Elements of Building Construction - I

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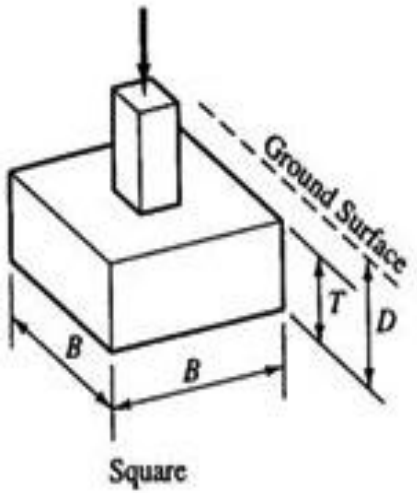
FOUNDATIONS

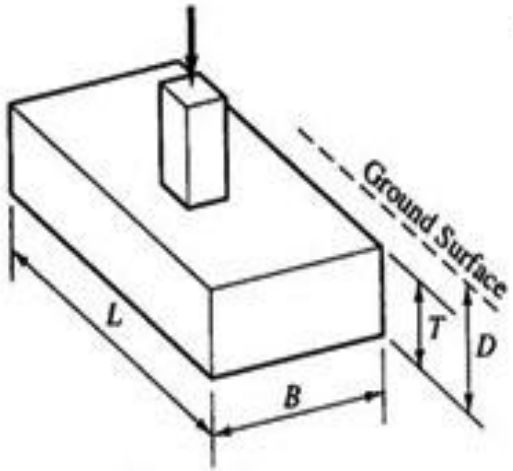
- Every building consists of two basic components : the Super – structure and the substructure or foundations.
- The substructure or foundations is the lower portion of the building, usually located below ground level, which transmits the load of the super structure to the sub-soil.
- A foundation is therefore that part of the structure which is in direct contact with the ground to which the loads are transmitted.
- The soil which is located immediately below the base of the foundation is called the sub-soil or foundation soil, while the lowermost portion of the foundation which is in direct contact with the sub-soil is called the footing.
- When the loads are transmitted to the sub-soil, it settles. If this settlement is slight and uniform throughout, no damage will be caused to the building.
- But if the settlement is excessive or unequal, serious damage may result in the form of cracked walls, distorted doors and window openings, etc., and sometime collapse of the building.
- The foundation is thus the most important part of a building. Since it remains below the ground level, the signs of failure of foundation are not noticeable till it has already affected the building.

- A foundation should be sufficiently strong to prevent excessive settlement as well as unequal settlement.
- Foundations may be broadly classified under two heads :
- (a) Shallow foundations : If the depth of foundation is equal to or less than its width, then it is defined as shallow foundations.
- (b) Deep Foundations : If the depth of foundations is greater than its width, then it is defined as deep foundations.
- From the design point of view, shallow foundations may be classified as, (1) Spread footings, (2) Combined footings, (3) Strap footings, (4) Mat (Raft)foundation.
- Deep foundations are classified as, (1) Deep strip, rectangular or square footings, (2) Pile foundations, (3) Pier foundation or drilled caisson foundation and (4) Well foundation or caissons.

