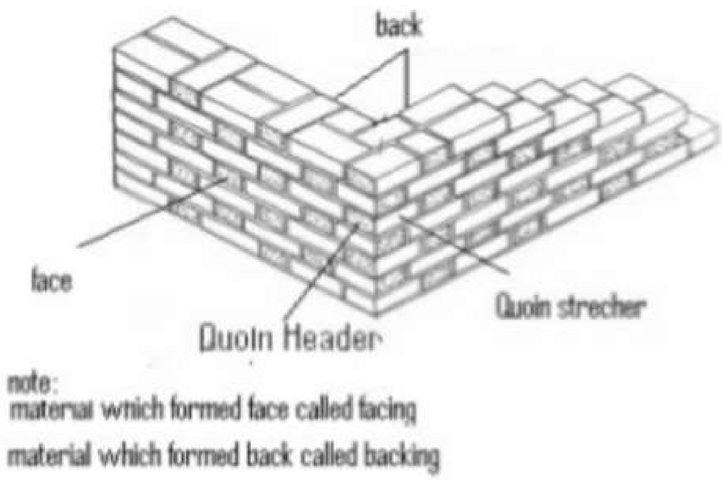
- The portions made by cutting across their length in such a manner that their one strecher face remains uncut or half cut.
- .queen closer King closer





Quoins

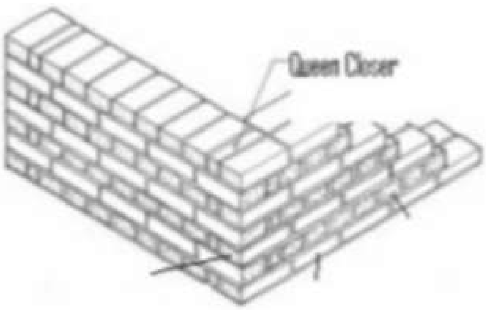
- The external corners of walls are called quoins
- The brick which form the external corner is known as quoin brick.
-



Bonds In Bricks

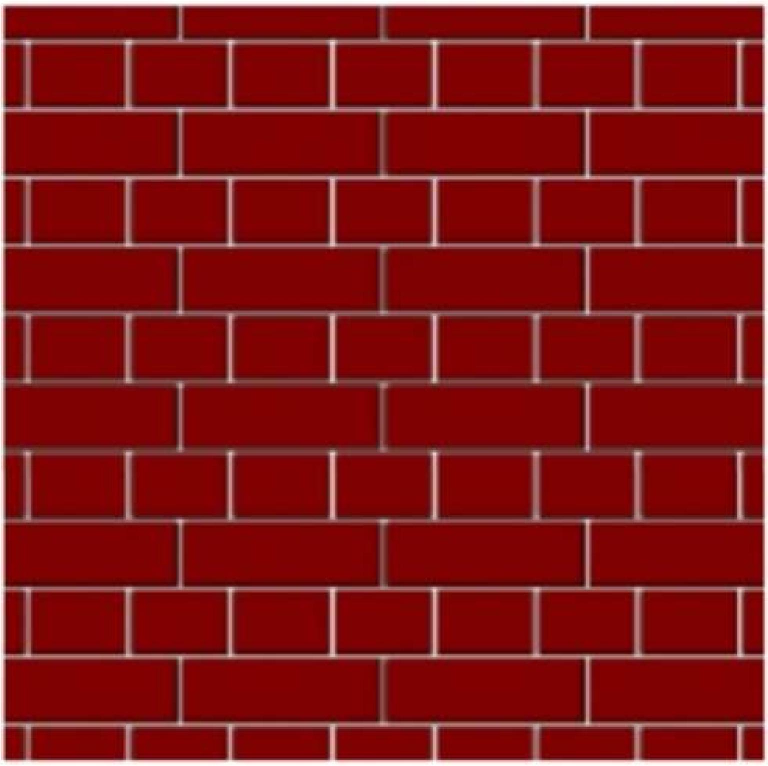
- The arrangement of bricks in brick work so that the vertical joints donot come over each other.
- Bonds in brick work is provided to achieve a united mass as soon as practicable to suit the length, height and thickness of brick work and stresses to which it is subjected

- To break the continuity of vertical joints and to provide proper bond in brick masonry portion of brick (closers or bats) are provided in alternative courses.



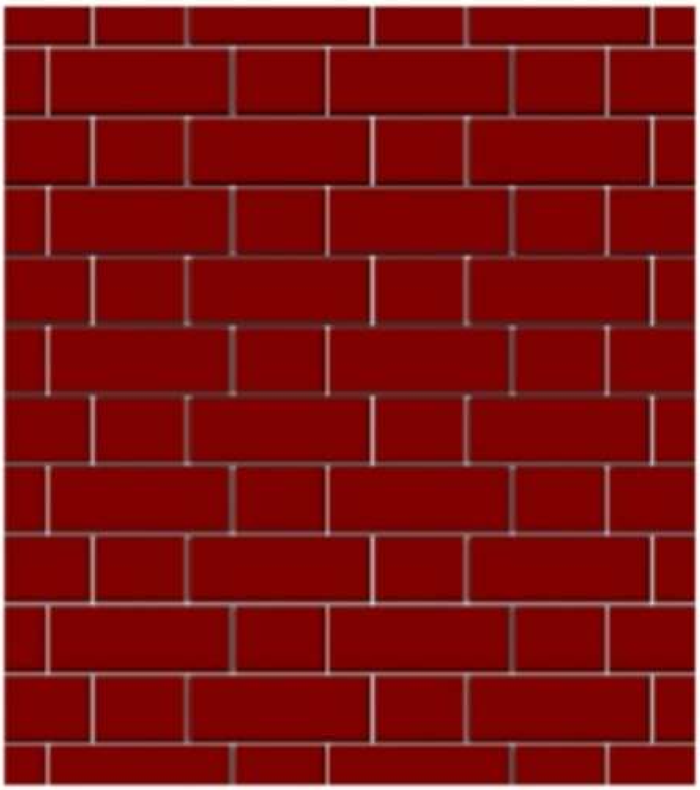
English Bond

- The strongest bond
- This bond maximizes the strength of wall
- Pattern on the face of the wall shows distinctive courses of headers & stretchers.

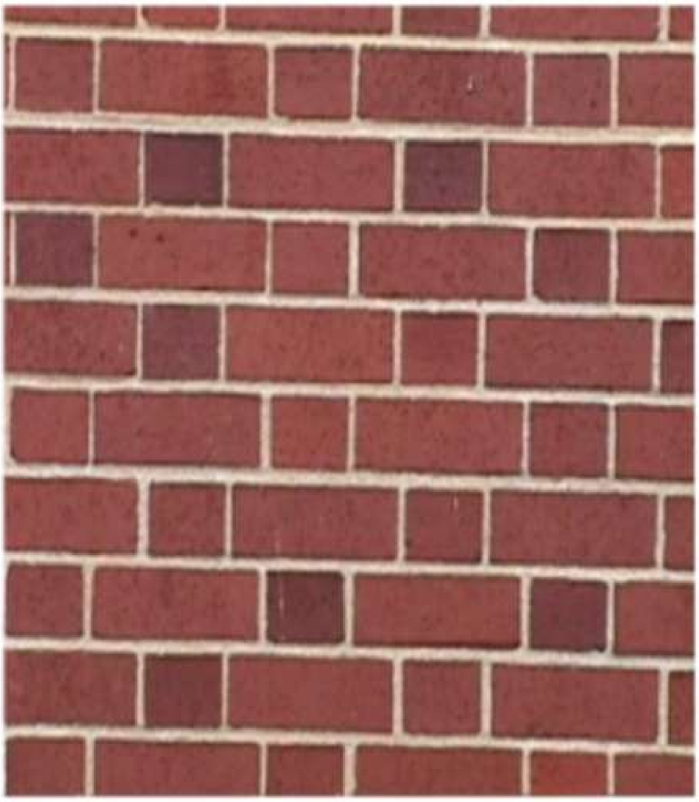


Flemish Bond

- Not such a strong as English bond
- Decorative pattern on face of the wall shows alternate headers & stretchers in each with the headers centered under and over stretchers in adjacent courses.

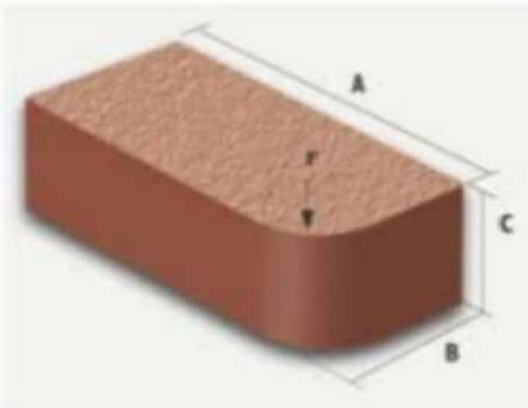


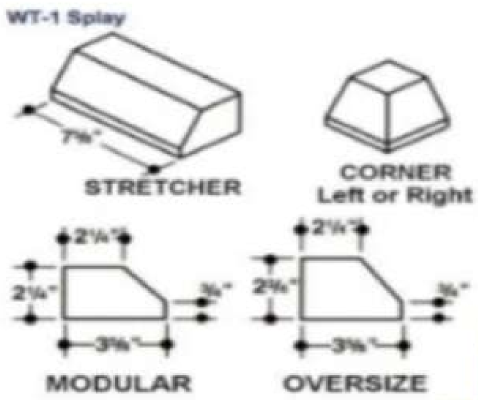
- In this bond a queen closer is provided after every queen header in the alternate coursesto brek the continuity of vertcal joints.
- Brick bats are to be used for forming this bond when thickness of wall is multiple of half brick.



Cont'd...

- Arris: it is the edge of the brick
- Bull Nose: it is a special molded brick with one edge rounded (single bull nose) or with two edge round (double bull nose). These are use in copings or in such positions were rounded corners are preferred to sharp arises.
- Splays: these are special molded bricks which are often used to form plinth. Splay stretcher (plinth stretcher) and splay header (plinth header)





Cont'd...

- Racking Back: It is the termination of a wall in a stepped fashion

- Toothing: it is the termination of the wall in such a fashion that each alternate course at the end projects in order to provide adequate bond if the wall is continued horizontally at a later stage.

Single Flemish Bond

- Single flemish bond is comprised of double flemish bond facing and English bond backing and hearting in each course. This bond thus used the strength of English bond and appearance of flemish bond. However this bond can be used for those walls having thickness at least equal to 1 ½ brick. Double flemish bond facing is done with good quality expensive bricks. However cheaper bricks can be used for backing and hearting.

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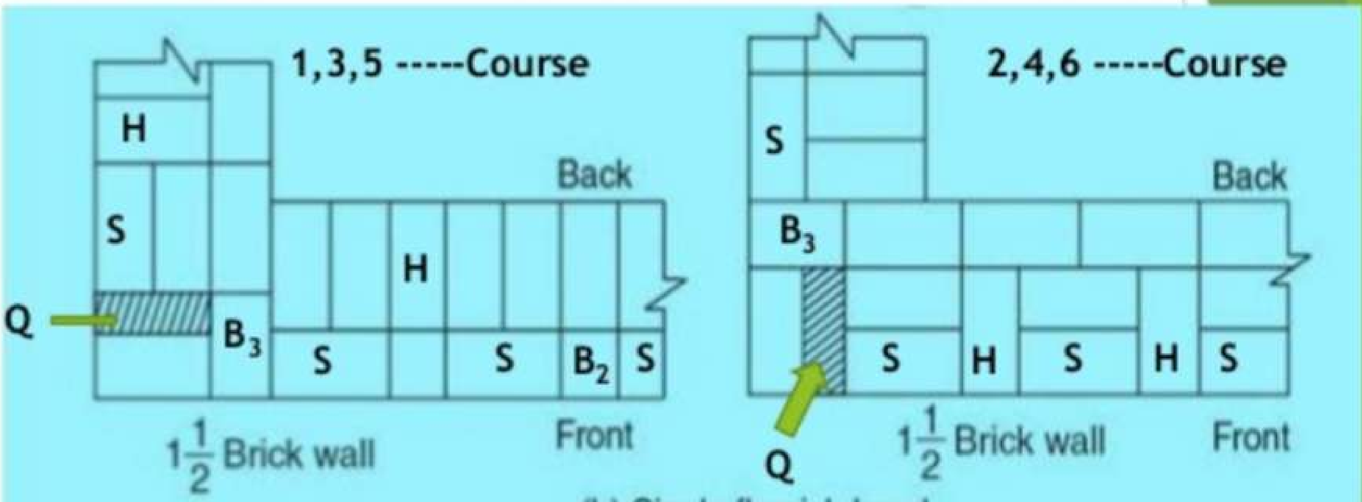


(b) Single flemish bond

S = Stretcher
Q= Queen's Closer
B_2 = Half Bat
B_3 = ¾ Brick; B_1 = Quarter Bat

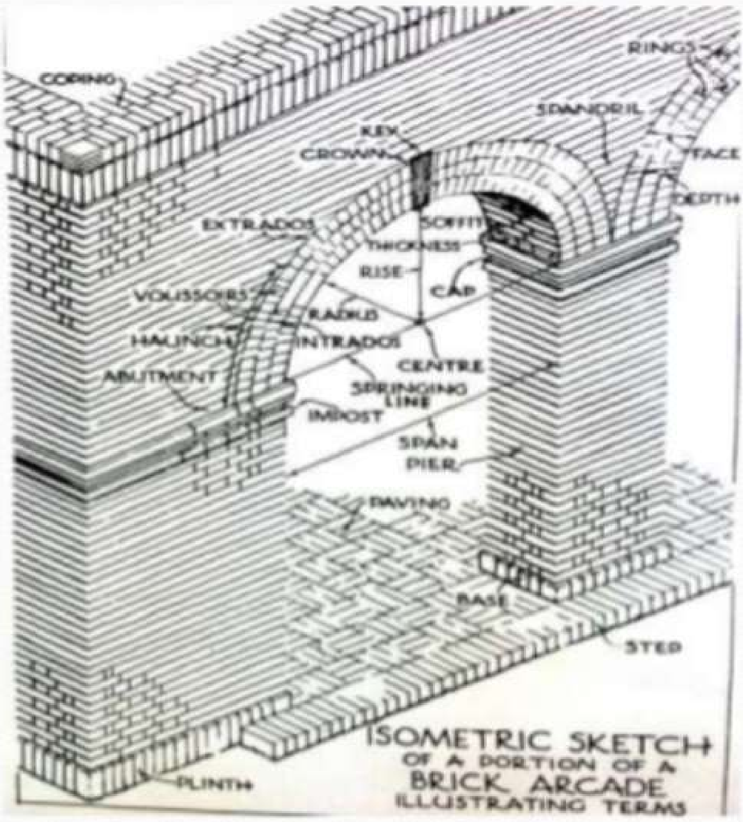
Cont'd...

- Comparison of English Bond and Flemish Bond

1. English bond is stronger than Flemish bond for wall thicker than 1 ½ brick.
2. Flemish bond gives more pleasing appearance than the English bond
3. Broken bricks can be used in the form of bats in Flemish bond. However, more mortar is required.
4. Construction with Flemish bond requires greater skill in comparison to English bond.

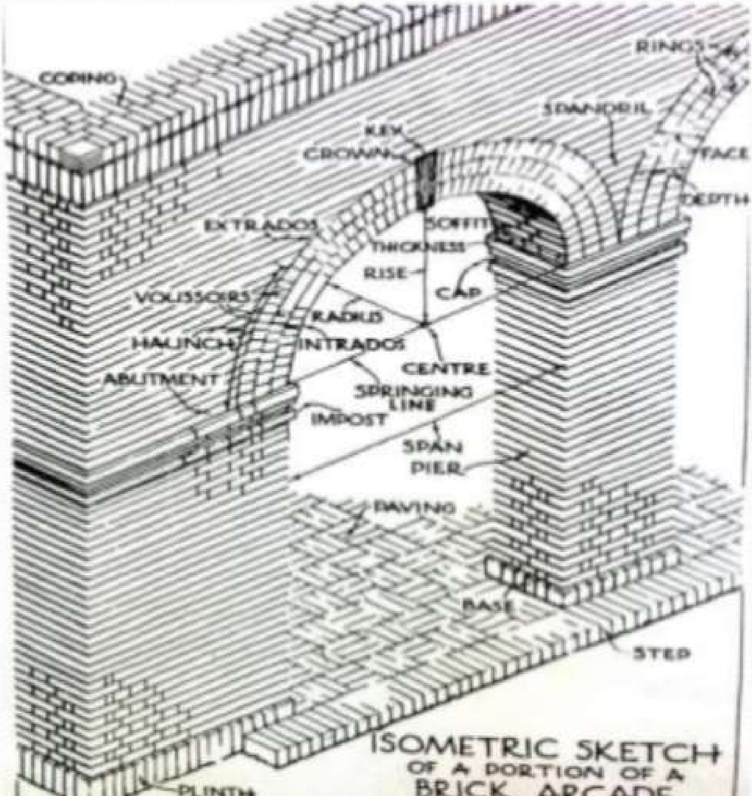
Terminology

1. **Intrados**:- This is an inner curve of an arch.
2. **Extrados**:- Outer Curve of an arch
3. **Soffit**:- Inner Surface of an arch.
4. **Voussoirs**:- These are wedge shaped units.
5. **Crown**:- Highest part of extrados



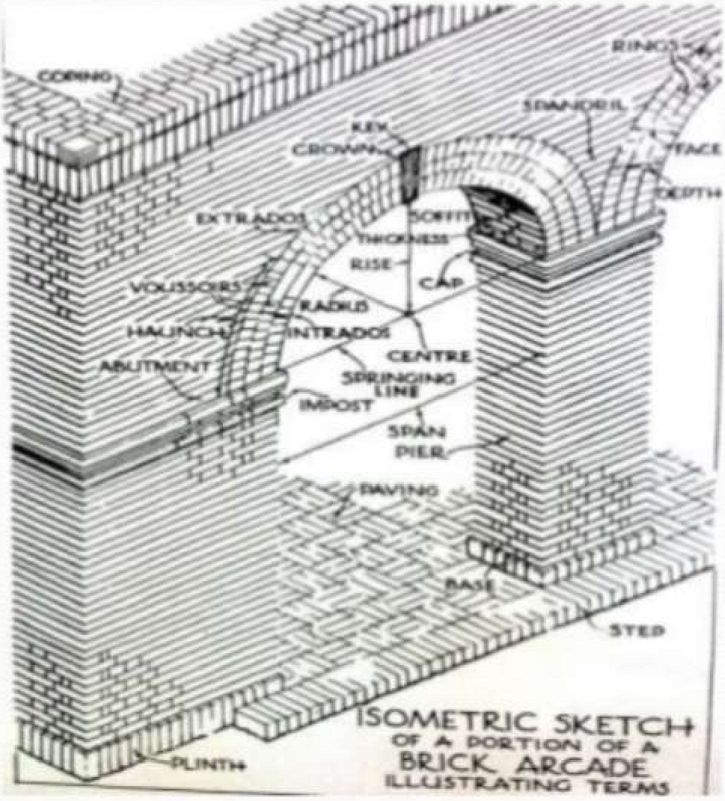
Reference- B.C.Punmia
W.C.MacKay

6. **<u>Spandril</u>:-** Curved triangular space form between extrados and horizontal line.
7. **<u>Key</u>:-** Wedge-shaped unit fixed at the crown of the arch.
8. **<u>Skew back</u>:-** It is inclined or splayed surface on the abutment.
9. **<u>Springing points</u>:-** These are the points from which the curve of the arch spring.
10. **<u>Springing line</u>:-** It is an imaginary line joining the springing point of either ends.



Reference- B.C.Punmia
W.C.MacKay

11. **Abutment**:-End point of an Arch.
12. **Springer**:- It is the first voussoir at springing level.
13. **Pier**:-Intermediate support of an archade.
14. **Arcade**:- It is a row of arches in continuation.
15. **Haunch**:-Lower half of the arch between the crown and skew back.



ISOMETRIC SKETCH OF A PORTION OF A BRICK ARCADE ILLUSTRATING TERMS

Reference- B.C.Punmia

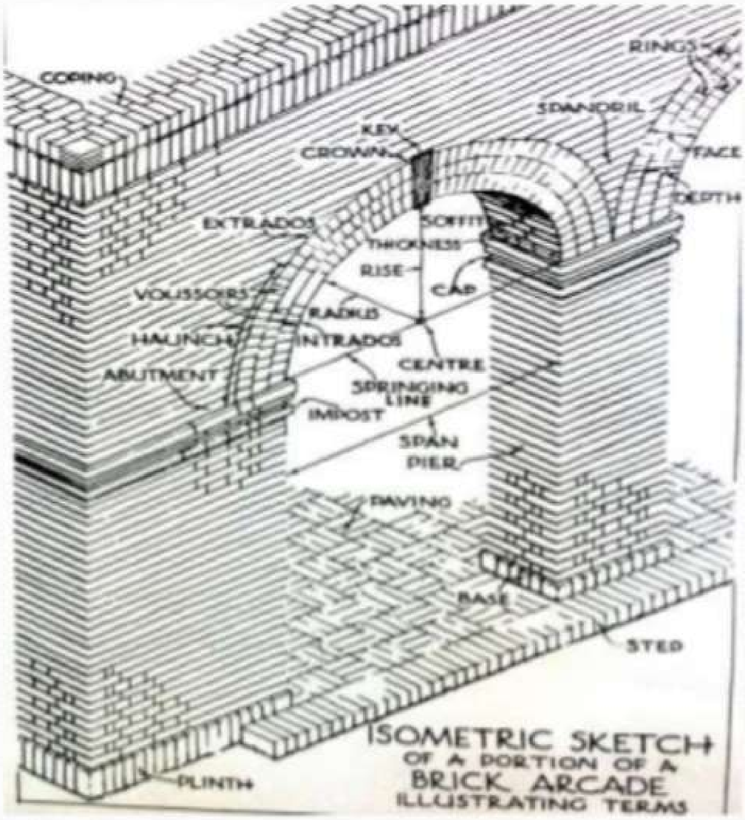
16. **Ring**:-It is the circular course forming an arch.

17. **Impost**:- It is the projecting course at upper part of pier or abutment to stress the springing line.

18. **Bed Joint**:-Joints between the Voussoirs which radiate from centre.

19. **Centre or Stricking Point**:- This is geometrical centre point from where the arc forming the extrados, arc rings, intrados.

20. **Span**:-Clear horizontal distance between the supports.



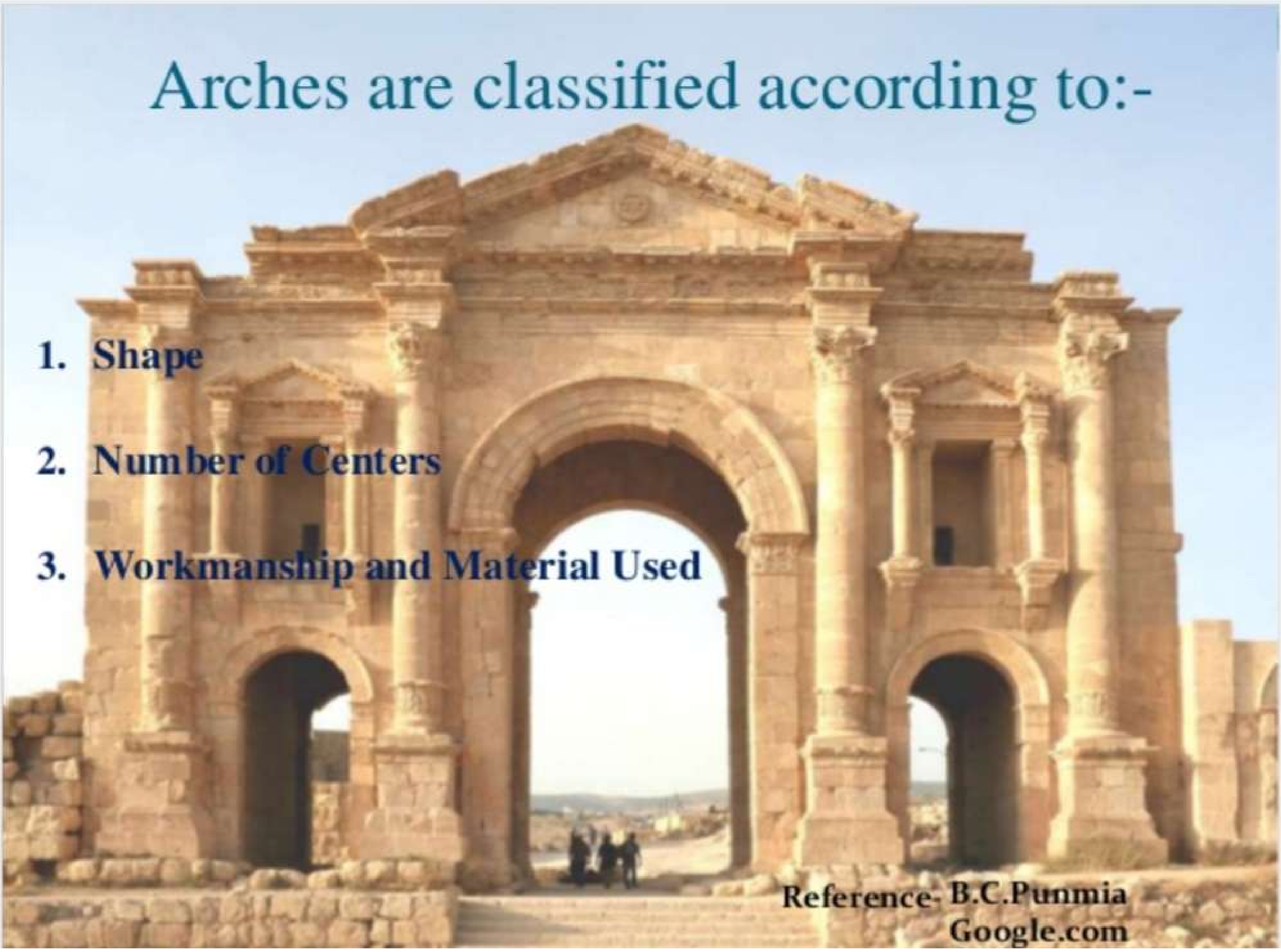
Reference- B.C.Punmia
W.C.MacKay

ARCH

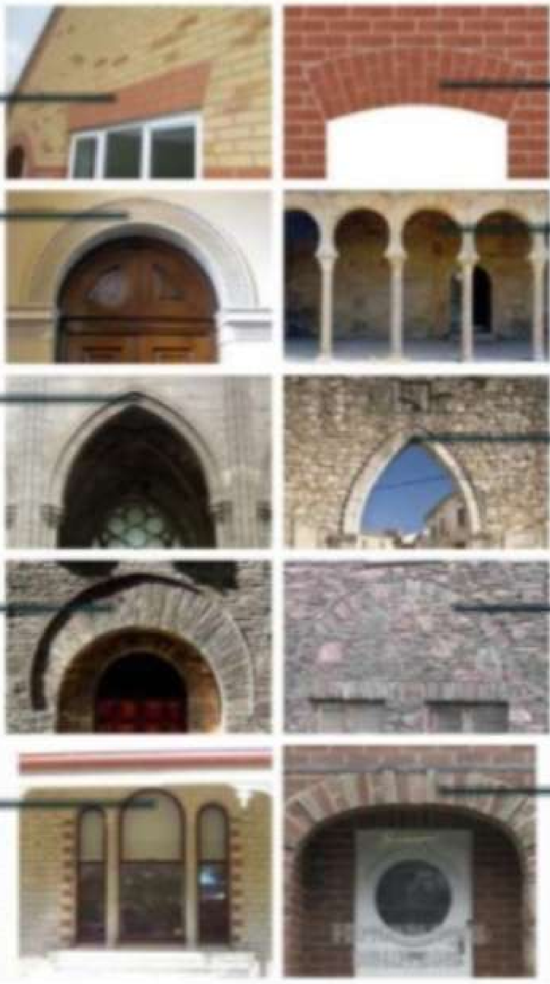
What is an Arch?

- An Arch is a structure constructed of wedge-shaped unit.
- It spans an opening to support the weight of the wall and other superimpose load.

Reference- B.C.Punmia
Google.com


Arches are classified according to:-
1. Shape
2. Number of Centers
3. Workmanship and Material Used
Reference- B.C.Punmia
Google.com

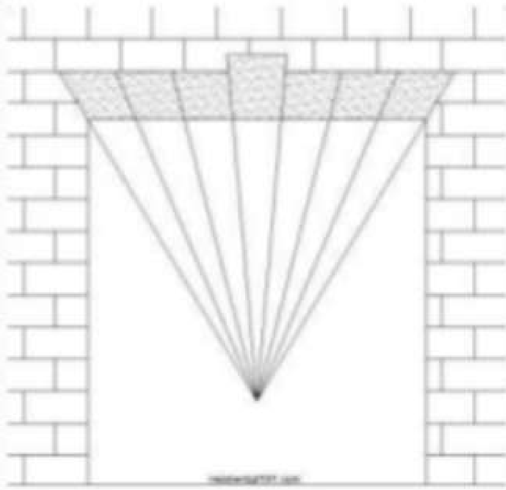
Classification According to Shape



Reference- B.C.Punmia
Google.com

Flat Arch

- Forms an equilateral triangle with intrados as base(at an angle of 60°)
- Used only for light loads
- Weakest Arch



Reference- B.C.Punmia
Google.com

Segmental Arch

- Center of Arch lies below springing line.
- Thrust transferred to the abutment is in inclined direction.
- Most Common type of Arch.

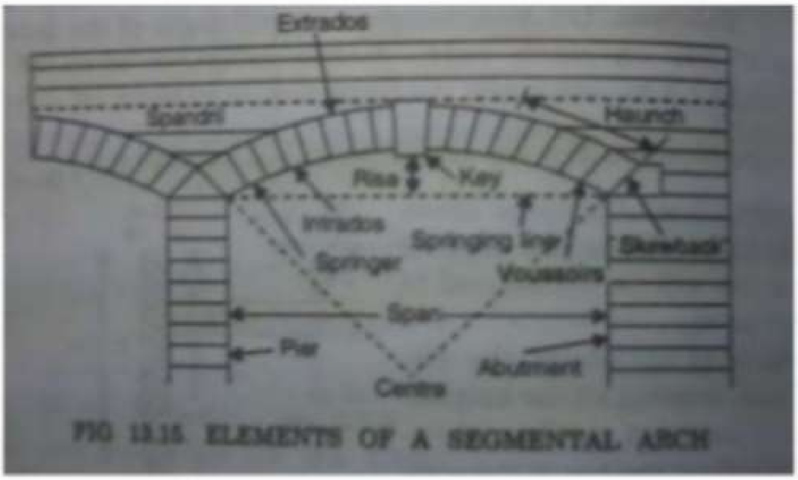
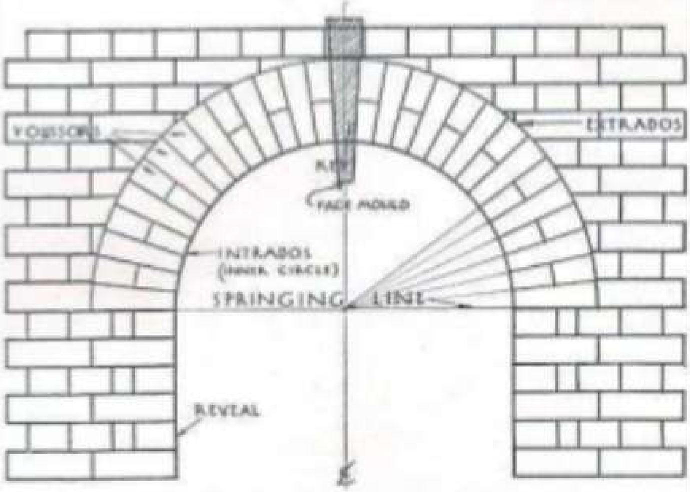


FIG 13.15 ELEMENTS OF A SEGMENTAL ARCH

Reference- B.C.Punmia
Google.com

Semi-circular Arch

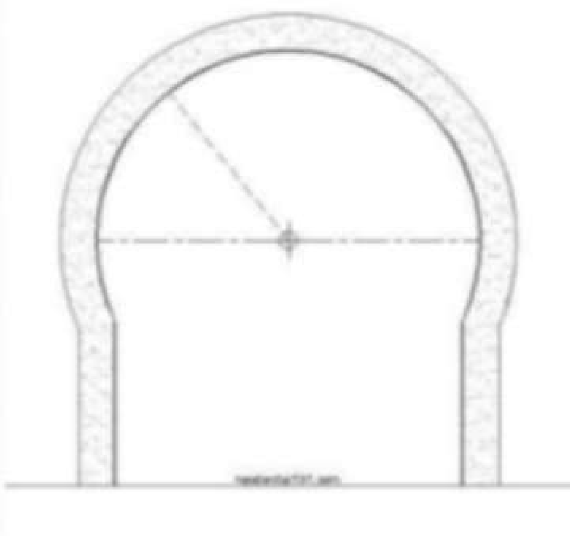
- Center Lie on Springing line
- Shape of the arch is Semi-circular
- Thrust transferred to the abutment is perfectly in vertical direction



Reference- B.C.Punmia
Google.com

Horse Shoe Arch

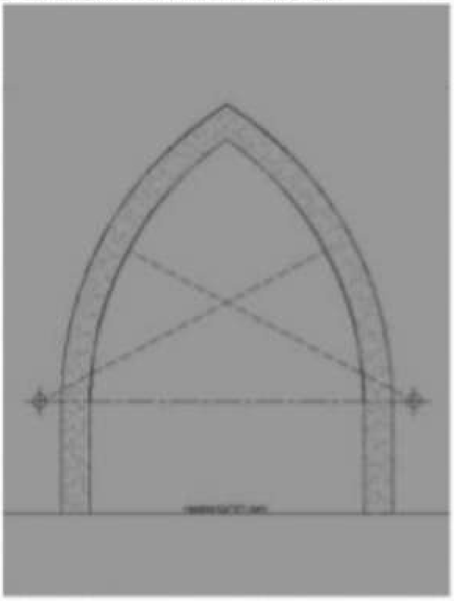
- The arch has the shape of a horse shoe.
- Incorporating more than a semi circle.
- Mainly use for Architectural consideration.



Reference- B.C.Punmia
Google.com

Pointed Arch

- Also known as Gothic Arch.
- It consist two arc of the circle meeting at apex.
- Triangle form may be equilateral or isosceles(also known as Lancet Arch).



Reference- B.C.Punmia
Google.com

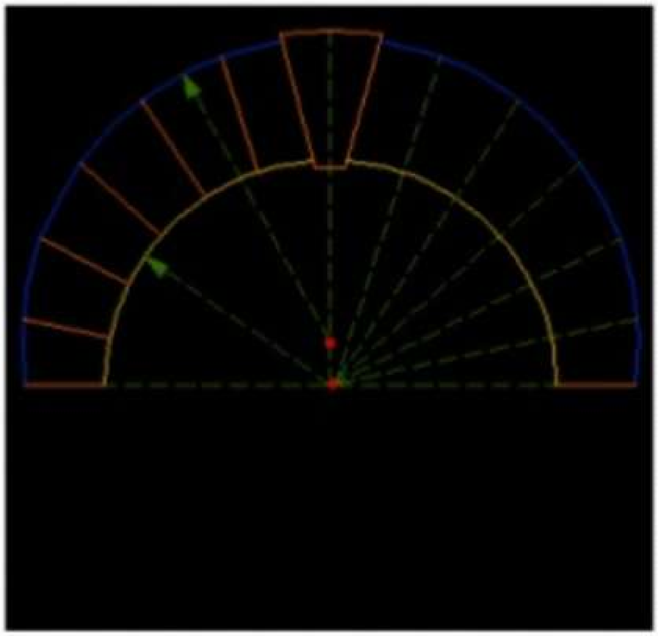
Venetian Arch

- This is another form of Pointed Arch.
- Has deeper depth at crown than springings.
- It Has four centers located on springing line.

Reference- B.C.Punmia
Google.com

Florentine Arch

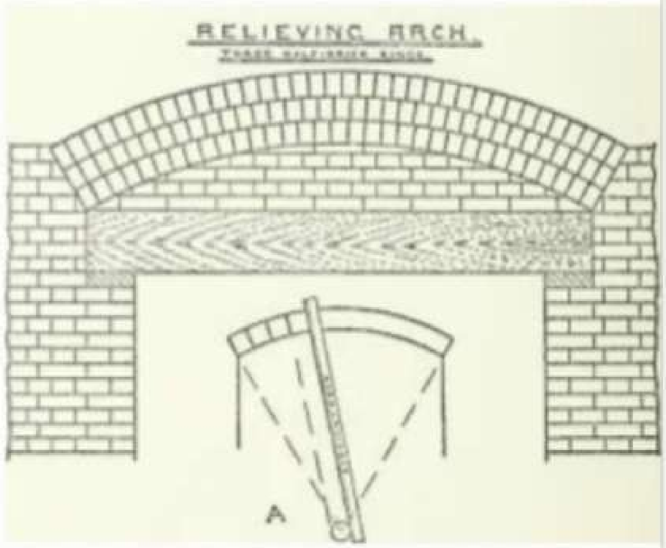
- This is similar to Venetian Arch.
- Its intrados is a semicircle.
- It has three centers located on springing line.



Reference- B.C.Punmia
Google.com

Relieving Arch

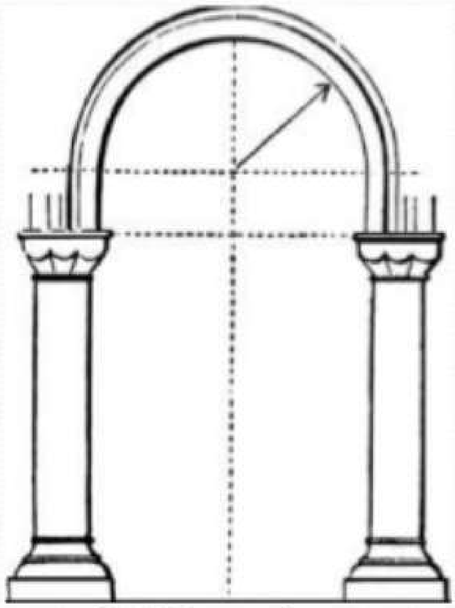
- The ends of Arch carried sufficiently into abutment.
- Its lintel can be replaced without effecting the Arch.
- The Arch is constructed on either flat arch or wooden lintel.



Reference- B.C.Punmia
Google.com

Stilted Arch

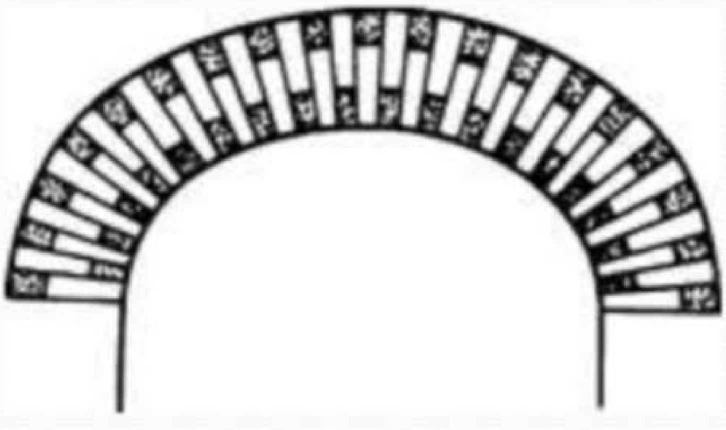
- An arch whose curve begins above the impost line.
- It consists a semi circular arch with two vertical portions at springings.
- The centre of the arch lies on the horizontal line.