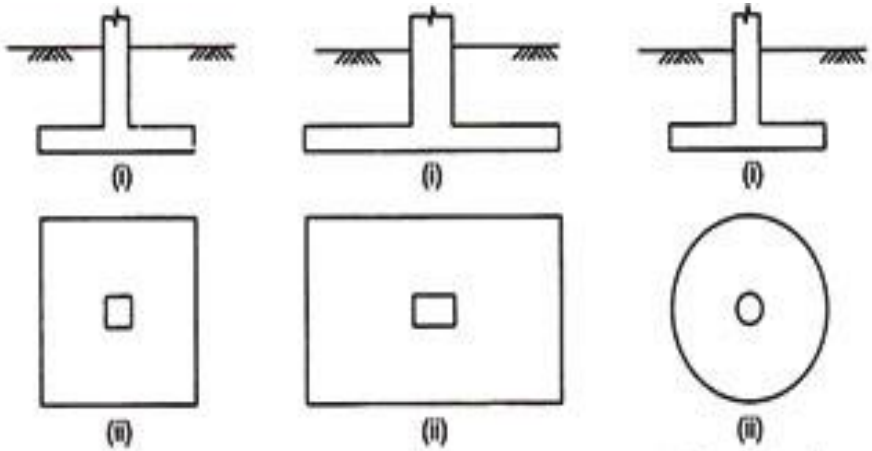
Shallow Foundations



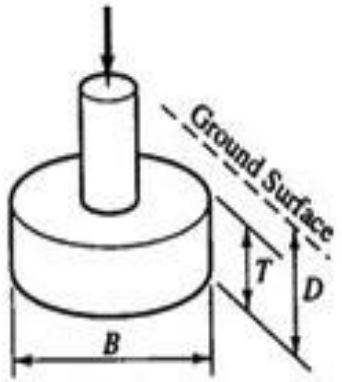
Square



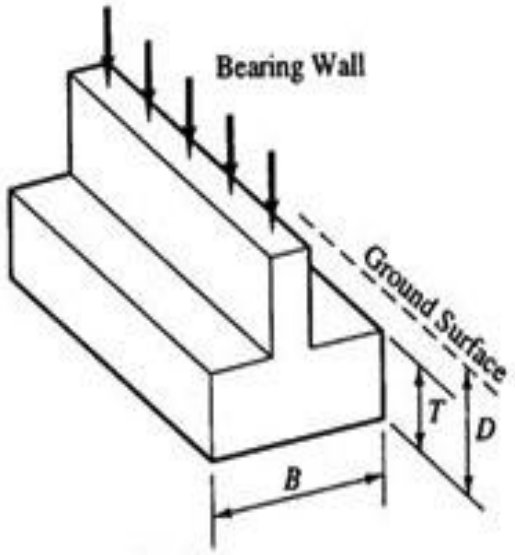
Rectangular



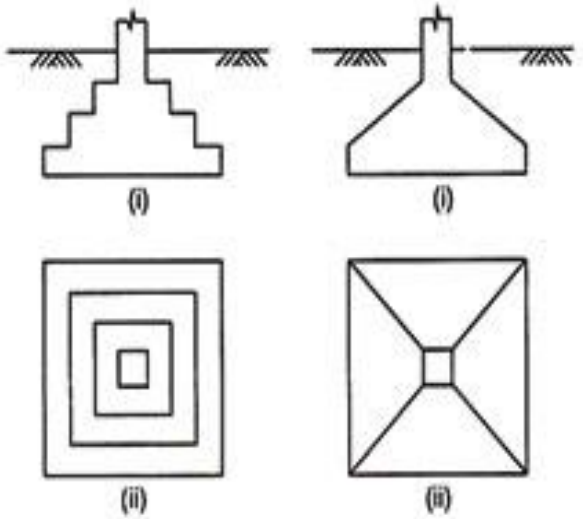
(a) Square footing (b) Rectangle footing (c) Circular footing