Reference- B.C.Punmia
Google.com

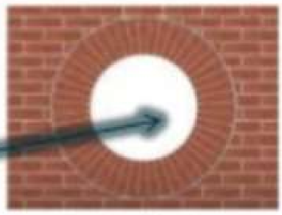
Semi-Elliptical Arch

- It has shape of semi-ellipse.
- It has either three centre or five centre.
- Also called a basket-handle arch.



Reference- B.C.Punmia
Google.com

Classification According to Number Of Centers



One-Centered Arch

Two-Centered Arch

Three-Centered Arch

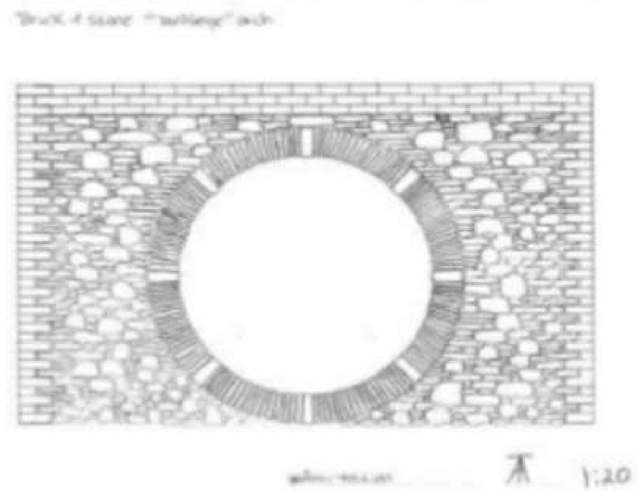
Four-Centered Arch

Five-Centered Arch

Reference- B.C.Punmia
Google.com

One-Centered Arch

- It has only one center.
- Segmental Arches, Semicircular Arches, Flat Arches, Horse Shoe Arches and Stilted Arches come under this Category.
- Sometimes full circular arch (Bulleye Arch) provided for circular windows.



Reference- B.C.Punmia
Google.com

Two-Centered Arch

- It has two centers.
- Pointed Arches comes under this category.
- Semi-elliptical arch and Florentine arch also comes under this category.

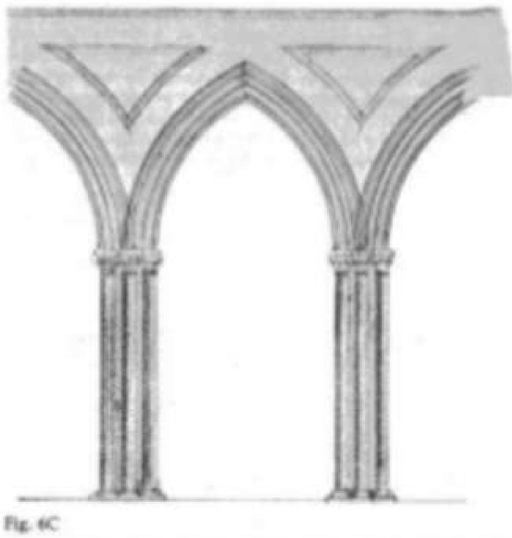


Fig. 6C

Reference- B.C.Punmia
Google.com

(3) SURFACE TREATMENT

- The surface treatment consists of application of layer of water repellant substances on the surface through which moisture enters.
- The use of water repellant metallic soaps such as Calcium & Aluminium Oletes and Stearates are effective against rain water penetration.
- Pointing & plastering of the exposed surfaces must be done carefully using water proofing agents like Sodium or Potassium silicates, Aluminium or Zinc sulphates, Barrium hydroxide and magnassium sulphate.
- Surface treatment is successful when moisture is superficial.

(4) Cavity Wall Construction

- In this method of damp prevention in which main wall of building is sheilded by an outer skin wall, leaving a cavity between the two.

(5) Guniting

- This consists of depositing layer of rich cement mortar by pressure to the exposed surface of wall, pipes.
- Cement mortar is 1:3 cement sand mix.
- Mortar is shot on clean surface with cement gun under 2 to 3 kg/cm2 pressure.
- Nozzle of machine is kept at a distance about 75 to 90 cm from wall.
- Curing of mortar is done for 10 days.

(6) Pressure Grouting

- In this method, cement grout is filled in cracks, voids in the structure of building by pressure.
- Foundation of building are subjected to grouting to make water-penetration-resistant.
- This method is effective to control entry of ground water through foundations

MATERIALS FOR DPC

- Ideal DPC should have following quality:
- Should be perfectly impervious
- Should not permit moisture penetration
- Material should be durable with life equal to building life.
- Material should be strong to resist superimposed load/ pressure.
- Material should be flexible to accommodate the structural movements without any craks.
- Material should not be costly.
- Material should remain steady in its position.

MATERIALS FOR DPC

(1) Hot bitumen:

- This is highly flexible.
- Can be applied with a minimum thickness of 3 mm.
- It is placed on bedding of concrete in hot condition

MATERIALS FOR DPC

(2) Mastic Asphalt

- It is made by mixing bitumen & sand & mineral fillers
- It is semi rigid material.
- It is squeezed out in hot climate or under pressure.

MATERIALS FOR DPC

(3) Bituminous Asphalt:

- It is ready made roll of dry asphalt sheets
- It is laid on levelled flat layer of cement mortar.
- An overlap 10 cm provided at joints.
- The laps is sealed with bitumen.
- It can not resist heavy load.
- It can accommodate slight movement.

MATERIALS FOR DPC

(4)
Metal Sheets

- Sheets of lead,copper,aluminium is used as DPC.
- Lead sheet is more flexible.
- Thickness of sheet should be such that its weight is not kless than 20 kg/m2.
- They are laid similar to bitumnous felts.
- Lead sheet is completely impervious, resistant to atmospheric corrosion, can take complex shaperesistant to sliding action.

MATERIALS FOR DPC

(5) Combination of sheets & bituminous felts

- Lead foils sandwiched between asphaltic or bitumious felts cabn be used as DPC.
- The combination known as Lead Core can be laid easily, is durable, efficient,economic & resistant to cracks.

MATERIALS FOR DPC

(6) Bricks

- Special bricks, having water absorption not less than 4.5 % of their weight can be used as DPC where dampness is excessive.
- Bricks are laid in 2 to 4 courses in cement mortar.
- The joints of bricks are kept open.

MATERIALS FOR DPC

(7) Stones

- Dense & sound stones, such as granite, trap,slates etc are laid in cement mortar 1:3 in two layer to form effective DPC.

- Stone should be extended to full width of wall.

MATERIALS FOR DPC

(8) Mortar

- Cement mortar 1:3 is used as bedding layer for housing other DPC.
- Small quantity of lime may be added to increase workability of mortar.
- In water used for mixing, 75 gm soap is dissolved per liter of water.
- This Mortar can be used for plaster of outer walls

MATERIALS FOR DPC

(9) Cement Concrete

- Concrete 1:2:4 mix or 1:11/2:3 mix is provided at plinth level to work as DPC.
- The thickness may vary from 4 cm to 15 cm.
- This layer prevent water rise in wall by capillary action.
- Where dampness is more two layer can be made.

MATERIALS FOR DPC

(10) Plastic sheets

- This is new type of DPC material made of black polythene sheet of 0.5 mm to 1 mm thickness.
- Available in 30 m length in market.
- The treatment is cheaper but not permanent.

DPC Treatment in Buildings

(1) Treatment to foundations against gravitational water :

- Foundation may receive water percolating from adjacent ground and this moisture may rise in walls.
- This can be checked by providing air drain parallel to the external wall.
- The width of air drain may be about 20 to 30 cm.
- The outer wall of the drain is kept above ground to check the entry of surface water.
- RCC cover is provided
- Openings with gratings are provided at regular interval for passage of air.
- Usual DPC are also provided horizontally and vertically.

(2) Treatment to basements

a) Provision of foundation drains and DPC.

- When basement rests on soils which are not properly drained, (such as peat soil) great hydrostatic pressure is exerted and the floor as well as wall receive water continuously oozing out.
- In such case it is necessary to make a trench all around upto foundation level & fill it with gravel, coke,
- Open jointed drains may be provided to collect the underground water.
- Drainage pipes,embeded in gravel bed, may also be provided before foundation concrete.
- Horizontal & vertical DPC are provided in wall as well as foundation concrete.
- Drain may have suitable longitudnal slope,ultimately draining water into catch drain.
- Drain pipes under basement slab may be provided at some interval.

(2) Treatment to basements

b) Provision of RCC raft

Dampness :-

- Dampness is presence of hygroscopic moisture .
- Dampness in building leads to unhealthy condition and unsafe from structural point of view.
- It is serious detoriation of stability of structure .
- To check the entry of water or moisture into building, Damp proof coarse is plated at various levels of building.
- Now a days, all building are provided with damp proof coarse to prevent dampness from affecting a building and person living in building.

Sources of Dampness

1. Geological and climatic sources
2. Structural sources
3. Use of poor materials in construction

The Two Point Problem

- In this problem, two well-defined points whose positions have already been plotted on the plan are selected. Then, by perfectly bisecting these points, a new station is established at the required position.

The Two Point Problem

- Suppose P and Q are two well-defined points whose positions are plotted on map as p and q. It is required to locate a new station at A by perfectly bisecting P and Q
- An auxiliary station B is selected at a suitable position. The table is set up at B, and leveled and oriented by eye estimation. It is then clamped.
- With the alidade touching p and q, the points P and Q are bisected and rays are drawn. Suppose these rays intersect at b

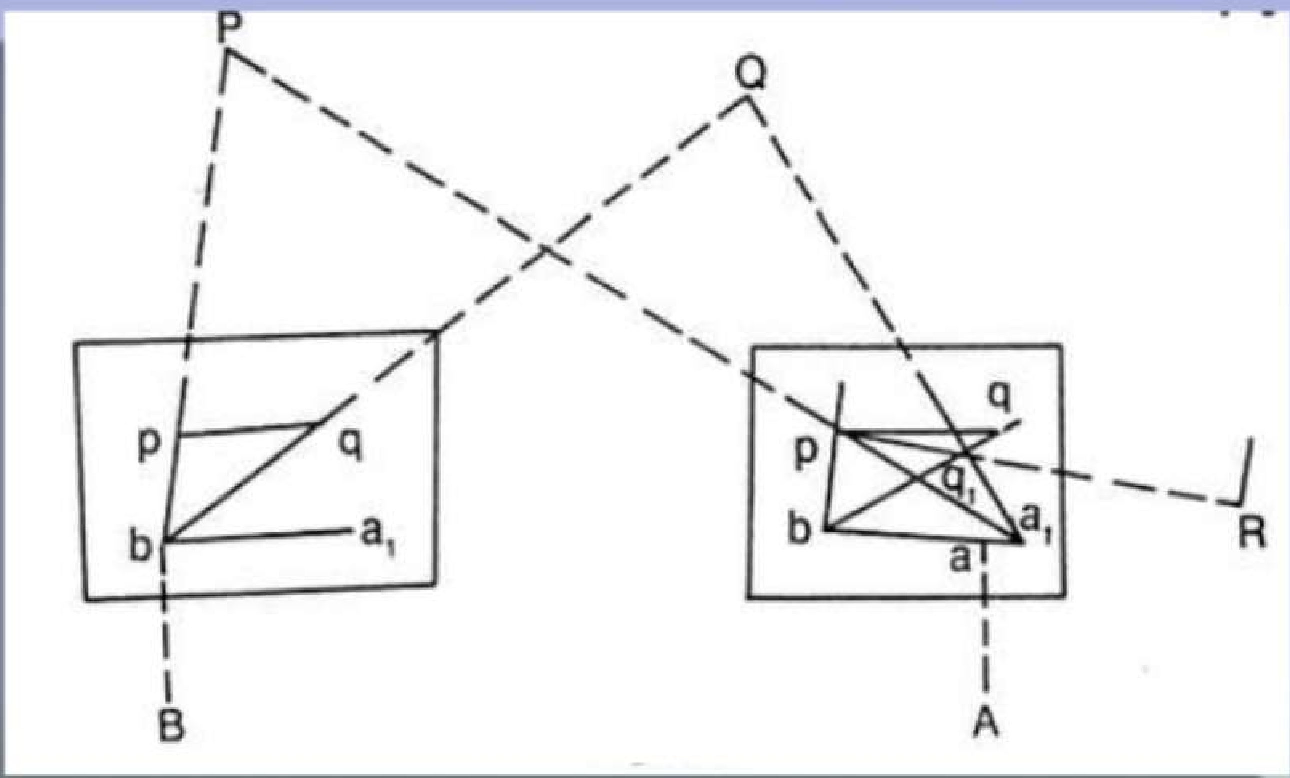
The Two Point Problem

- With the alidade centre on b, the ranging rod at A is bisected and rays is drawn. Then, by eye estimation, a point a_1 is marked on this ray.
- The table is shifted and centre on A with a_1 just over A. It is leveled and oriented by back sighting. With the alidade touching p, the point P is bisected and a ray is drawn. Suppose this ray intersects the line ba_1 at point a_1, as was assumed.

The Two Point Problem

- With the alidade centered on a_1 the point Q is bisected and a ray is drawn. Suppose this ray intersects the ray bq at a point q_1. The triangle pqq_1 is known as the triangle of error, and is to be eliminated.
- The alidade is placed along the line pq_1 and a ranging rod R is fixed at some distance from the table. Then, the alidade is placed along the line pq and the table is turned to bisect R. At this position the table is said to be perfectly oriented.
- Finally, with the alidade centered on p and q, the points P and Q are bisected and rays are drawn. Suppose these rays intersect at a point a. This would represent the exact position of the required station A. Then the station A is marked on the ground.

The Two Point Problem



The Three Point Problem

- In this problem, three well defined points are selected, whose position have already been plotted on the map. Then, by perfectly bisecting these three well-defined points. A new station is established at the required position.
- No auxiliary station is required in order to solve this problem. This table is directly placed at the required position. The problem may be solved by following methods
- (a) Bessel's method
- (b) Mechanical Method
- (c) The trial and error method

The Three Point Problem

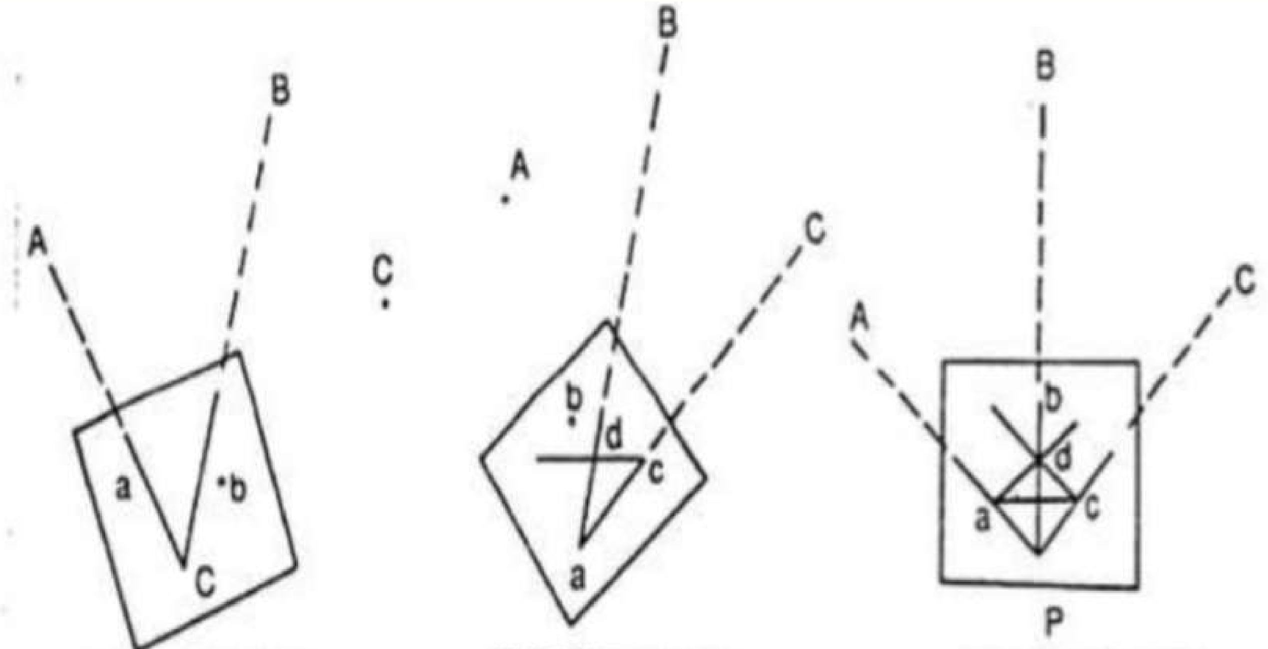
The graphical method or Bessel's method

- (i) suppose A,B, and C are three well-defined points which have been plotted as a, b and c. Now it is required to locate a station at P.
- (ii) The table is placed at the required station P and leveled. The alidade is placed along the line ca and the point A is bisected. The table is clamped. With the alidade in centre on C, the point B is bisected and rays is drawn

The Three Point Problem

- Again the alidade is placed along the line ac and the point C is bisected and the table is clamped. With the alidade touching a, the point B is bisected and a ray is drawn. Suppose this ray intersects the previous ray at a point d
- The alidade is placed along db and the point B is bisected. At this position the table is said to be perfectly oriented. Now the rays Aa, Bb and Cc are drawn. These three rays must meet at a point p which is the required point on the map. This point is transferred to the ground by U-fork and plumb bob.

Bessel's Method



1ST OPERATION
(a)

2ND OPERATION
(b)

3rd OPERATION
(c)

The Three Point Problem

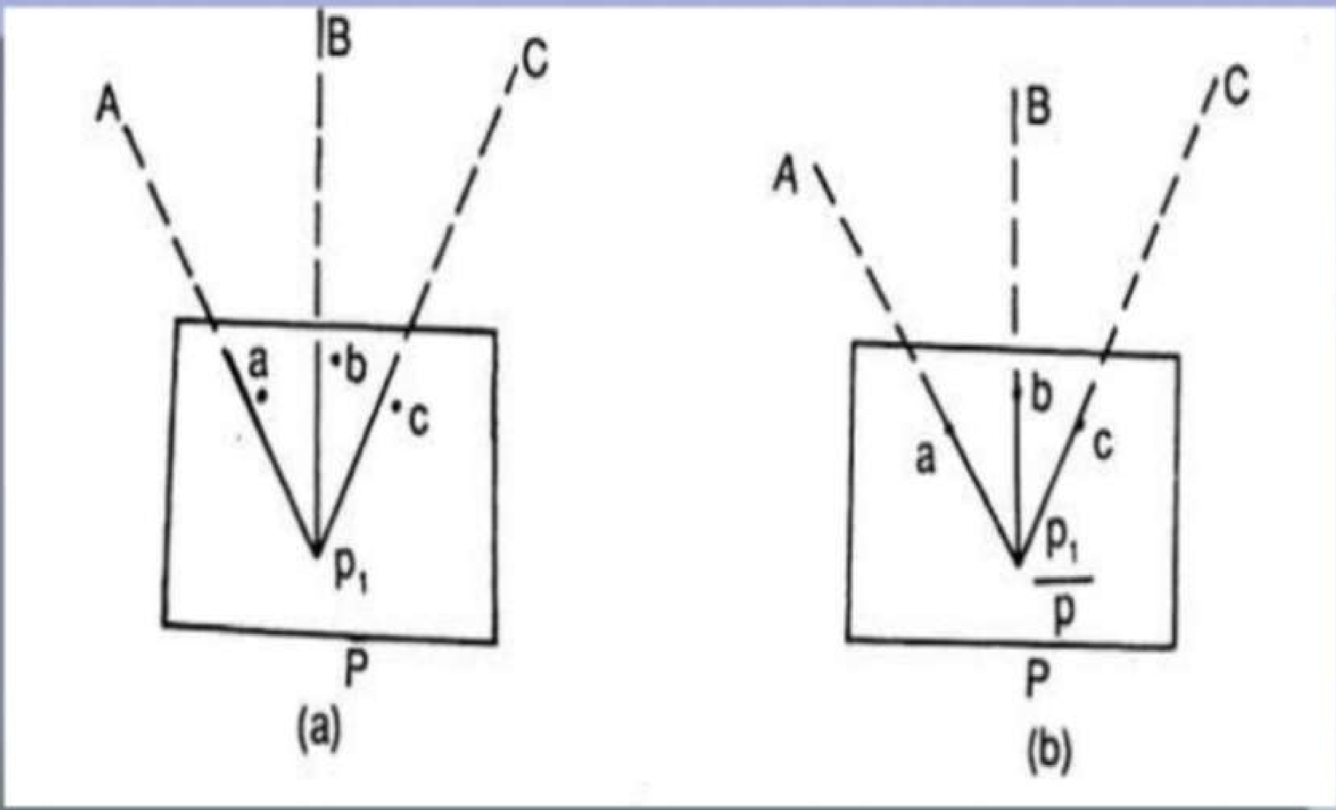
The Mechanical Method

- Suppose A, B and C are the three well-defined points which have been plotted on the map as a, b and c. It is required to locate a station at P.
- The table is placed at P and leveled. A tracing paper is fixed on the map and a point p is marked on it.
- With the alidade centered on P the points A, B and C are bisected and rays are drawn. These rays may not pass through the points a, b and c as the orientation is done approximately

The Three Point Problem

- Now a tracing paper is unfastened and moved over the map in such a way that the three rays simultaneously pass through the plotted positions a, b and c. Then the points p is pricked with a pin to give an impression p on the map. P is the required points on the map. The tracing paper is then removed.
- Then the alidade is centered on p and the rays are drawn towards A, B and C. These rays must pass through the points a, b and c

The Mechanical Method

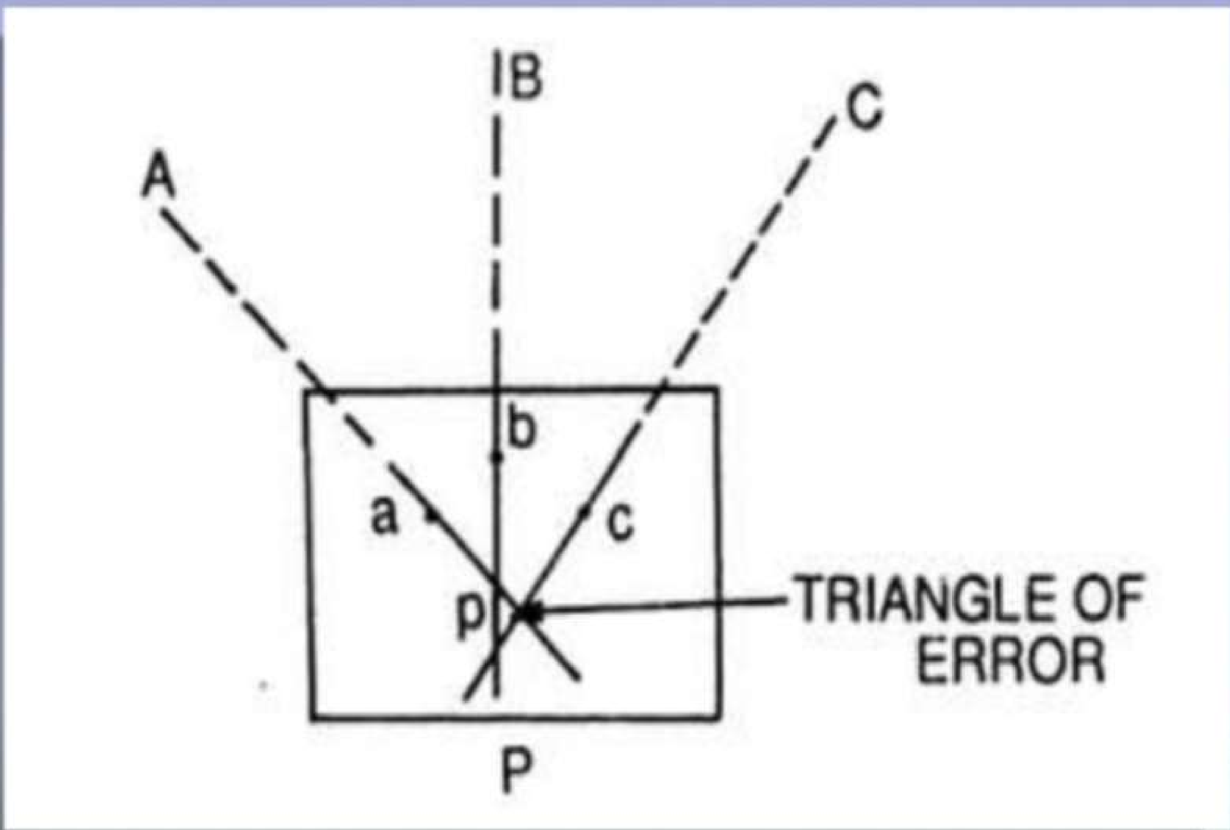


The Three Point Problem

The method of Trial and error

- Suppose a, B and C are the three well-defined points which have been plotted as a, b and c on the map. Now it is required to establish a station at P.
- The table is set up at P and leveled. Orientation is done by eye estimation
- With the alidade, rays Aa, Bb and Cc are drawn. As the orientation is approximately, the rays may not intersect at a point, but may form a small triangle the triangle of error.
- To get the actual point, this triangle of error is to be eliminated. By repeatedly turning the table clockwise or anticlockwise. The triangle is eliminated in such a way that the rays Aa, Bb and Cc finally meet at a point p. This is the required point on the map. This point is transferred to the ground by U-fork and plumb bob.

The method of Trial and Error



GENERAL

The formation of the chemically treated soil barrier shall be accomplished in stages as the building construction work progresses and due care shall be exercised to ensure that each stage of treatment is well integrated with that previously applied so that no unprotected avenues of entry are left open to th termites.

All work shall in general be executed as specified in IS: 6313 Part II-2001 and a per approved specification of the agency having special know-how for the job

The Contractor shall furnish all tools, plant, instruments, qualified supervisor staff, labour, materials, any temporary works, consumables and everything necessary, whether or not such items are specifically stated herein, for completion of the job in accordance with the specification requirements.

Indian Standards to be followed are

1) IS 4015 (Part-I & II) - Guide for handling cases of pesticide poisoning.

2) IS 6313 (Part-I) - Code of practice for Anti- termite measures in buildings constructional measures

3) IS 6313 (Part - II) - Code of practice for anti-termite measures in Building (pre constructional chemical treatment)

4) IS 8944 - Specification for Chloropyrifos Emulsified concentrates.

5) IS 632 - Specification for Lindane

Site preparation

In order to ensure uniform distribution of the chemical emulsion and to assist penetration, the following site preparation shall be carried out:

- a) Remove all trees, stumps, logs or roots from the building site.
- b) Remove all concrete form work if left anywhere, leveling pegs, timber off-cuts and other building debris from the area to be treated.
- c) If the soil to be treated is sandy or porous, preliminary moistening will be required to fill capillary spaces in soil in order to prevent the loss of emulsion through piping or excessive percolations.
- d) In the event of water logging of foundation, the water shall be pumped out before application of chemical emulsion and it should be applied only when the soil is absorbent.
- e) On clays and other heavy soils where penetration is likely to be slow and on sloping sites, where run-off of the treating solution is likely to occur, the surface of the soil should be scarified to a depth of 75mm at least.

What are Termites?

ermites are a group of eusocial insects that reside inside earth and eed on wood and can be highly destructive to trees and timber.

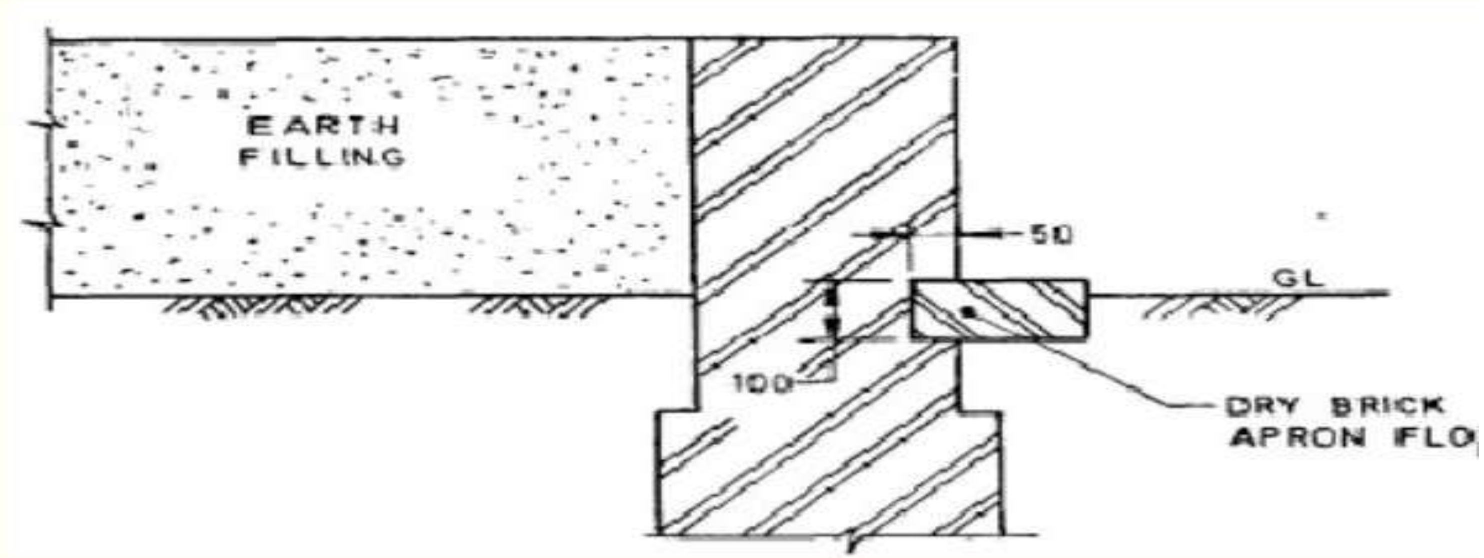
Termites

Termite Damages


Termite damage indoors on walls
Termite holes on wood
Termite destruction of wooden Doors
Termi
nest
wall
SECURE PVT.

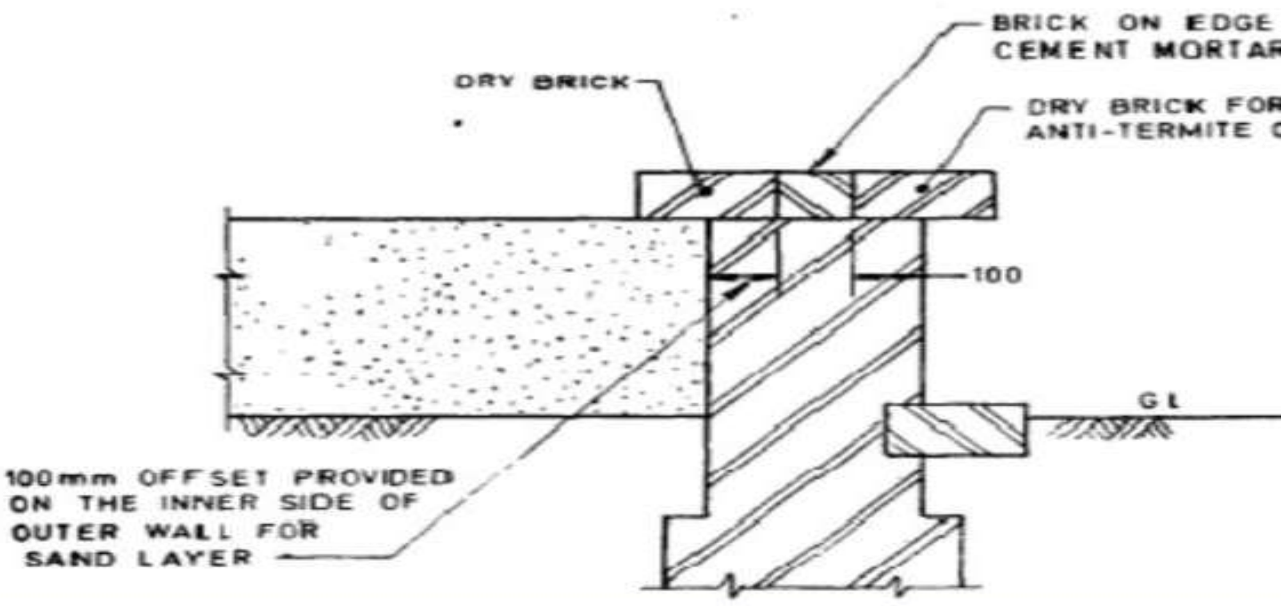
Anti Termite Construction Stage-1

Earth free from roots, dead leaves, or other organic matter shall be placed and compacted in successive horizontal layers of loose material not more than 200 mm thick. Dry brick shall be inserted at least 50 mm in brick masonry for providing apron floor alround the periphery



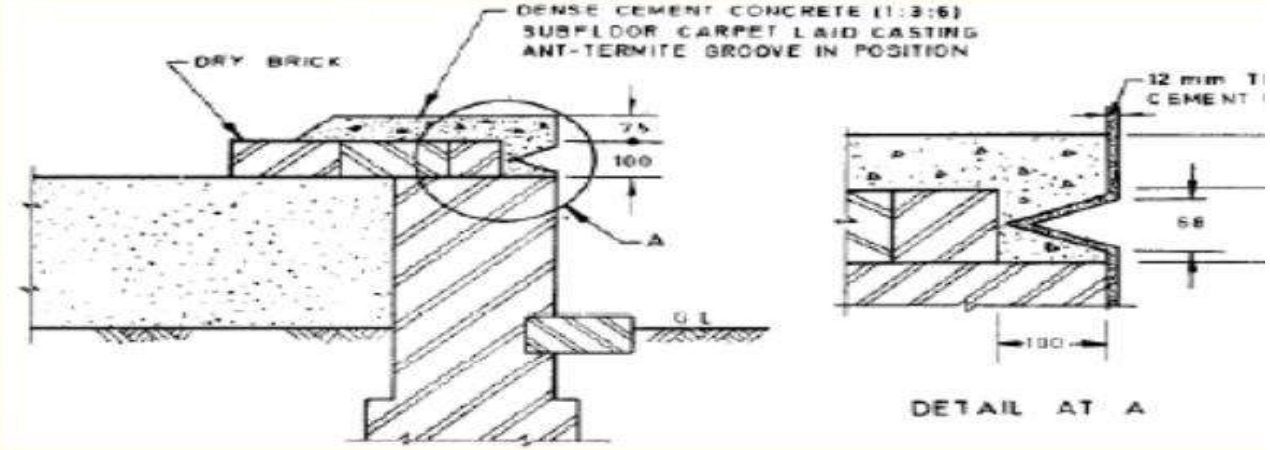
Anti Termite Construction Stage-2

Brick on edge masonry in cement mortar shall be laid on the plinth wall. Dry brick shall be placed on the inner side of plinth wall for getting anticipated offset space for coarse sand and on the other side for installing anti-termite masonry groove. In the case of intermediate walls, dry bricks are placed on either side of the brick on edge masonry for getting offset space for coarse



Anti Termite Construction Stage-3

The dry brick for the anti-termite groove shall be taken out and dense cement concrete 1 : 3 : 6 (1 cement : 3 sand : 6 coarse aggregate, by volume) sub-floor carpet shall be laid casting the anti-termite groove in position. In case of internal partition walls, the cement concrete subfloor shall be laid on either side over the dry bricks to sufficient extent for getting staggered vertical



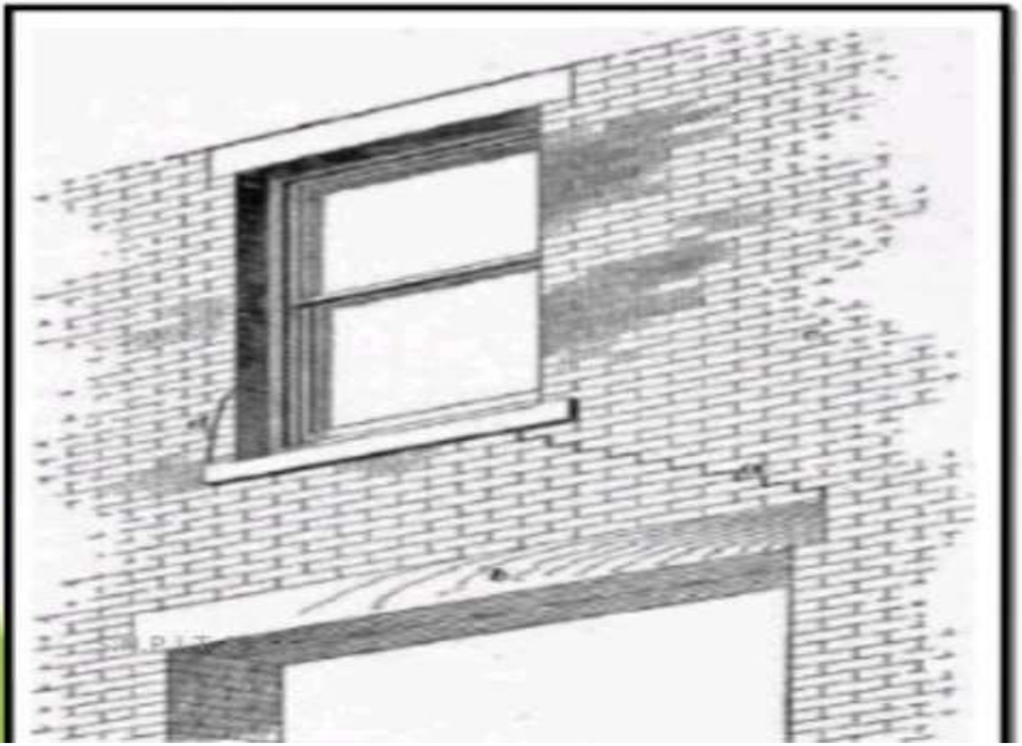
Necessity of Anti-termite measures

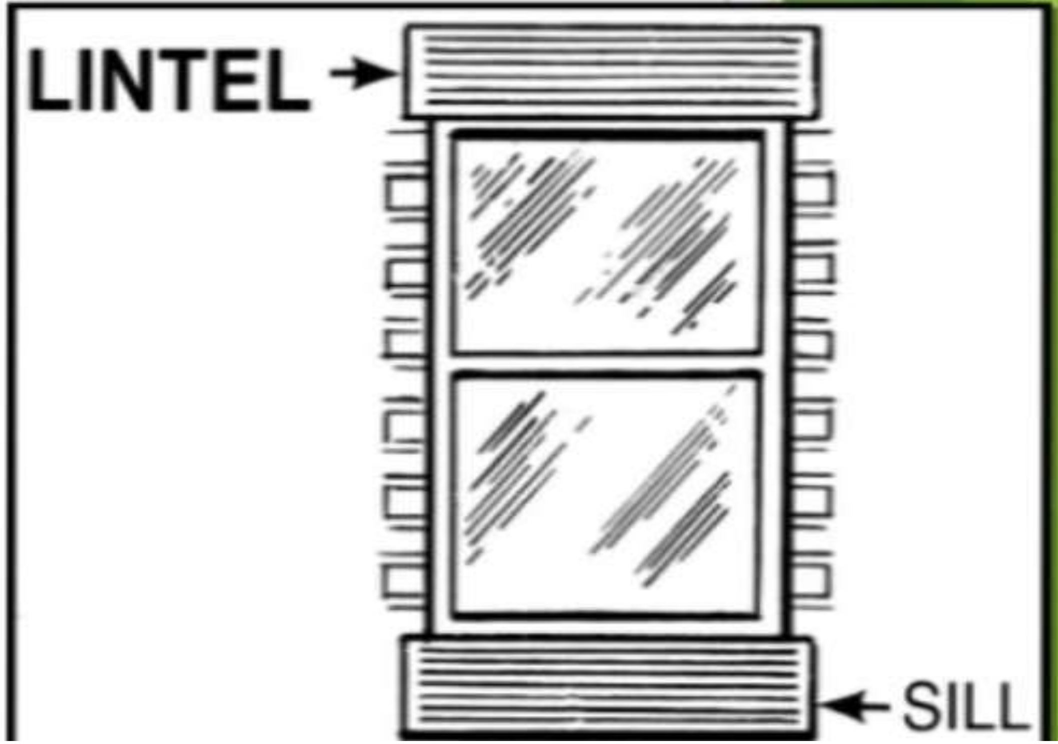
Termite control in buildings is very important as the damage likely to be caused by the termites is huge. Wood is one of the cellulosic materials which termites damage, cellulose forming their basic nutrient.

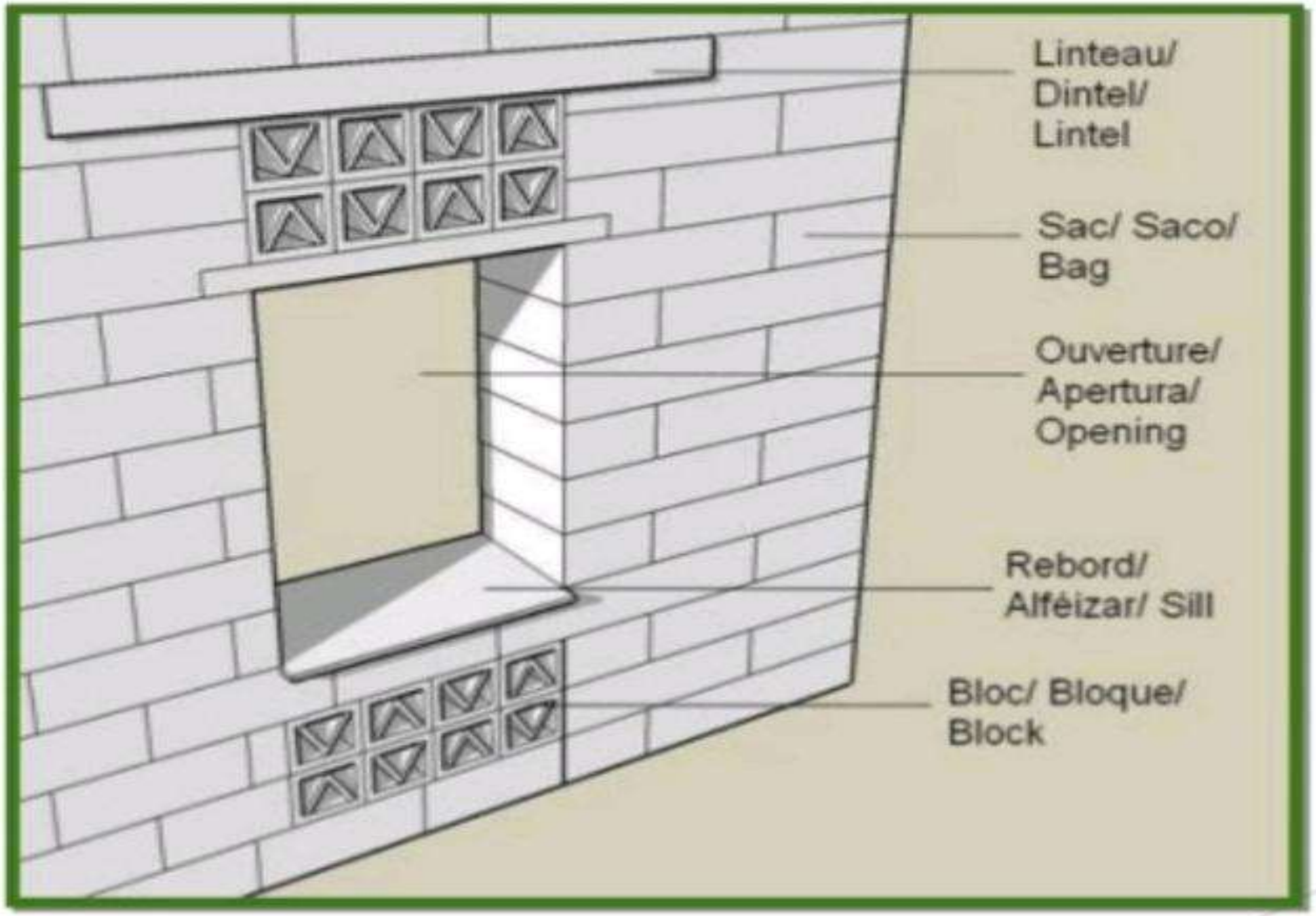
Termites are also known to damage non-cellulosic substance in their search for food. Rubber, leather, plastic, neoprene as well as lead coating used for covering of underground cables are damaged by termites.

Introduction

- A lintel is defined as a horizontal structural member which is placed across the opening.






Linteau/
Dintel/
Lintel
Sac/ Saco/
Bag
Ouverture/
Apertura/
Opening
Rebord/
Alféizar/ Sill
Bloc/ Bloque/
Block

Lintels are classified into the following types, according to the materials of their construction:

- [1] Timber lintels
- [2] Stone lintels
- [3] Brick lintels
- [4] Reinforced Brick lintels
- [5] Steel lintels
- [6] Reinforced cement concrete lintels

Timber lintels

- Easily available in hilly area.
- Relatively costly, structurally weak and valnerable to fire.
- Easily decay, if not properly taken care.

TIMBER LINTEL

Stone lintels

- Used , where stones are easily available.
- Consists of a simple stone slab of greater thickness.
- Due to high cost and its inability to with stand the transverse stress load.

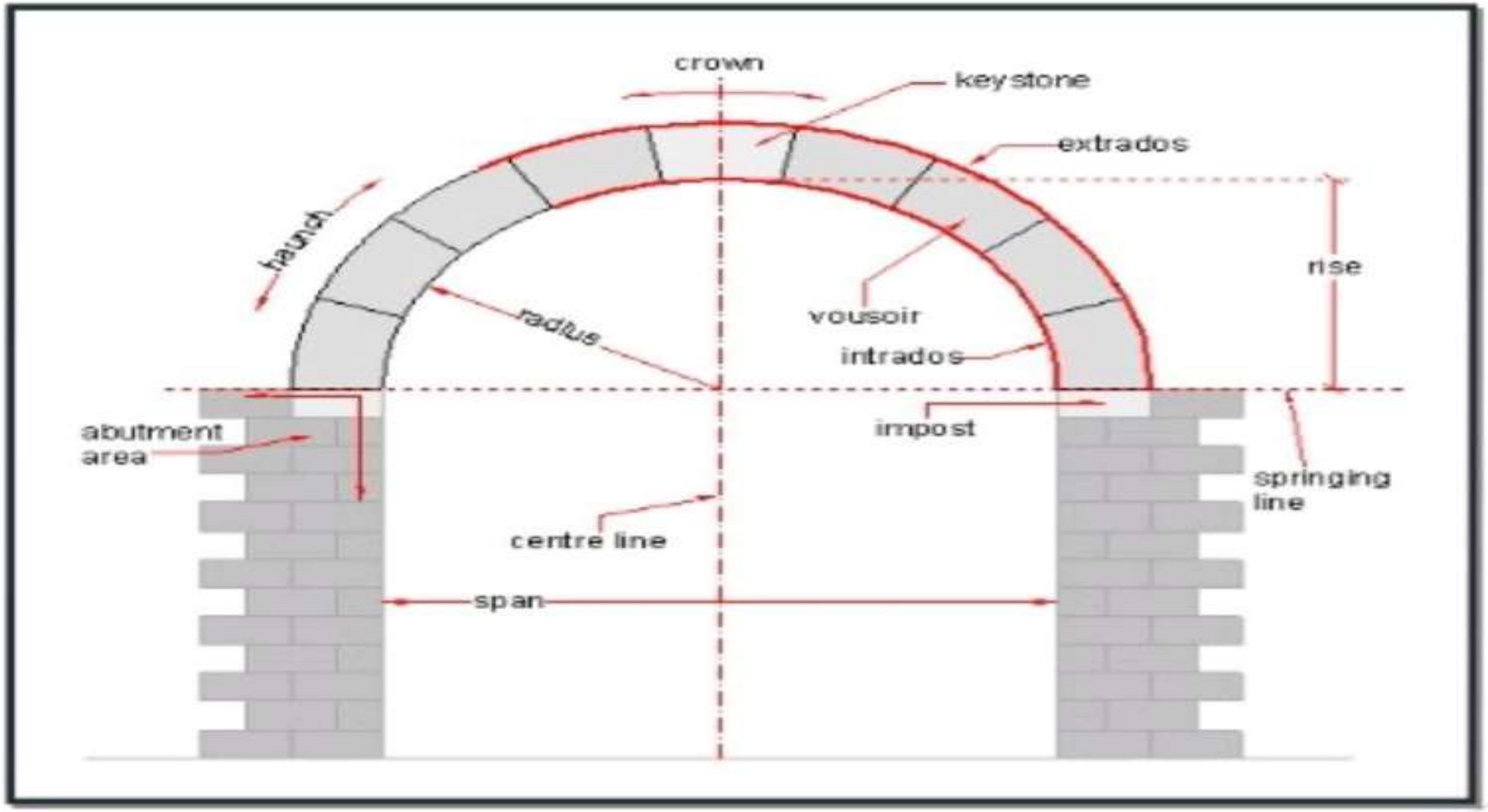
STONE LINTEL

Brick lintels

- The brick are hard, well burnt , first class bricks .
- Suitable for small span.
- The bricks having frogs are more suitable.

ARCHES

- The structure constructed of wedge shaped block of stones or bricks ,jointed together with mortar and provided across the opening to carry the weight of the structure above the opening.



ELEMENTS OF ARCHES

TECHNICAL TERMS

The various technical terms used in arches are as follows:-

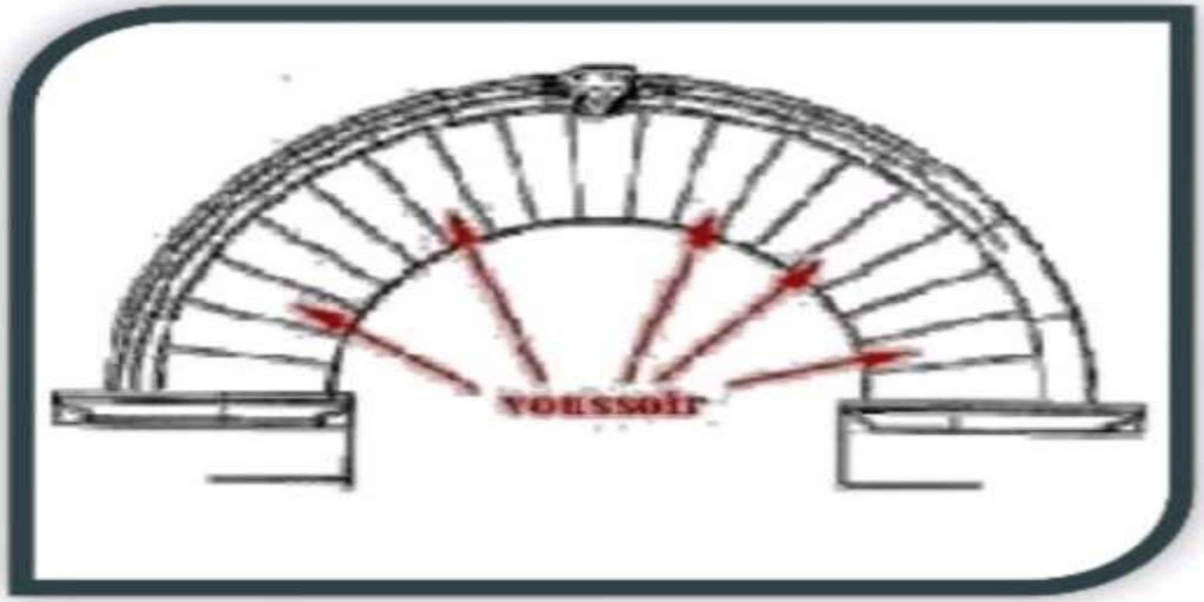
)Abutment:-This is the end support of an arches.

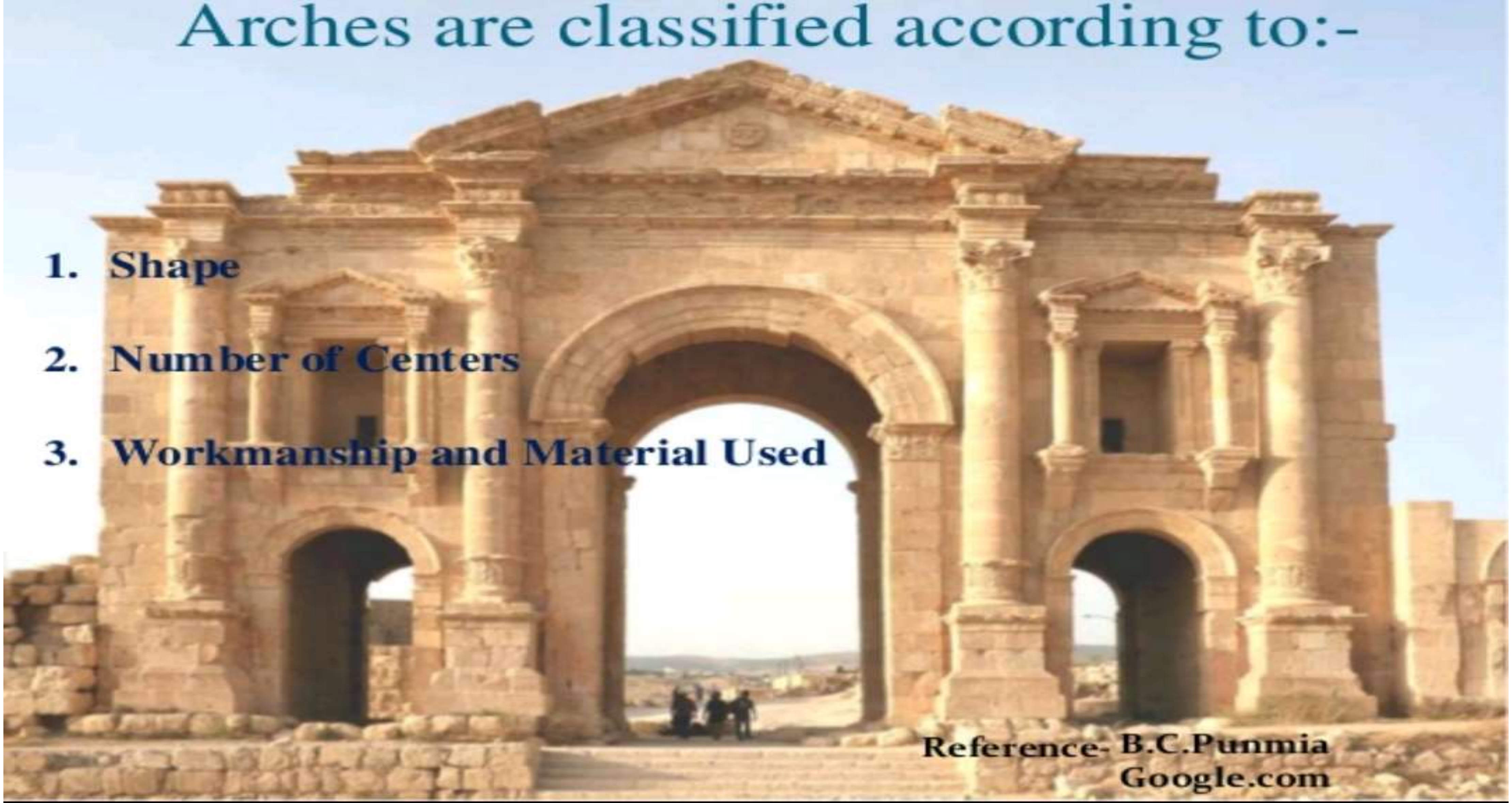
2)Pier:-This is support an intermediate of an arch.

3)Intrados :-This is the inner curve or surface of an arch.

4)Extrados :-This is the outer curve or surface of the arches.

5)Voussoirs :-The voussoirs or arch stones are the wedge shaped units forming the arch.




Arches are classified according to:-
1. Shape
2. Number of Centers
3. Workmanship and Material Used
Reference- B.C.Punmia
Google.com

Classification According to Shape

Reference- B.C.Punmia
Google.com

Function of lintels

Followings are the function of lintel beams:

1. Lintel supports the walls above the openings like doors, windows etc.
2. Lintels provide a safeguard of the windows and doors.
3. Lintel withstands the imposed loads coming from above bricks or block including the roofing members.
4. The lintel is used to transfer all imposed loads to the side walls.
5. Sometimes lintels are used as decorative architecture element.

BUILDINGS & BUILDING PLANNING

CONSIDERATION IN BUILDING DESIGN:-

- CLIMATES & ITS EFFECT.
- PEOPLE & THEIR REQUIREMENT.
- MATERIALS FOR CONSTRUCTION.
- REGULATIONS & BYE- LAWS OF SANCTIONING AUTHORITIES.

TYPES OF BUILDINGS:-

- GROUP A- RESIDENTIAL BUILDINGS.
- GROUP B- EDUCATIONAL BUILDINGS.
- GROUP C- INSTITUTIONAL BUILDINGS.
- GROUP D- ASSEMBLY BUILDINGS.
- GROUP E- BUSINESS BUILDINGS.
- GROUP F- MERCENTILE BUILDINGS.
- GROUP G- INDUSTRIAL BUILDINGS.
- GROUP H- STORAGE BUILDINGS.
- GROUP J- HAZARDOUS BUILDINGS.

SITE SELECTION

- SITE SHOULD PREFERABLY BE SITUATED ON AN ELEVATED AND LEVELLED GROUND.
- IT SHOULD NOT BE LOCATED IN A FLOOD PRONE AREA.
- THE SOIL AT SITE SHOULD HAVE GOOD VALUE OF BEARING CAPACITY.
- THE SITE SHOULD NOT BE IRREGULAR IN SHAPE. THE SITE SHOULD BE RECTANGULAR OR SQUARE IN SHAPE.
- THE SITE SHOULD BE LOCATED IN DEVELOPED AREA.

BUILDING BYE-LAWS:-

THE VARIOUS ASPECTS OF BUILDING ACTIVITIES COVERED BY BYE-LAWS ARE UNDER:

- DISTANCE FROM ELECTRIC LINES
- SET BACKS IN A PLOT.
- BUILT UP AREA LIMITATIONS.
- NORMS RELATED TO HEIGHT OR SIZES OF ROOMS.
- LIGHTING & VENTILATION OF ROOMS.
- BUILDING SERVICES.

MINIMUM HEIGHTS OF DIFFERENT PARTS OF BUILDINGS:-

- HABITABLE ROOMS- 2.75 M.
- KITCHEN- 2.75 M.
- BATH ROOMS- 2.4 M.
- WC – 2.4 M.
- PLINTH LEVEL- 30 CM.

MINIMUM SIZES OF DIFF. PARTS OF BUILDINGS:-

- HABITABLE ROOMS-

  MIN WIDTH:- 2.4 M.

  MIN AREA :- 9.5 SQ.M
- DRAWING ROOM-

  MIN WIDTH:- 3 M.

  MIN AREA :- 11 SQ.M
- STUDY ROOM -

  MIN WIDTH:- 2.4 M.

  MIN AREA :- 9.5 SQ.M

LIGHTING & VENTILATION OF ROOMS:-

- 1/10th OF FLOOR AREA IN DRY HOT CLIMATE.
- 1/6TH OF FLOOR AREA IN WET HOT CLIMATE.
- AREA OF DOORS & WINDOWS IN A ROOM IS NOT LESS THAN 1/7TH OF FLOOR AREA.

BUILT UP AREA LIMITATION:-

BUILTUP AREA OR COVERED AREA OF A BUILDING ON GROUND-

PLOT AREA- AREA OF OPEN SPACES AROUND THE BUILDING.

F.A.R (FLOOR AREA RATIO):-

$$F.A.R = \frac{\text{COVERED AREA OF ALL FLOORS}}{\text{PLOT AREA}}$$

BUILDING SERVICES:-

- **Water Supply Requirements for Buildings**

Water Supply for Residences:-

a) A minimum of 70 to 100 litres per head per day for domestic needs of urban communities.

b) For communities with population upto 20000 and without flushing system:

1) water supply through = 40 lphd, *Min* standpost.

2) water supply through = 70 to 100 lphd house. service connection

WATER SUPPLY REQUIREMENTS FOR BUILDINGS

c) For communities with population 20000 to100000 together with full flushing system.

= 100 to 150 lphd.

d) For communities with population above 100000 together with full flushing system.

= 150 to 200 lphd.

- Out of the 150 to 200 litres per head per day,

45 litres per head per day may be taken for flushing requirements and the remaining quantity for other domestic purposes.

BUILDINGS & BUILDING PLANNING

CONSIDERATION IN BUILDING DESIGN:-

- CLIMATES & ITS EFFECT.
- PEOPLE & THEIR REQUIREMENT.
- MATERIALS FOR CONSTRUCTION.
- REGULATIONS & BYE- LAWS OF SANCTIONING AUTHORITIES.

TYPES OF BUILDINGS:-

- GROUP A- RESIDENTIAL BUILDINGS.
- GROUP B- EDUCATIONAL BUILDINGS.
- GROUP C- INSTITUTIONAL BUILDINGS.
- GROUP D- ASSEMBLY BUILDINGS.
- GROUP E- BUSINESS BUILDINGS.
- GROUP F- MERCENTILE BUILDINGS.
- GROUP G- INDUSTRIAL BUILDINGS.
- GROUP H- STORAGE BUILDINGS.
- GROUP J- HAZARDOUS BUILDINGS.

SITE SELECTION

- SITE SHOULD PREFERABLY BE SITUATED ON AN ELEVATED AND LEVELLED GROUND.
- IT SHOULD NOT BE LOCATED IN A FLOOD PRONE AREA.
- THE SOIL AT SITE SHOULD HAVE GOOD VALUE OF BEARING CAPACITY.
- THE SITE SHOULD NOT BE IRREGULAR IN SHAPE. THE SITE SHOULD BE RECTANGULAR OR SQUARE IN SHAPE.
- THE SITE SHOULD BE LOCATED IN DEVELOPED AREA.

BUILDING BYE-LAWS:-

THE VARIOUS ASPECTS OF BUILDING ACTIVITIES COVERED BY BYE-LAWS ARE UNDER:

- DISTANCE FROM ELECTRIC LINES
- SET BACKS IN A PLOT.
- BUILT UP AREA LIMITATIONS.
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= 150 to 200 lphd.

- Out of the 150 to 200 litres per head per day,

45 litres per head per day may be taken for flushing requirements and the remaining quantity for other domestic purposes.

WATER PROOFING IS THE METHOD OF CREATING A PROTECTIVE LAYERING AROUND THE BUILDING PREVENTING THE WATER FROM SEEPING INTO THE BUILDING. WATER PROOFING IN BASEMENTS IS CARRIED OUT SO AS TO PREVENT THE INTRUSION OF FLUIDS OR SMELLS INTO THE BASEMENTS. WATER INTRUSION DAMAGES STRUCTURAL ELEMENTS. THE IMPORTANT ELEMENTS OF WATERPROOFING ARE SOIL, CONCRETE (BUILDING) AND WATER.

THE DIFFERENT TYPES OF WATER-RELATED PROBLEMS WHICH CAN OCCUR IN THE BASEMENTS CAN BE SEEN BELOW:

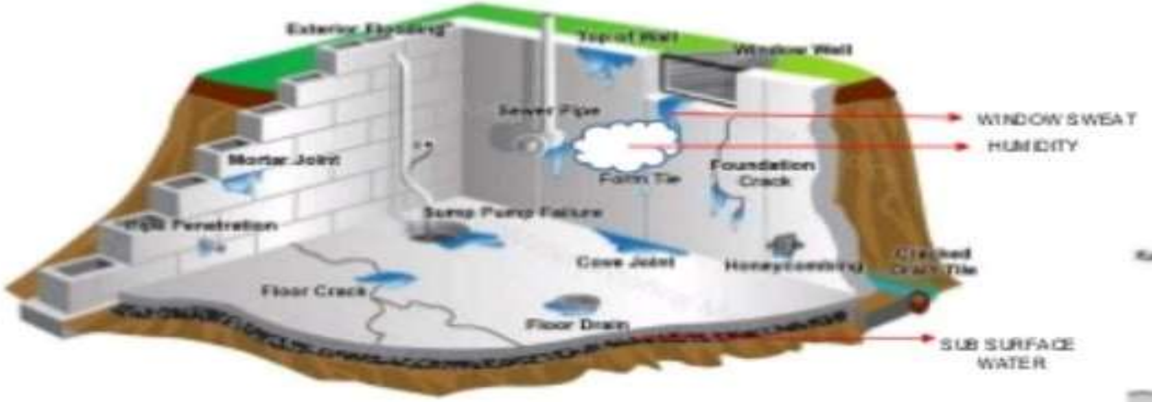
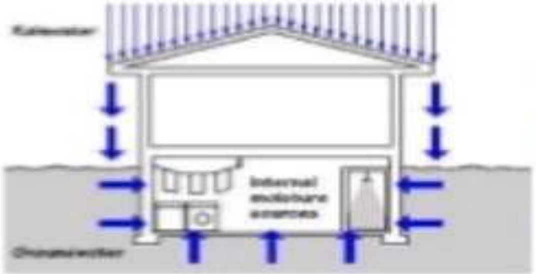


DIAGRAM SHOWING THE DIFFERENT TYPE OF LIQUID LEAKAGE/ SEEPAGES IN BASEMENTS

STANDING WATER IN BASEMENT

WHITE MOLDS IN BASEMENT



CAUSE OF MOISTURE IN BASEMENT

ODOUR IN BASEMENT

WHY IS WATER PROOFING ESSENTIAL ?

THE ABOVE PICTURES SHOW THE PROBLEMS IMPOSED ON BASEMENTS BY FLUID MATTER (GASEOUS + LIQUID) THUS MAKING THE BASEMENTS UNHYGIENIC AND WEAK.

WATERPROOFING IS ESSENTIAL AT BELOW-GRADE AREAS TO PREVENT WATER INTRUSION AND STRUCTURAL DAMAGE. IT IS GENERALLY DONE WHEN THE BUILDING IS ON OR BELOW THE GROUND LEVEL. FLOODING, WATER DAMAGE AND MOLDS (HIGH MOISTURE LEVELS LEAD TO MOLDS) ARE MANY OF THE CAUSES THAT DAMAGE CONSTRUCTION.

WATER PROOFING : REASONS

BUILDING CONSTRUCTION REPORT

SHEET NO. 1

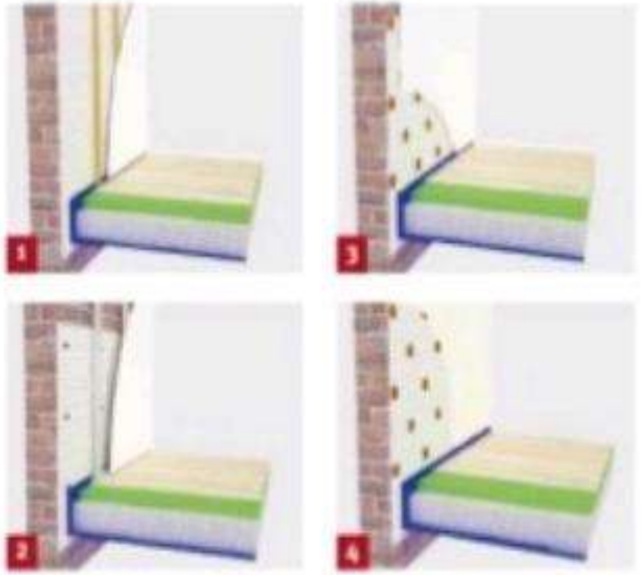
RIYA BAGCHI
III YEAR – B

D.O.A : 17.09.2015
D.O.S. : 24.09.2015

Summary

Damp Proofing	Water Proofing
Is tar based	Is rubber based.
Slows the process of water absorption.	Prevents the process of water absorption.
Is initially more expensive.	Is cheaper in the beginning, but leads to more expensive problems later on.
Cracks along with the foundation	Water proofing stretches to cover those cracks
Does not resist water well enough to prevent oversaturation from ground water	Prevents ground water from rain

Damp Proofing

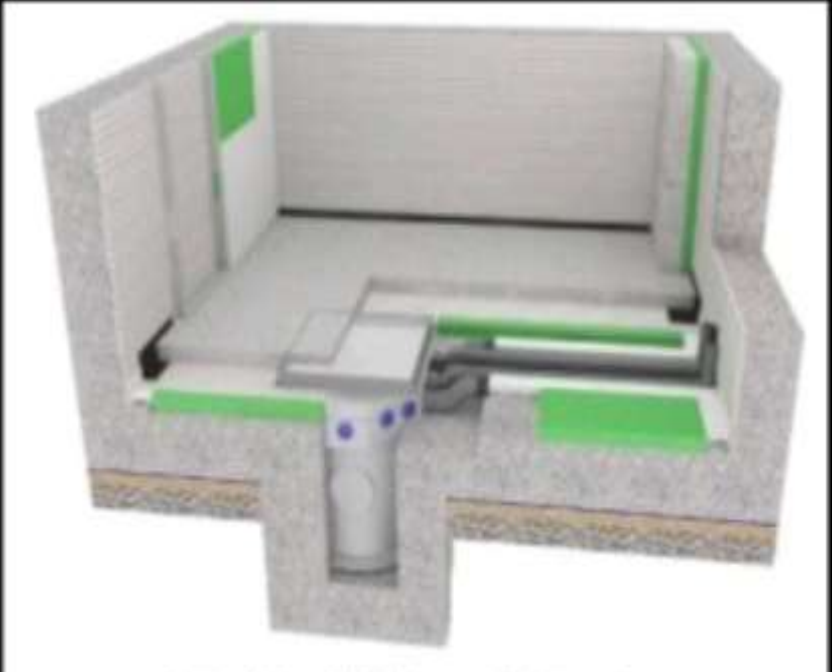


Fixing of Newton System 800 Damp Proof Membranes with 1. Battens, 2. Metal Frame, 3. Dot and Dab, 4. Plaster/Lime or Plaster/Render

Damp proofing method can be applied for a property when the external ground level is lower than the floor level inside the building. When the earth around is lower, the risk of pressurized water ingress is reduced, and here you can apply damp proofing.

For example, when dampness is found you could apply a damp proofing membrane that can manage the capillary held moisture applicable in the case of walls and floors.

Waterproofing



Newton System 500 For Basement Waterproofing

Waterproofing is crucial if the external grounds are on a higher plane than the internal floors. This is because there are more chances of water entering the property through the earth, and hence you need a waterproofing solution that can collect and remove the water away from the building.

Water proofing is done with a concoction that includes rubber, preventing moisture and water from penetrating any material.

Causes of Dampness in Buildings –

- Old bathroom pipes Damaged seals around baths and showers.
- Corroded water pipes that are inside the walls.
- Old bathroom pipes.
- Plumbing for central heating, kitchens and bathrooms.
- Moisture entrapped during construction.
- Defective orientation of building.
- Drain ability of soil.
- Poor Quality of Construction Material.

Requirements of ideal materials for damp proofing :-

They should be :-

- impervious.
- Durable
- Capable of bearing the load
- Dimensionally stable
- Flexible
- Free from sulphates, chlorides and nitrates.
- Inexpensive

Principles of damp proofing

- ✓ mortar bed prepared to receive damp-proof course should be leveled.
- ✓ The horizontal damp proofing course should cover the full width of wall excluding rendering.
- ✓ If sheets or mastic asphalt are used, the gap should not be less than 100mm at any point
- ✓ At joints and corners. Damp proof course should be continuous.
- ✓ Damp proofing course should not be kept exposed on the wall surface.
- ✓ At vertical and horizontal junctions, damp proof courses should be continuous and a cement mortar fillet of about 75mm should cover joints.

2. Classification of material

The materials commonly used to check dampness can be divided into the following four categories

a) Flexible material

Material like bitumen felts (which may be Hessian based or fibre/glass fibre based), plastic sheeting (polythene sheet) etc

Semi rigid materials

Materials like mastic asphalts combination of materials or layers.

3. Material used for damp proofing

Following are the materials, which are commonly used for damp proofing.

1. **Hot bitumen**

   This is a flexible material and is placed on the bedding of concrete or mortar. This material should be applied with a minimum thickness of 3 mm.

2. Mastic asphalt

This is a semi rigid material and it forms an excellent impervious layer for damp proofing. The good asphalt is very durable and completely impervious material. It can withstand only very slight distortion. It is liable to squeeze out in very hot climates or under very heavy pressure. It should be laid by experienced men of the specially firms.

General : An Overview

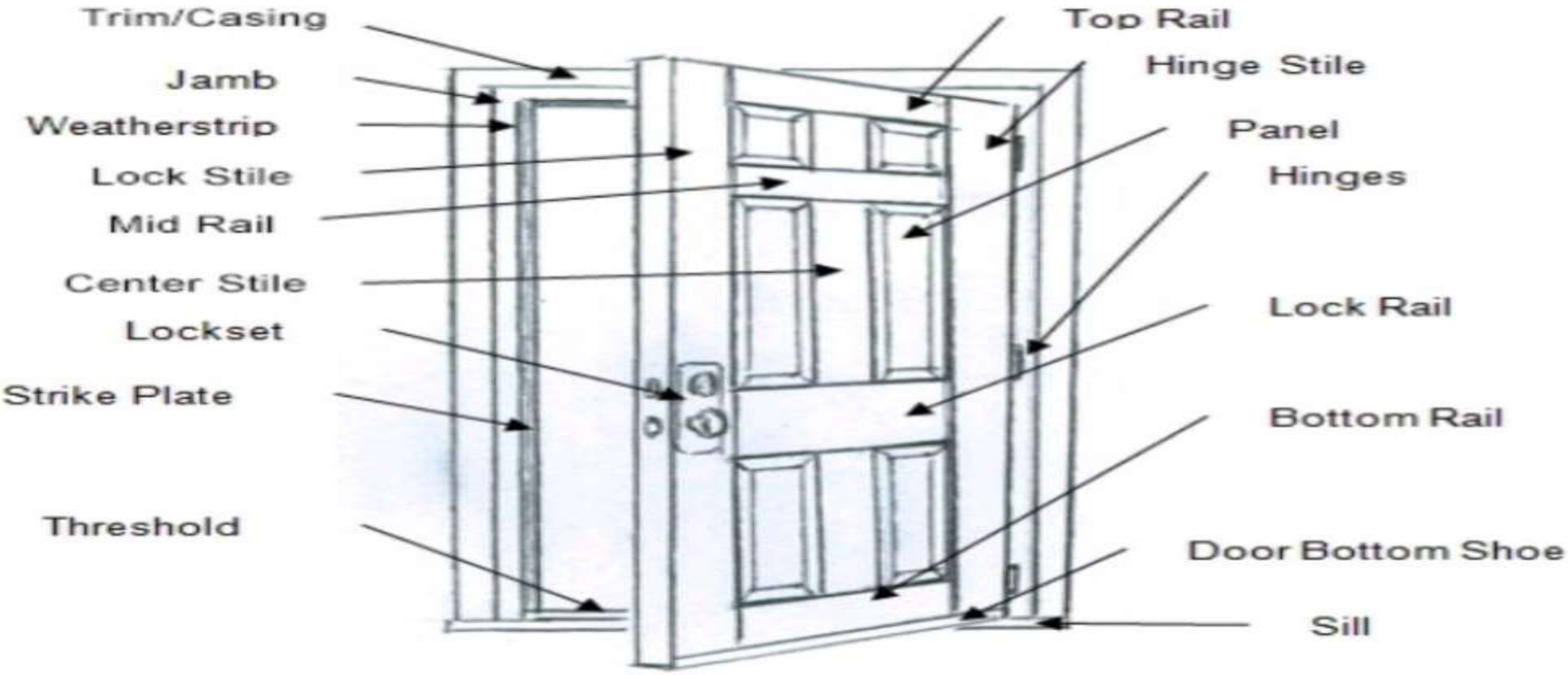
- **Doors**
- A Door may be defined as an openable barrier secured in wall opening,
- A door is an accessible barrier which is provided in a wa opening to give an access to the inside of a room of building. The internal portions of a building are connecte by doors.

Window

- It is a vented barrier secured ina wall opening,
- Function of window is to admit light and air to the building and to give a view to outside.
- It must provide insulation against heat loss and in some case again sound.
- It alos required to give a measure resistance to fire.

- **Ventilator**
- It is a small window secured in an opening wall provided at greater height i.e. near to roof of room or at lintel level or at top of door or window for purpose of providing ventilation in room.
- It generally provided in w.c. , bath & storeroom.

Components of Doors....



Size of Doors...

- It should be such that to allow movement of larges object or tallest person likely to use door.
- As per rule the height of a door should not be less tha 1.8 m to 2 m
- The width of door should be such that two person ca pass through it walking shoulder to shoulder
- Width = 0.4 m to 0.6 Height
- Height = (width + 1.2) meter.

Types of doors...

It is based depending upon...