Circular

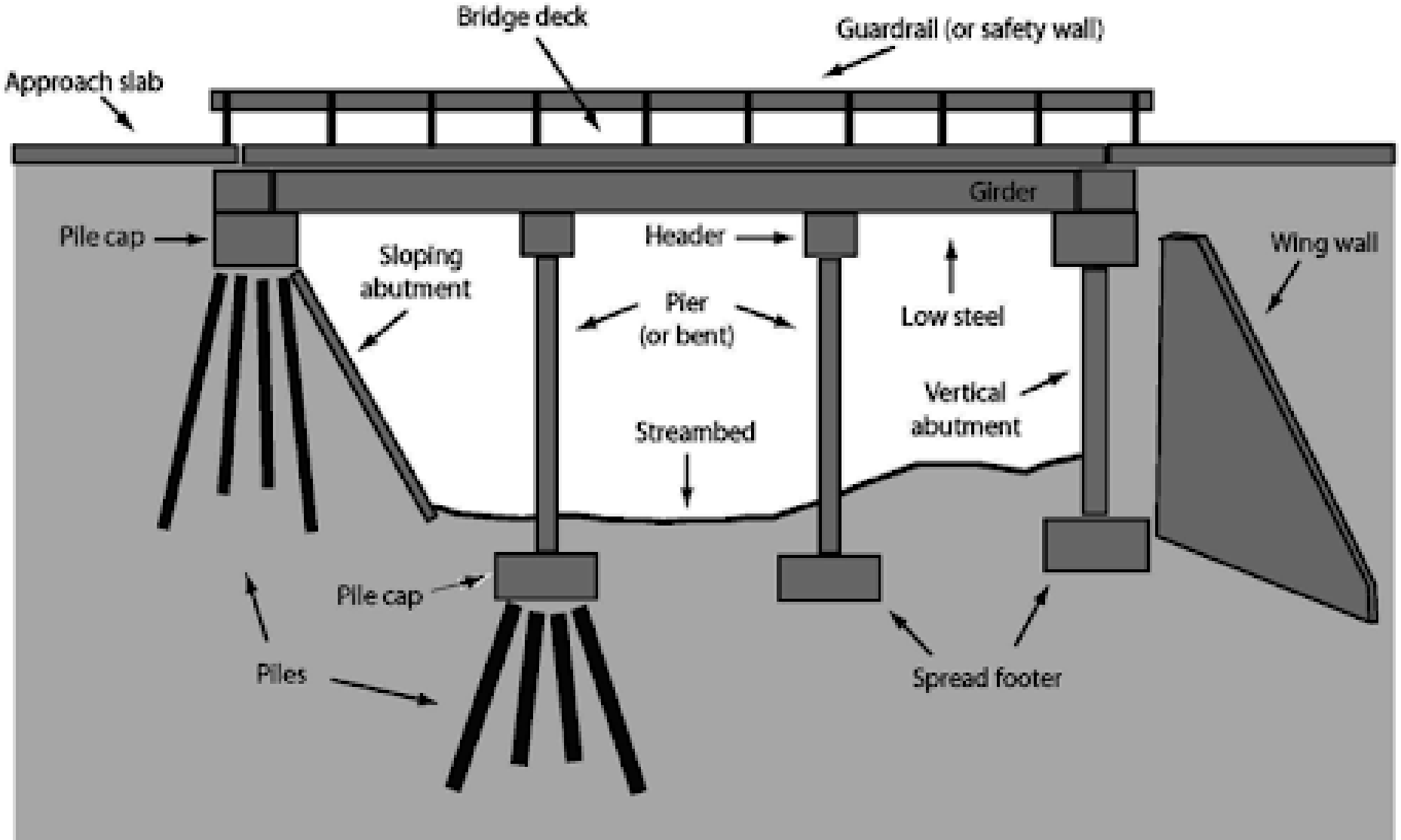


Continuous



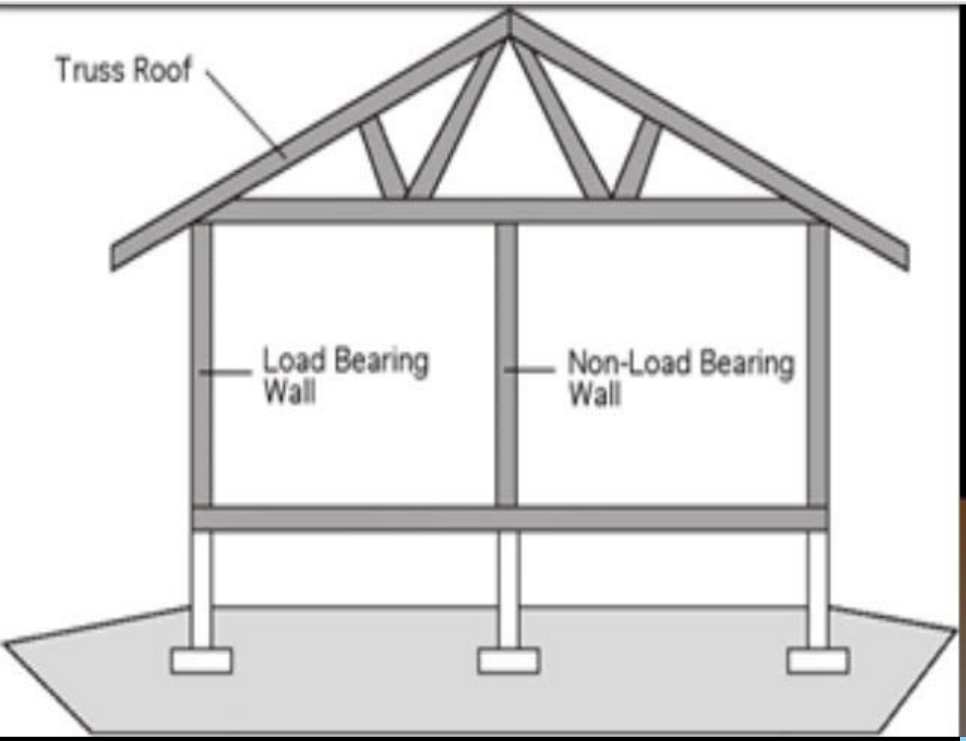