(1.) Types of materials used

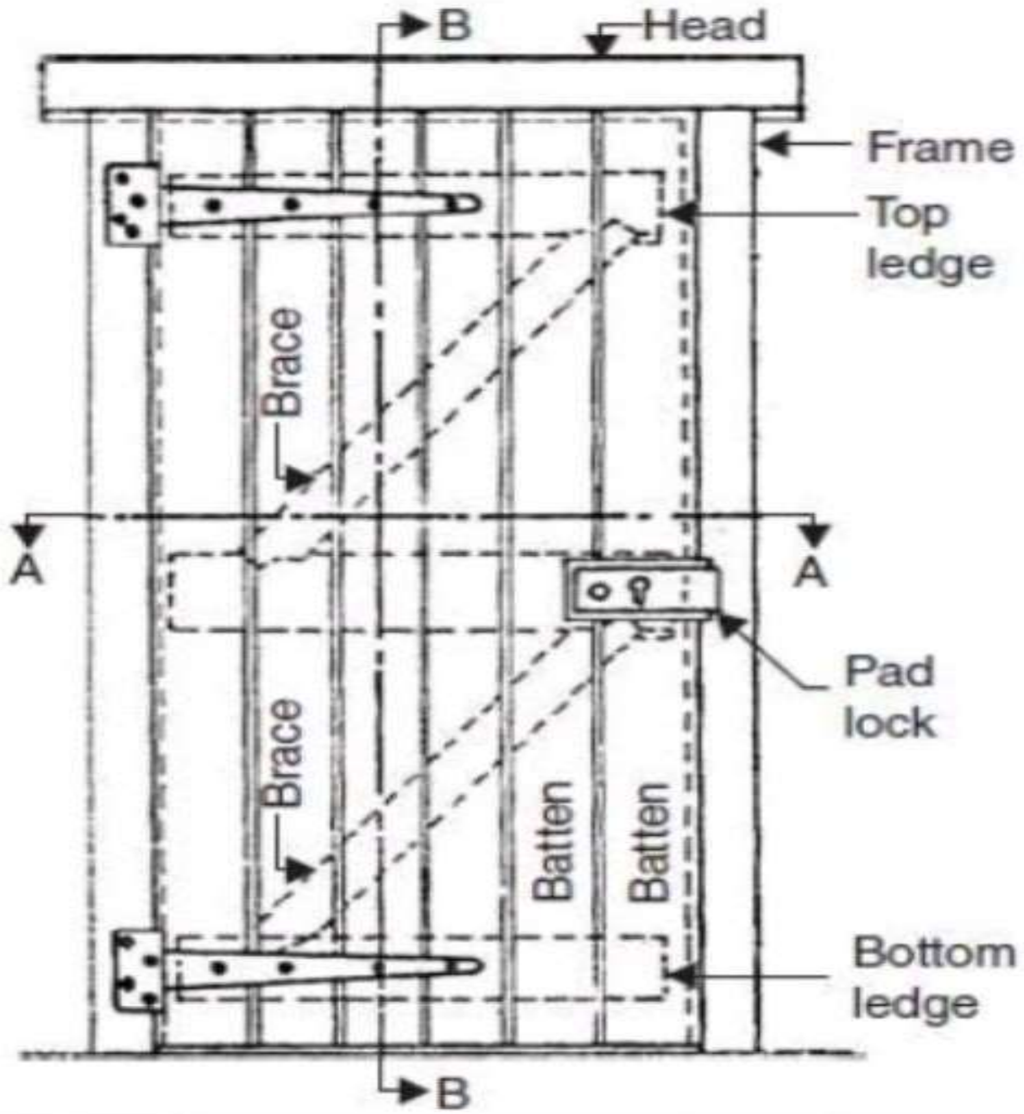
Timber, Steel section, Aluminum section, Concrete, etc..

(2) Arrangement of different components of the door

1. Battened & ledge doors..
2. Battened , ledge & braced doors...
3. Battened, ledge, framed doors...
4. Battened, ledge, braced, & framed doors..

(3) Method of construction

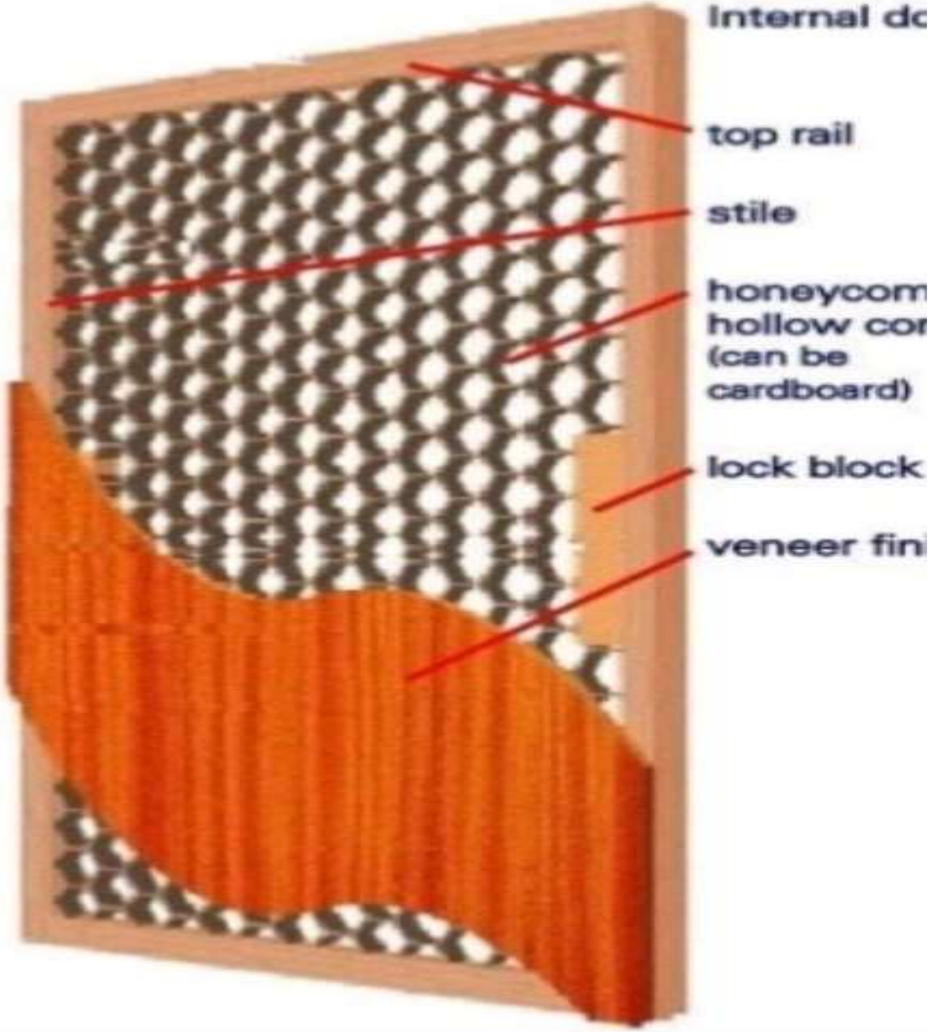
1. Framed & panneled doors...
2. Glazed or sash doors...
3. Flush doors...
4. Louvered doors
5. Wire-gauged doors...


B
Head
Frame
Top
ledge
Brace
A
A
Pad
lock
Brace
Batten
Batten
Bottom
ledge
B


ledge
batten
braces
ledge
ledge

Hollow Core and Cellular Core Flush Door

- In this case also stiles and rails are provided for frame. But, a minimum of two intermediate rails should be provided.
- The inner space of door consists of equally space battens of width 25mm each. Other space is called void space which does not exceed 40% of the area of door.
- Here also face veneer and cross-bands are glued under high pressure.



Selection Criteria for Windows

- Selection of suitable window in a particular place should be dependent of following factors.

1. Location of room
2. Size of room
3. Direction of wind
4. Climatic conditions
5. Utility of room
6. Architectural point of view

Types of Windows

There are so many types of windows are available based on the positions, materials and functioning. Windows are classified as follows.

- Fixed Windows
- Sliding Windows
- Pivoted Windows
- Double Hung Windows
- Louvered Windows
- Casement Windows
- Metal Windows
- Sash Windows
- Corner Windows
- Bay Windows
- Dormer Windows
- Clerestory Windows
- Lantern Windows
- Gable Windows
- Ventilator
- Skylights

Ventilators

- Ventilators are provided for the purpose of ventilation in the room. They are provided at greater height than windows nearer to roof level. It is in very small size. Horizontally pivoted shutters are provided for ventilators. Sometimes shutter is replaced by wired mesh, in this case sunshade is provided to prevent against rain water.

INTRODUCTION

- Floors are horizontal elements of building structures which divide building into different levels for the purpose of creating more accommodation with in the restricted space, one above the other and also provide support to the occupants, furniture and equipment of a building.

CHARACTERISTICS OF A GOOD FLOORIN

- It should be durable
- It should be easy to clean
- Noiseless
- Have Good Appearance
- Free from dampness
- Fire Resistant
- Low Maintenance cost

TYPES OF FLOORING

- Mud flooring
- Brick flooring
- Stone flooring
- Cement Concrete flooring
- Terrazzo or Mosaic flooring
- Marble flooring
- Tile flooring
- Wooden flooring

MUD FLOORING

THE EASIEST FORM OF MATERIAL AVAILABLE FOR BUILDING CONSTRUCTION. IT HAS BEEN ADOPTED FOR VARIOUS ELEMENTS IN THE HOUSE IN DIFFERENT FORMS. FLOORIN ADOPTED IN VILLAGE HOUSING AS BESIDES BEING ECONOMICAL, MUD IS READILY AVAILABLE AND THE FLOORING IS EASY TO CONSTRUCT AND MAINTAIN.

Mud flooring

- Cheap, hard, fairly impervious, easy to construct
- Used in low cost housings
- Good thermal insulation property; remains cool in summer and warm in winter
- Method : Over a well prepared ground, a 25 cm thick selected moist earth is spread and rammed to get a thickness of 15 cm; Small quantity of chopped straw is mixed in moist earth to prevent cracks; cow dung is also mixed

BRICK FLOORING

N THE MAINSTAY OF BUILDING CONSTRUCTION IN INDIA SINCE TIME OF MOHENJODARO AND HARAPPA. IT HAS BEEN SUCCESSFULLY USED FOR FOUNDATIONS, WALLS, FL

NTAGEOUS IN AREAS WHERE BRICKS ARE AVAILABLE LOCALLY. SUCH FLOORINGS ARE EASY TO CONSTRUCT WITH THE HELP OF LOCAL MASON AND ARE ALSO ECONOMIC

STONE FLOORING

- STONES ARE AVAILABLE IN PLENTY ACROSS THE ENTIRE STRETCH OF THE COUNTRY. MANY OF THESE ARE SUITABLE FOR PROVIDING FLOORS IN RESIDENTIAL CONSTRUCTION. STONES SUITED FOR THE PURPOSE SHOULD BE STRONG AND ABLE TO RESIST ABRASION AND IMPACT BESIDES GIVING A PLEASING APPEARANCE. For e.g. marble, granite.

Advantages

- This is the olden method since followed due to the durability
- This can be used in all the part of the house
- The roughness depends on the type of stone flooring

disadvantageous

- This is one of the costliest types
- It requires more professionals for the careful installation

TERRAZZO FLOORING OR MOSAIC FLOORING

- Terrazzo flooring is yet another type of flooring that has been commonly used in India. As this type of flooring gives a pleasing look, it has been extensively provided in living rooms, bed rooms etc.

TILE FLOORING

FLOORING TILES IN INDIA HAVE OVER THE YEARS GAINED POPULARITY OVER THE CEMENT AND CONCRETE FLOORING. TILES ARE AVAILABLE IN DIFFERENT PATTERNS, DESIGNS AND UTILITY OPTIONS. USUALLY COSTLIER THAN THE CEMENT CONCRETE FLOORING AND ITS COST DEPENDS UPON THE TYPE OF TILE BEING USED.

WOODEN FLOORING

OODEN FLOORING IS MOST COMMONLY USED IN HILLY REGIONS OF THE COUNTRY WHERE THE TEMPERATURE ARE QUITE LOW. AT PRESENT THEY ARE ALSO BEING PROVI
OORS OF HIGH END HOUSING TO GIVE A GOOD APPEARANCE.

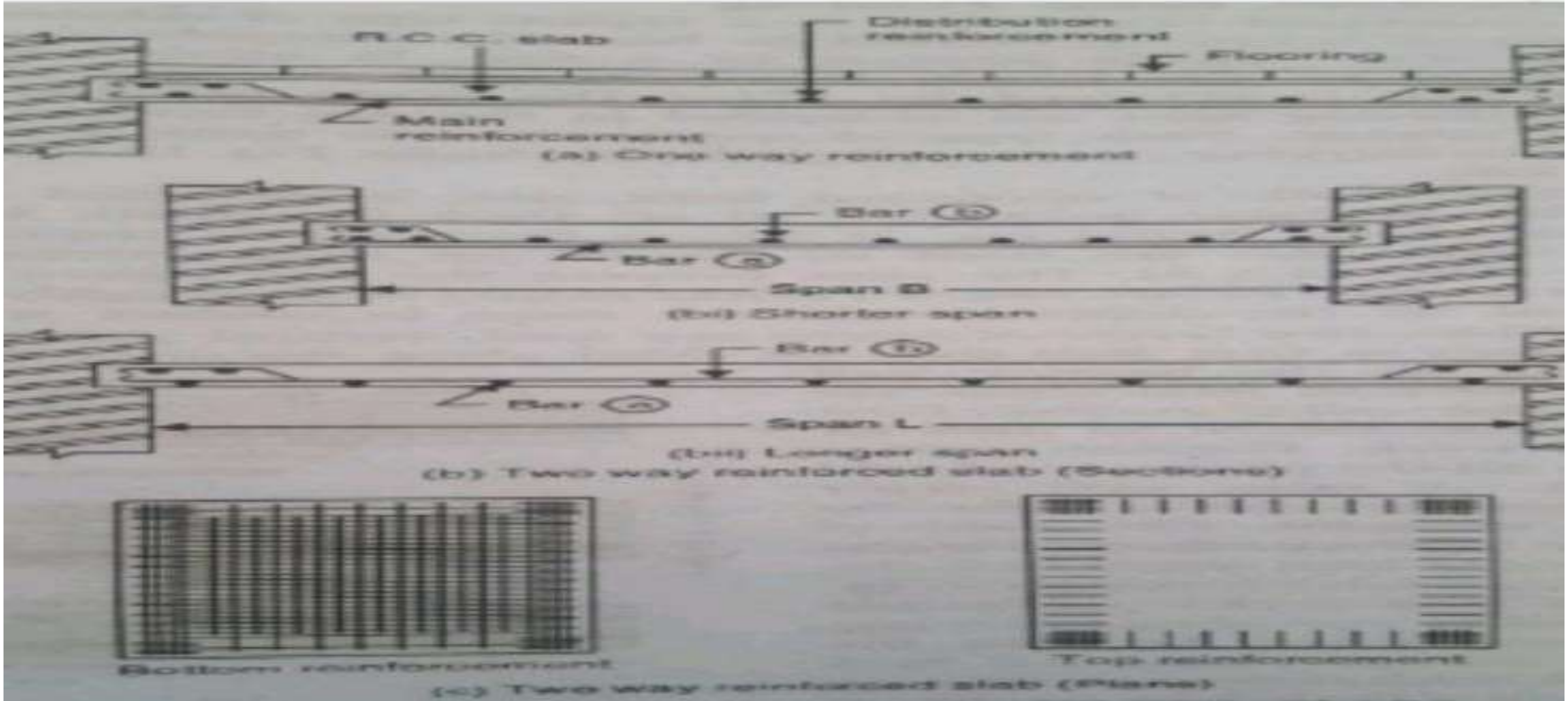


FIG. 12.4. REINFORCED CONCRETE SLABS.

Beam slab flooring

- When width of room becomes more, span of slab increases, simple RCC flooring becomes uneconomical
- Floor structure consists of RCC beams and slabs cast monolithically.
- T beams act as intermediate supports to the slabs which is continuous over beams

Foundation...

- Deep foundation :
- Deep foundation consists of pile and pier foundations.
- This consists in carrying down through the soil a huge masonry cylinder which may be supported by the sides of soil or may be supported on solid rock (hard stratum).

- Pile foundation :
- Pile is an element of construction used as foundation. It may be driven in the ground vertically or with some inclination to transfer the load safely.

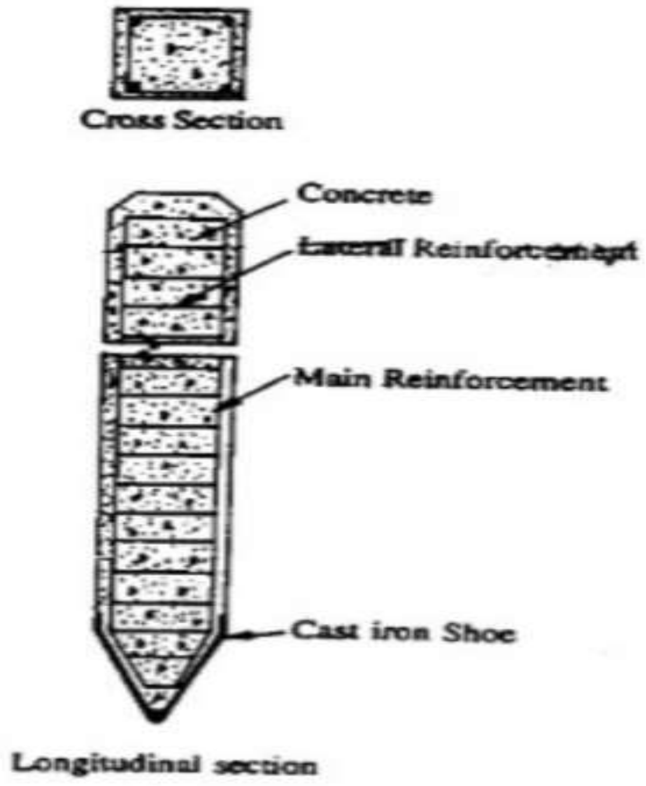
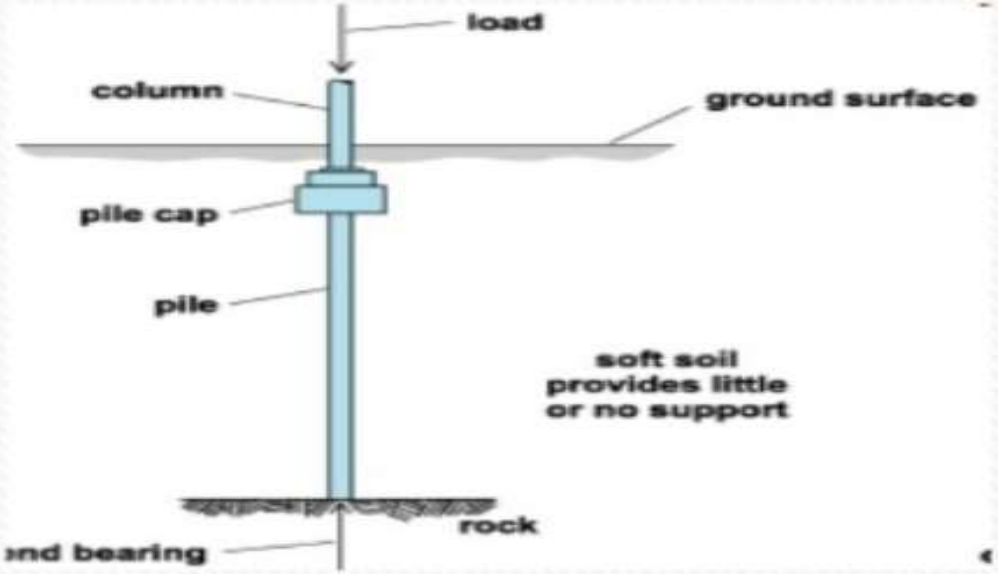
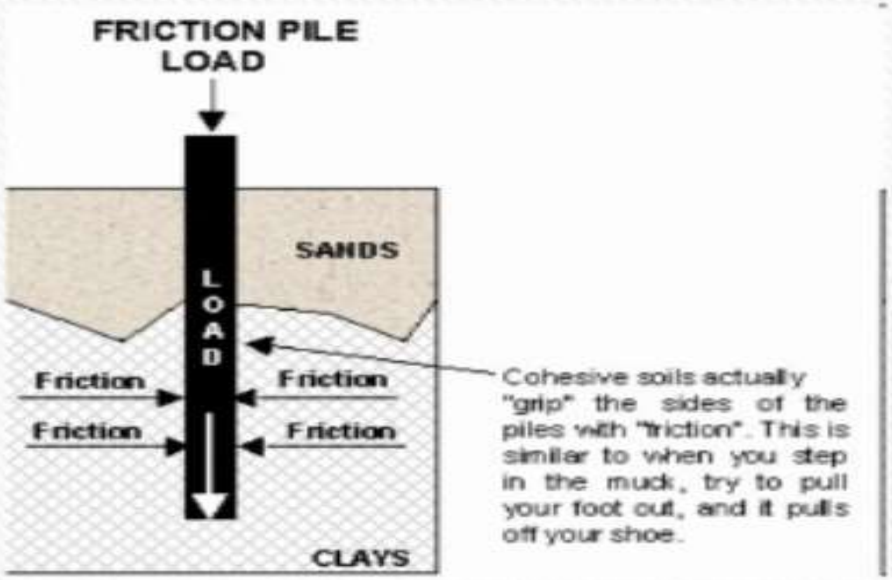


Fig. 2.3 *Concrete pile*

Load Bearing Pile

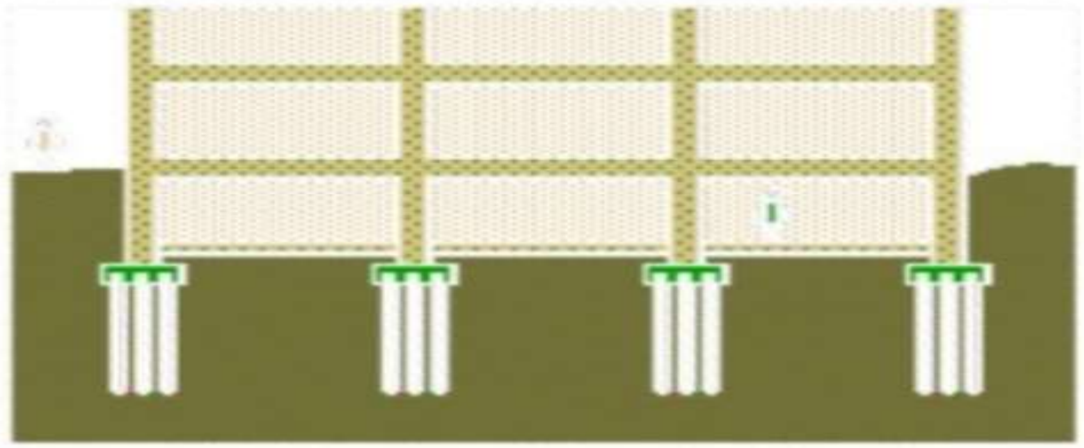
Friction Piles





Foundation…

- **Pile :**
- A slender, structural member consisting steel or concrete or timber.
- It is installed in the ground to transfer the structural loads to soils at some significant depth below the base of the structure.



Lift :

The vertical distance for removal with reference to the ground level. The excavation up to 1.5 metres depth below the ground level and depositing the excavated materials upto 1.5 metres above the ground level are included in the rate of earth work. Lifts inherent in the lead due to ground slope shall not be paid for.

Foundation…

- **Pile foundation…**
- Loads are supported in two ways.
- If the load is supported by the effect of friction between the soil and the pile skin, it is called friction pile.
- Friction piles may be made of cast iron, cement concrete, timber, steel, wrought iron and composite materials.
- If the load is supported by resting the pile on a very hard stratum, it is called load bearing pile.
- Load bearing piles are steel sheet piles, concrete piles and timber piles.

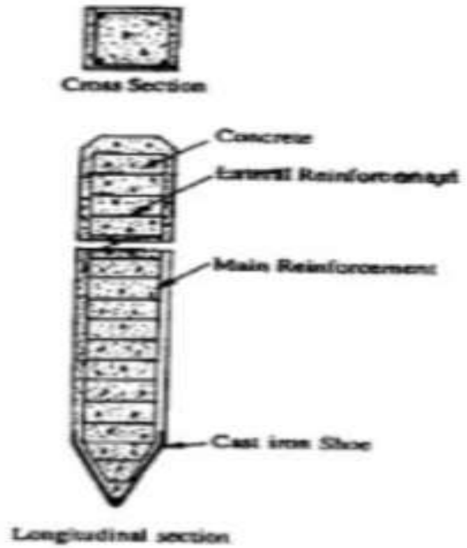


Fig. 2.3 Concrete pile

- Piles may be cast-in-situ or precast.
- They may be cased or uncased.

MATERIAL USED FOR FOUNDATION…

- Foundation must be constructed of a durable material of an adequate strength.

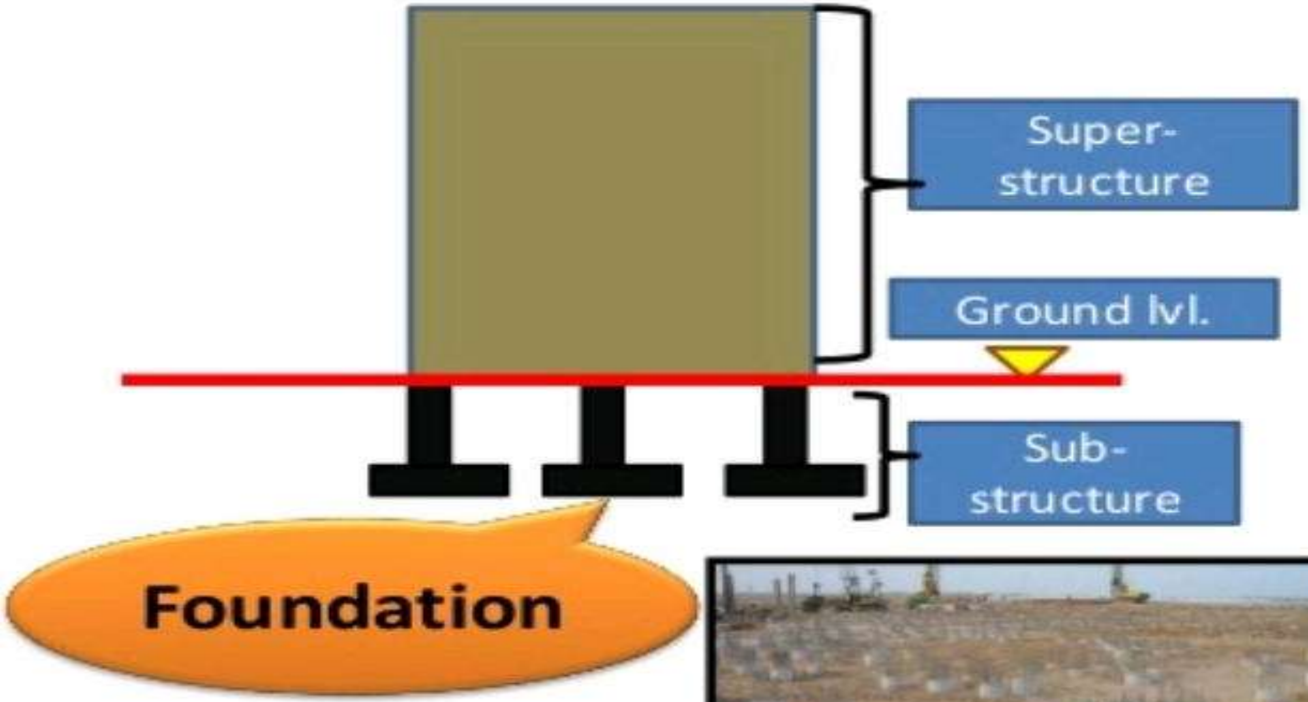
- Concrete
- Metal
- Aggregate
- Waterproofing Materials
- Wood

Lead

All distances shall be measured over the shortest practical route and not necessarily the route actually taken. Route other than shortest practical route may be considered in cases of unavoidable circumstances and approved by Engineer-in-charge along with reasons in writing. Carriage by manual labour shall be reckoned in units of 50 metres or part thereof. Carriage by animal and mechanical transport shall be reckoned in one km. unit. Distances of 0.5 km or more shall be taken as 1 km. and distance of less than 0.5 km. shall be ignored. However, when the total lead is less than 0.5 km., it will not be ignored but paid for separately in successive stages of 50 metres subject to the condition that the rate worked on this basis does not exceed the rate for initial lead of 1 km. by mechanical/animal transport

INTRODUCTION

IDENTIFYING......

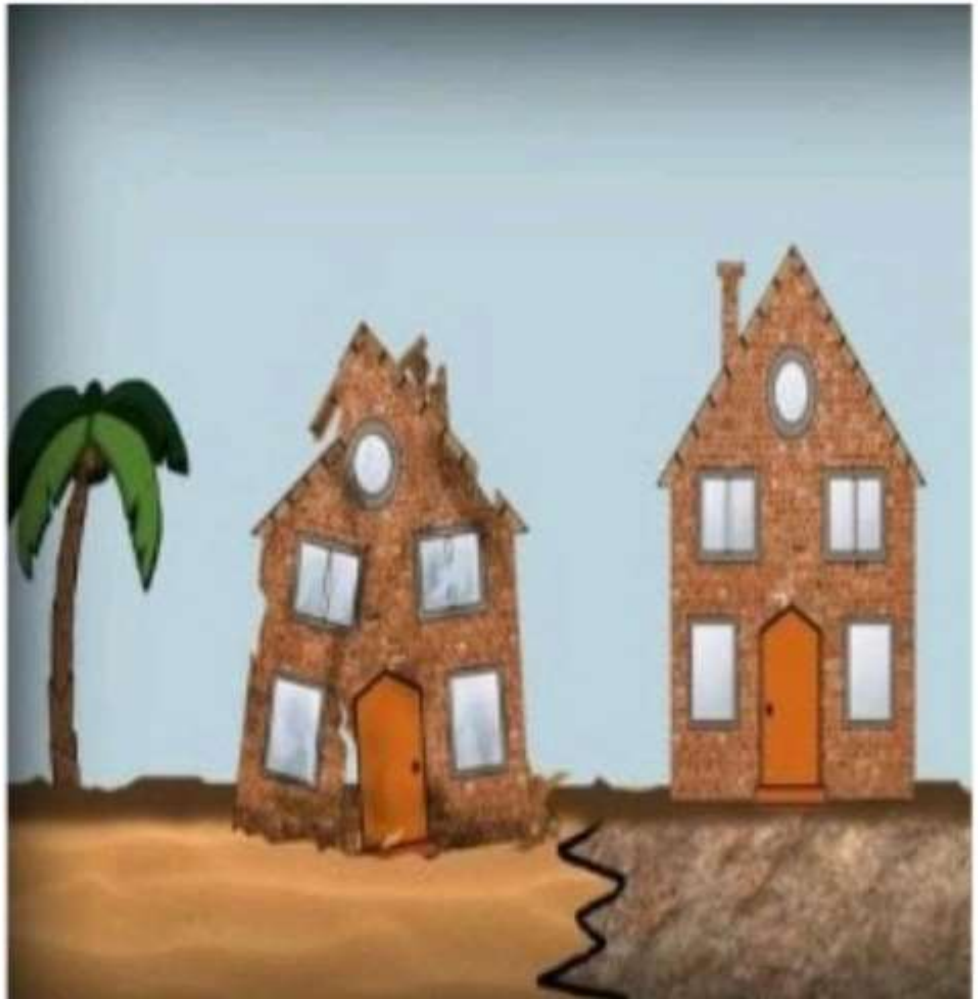


In your opinion, what is the purpose of foundation for a building?

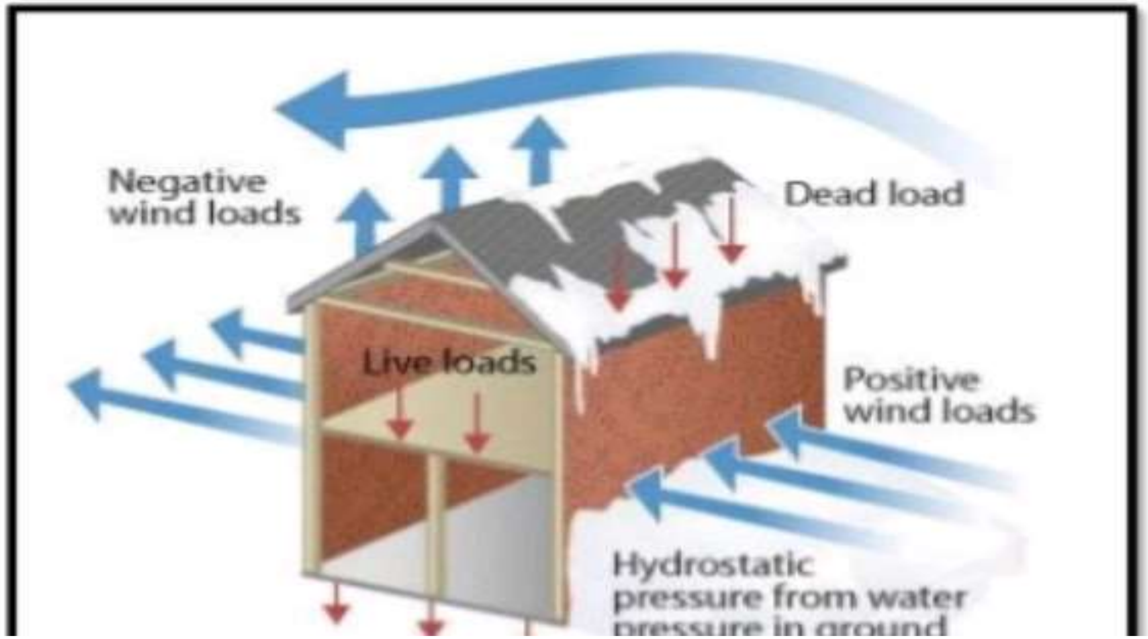
Foundation is the element that provides ultimate supports for the structure and it is for both static and dynamic loads.

The foundation include not only that element below groundwater level, but also the under line soil and rock

THE IMPORTANCE OF FOUNDATIONS IN BUILDING CONSTRUCTIONS



- To distribute the total load of the structure on a larger area
- To support the structure
- To give enough stability to the structures against various disturbing forces such as wind and rain
- To prepare a level surface for concreting and masonry work



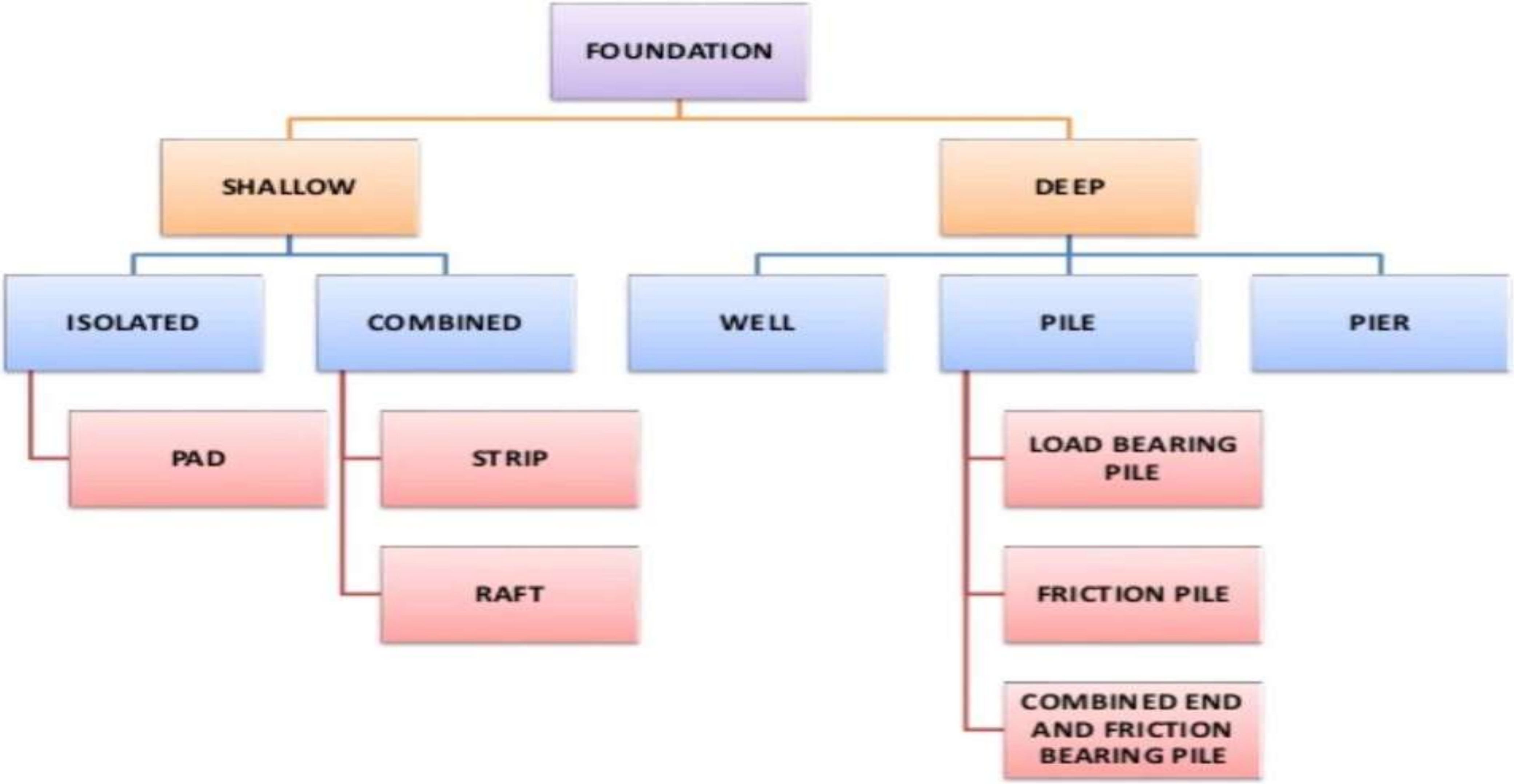
FACTORS AFFECTING FOUNDATION

- Soil types and ground water table conditions
- Structural requirements and foundations
- Construction requirements
- Site condition and environmental factor
- Economy

FACTORS THAT INFLUENCE THE FOUNDATION DESIGNING

- LOAD
  - DEAD LOAD
  - LIVE LOAD
  - WIND LOAD
- GROUND CHARACTERISTICS
  - BEARING CAPACITY
  - WATER GROUND LEVEL
  - CHEMICAL CONTENT
- COST
  - MATERIAL
  - MACHINE
- TECHNOLOGY
  - MASTERLY
  - SKILLFUL WORKER

TYPES OF FOUNDATION



Spread footing

- Supports either one wall or column.
- Strip footing: Spread footing for wall; footing provided when wall carries light loads or when the safe bearing pressure is high, the wall rests on the concrete base.
- Pad footing: Isolated footing for a column

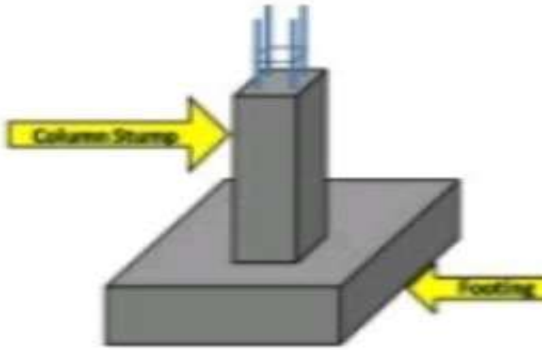


Fig: Spread footing

Combined footing

Supports two columns; provided when columns are very near to each other so that their footings overlap; bearing capacity of soil is less

If footing supports more than two columns, then it is known as Continuous footing.

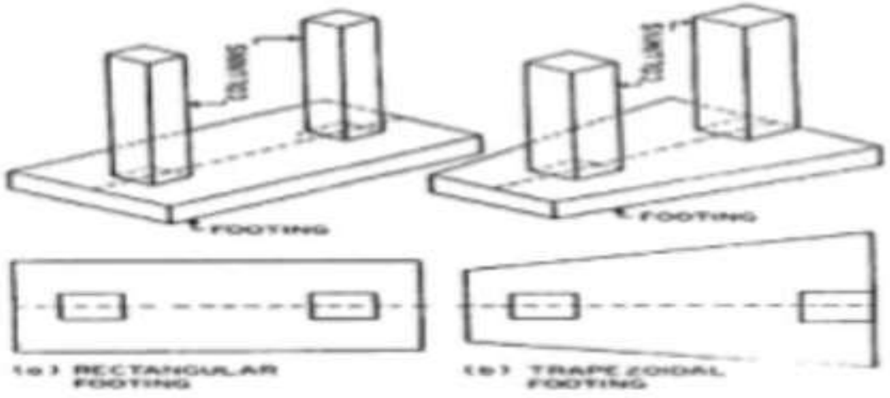
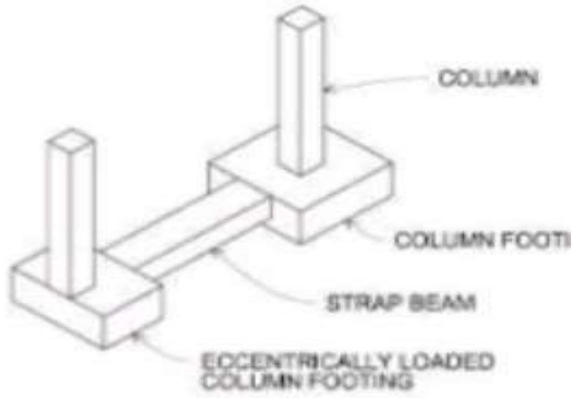


Fig: Combined footing

Combined footing

Strap or Cantilever footing

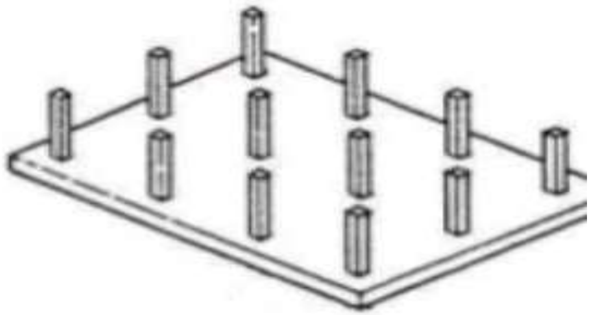
- Comprises of two or more footings connected by a beam called strap.
- If the distance between two adjacent columns is large, strap footing is provided.
- The strap beam doesn't remain in contact with soil and doesn't transfer any pressure to the soil. It is assumed to be rigid and transfers the column loads on to the soil with uniform pressure(C.G. of combined loads of two columns pass through C.G. of the two footing areas).
- The strap should be properly designed to withstand shear force and bending moments.



Figure

Mat or raft foundation

•Combined footing that covers the entire area beneath a structure and supports all the walls and columns.
•Provided when allowable soil pressure is low or building loads are heavy or the soil mass is erratic.
•A true raft or mat is a flat concrete slab with uniform thickness throughout the area



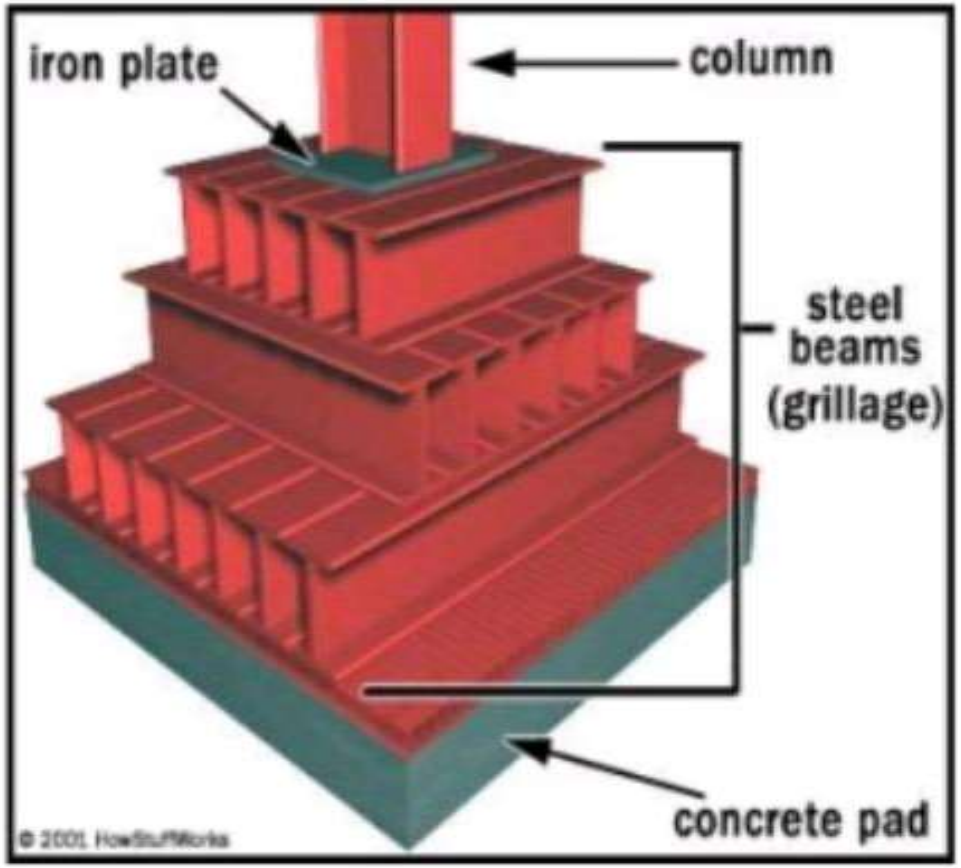
Figure

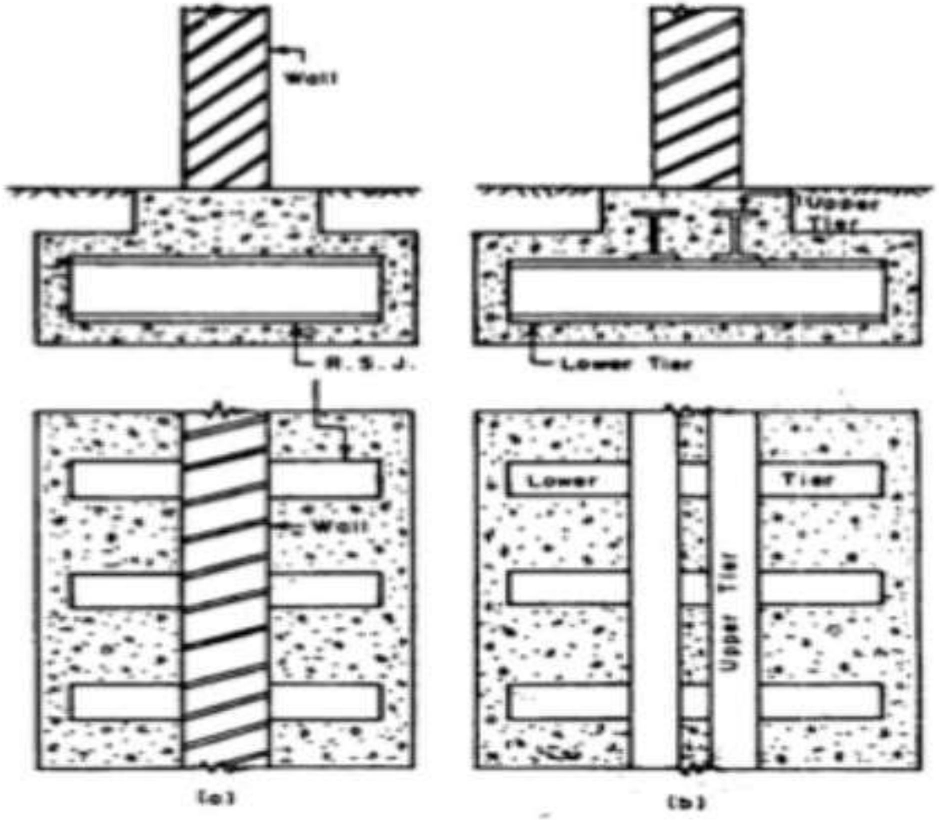
Raft foundation

Grillage foundation

- A type of foundation often used at the base of a column. It consists of one, two or more tiers of steel beams super imposed on a layer of concrete, adjacent tiers being placed at right angles to each other, while all tiers are encased in concrete.
- This is dependable foundation and is used in those place where the load of the structure is pretty high and bearing capacity of soil comparatively poor; extends to a depth of 1m to 1.5m

Grillage foundation





Grillage foundation

DEEP FOUNDATIONS

- Deep foundations are those founding too deeply below the finished ground surface for their base bearing capacity to be affected by surface conditions.
- This is usually at depths of 3 meter below finished ground level.
- Deep foundations can be used to transfer the load to a deeper, more competent strata at depth if unsuitable soils are present near the surface.

Types of Deep Foundations

- Pile Foundations
- Caisson Foundation
- Well foundation

Pile Foundations

- These are relatively long, slender members that transmit foundation loads through soil strata of low bearing capacity to deeper soil or rock strata having a high bearing capacity.
- They are used when for economic, constructional or soil condition considerations it is desirable to transmit loads to strata beyond the practical reach of shallow foundations.

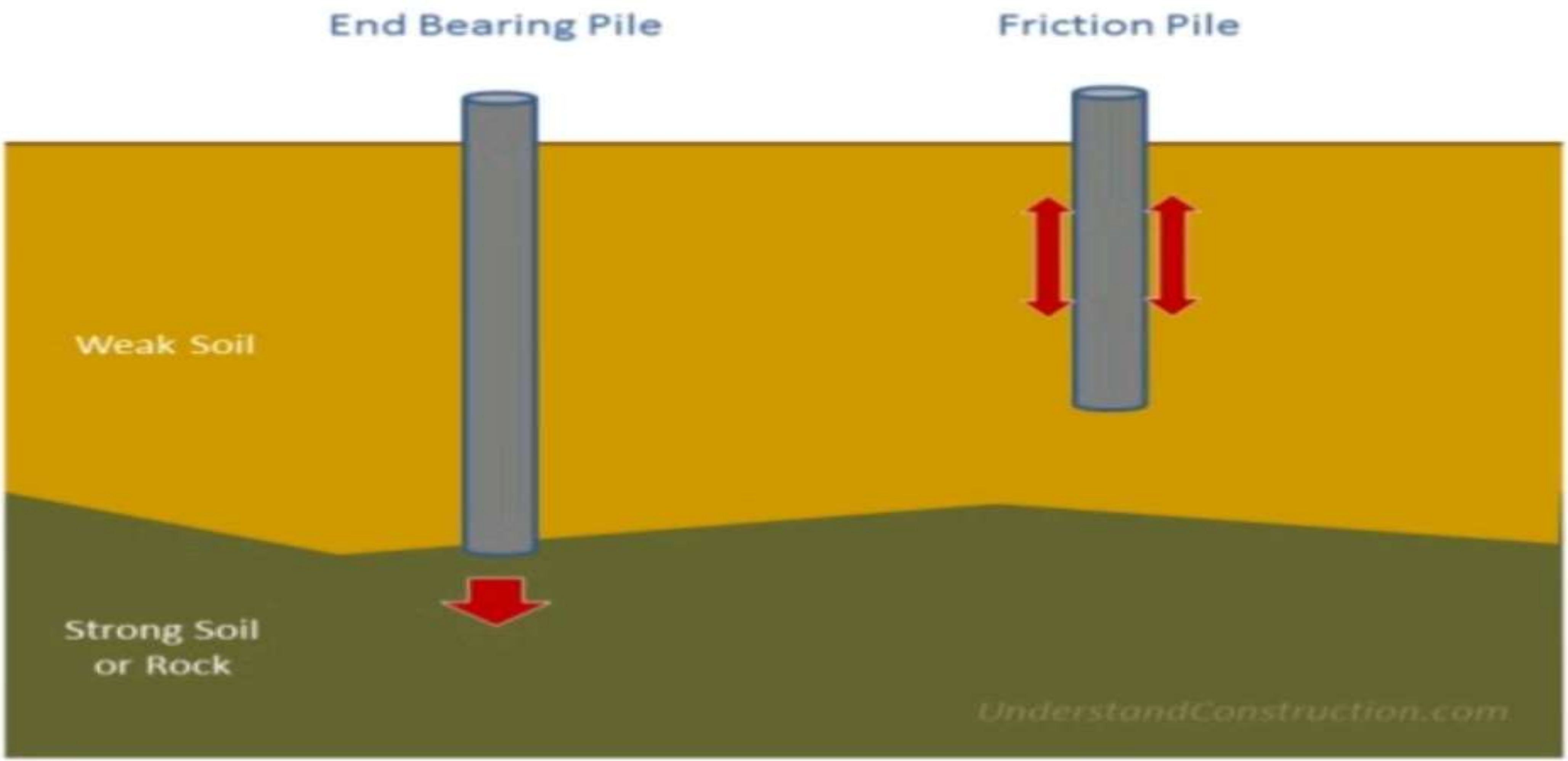
Pile foundations are used in the following situations:

- The load of the super structure is heavy and its distribution is uneven
- The top soil has poor bearing capacity
- The subsoil water level is high
- There is large fluctuations in subsoil water level
- Canal or deep drainage lines exist near the foundation
- The structure is situated on the sea shore or river bed

Classification of piles

Based on function

- **End bearing pile**: In end bearing piles, the bottom end of the pile rests on a layer of especially strong soil or rock. The load of the building is transferred through the pile onto the strong layer.
- **Friction pile**: Transfer loads by means of skin friction along the length of piles
- **Compaction pile**: Used to compact loose granular soils, thus increasing their bearing capacity; don't carry any loads; hence may be of weaker material such as sand
- **Tension pile or uplift pile**: Anchor down the structures subjected to uplift due to hydrostatic pressure or due to overturning moment.
- **Sheet pile**: Used as impervious cut off to reduce seepage and uplift under hydraulic structure.


End Bearing Pile
Friction Pile
Weak Soil
Strong Soil
or Rock
UnderstandConstruction.com

Casing

Based on Materials and composition

- **Concrete piles**
  - Pre cast: Manufactured off site; Max design load 800 KN; require more time to set; high cost; require heavy pile driving machinery, 30-50 cm dia, 20 m or more
  - Cast in situ: Max design load 750 KN;
    1. Driven: driven into the ground by machinery
    2. Bored: under reamed piles, bored compaction piles

- **Timber piles**: Made from trees deodar, babul, teak; treated with creosote oil as preservative; low bearing capacity; shouldn't be driven through hard stratum.
- **Steel piles**:
  - H-pile: desirable in hard rock stratum; high bearing capacity; very high cost; construction of bridges
  - Sheet pile: prevent seepage of water below dams; driven into the ground
  - Box pile: driven pile; deep beams; Great lateral strength; support sea structures.

Caisson Foundation

- A **caisson** foundation also called as pier foundation is a watertight retaining structure used as a bridge pier, in the construction of a concrete dam, or for the repair of ships. It is a prefabricated hollow box or cylinder sunk into the ground to some desired depth and then filled with concrete thus forming a foundation. Caissons are adopted when the depth of water is great and the foundations are to be laid under water. Caissons are generally built on the shore and launched in to the river floated to the site and sunk at the proper position.

Well foundation

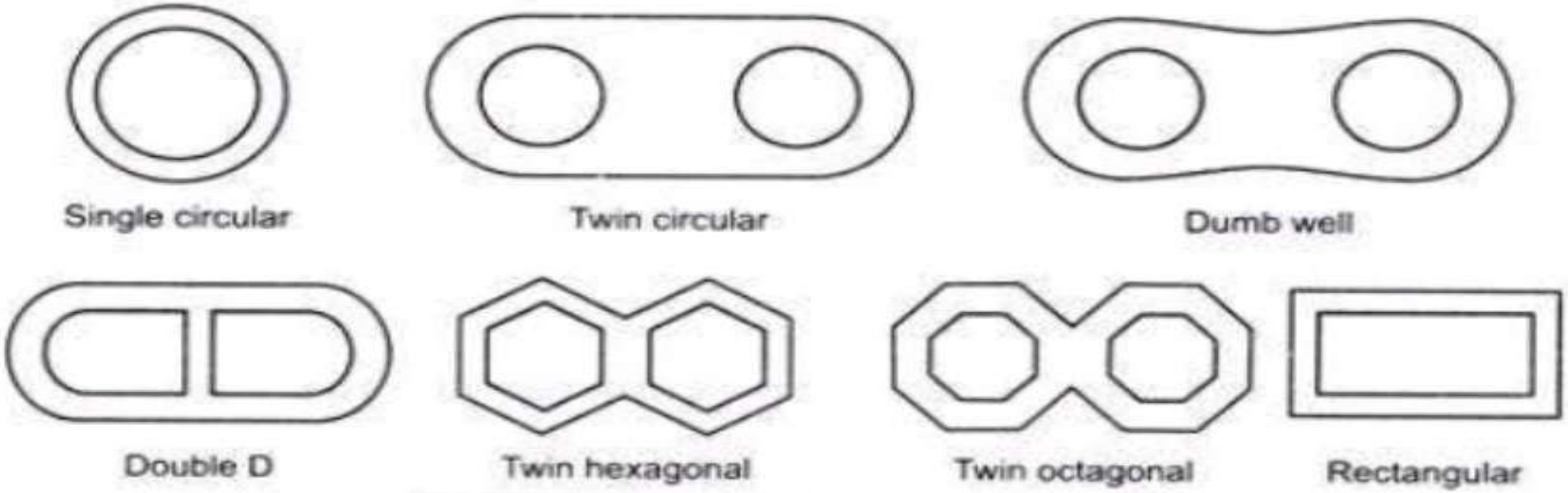


FIG. 11.30 Different shapes of wells

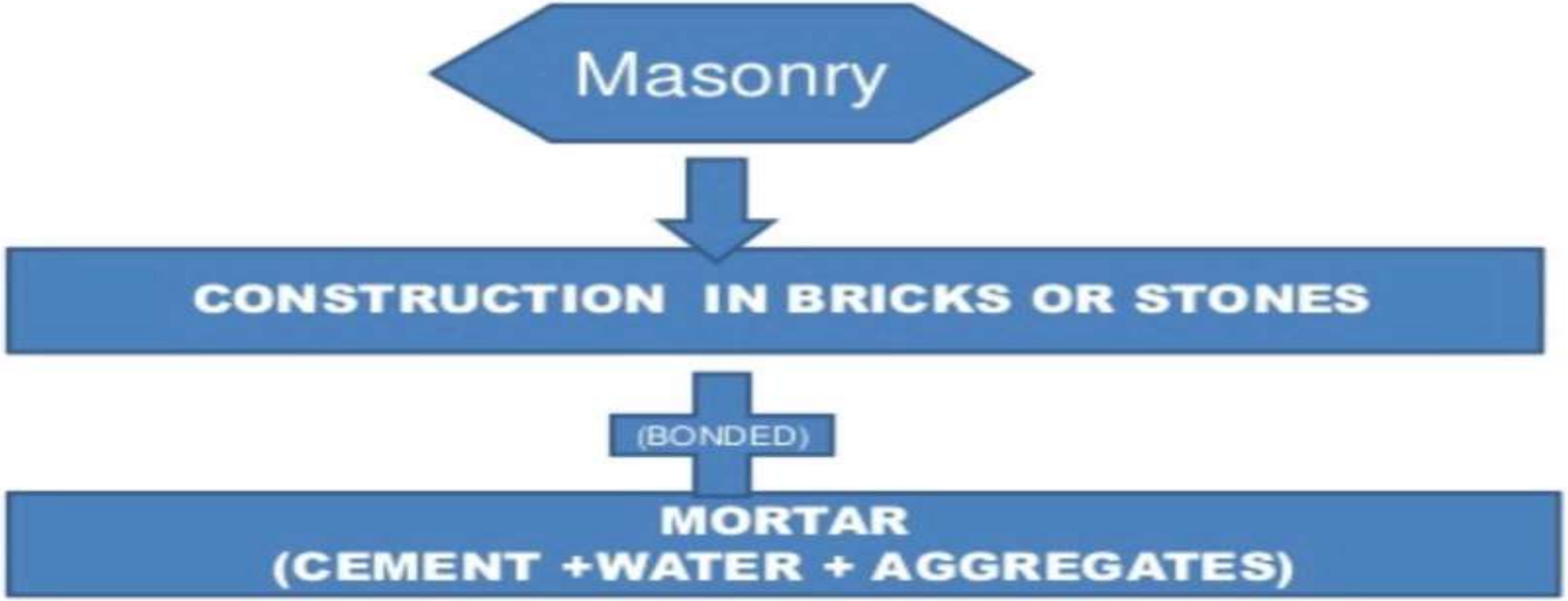
The choice of a particular shape of well depends upon the size of the pier, the care and cost of sinking, the considerations of tilt and shift during sinking and the vertical and horizontal forces to which well is subjected.

Factors affecting design of foundation

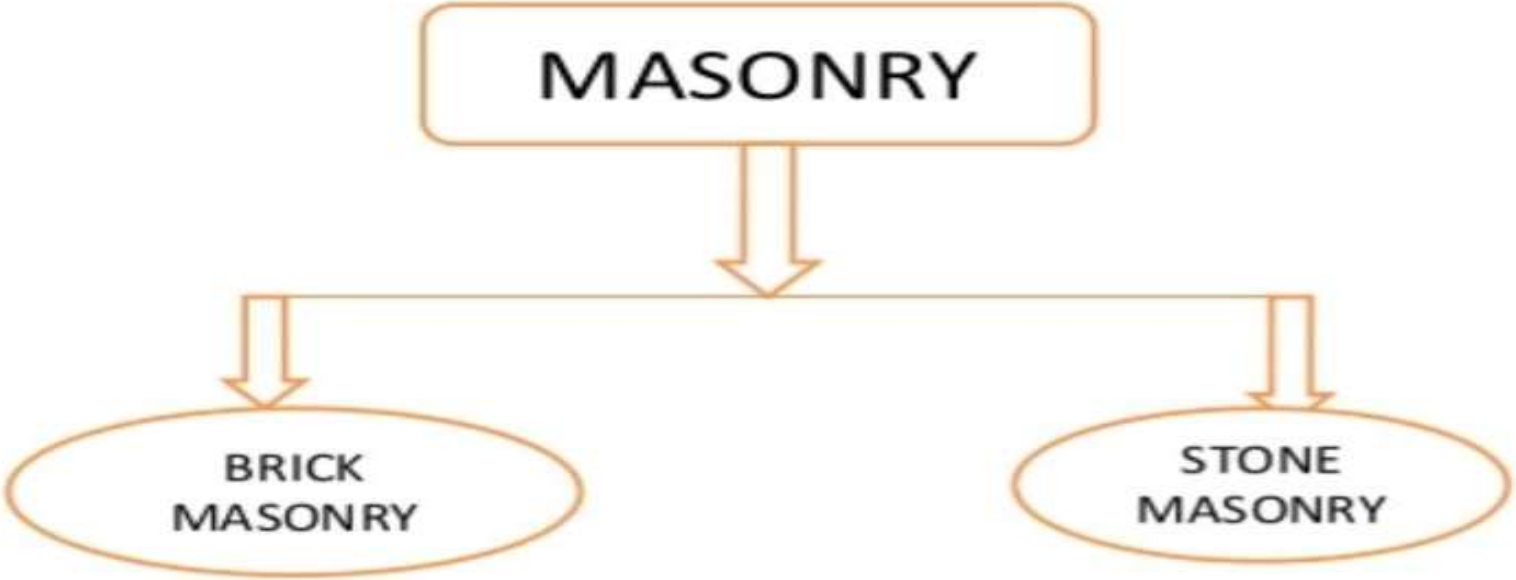
- Soil types and ground water table conditions.
- Structural requirements and foundations.
- Construction requirements .
- Site condition and environmental factor.
- Economy etc.

MASONRY

- Construction of building units such as bricks, stones or precast concrete blocks bonded with mortar.
- **Types:** Stone masonry, Brick masonry, Hollow concrete blocks masonry, Composite masonry

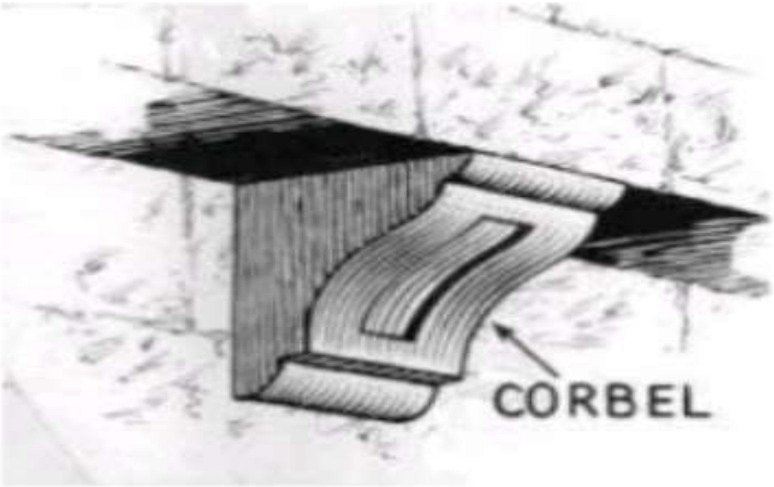


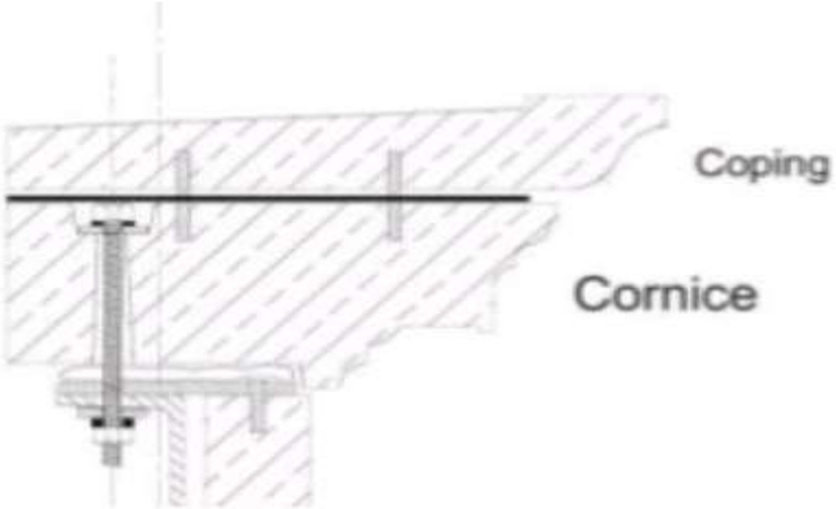
TYPES

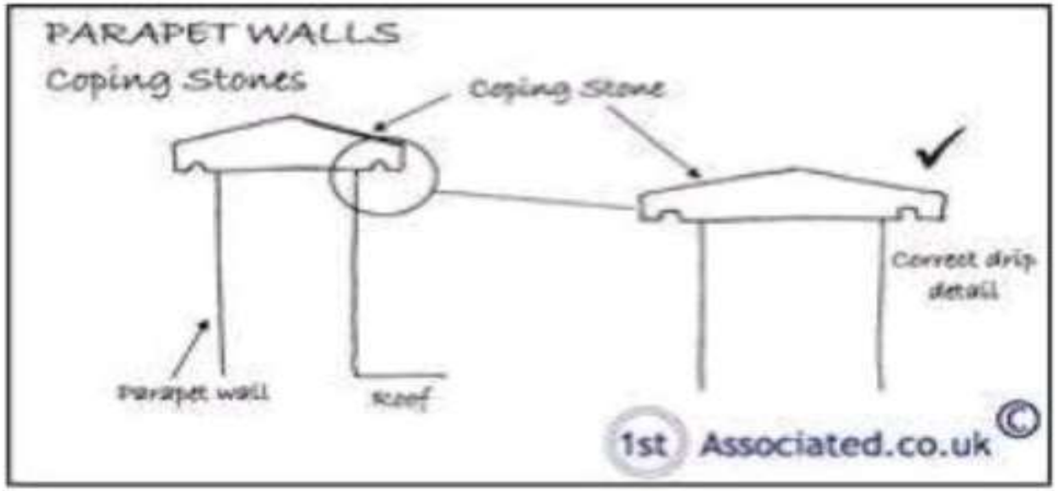


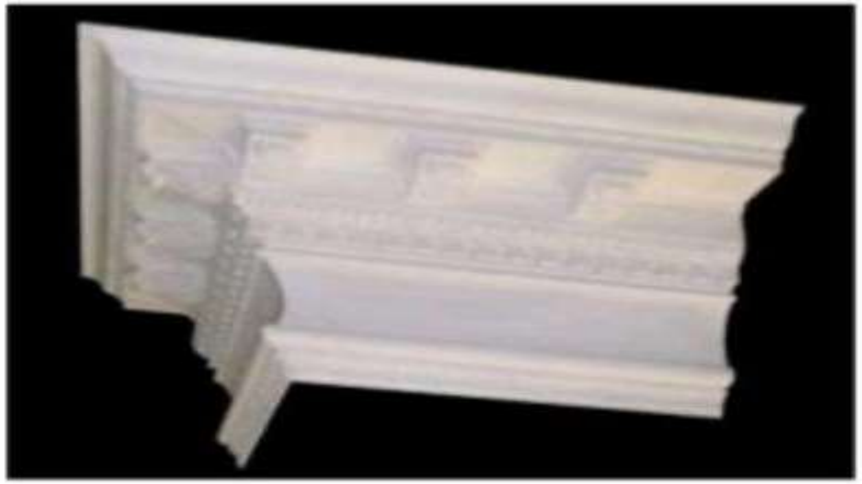
Systematic arrangement of bricks and bonding them together with cement mortar.

Construction carried out using stones with mortar


CORBEL


Coping
Cornice


PARAPET WALLS
Coping Stones
Coping Stone
Correct drip detail
Parapet wall
Roof
1st Associated.co.uk ©



CLASSIFICATION OF STONE MASONRY

1. Rubble masonry
2. Ashlar masonry

Rubble masonry

Wall is made up of stones of irregular sizes and shapes i.e. stones are roughly dressed. The stones from the quarry are broken into small pieces and are directly used in construction work.

Ashlar masonry

Wall is made of accurately dressed stones with extremely fine bed and end joints. Block may be either square and rectangular shaped.

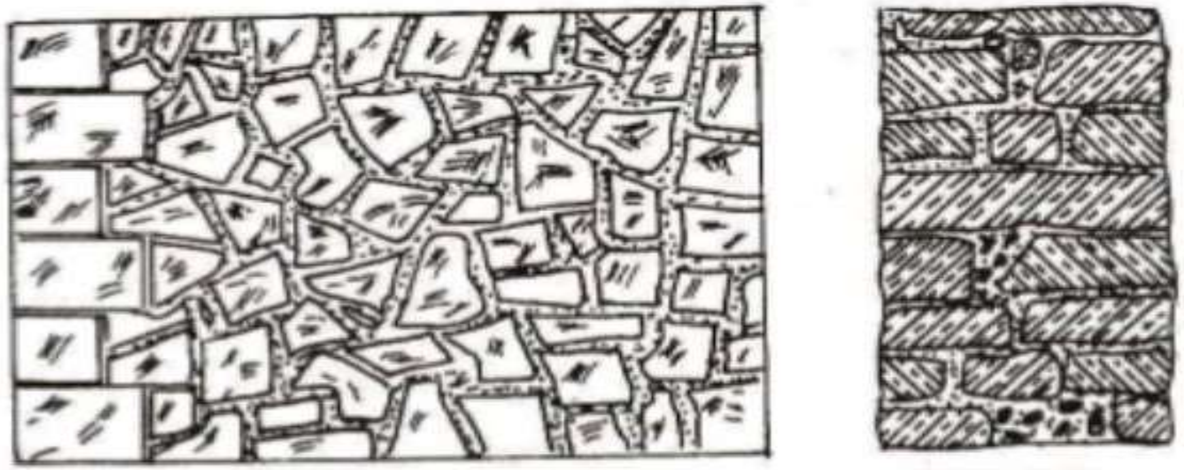
Rubble masonry

Following types:

1. Random rubble masonry

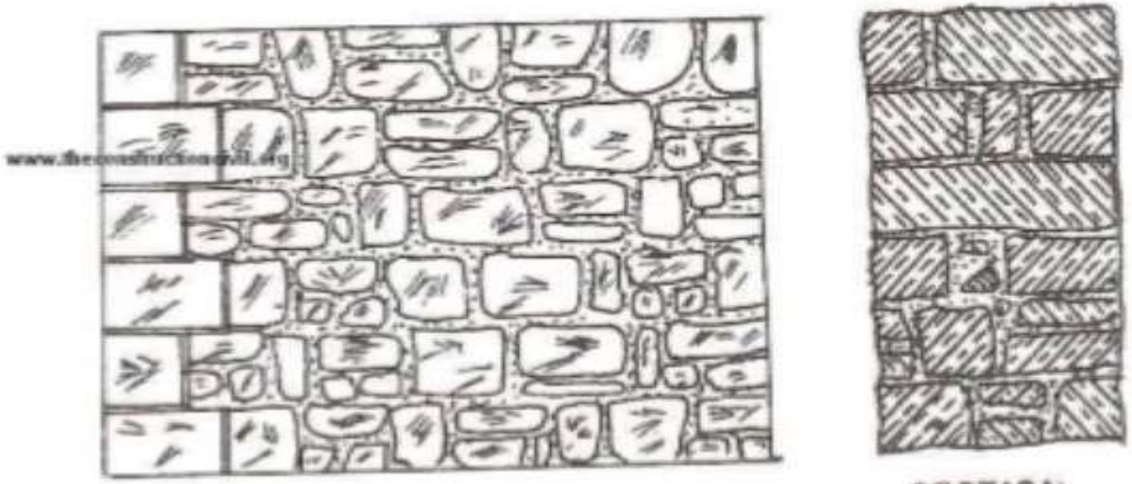
i. Un-coursed random rubble masonry: Roughest and cheapest form of stone walling. Stones are of different sizes. Greater care must be taken to arrange them so that they distribute loads uniformly and no long vertical joints are formed.

ii. Coursed random rubble masonry: Work is roughly levelled up to form courses of 30 cm to 40 cm thick. All courses are of not same height. For construction, quoins are built first and line is stretched between tops of quoins. The intervening walling is then brought up to this level by using different size of stones. This masonry is better than un-coursed random rubble masonry.



ELEVATION SECTION

uncoursed RR Masonry



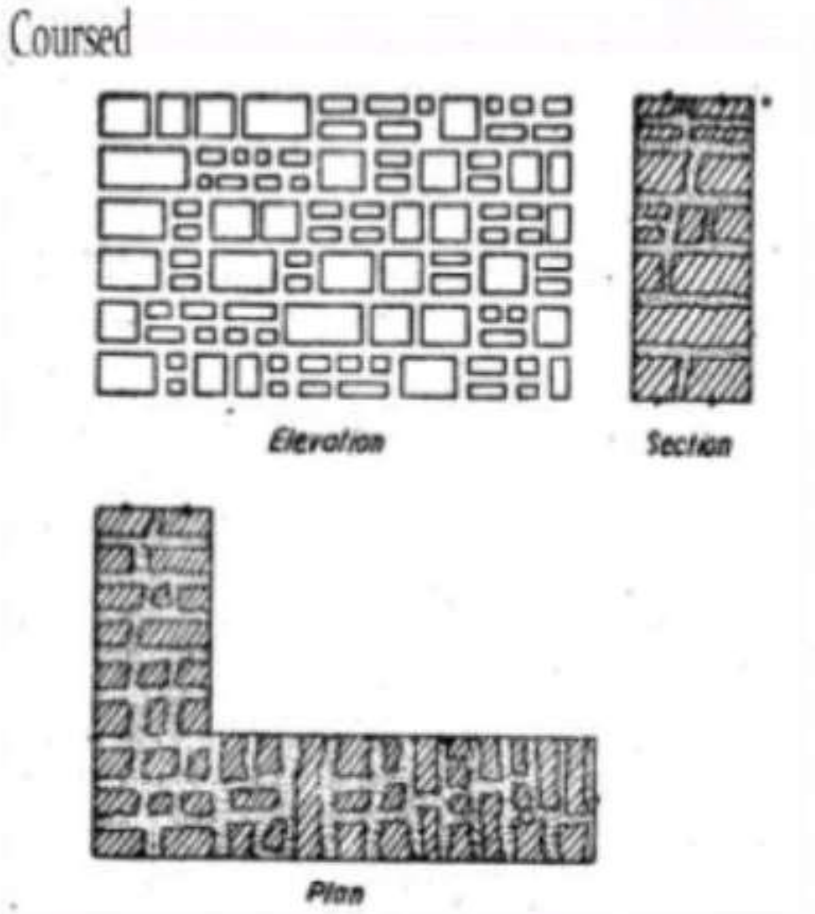
ELEVATION SECTION

Randon Rubble Masonry

2. Square rubble masonry

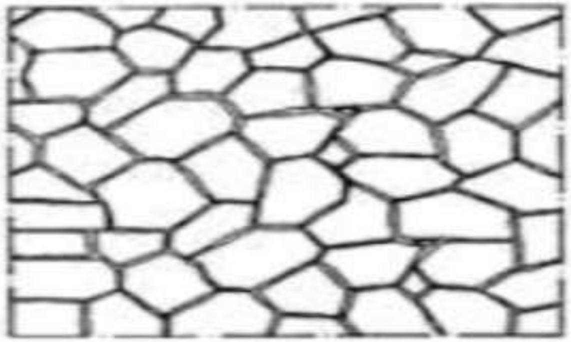
i. **Un-coursed square rubble masonry**: Uses stones having straight bed and sides. Stones are usually squared and brought to hammer dressed or straight cut finish. Good appearance can be achieved by using risers(large stone) , leveller (thinner stones), and sneck (small stones) in a pattern having their depths 3:2:1.

ii. **Coursed square rubble masonry:** Same stones as uncoursed masonry but the work is levelled up to courses of varying depth. Courses are of different heights. Each course consists of quoins, throughs of same height with smaller stones built in between upto the height of large stones.



3. **Polygonal rubble masonry**

- The stones are hammer finished on face to an irregular polygonal shape. These Stones are bedded in position to show face joints running irregularly in all directions. Two types: Rough picked and close picked.



4. **Flint rubble masonry**

- Flint or cobbles used; may be coursed or uncoursed; thickness from 7.5 to 15 cm; length 15 to 30 cm; made of silica; stones are hard but brittle. Strength of flint wall may be increased by lacing courses of bricks or long stones at vertical interval of 1 to 2 metres.

5. **Dry rubble masonry**

- Coursed; mortar not used in joints; cheapest and require more skill in construction; used for non load bearing walls such as compound wall.

Dry rubble masonry

Ashlar Masonry

1. **Ashlar fine tooled**: Finest type of stone masonry; stones are cut to rectangular sizes; beds, joints and faces are chiselled to remove unevenness; thickness of course not less than 15 cm; thickness of mortar joint should not be more than 5 mm

2. **Ashlar rough tooled**: exposed face is dressed by rough tooling; a strip of 25 mm wide made by chisel is provided around the perimeter of the rough dressed face of each stone. Thickness of mortar should not be more than 6mm.

Ashlar rough tooled

Ashlar masonry

It is finely dressed (cut, worked) **masonry**, either an individual stone that has been worked until squared

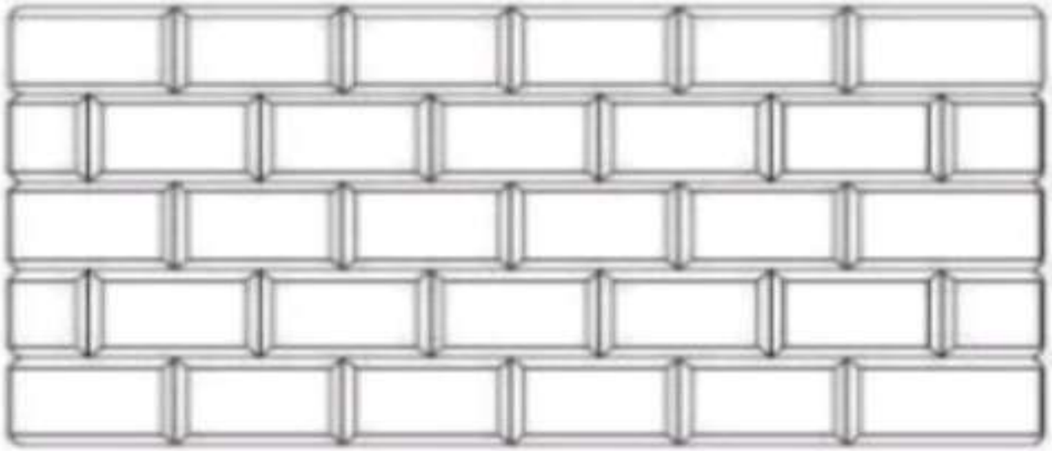
Ashlar Fine

Ashlar Rough Tool

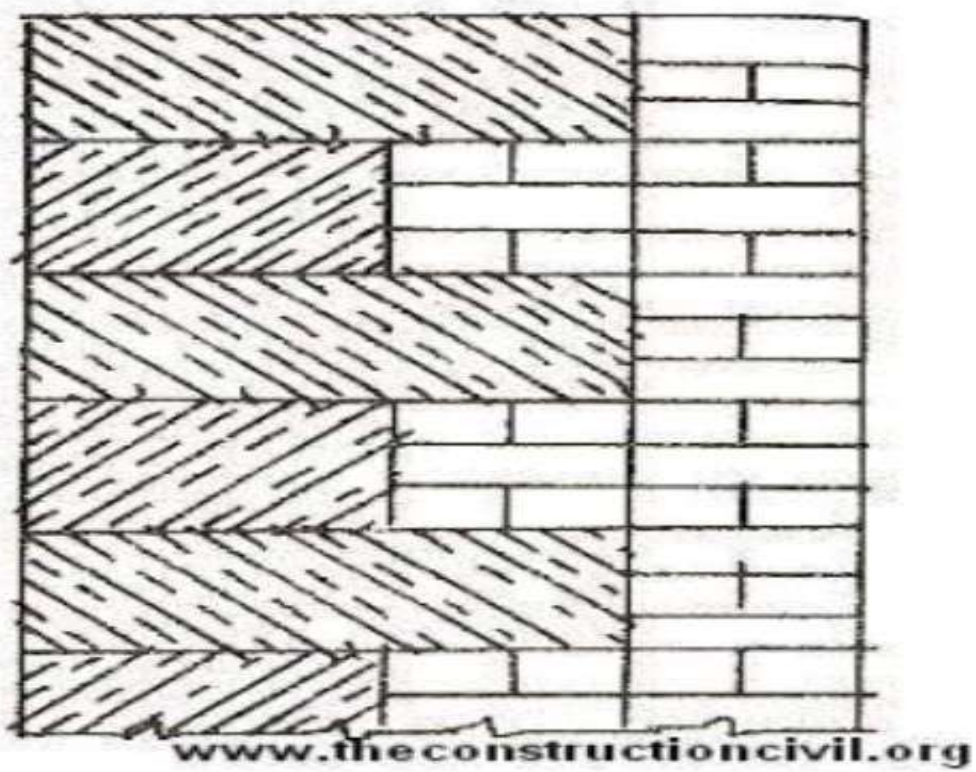
Ashlar Chamfered

Ashlars Facing

Ashlar chamfered masonry



Ashlar Facing



Tools for stone dressing

Spall hammer

- Rough dressing of stones

Gad

- Split stones

Tooth chisel

- Dress hard stones

Drafting chisel

- Fine dressing

Cross cut saw

- Cut hard stones

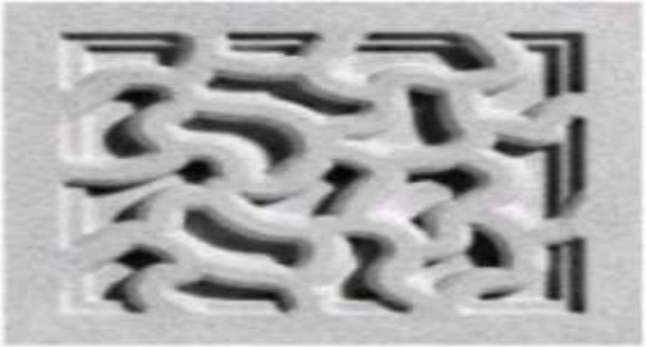
Types of surface finishes

- **Pitched Faced Dressing-** The edges of a pitched faced dressed stone shall be level and shall be in the same plane being absolutely square with the bed of the stone. Superfluous stone on the face shall be allowed to remain there and left raised in the form of a natural rounded cobble stone. The minimum width of pitched faced dressing round the four edges of the face of the stone shall be 25 mm.

- **Hammer Dressing** - A hammer dressed stone shall have no sharp and irregular corners and shall have a comparatively even surface so as to fit well in masonry. Hammer dressed stone is also known as hammer faced, quarry faced and rustic faced.

- **Plain finish**: surface made smooth with a saw or chisel.

- **Vermiculated finish**: After having the stone to a level and smooth finish, marginal drafts are sunk about 10 mm below the surface. These sinkings are cut to form ridges; gives worm eating appearance



- **Polished finish**: Used in marbles, granite. Glossy surface; Polished manually or with machine

STONE MASONRY

Stone Masonry

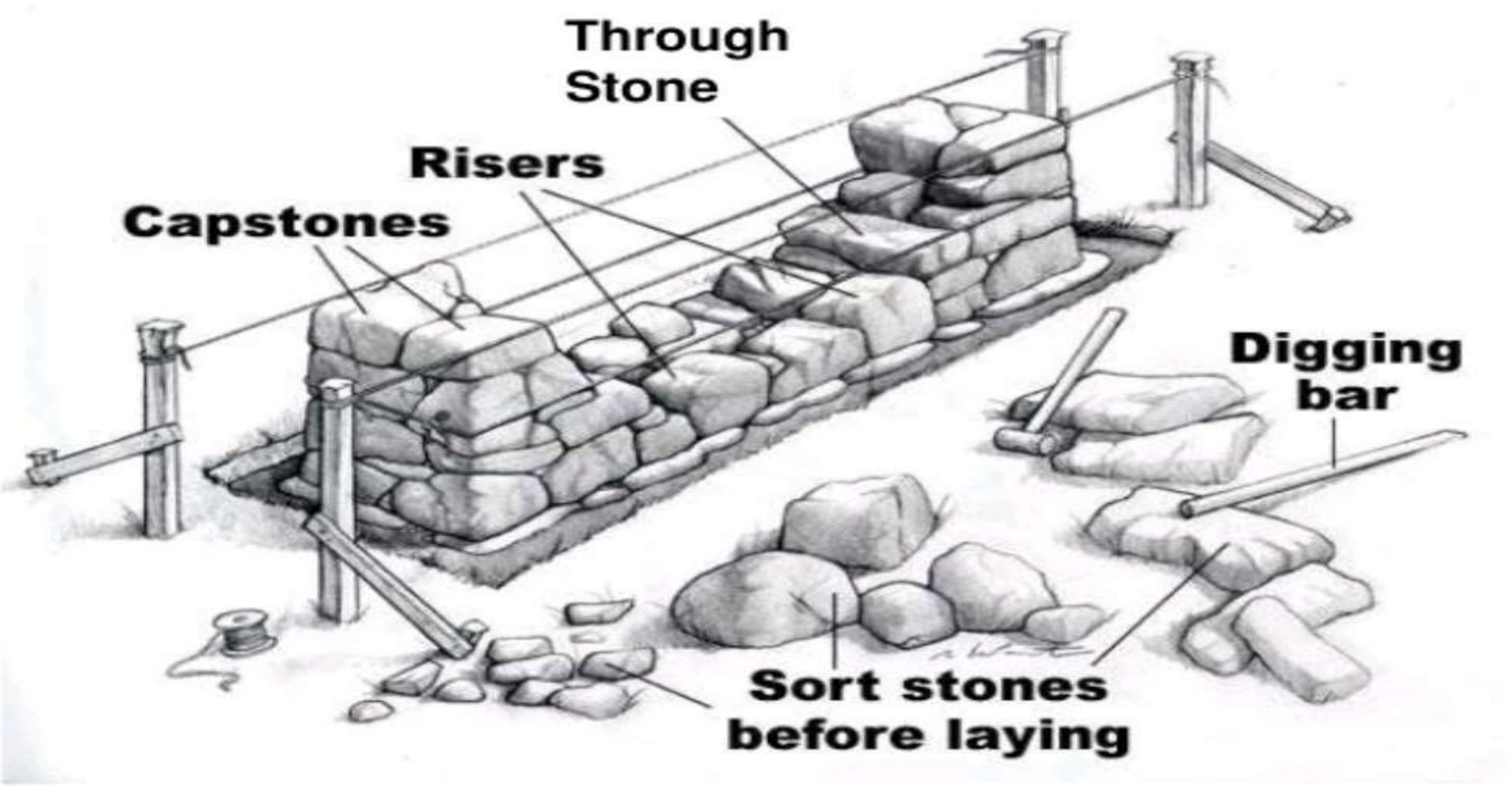
- The construction of stones bonded together with mortar is termed as stone masonry where the stones are available in a abundance in nature, on cutting and dressing to the proper shape, they provide an economical material for the construction of various building components such as walls, columns, footings, arches, lintels, beams etc.

Uses

1) Building foundations, walls, piers, pillars, and architectural works.
2) Lintels, Beams, beams Arches, domes etc.,
3) Roofs and Roof coverings.
4) Cladding Works
5) Dams, light houses, monumental structures.
6) Paving jobs
7) Railway, ballast, black boards and electrical switch

Selection of stone for stone masonry:

1) Availability
2) Ease of working
3) Appearance
4) Strength and stability
5) Polishing characteristics
6) Economy
7) Durability


Through
Stone
Risers
Capstones
Digging
bar
Sort stones
before laying

Types of Stone Masonry:

Based on the arrangement of the stone in the construction and degree of refinement in the surface finish, the stone masonry can be classified broadly in the following two categories

1. Rubble masonry
2. Ashlar masonry

1) Rubble masonry:

In this category, the stones used are either undressed or roughly dressed having wider joints. This can be further subdivided as uncoursed, coursed, random, dry, polygonal and bint.

- ***(i) Uncoursed rubble masonry:*** This is the cheapest, roughest and poorest form of stone masonry. The stones used in this type of masonry very much vary in their shape and size and are directly obtained from quarry. Uncoursed rubble masonry can be divided into the following.

  a) Uncoursed random rubble
  b) Uncoursed squared rubble

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  a) Uncoursed random rubble
  b) Uncoursed squared rubble

Ashlar Masonry

- This type of masonry is built from accurately dressed stones with uniform and fine joints of about 3mm thickness by arranging the stone blocks in various patterns.

- The backing of Ashlar masonry walls may be built of Ashlar masonry or rubble masonry. The size of stones blocks should be in proportion to wall thickness.

Ashlar Masonry

- The various types of masonry can be classified under the following categories are

1) Ashlar fine
2) Ashlar rough
3) Ashlar rock or quarry faced
4) Ashlar facing
5) Ashlar chamfered
6) Ashlar block in course

Ashlar Masonry

Ashlar fine

Ashlar rough

PLINTHS

Traditional Plinth

MORTAR

- **Mortar** is a workable paste used to bind construction blocks together and fill the gaps between them. The word comes from Latin *moratorium* meaning crushed.
- Mortar may be used to bind masonry blocks of stone, brick, etc.
- Mortar becomes hard when it sets, resulting in a rigid aggregate structure.
- Mortar can also be used to fix, or *point*, masonry when the original mortar has washed away

MORTAR

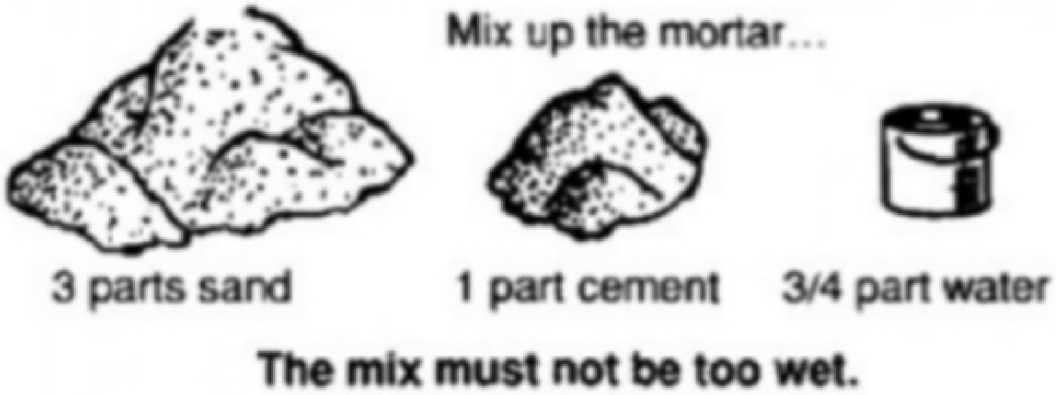
- Mortars are usually named according to the binding material used in their preparation.
- They are essentially required for masonry work, plastering and pointing etc.

FUNCTIONS OF MORTAR:

- To bind together the bricks or stones properly so as to provide strength to the structure.
- To form a homogenous mass of the structure so as to resist all the loads coming over it without disintegration.

Composition of Mortar

- Modern mortars are typically made from a mixture of
  - sand,
  - a binder such as cement or lime, and
  - water.



An ideal mortar:

- Adheres completely and durably to all the masonry unit to provide stability.
- Remains workable long enough to enable the operative to set the masonry unit right to line and level; this implies good water retentivity.
- Stiffens sufficiently quickly to permit the laying of the units to proceed smoothly, and provides rapid development of strength and adequate strength when hardened.
- Is resistant to the action of environmental factors such as frost and/or abrasion and the destructive effects of chemical salts such as sulfate attack.
- Resists the penetration of rain.
- Accommodates movement of the structure.
- Accommodates irregularities in size of masonry units.
- Contributes to the overall aesthetic appearance.
- Is cost effective

Mortar as Binding Material

Plastering

Pointing

Masonry joint

Cement Slurry

Nature of application

- Brick Laying Mortars

Finishing Mortars

Workability

- Workability may be defined as the behavior of a mix in respect of all the properties required, during application, subsequent working and finishing.
- Ease of use, i.e. the way it adheres or slides on the trowel.
- Ease of spread on the masonry unit.
- Ease of extrusion between courses without excessive dropping or smearing.
- Ease of positioning of the masonry unit without movement due to its own weight and the weight of additional courses

Water Retentivity & Air content

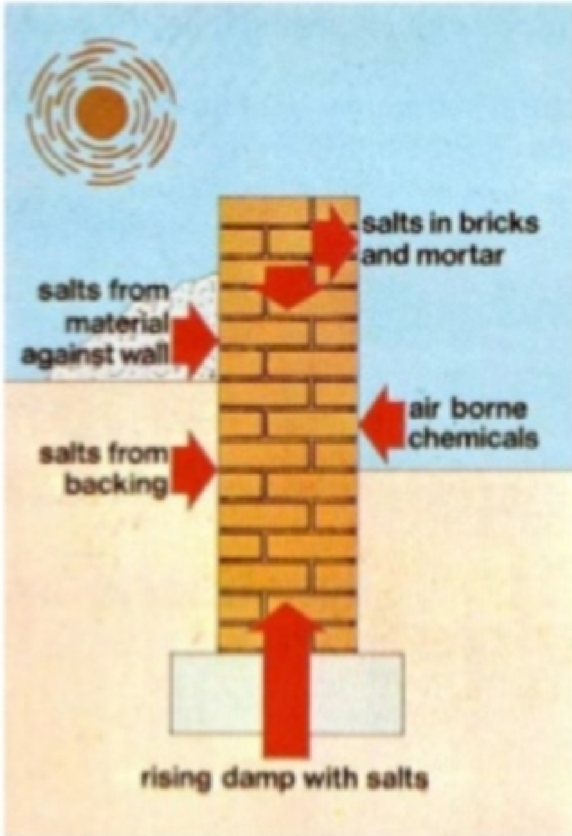
- This is the property of mortar that resists water loss by absorption into the masonry units (suction) and to the air, in conditions of varying temperature, wind and humidity. Water retentivity is related to workability.
- The air content of the mortar in its plastic state is also important. In order to achieve good durability it is necessary that there is sufficient air content (entrained air) to enable freeze-thaw cycles to be resisted without disrupting the matrix of the material.

Stiffening and hardening

- The progression of stiffening, defined in the European Standard as workable life, refers to the gradual change from fresh or plastic mortar to setting or set mortar.
- Hardening refers to the subsequent process whereby the set mortar progressively develops strength.

Properties of hardened mortar

- Durability of mortar may be defined as its ability to endure aggressive conditions during its design life. A number of potentially destructive influences may interact with the mortar: these include water, frost, soluble salts and temperature change. In general, as the cement content increases so will durability. Air entrainment of mortars improves resistance to freeze-thaw damage.



Compressive strength

- The use of too much cement will produce a more rigid mortar, which may result in vertical cracking passing through units and mortar joints as stresses are imposed

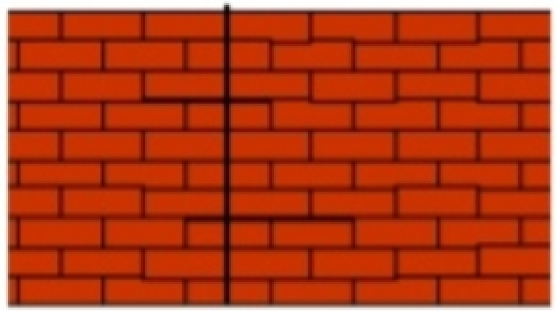


Figure 4: Vertical cracking in brickwork

- Use of the appropriate mortar should not result in cracking, but any that does occur, (e.g. due to movement), will tend to follow the joints, which will be much easier to repair

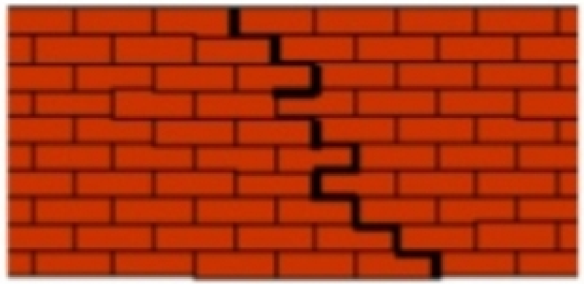


Figure 5: Cracking following the mortar joint

S. No.	*Works*	*Cement: Sand*
1	Masonry works	1:6 to 1:8
2	Plastering masonry	1:3 to 1:4
3	Plastering concrete	1:3
4	Pointing	1:2 to 1:3

MIXING THE MORTAR:

•The sand and the cement have to be thoroughly mixed by hand or in a mechanical mixer before adding any water - do not use dirty water, or water from puddles or ponds, as this could impair the final strength of the mortar.

•Similarly, keep any sugar-containing liquids, such as soft drinks, well away from the mix - sugar, even in small amounts, seriously impairs the setting ability of the cement.

Types of Mortars

- Mortars are classified on the basis of the following

- BULK DENSITY
- KIND OF BINDING MATERIAL
- NATURE OF APPLICATION
- SPECIAL REQIREMENTS

FUNCTION OF SAND AND SURKHI IN MORTARS:

Functions of sand:

- It reduces shrinkage of the building material.
- It prevents development of cracks in the mortar on drying.
- It helps in making mortars and concretes of desired strength by varying its proportions with the binding material.
- A well graded sand adds to the density of mortars and concretes.

Functions of surkhi:

- It provides brick color and make the mortar economical

LIME MORTAR

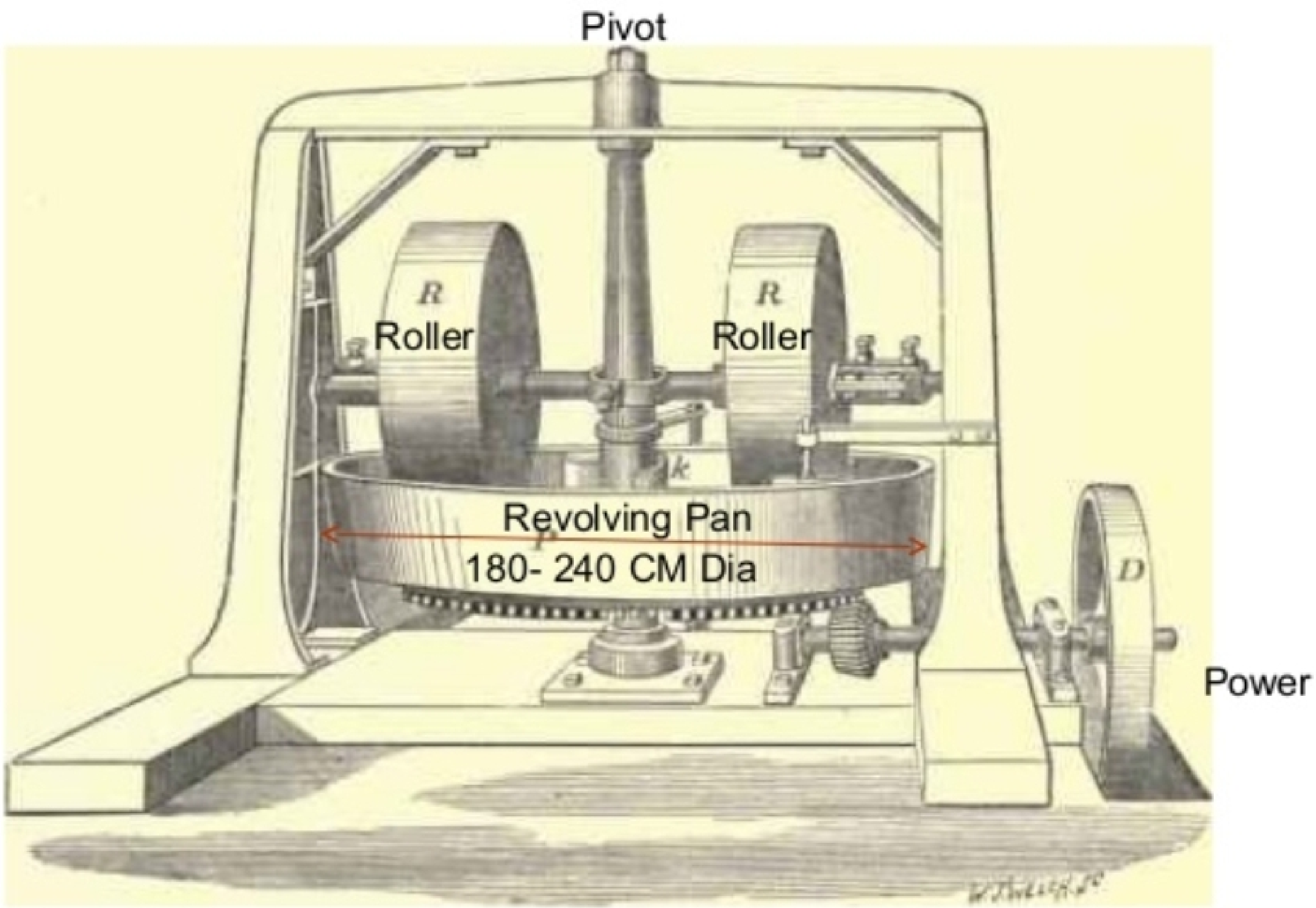
LIME MORTAR

- **Lime mortar** is a type of mortar composed of lime and an aggregate such as sand, mixed with water.
- Lime mortar is primarily used in the conservation of buildings originally built using lime mortar, but may be used as an alternative to ordinary portland cement.
- A **lime kiln** is used to produce quicklime through the calcination of limestone (calcium carbonate).

$$CaCO_3 + \text{heat} \rightarrow CaO + CO_2$$

Lime mortar:

- The paste is prepared by mixing lime and sand or surkhi in suitable proportions in addition to water.
- If surkhi is to be added in lime mortar the equal proportions of sand and surkhi should be mixed with lime.
- These mortars are inferior to cement mortars in strength as well as water tightness.
- These mortars should not be used for underground works as they set in the presence of carbon dioxide and break up in damp conditions.
- This type is used for construction work above ground level i.e. exposed positions.



POWER DRIVEN GRINDING MILL

MUD MORTAR

Mud mortar:

- The paste is prepared by mixing suitable clay, soil with water.
- The soil which is used for preparing mud mortar should be free from grass, pebbles etc.
- These are the cheapest mortars but weakest in strength.
- These mortars are used for brickwork of ordinary buildings and for plastering walls in rural areas.

PREPARATION OF CLAY

Mixing With Hand

Ramming

Homogenous Mixture Clay Mortar

MUD wall

Applications of MUD MORTAR

Walls

Mud being Plastered to wooden Framework

Mud wall

Mud Plaster

Wall with Mud Blocks

Binding Material





Foundation...

- Deep foundation :
- Deep foundation consists of pile and pier foundations.
- This consists in carrying down through the soil a huge masonry cylinder which may be supported by the sides of soil or may be supported on solid rock (hard stratum).

- Pile foundation :
- Pile is an element of construction used as foundation. It may be driven in the ground vertically or with some inclination to transfer the load safely.

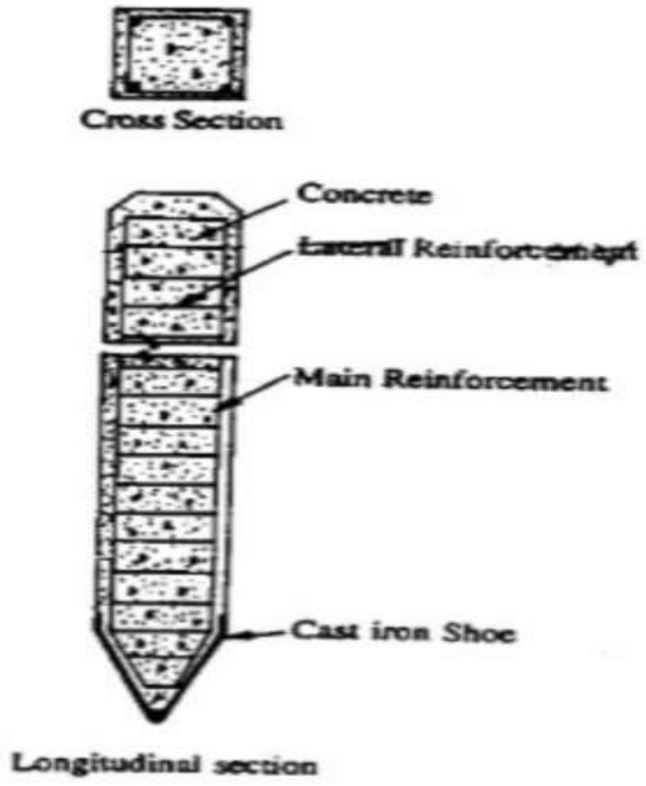
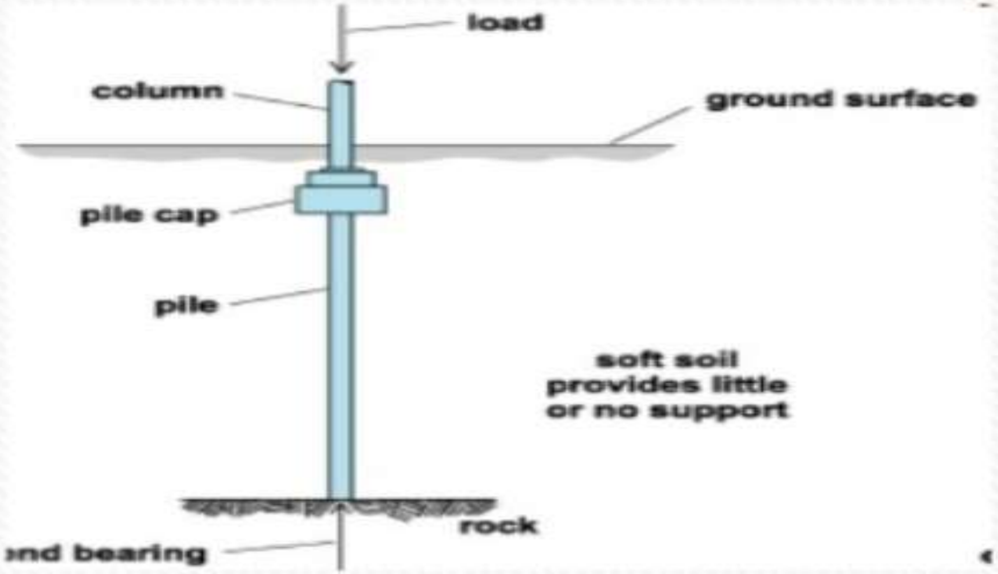
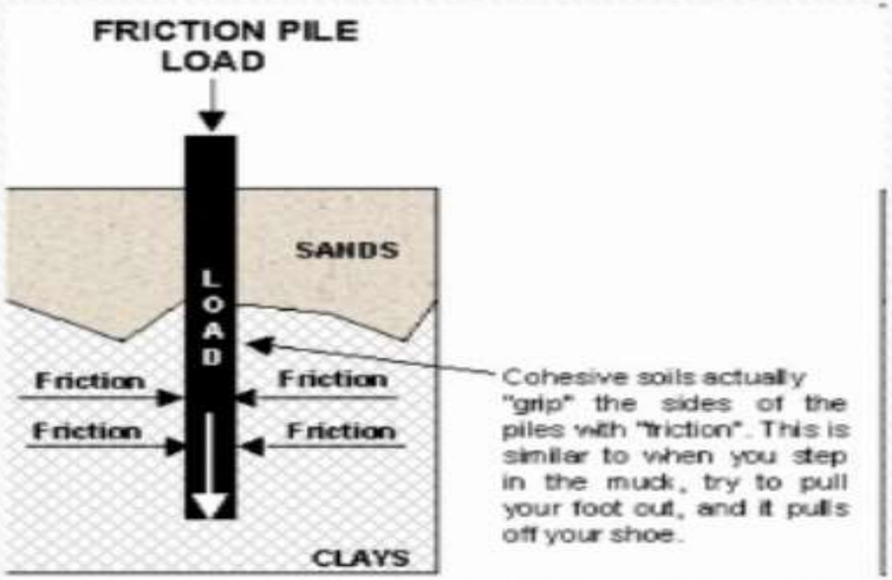


Fig. 2.3 *Concrete pile*

Load Bearing Pile

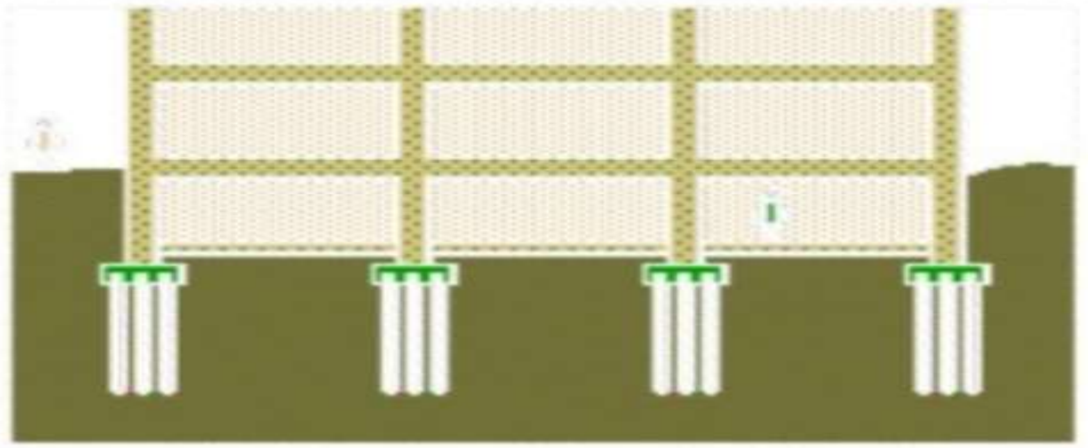


Friction Piles



Foundation...

- **Pile :**
- A slender, structural member consisting steel or concrete or timber.
- It is installed in the ground to transfer the structural loads to soils at some significant depth below the base of the structure.



Lift :

The vertical distance for removal with reference to the ground level. The excavation up to 1.5 metres depth below the ground level and depositing the excavated materials upto 1.5 metres above the ground level are included in the rate of earth work. Lifts inherent in the lead due to ground slope shall not be paid for.

Foundation…

- **Pile foundation…**
- Loads are supported in two ways.
- If the load is supported by the effect of friction between the soil and the pile skin, it is called friction pile.
- Friction piles may be made of cast iron, cement concrete, timber, steel, wrought iron and composite materials.
- If the load is supported by resting the pile on a very hard stratum, it is called load bearing pile.
- Load bearing piles are steel sheet piles, concrete piles and timber piles.

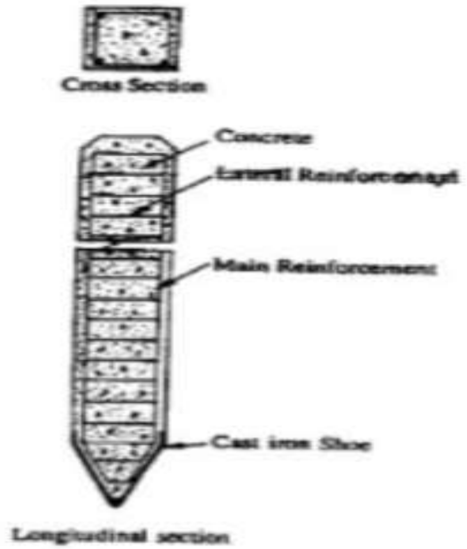


Fig. 2.3 Concrete pile

- Piles may be cast-in-situ or precast.
- They may be cased or uncased.

MATERIAL USED FOR FOUNDATION...

- Foundation must be constructed of a durable material of an adequate strength.

- Concrete
- Metal
- Aggregate
- Waterproofing Materials
- Wood

Lead

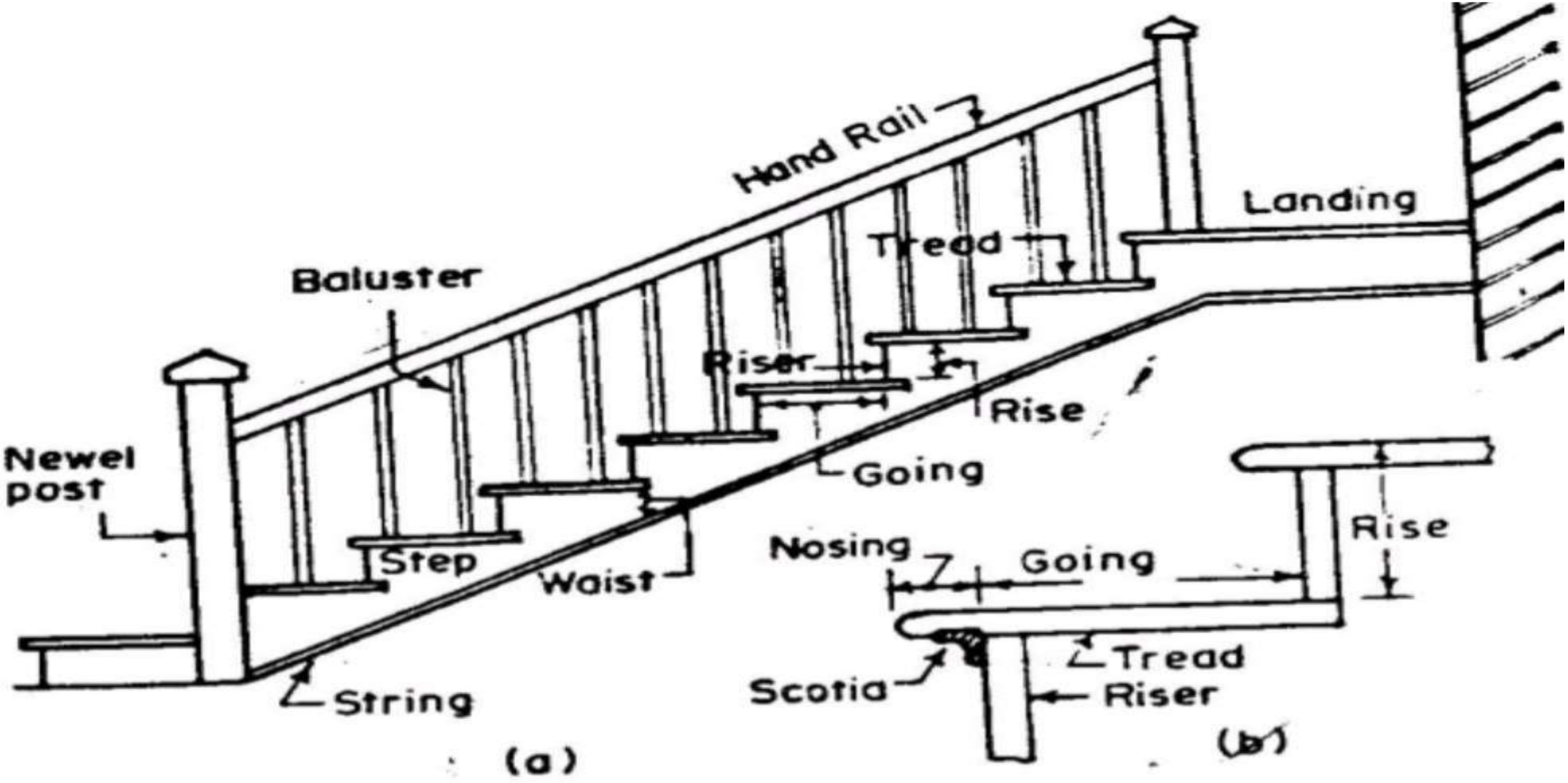
All distances shall be measured over the shortest practical route and not necessarily the route actually taken. Route other than shortest practical route may be considered in cases of unavoidable circumstances and approved by Engineer-in-charge along with reasons in writing. Carriage by manual labour shall be reckoned in units of 50 metres or part thereof. Carriage by animal and mechanical transport shall be reckoned in one km. unit. Distances of 0.5 km or more shall be taken as 1 km. and distance of less than 0.5 km. shall be ignored. However, when the total lead is less than 0.5 km., it will not be ignored but paid for separately in successive stages of 50 metres subject to the condition that the rate worked on this basis does not exceed the rate for initial lead of 1 km. by mechanical/animal transport

Content

- Introduction
- Requirement
- Design Dimension
- Types of stair

Introduction

- A stair is a set of steps, leading from one floor to other , provided to afford the means of ascent or descent between the various floors of building.
- The room or enclosure of building in which the stair is located is known as stair-case.


Hand Rail
Landing
Tread
Baluster
Riser
Rise
Newel post
Going
Step
Waist
Nosing
Going
Rise
Tread
Scotia
Riser
String
(a)
(b)

Some Technical Terms

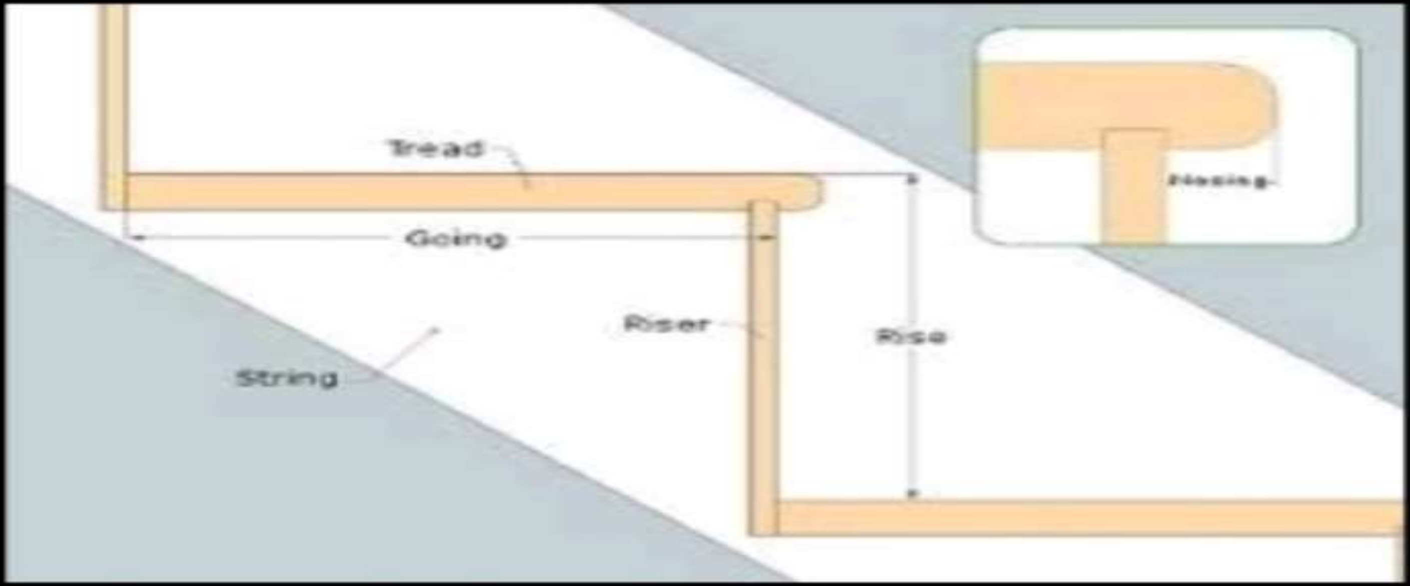
- ***STEP:*** It's a portion of stair which permits ascent or descent it is comprised of a trend and a riser

TREAD

- The upper horizontal of a step upon which the foot is placed while ascending or descending

RISER

- It is the vertical portion of step providing a support to the tread

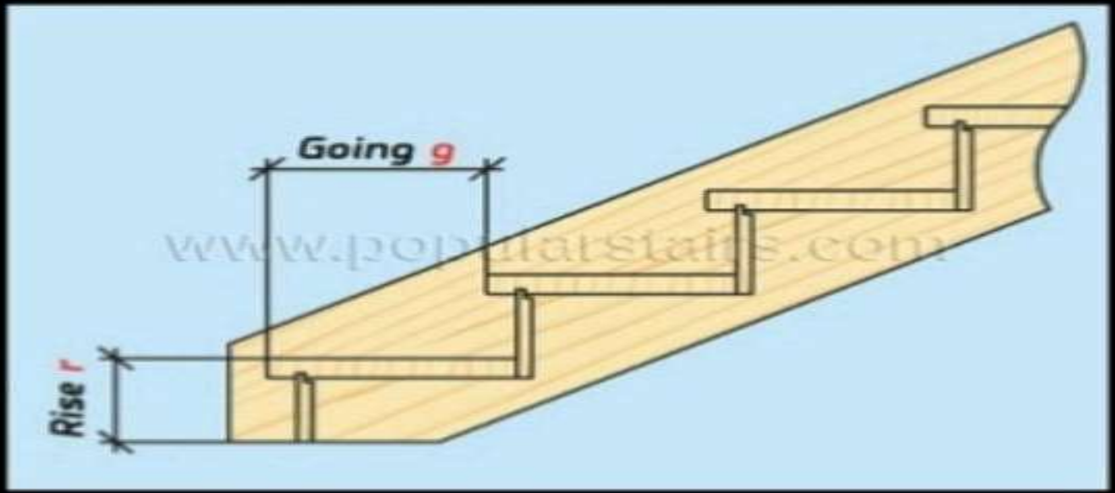


FLIGHT & LANDING

- This is an unbroken series of steps between lading
- Its level platform at the top or bottom of a flight between the floors
- Main reason for lading is providing some rest for the climber

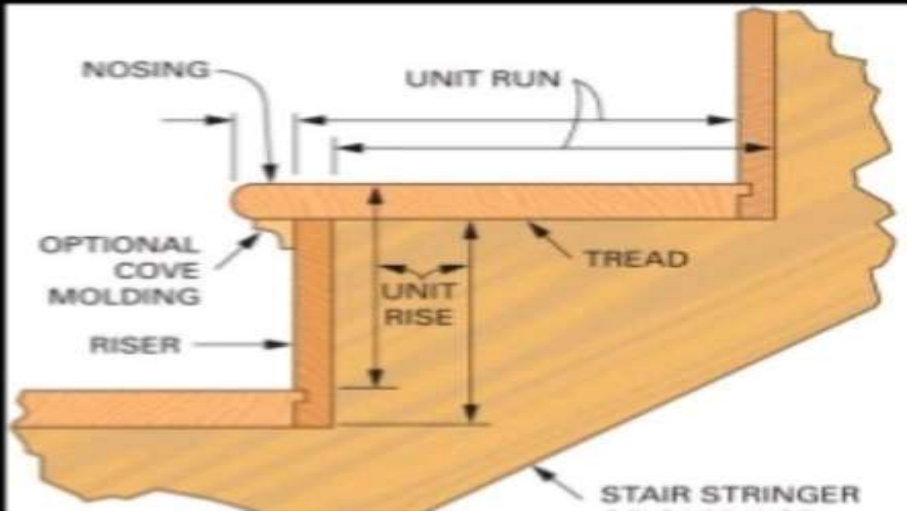
RISE & GOING

- Vertical distance between two successive tread faces.
- It's the horizontal distance between two successive riser faces



NOSING & SOFFIT

- It is the projecting part of the tread beyond the face of the riser
- It is the underside of a stair



Requirements of good Stair

REQUIREMENTS OF GOOD STAIRS

1. LOCATION

- It should preferably be located centrally, ensuring sufficient light and ventilation.

2. WIDTH OF STAIR

- The width of stairs for public buildings should be 1.8 m and for residential buildings 0.9 m.

3. LENGTH

- The flight of the stairs should be restricted to a maximum of 12 and minimum of 3 steps.

REQUIREMENTS OF GOOD STAIRS

4. PITCH OF STAIR

The pitch of long stairs should be made flatter by introducing landing. The slope should not exceed 400 and should not be less than 250.

5. HEAD ROOM

The distance between the tread and soffit of the flight immediately above it, should not be less than 2.1 to 2.3 m. This much of height is maintained so that a tall person can use the stairs with some luggage on its head.

TYPES OF STAIR

Straight	Turning	Continuous
• Single Flight	• Quarter Turn	• Circular
• Double Flight	• Half Turn	• Spiral
	• 3 Quarter Turn	• Helical
	• Bifurcated	

STONE MASONRY

Stone Masonry

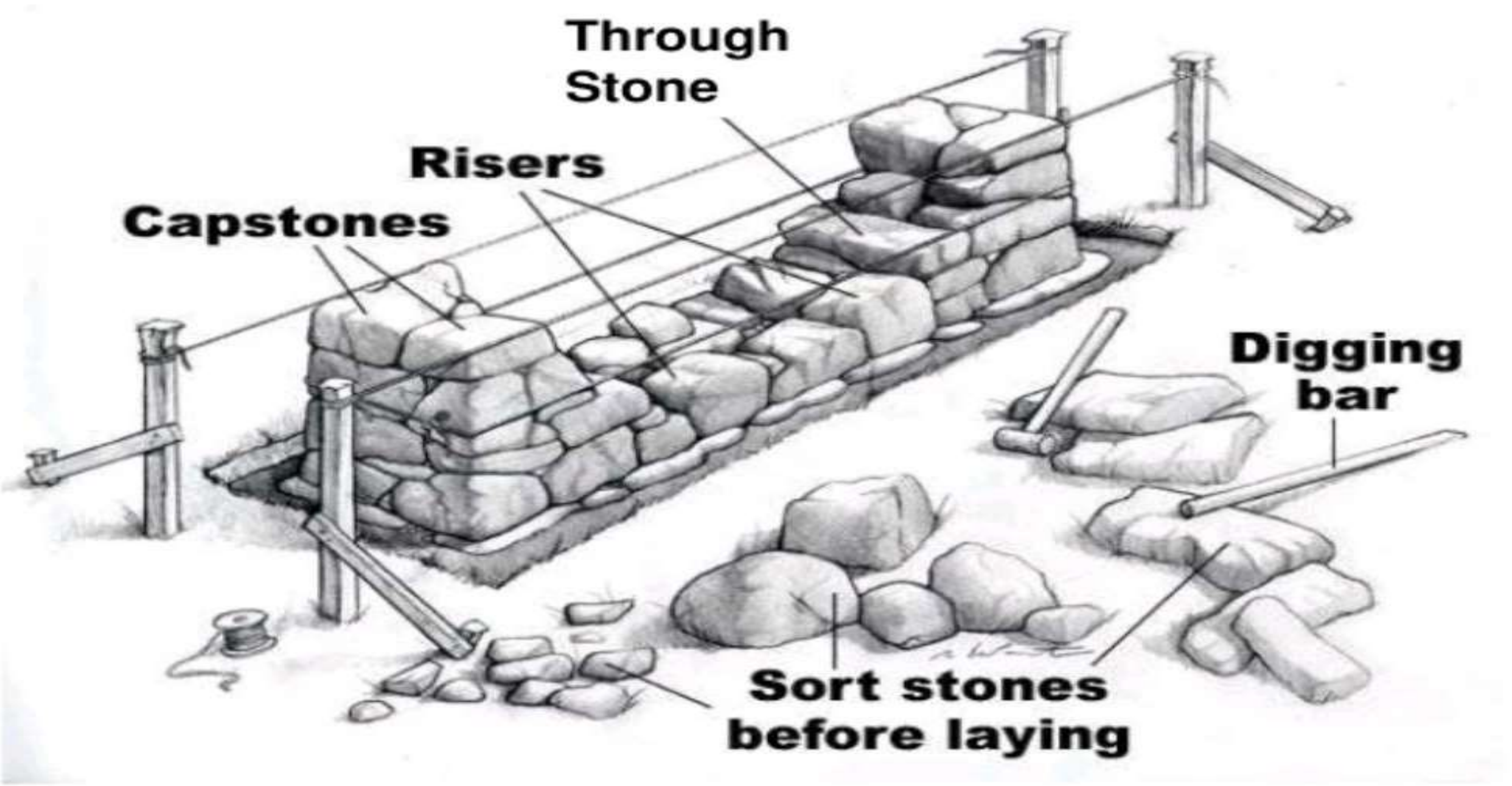
- The construction of stones bonded together with mortar is termed as stone masonry where the stones are available in a abundance in nature, on cutting and dressing to the proper shape, they provide an economical material for the construction of various building components such as walls, columns, footings, arches, lintels, beams etc.

Uses

1) Building foundations, walls, piers, pillars, and architectural works.
2) Lintels, Beams, beams Arches, domes etc.,
3) Roofs and Roof coverings.
4) Cladding Works
5) Dams, light houses, monumental structures.
6) Paving jobs
7) Railway, ballast, black boards and electrical switch

Selection of stone for stone masonry:

1) Availability
2) Ease of working
3) Appearance
4) Strength and stability
5) Polishing characteristics
6) Economy
7) Durability


Through
Stone
Risers
Capstones
Digging
bar
Sort stones
before laying

Types of Stone Masonry:

Based on the arrangement of the stone in the construction and degree of refinement in the surface finish, the stone masonry can be classified broadly in the following two categories

1. Rubble masonry
2. Ashlar masonry

1) Rubble masonry:

In this category, the stones used are either undressed or roughly dressed having wider joints. This can be further subdivided as uncoursed, coursed, random, dry, polygonal and bint.

- ***(i) Uncoursed rubble masonry:*** This is the cheapest, roughest and poorest form of stone masonry. The stones used in this type of masonry very much vary in their shape and size and are directly obtained from quarry. Uncoursed rubble masonry can be divided into the following.

  a) Uncoursed random rubble
  b) Uncoursed squared rubble

1) Rubble masonry:

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Ashlar Masonry

- This type of masonry is built from accurately dressed stones with uniform and fine joints of about 3mm thickness by arranging the stone blocks in various patterns.
- The backing of Ashlar masonry walls may be built of Ashlar masonry or rubble masonry. The size of stones blocks should be in proportion to wall thickness.

Ashlar Masonry

- The various types of masonry can be classified under the following categories are

1) Ashlar fine
2) Ashlar rough
3) Ashlar rock or quarry faced
4) Ashlar facing
5) Ashlar chamfered
6) Ashlar block in course

Ashlar Masonry

Ashlar fine

Ashlar rough

PLINTHS

Traditional Plinth

Content:-

- Introduction
- Timbering Trenches
- Scaffolding
- Shoring
- Underpinning

What are temporary works?

- Any temporary Construction necessary to assist the execution of the permanent works and which will be removed (sometimes not) from the site on completion.
- Examples:-
    - Scaffolding
    - Timbering in trenches
    - Shoring
    - Underpinning

Timbering in Trenches

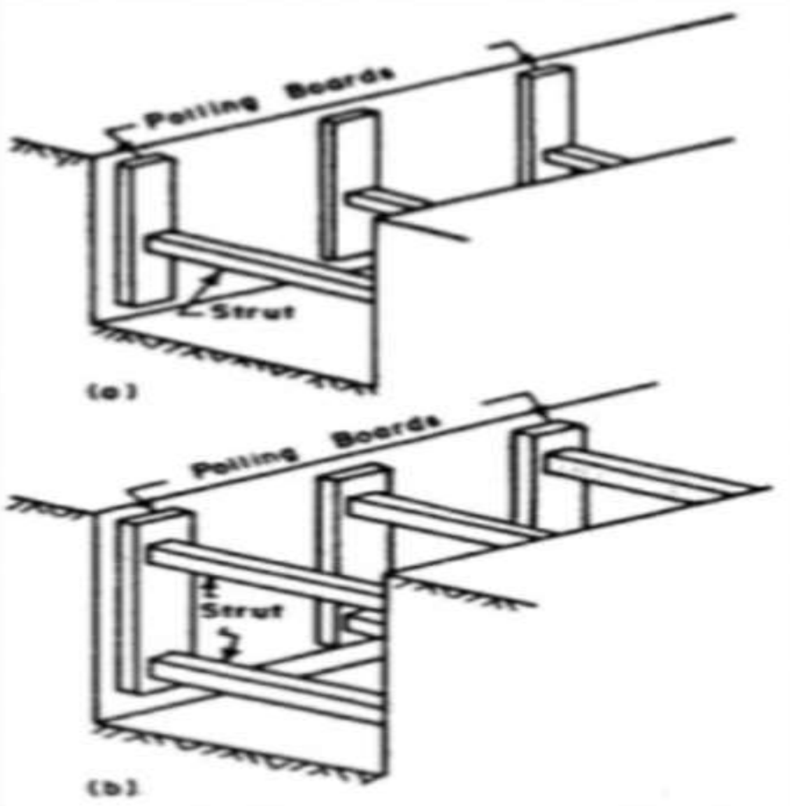
- When the depth of trench is large or when the sub-soil is loose ,the sides of trench may cave in.
- The problem can by adopting a suitable method of timbering
- Timber of trenches ,sometime also known as ‘shoring’ consists of providing timber planks or boards and struts to give temporary support to the sides of the trench.

Various methods of timbering:-

- Stay bracing
- Box sheeting
- Vertical sheeting
- Runners system
- Sheet piling

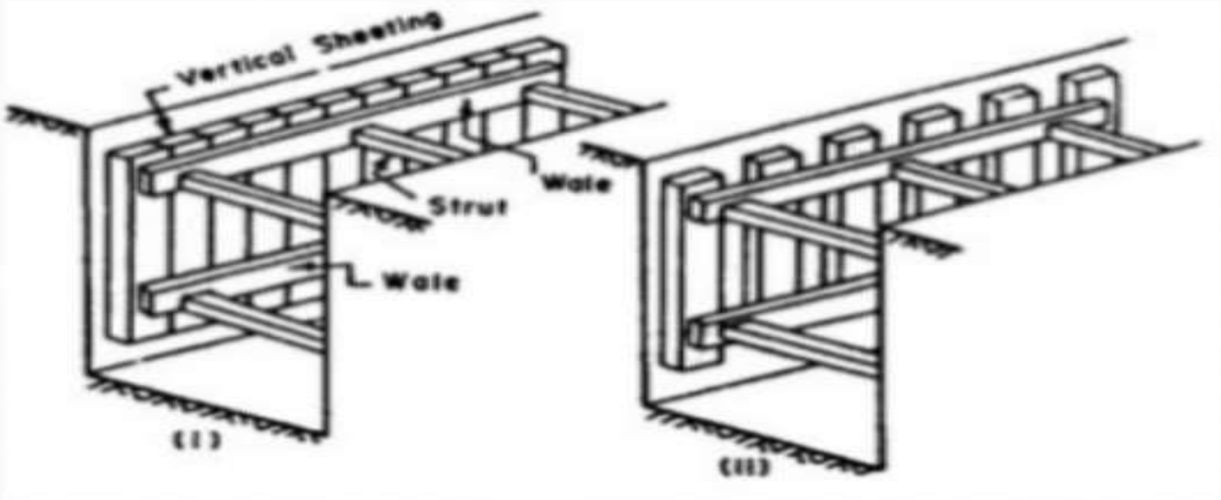
1. Stay bracing

- When the trench soil is firm and the depth of excavation does not exceed 2.0 meters, this method is used for supporting the sides of a trench.



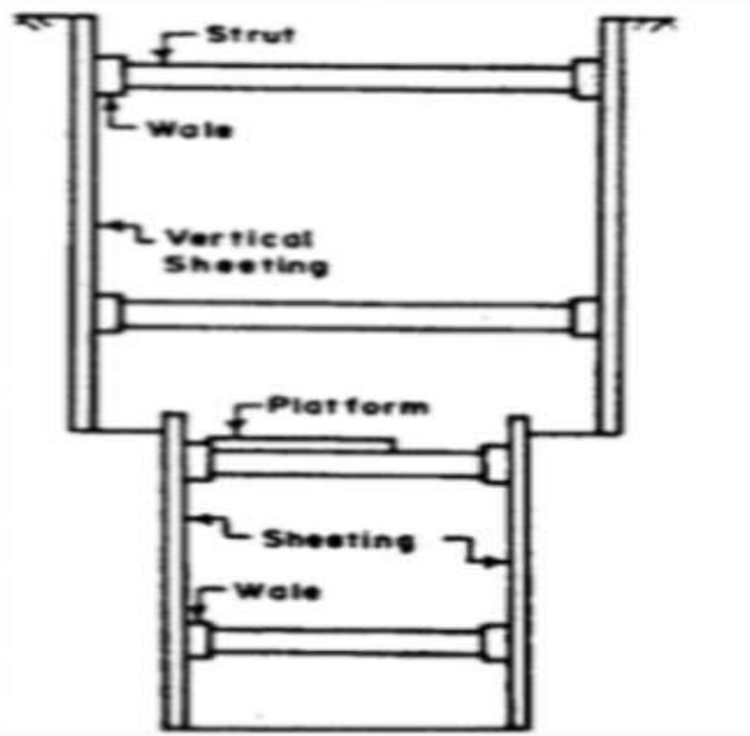
2. Box Sheeting

- This Method is used when excavation is to be carried out in loose soil and when the depth of excavation does not exceed 4 meters.



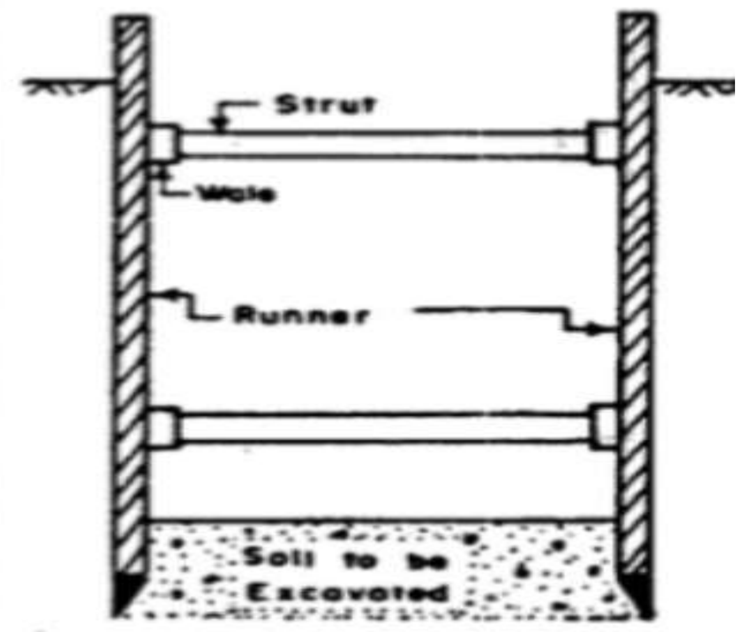
3. Vertical Sheeting

- This method is adopted for deep trenches (up to 10 m depth) in soft ground.
- This method is similar to box sheeting except that the the excavation is carried out in stages and at the end of each stage an offset is provided.



4. Runners

- In case of extremely loose and soft ground runner system is provided.
- The system is similar to Vertical sheeting. Except that in place of vertical sheeting runners are provided.



5. Sheet piling

- Sheet piles are designed to resist lateral earth pressure.
- These are driven in the ground by mechanical means (pile driving equipments).
- This method is adopted when,
    - Soil to be excavated is loose or soft.
    - Width of trench is large.
    - Depth of excavation is large.
    - Sub soil water is present.

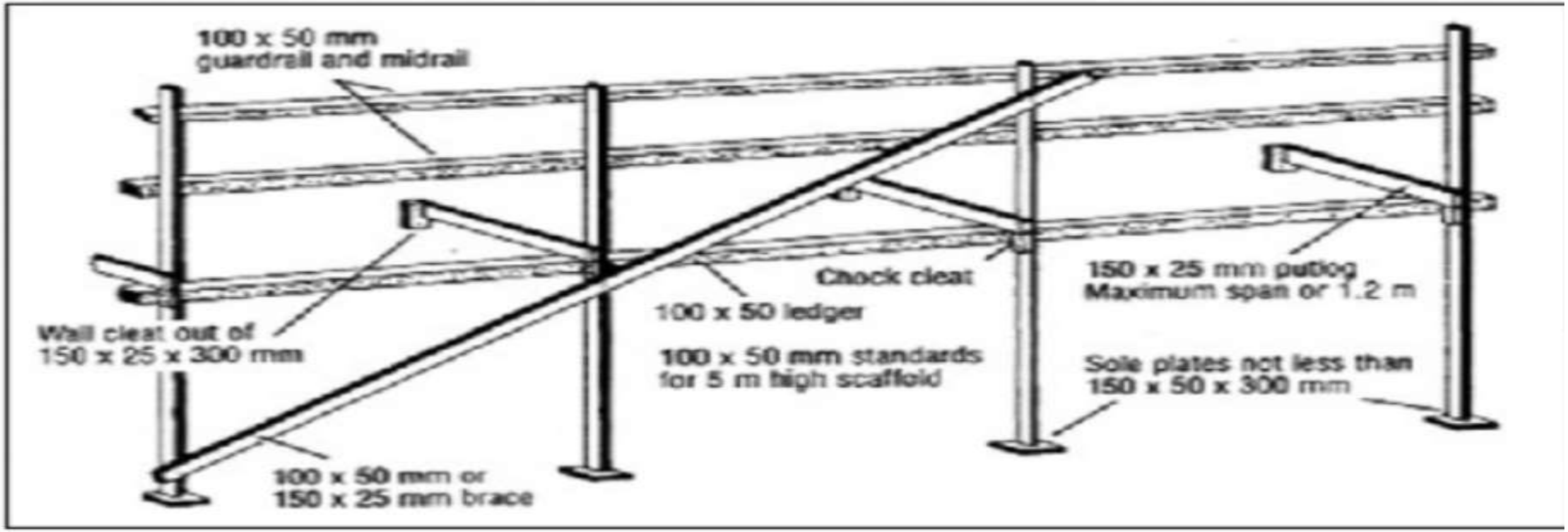
Scaffolding

- What is scaffolding?
  - Scaffolding, also called staging, is a temporary structure used to support people or material and material in the construction or repair of buildings and other structures.

Types of scaffolding

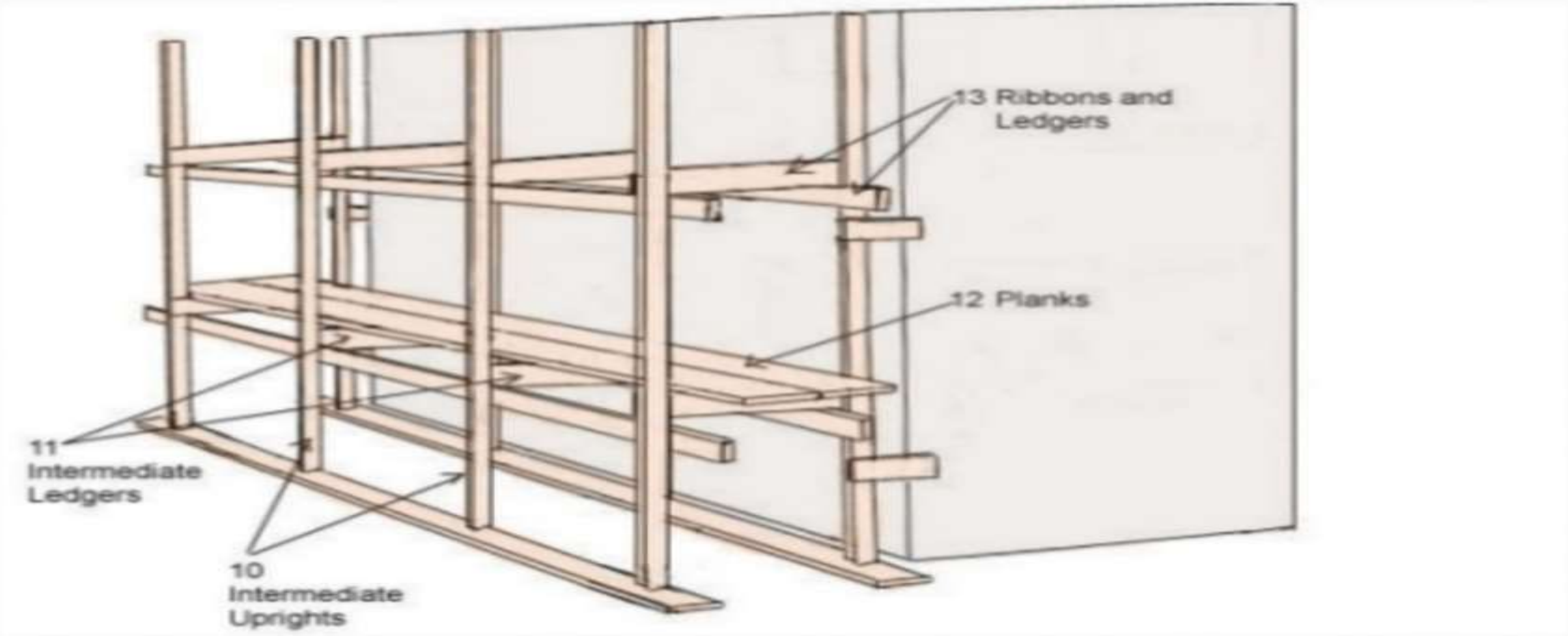
- Single scaffolding
- Double scaffolding
- Needle Scaffolding
- Trestle Scaffolding
- Suspended Scaffolding
- Steel Scaffolding
- Patented Scaffolding

1. Single Scaffolding



- This is the most common type scaffolding and is widely used in the construction or brickwork.
- It consists a single row of standards placed at a distance about 1.20 m from the wall.
- Standards are placed at 2 to 2.5 m interval.

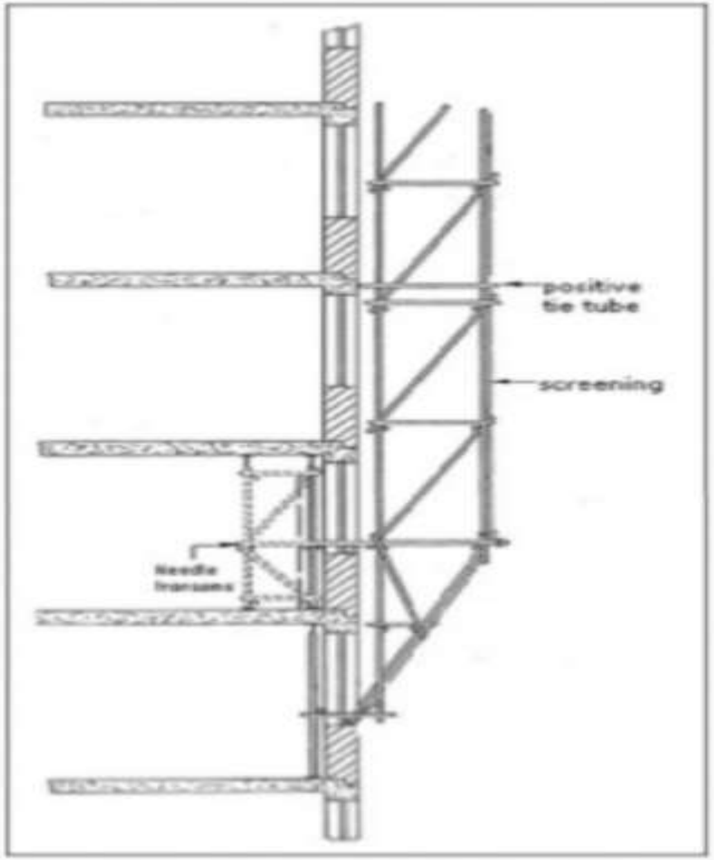
2. Double Scaffolding



- This scaffolding is stronger than the single scaffolding.
- It is used in the construction of stonework.

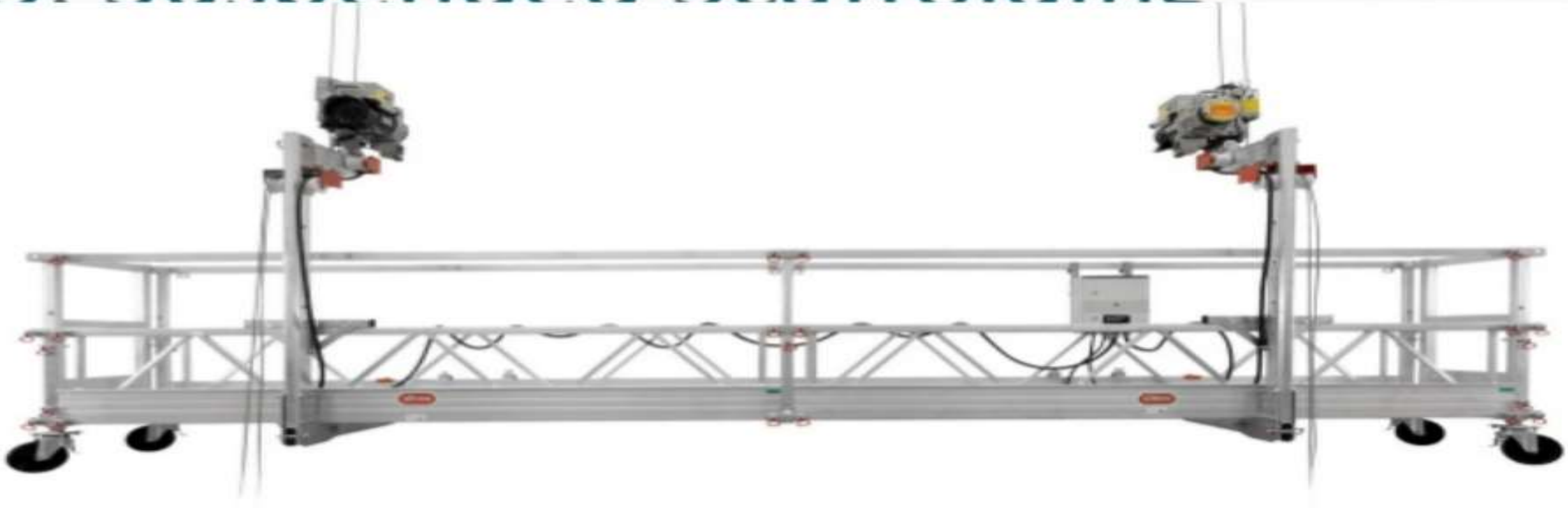
3. Needle Scaffolding

- Ground is weak to support the standards.
- Construction of upper part of the wall is to be carried out.
- It is required to keep the ground near wall, free for traffic, etc.



4.

5. Suspended Scaffolding



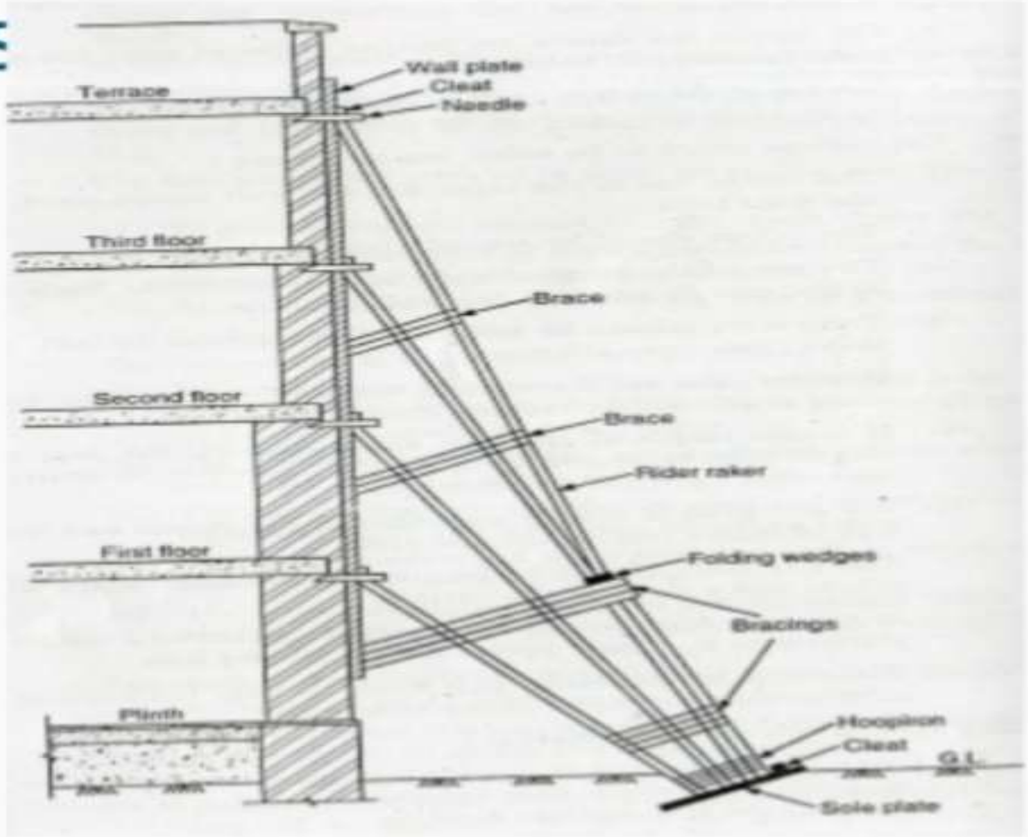
- This is a light weight scaffolding used for repair works such as painting, pointing, etc.
- The working platform is suspended from roofs by means of ropes or chains etc.
- The platform can be raised or lowered at any desired level.

Shoring

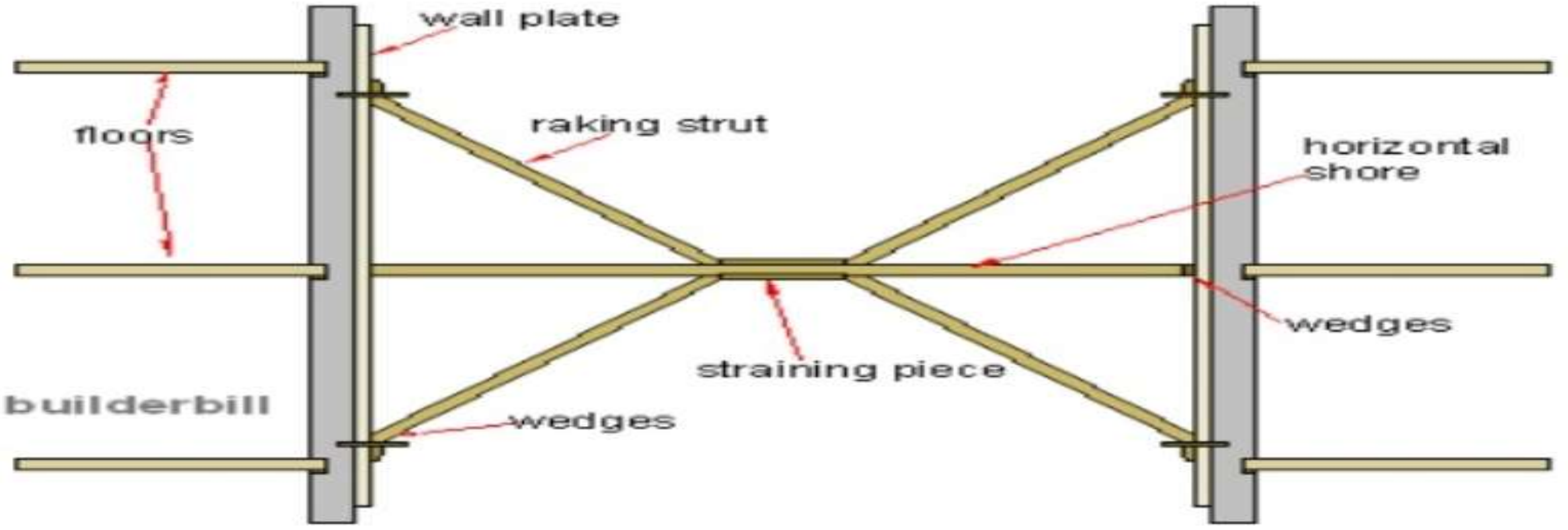
- What is Shoring?
  - Shoring is the construction of temporary structure to support temporarily an unsafe structure.
  - Types of shoring:-
    - Raking Shores
    - Flying Shores
    - Dead Shores

1. Raking Shores

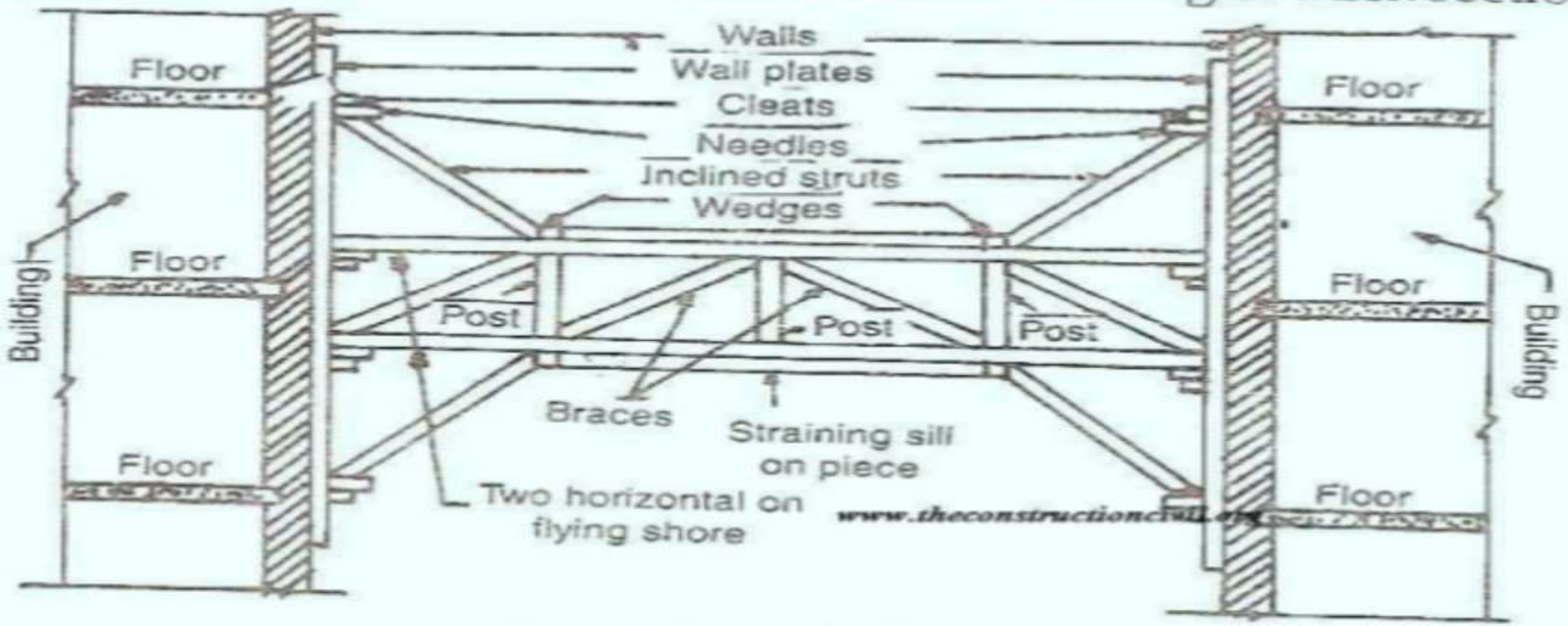
- This is a system of giving temporary support to an unsafe wall.
- The construction of raking shores ,varies with the Condition at site.
- In this method inclined members called rakers are used to give lateral support to the wall.



2. Flying Shores



Part Elevation Through Two Buildings
With A Single Flying Timber Shore



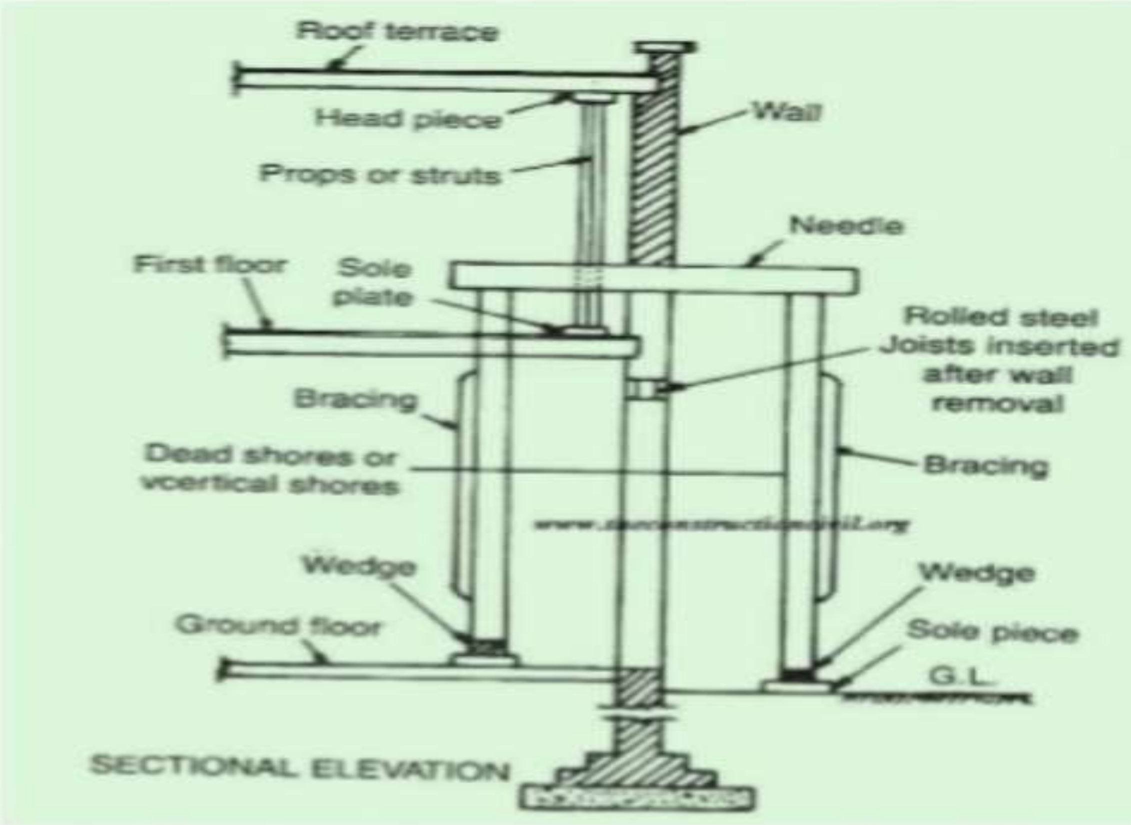
SECTIONAL ELEVATION

Details of double flying shore or horizontal shore.

- In this type of shoring horizontal supports are provided for supporting temporarily the parallel walls of the two adjacent building which may tend to collapse or damage.
- If the walls are quite near to each other (up to 9 m) single flying shore can be constructed.
- When the distance between two parallel walls is more than 9 m a double shore can be constructed.

3. Dead Shores

- Use of dead shores in rebuilding or deepening of foundation, or for removal of lower part of defective wall.

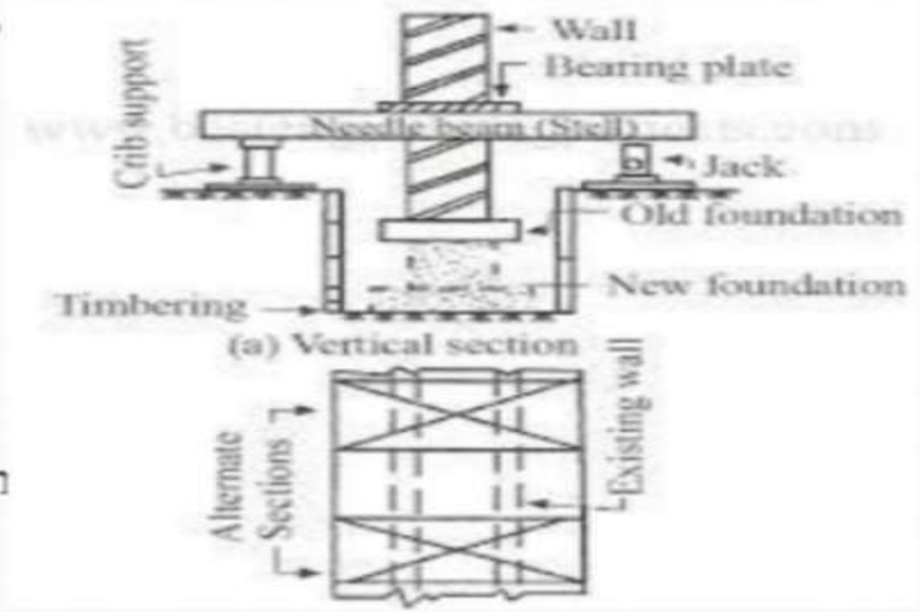


Underpinning

- What is underpinning?
    - The term underpinning is applied to the construction of a new foundation underneath the existing one for strengthening purposes.
    - Types of underpinning
        - Pit Method
        - Pile Method

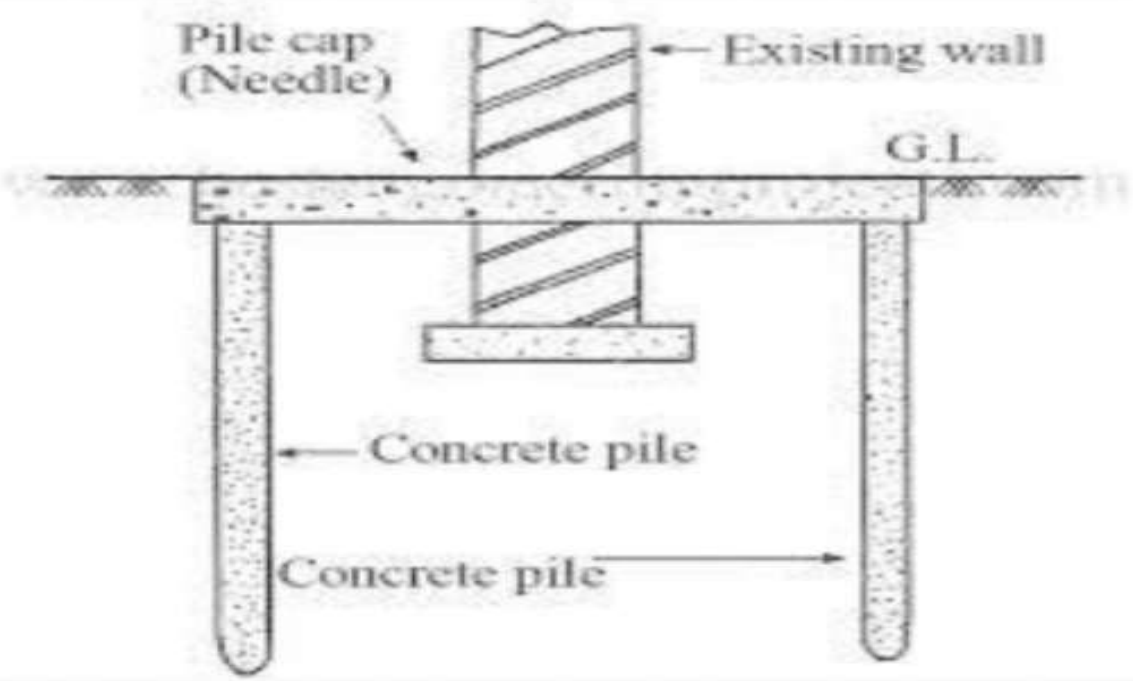
1. Pit Method

- In this method existing wall over the foundations divided into various sections, generally 1.2 to 1.5 m in length.
- Holes are than made at adequate height in the existing wall.
- In these holes steel needle beams with bearing plates are inserted and supported on either side of th by means of crib supports.



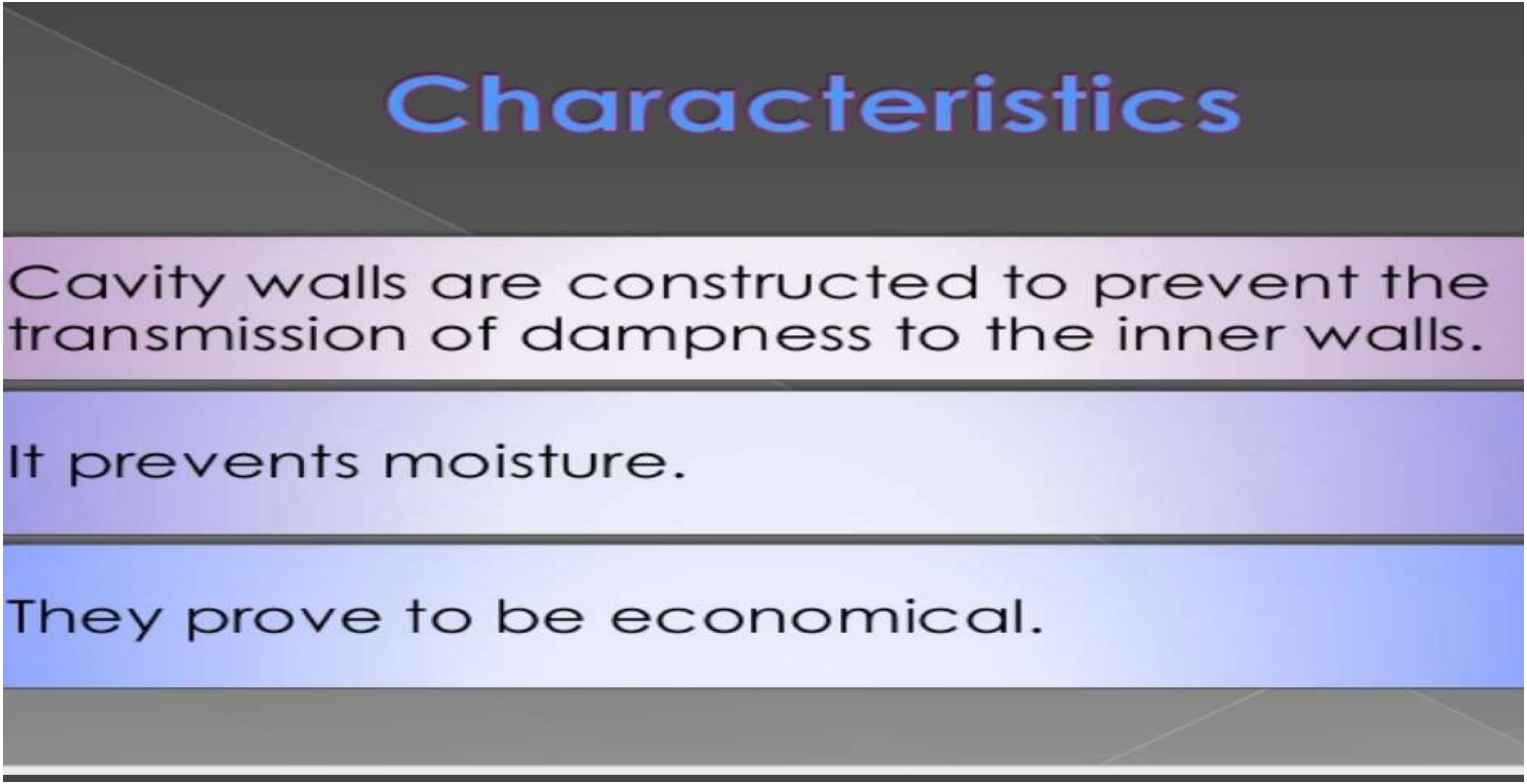
2. Pile Method

- In this method, piles are driven at regular interval along both the sides of the wall.
- The piles are connected by concrete or steel needles, penetrating through the wall.
- This method is very much useful in clayey soils, and i water logged areas.



Introduction

- A Vertical load-bearing member.
- Wall fulfills the function of privacy, security and protection against natural factors.


Characteristics
Cavity walls are constructed to prevent the transmission of dampness to the inner walls.
It prevents moisture.
They prove to be economical.

Other category of walls

- Cavity walls
- Partition walls.

Types of Walls

Load Bearing Walls

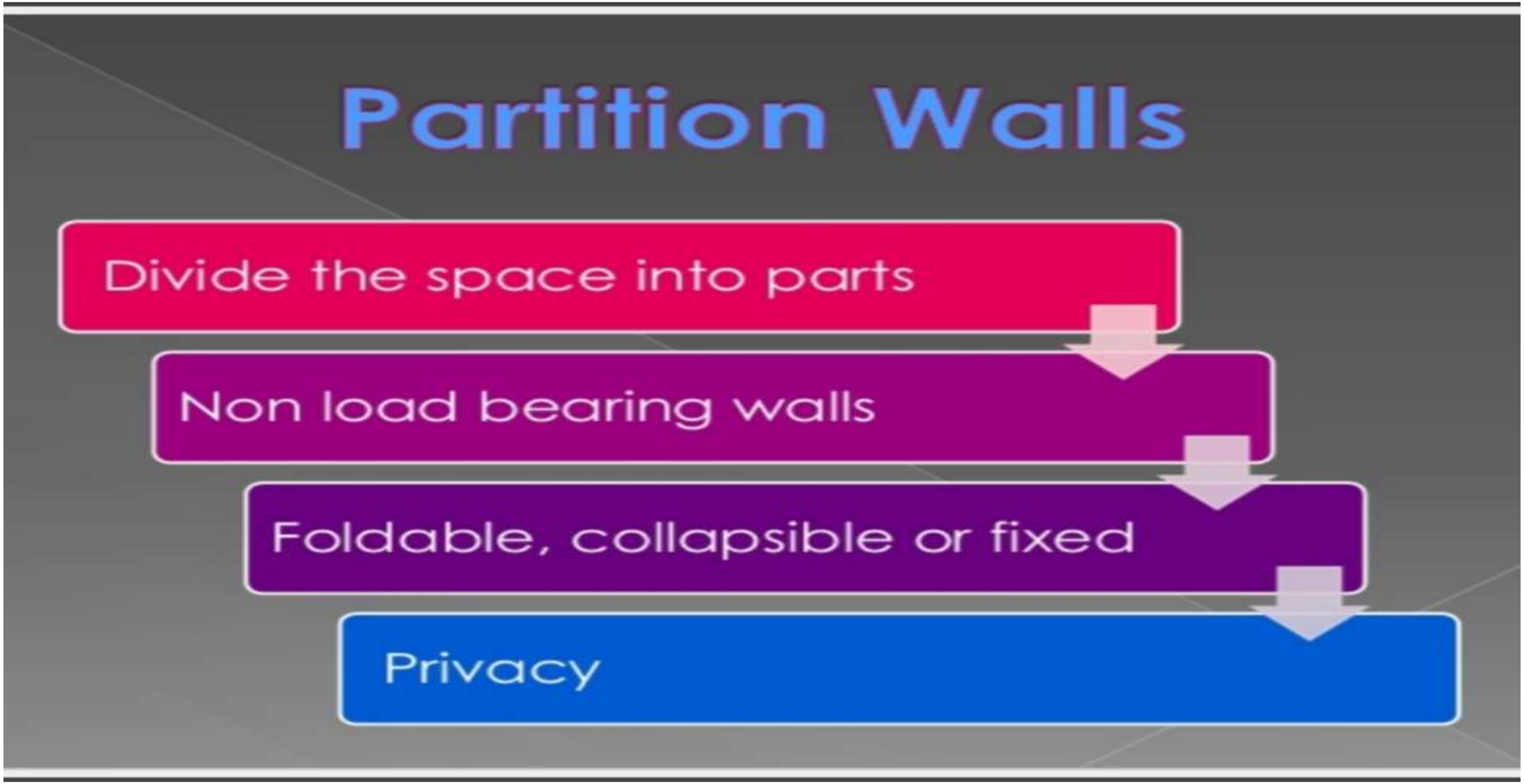
Non-load bearing walls

Load-bearing Walls

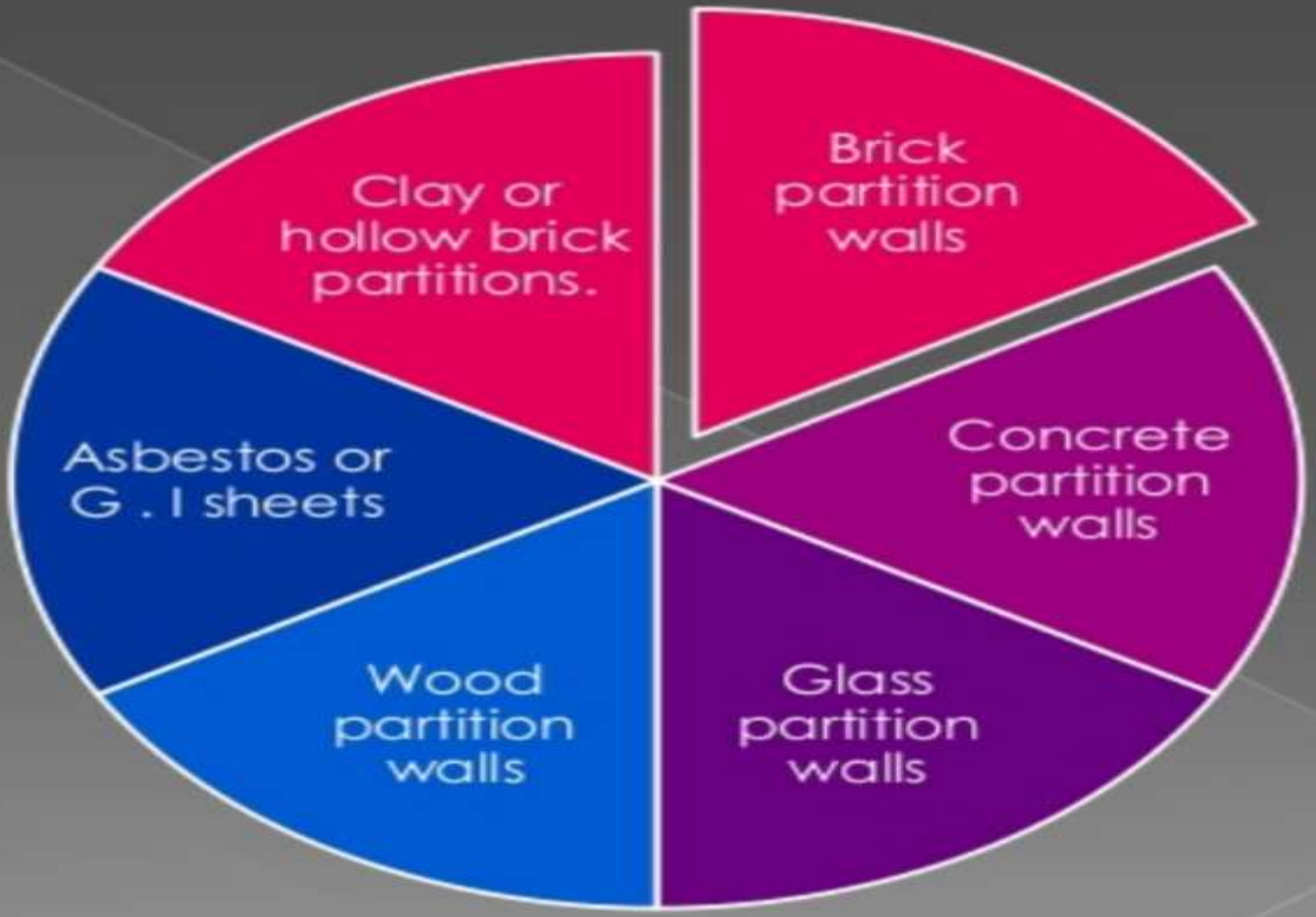
- Load-bearing walls always run perpendicular to the ceiling joists of your home.
- All exterior walls are load bearing; interior walls that are aligned above support beams are also lead bearing.

Non-load bearing Walls

- They carry their own load only.
- The main purpose of these walls is to divide walls or serve as partition walls.
- They run perpendicular to the floors and ceiling.


Partition Walls
Divide the space into parts
Non load bearing walls
Foldable, collapsible or fixed
Privacy

Types of partition walls



Cavity walls

- A cavity wall has two separate walls constructed with a gap in between the two walls .
- The two leaves of cavity walls can be of equal thickness if it is non load bearing wall.

Brick partition wall

Plain brick artition

- This type of partition are cheapest as well as considered strong and fire resistant .

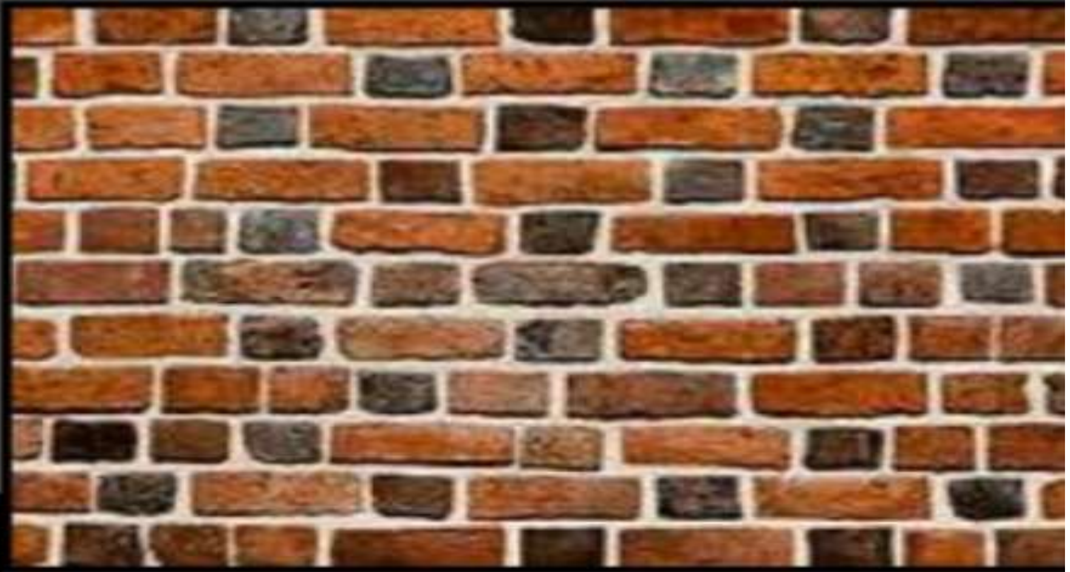
einforce d brick artition

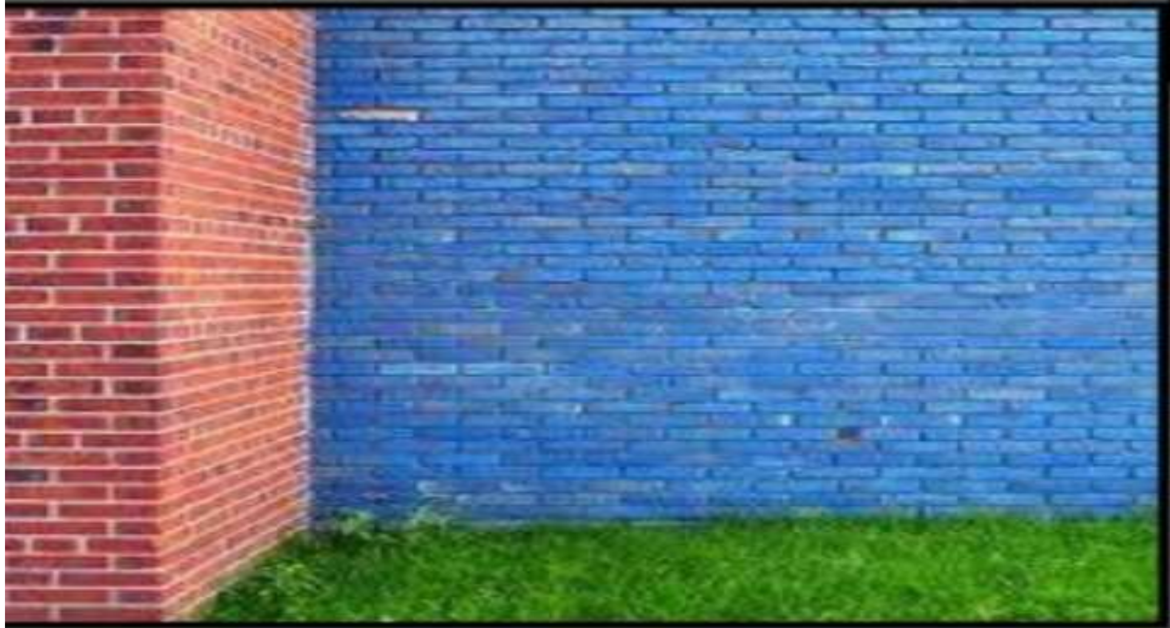
- Bricks are reinforced with iron strops or steel bars.

Brick ogging artition

- It consists of brick work within the frame work of wooden members namely studs (vertical members)and nogging pieces (horizontal member).

It supports roof and ceilings.





The main purpos of the wall is to divide the spac of the building.

Asbestos sheet

Brick nogging partition

Wood partition

Concrete partition

Asbestos sheet

- Wooden frame is used to fix the this sheets for the partition.
- They are lighter in weight , thin and cheaper.
- To make it more strong ,specially manufactured asbestos slabs are used.
- Fire-resistant and makes it have good heat and sound insulation properties.

Clay or hollow bricks partition

- They are made from clay , terra-cotta or concrete.
- They are light in weight , rigid ,strong , economical and good insulation.
- They are available in variety of sizes.

Hollow brick partition

- Glass block adds to the architectural beauty and also provide good day light.
- They are soundproof and fire proof.
- Needs care and mainteance.

Glass partition

Glass partition

Concrete partition

- Can be plain or reinforced.
- It may be cast in site or built from panels or blocks precast in advance.
- This partition are rigid and stable along both vertical and horizontal directions.

Glass partition

- These may be made from sheet glass or hollow glass bricks.
- Sheets of glass are fixed in the framework of wooden members dividing the entire area into a number of panels.

Wood partition

- This type of partition walls consists of a wooden framework either supported on the floor below or by side walls.
- Such partitions are not fire-resistant and the timber forming the partition is likely to decay or be eaten away by white ants.
- The major advantage of using this partition is light in weigth though costlier.

WATER PROOFING IS THE METHOD OF CREATING A PROTECTIVE LAYERING AROUND THE BUILDING PREVENTING THE WATER FROM SEEPING INTO THE BUILDING. WATER PROOFING IN BASEMENTS IS CARRIED OUT SO AS TO PREVENT THE INTRUSION OF FLUIDS OR SMELLS INTO THE BASEMENTS. WATER INTRUSION DAMAGES STRUCTURAL ELEMENTS. THE IMPORTANT ELEMENTS OF WATERPROOFING ARE SOIL, CONCRETE (BUILDING) AND WATER.

THE DIFFERENT TYPES OF WATER-RELATED PROBLEMS WHICH CAN OCCUR IN THE BASEMENTS CAN BE SEEN BELOW:

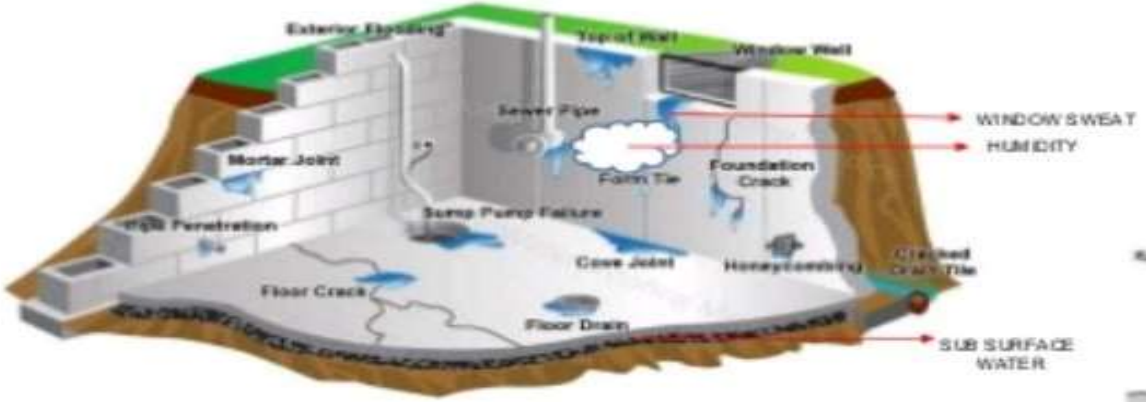
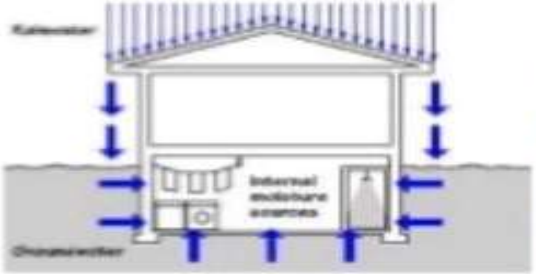


DIAGRAM SHOWING THE DIFFERENT TYPE OF LIQUID LEAKAGE/ SEEPAGES IN BASEMENTS

STANDING WATER IN BASEMENT

WHITE MOLDS IN BASEMENT



CAUSE OF MOISTURE IN BASEMENT

ODOUR IN BASEMENT

WHY IS WATER PROOFING ESSENTIAL?

THE ABOVE PICTURES SHOW THE PROBLEMS IMPOSED ON BASEMENTS BY FLUID MATTER (GASEOUS + LIQUID) THUS MAKING THE BASEMENTS UNHYGIENIC AND WEAK.

WATERPROOFING IS ESSENTIAL AT BELOW-GRADE AREAS TO PREVENT WATER INTRUSION AND STRUCTURAL DAMAGE. IT IS GENERALLY DONE WHEN THE BUILDING IS ON OR BELOW THE GROUND LEVEL. FLOODING, WATER DAMAGE AND MOLDS (HIGH MOISTURE LEVELS LEAD TO MOLDS) ARE MANY OF THE CAUSES THAT DAMAGE CONSTRUCTION.

WATER PROOFING : REASONS

BUILDING CONSTRUCTION REPORT

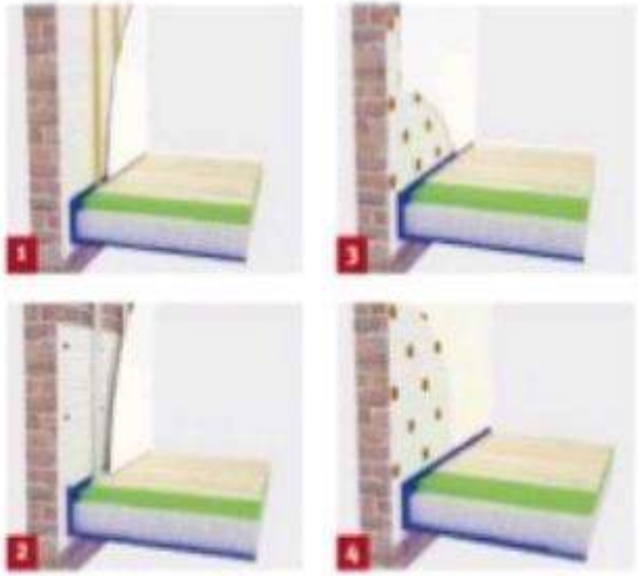
SHEET NO. 1

RIYA BAGCHI
III YEAR – B
D.O.A : 17.09.2015
D.O.S. : 24.09.2015

Summary

Damp Proofing	Water Proofing
Is tar based	Is rubber based.
Slows the process of water absorption.	Prevents the process of water absorption.
Is initially more expensive.	Is cheaper in the beginning, but leads to more expensive problems later on.
Cracks along with the foundation	Water proofing stretches to cover those cracks
Does not resist water well enough to prevent oversaturation from ground water	Prevents ground water from rain

Damp Proofing

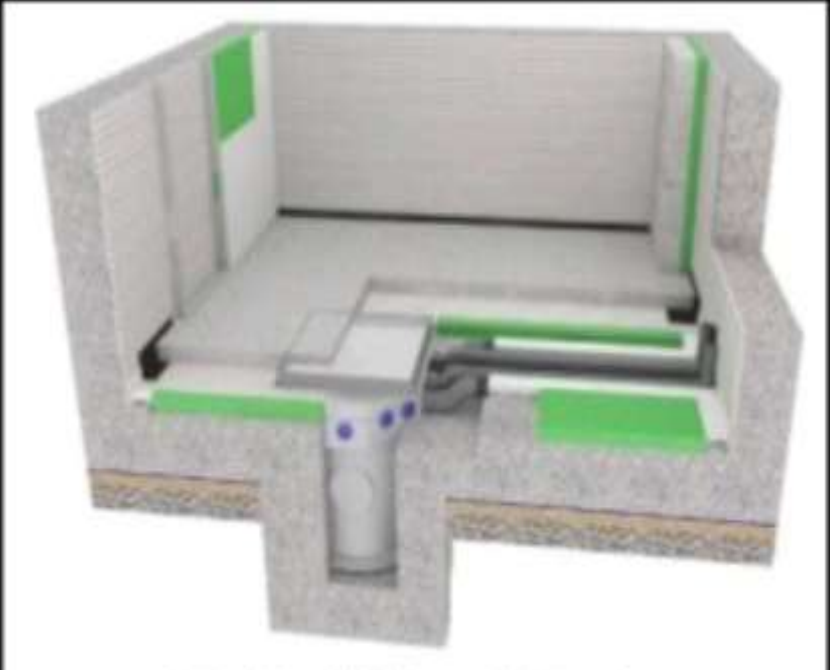


Fixing of Newton System 800 Damp Proof Membranes with 1. Battens, 2. Metal Frame, 3. Dot and Dab, 4. Plaster/Lime or Plaster/Render

Damp proofing method can be applied for a property when the external ground level is lower than the floor level inside the building. When the earth around is lower, the risk of pressurized water ingress is reduced, and here you can apply damp proofing.

For example, when dampness is found you could apply a damp proofing membrane that can manage the capillary held moisture applicable in the case of walls and floors.

Waterproofing



Newton System 500 For Basement Waterproofing

Waterproofing is crucial if the external grounds are on a higher plane than the internal floors. This is because there are more chances of water entering the property through the earth, and hence you need a waterproofing solution that can collect and remove the water away from the building.

Water proofing is done with a concoction that includes rubber, preventing moisture and water from penetrating any material.

Causes of Dampness in Buildings –

- Old bathroom pipes Damaged seals around baths and showers.
- Corroded water pipes that are inside the walls.
- Old bathroom pipes.
- Plumbing for central heating, kitchens and bathrooms.
- Moisture entrapped during construction.
- Defective orientation of building.
- Drain ability of soil.
- Poor Quality of Construction Material.

Requirements of ideal materials for damp proofing :-

They should be :-

- impervious.
- Durable
- Capable of bearing the load
- Dimensionally stable
- Flexible
- Free from sulphates, chlorides and nitrates.
- Inexpensive

Principles of damp proofing

- ✓ mortar bed prepared to receive damp-proof course should be leveled.
- ✓ The horizontal damp proofing course should cover the full width of wall excluding rendering.
- ✓ If sheets or mastic asphalt are used, the gap should not be less than 100mm at any point
- ✓ At joints and corners. Damp proof course should be continuous.
- ✓ Damp proofing course should not be kept exposed on the wall surface.
- ✓ At vertical and horizontal junctions, damp proof courses should be continuous and a cement mortar fillet of about 75mm should cover joints.

2. Classification of material

The materials commonly used to check dampness can be divided into the following four categories

a) Flexible material

Material like bitumen felts (which may be Hessian based or fibre/glass fibre based), plastic sheeting (polythene sheet) etc

Semi rigid materials

Materials like mastic asphalts combination of materials or layers.

3. Material used for damp proofing

Following are the materials, which are commonly used for damp proofing.

1. **Hot bitumen**

   This is a flexible material and is placed on the bedding of concrete or mortar. This material should be applied with a minimum thickness of 3 mm.

2. Mastic asphalt

This is a semi rigid material and it forms an excellent impervious layer for damp proofing. The good asphalt is very durable and completely impervious material. It can withstand only very slight distortion. It is liable to squeeze out in very hot climates or under very heavy pressure. It should be laid by experienced men of the specially firms.