(d) Stepped footing (e) Tapered footing

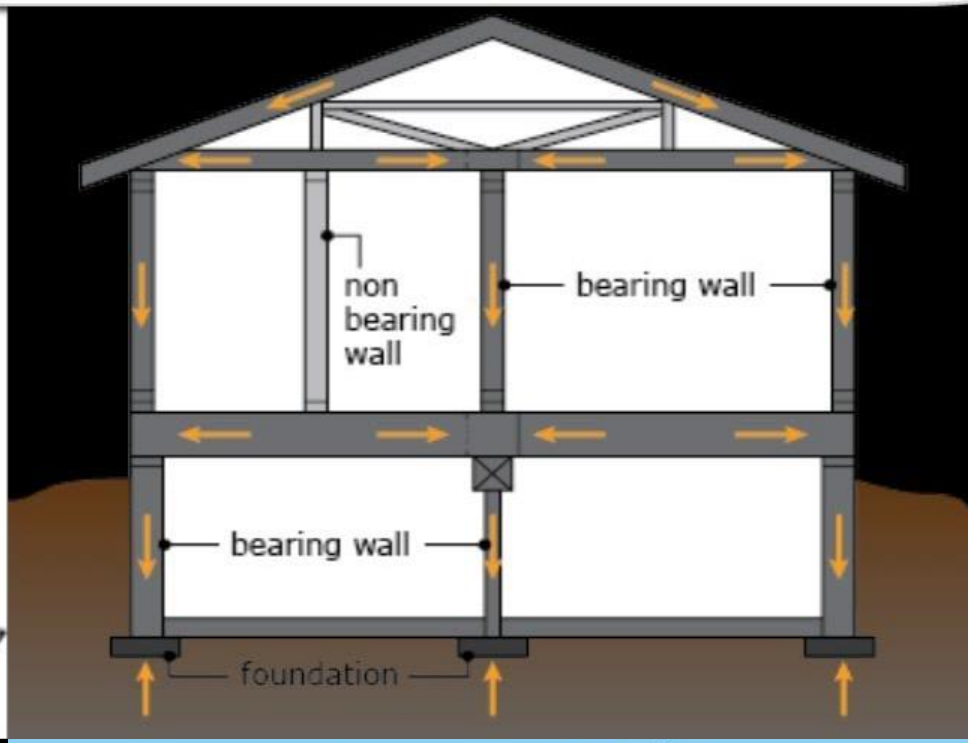
Deep Foundations



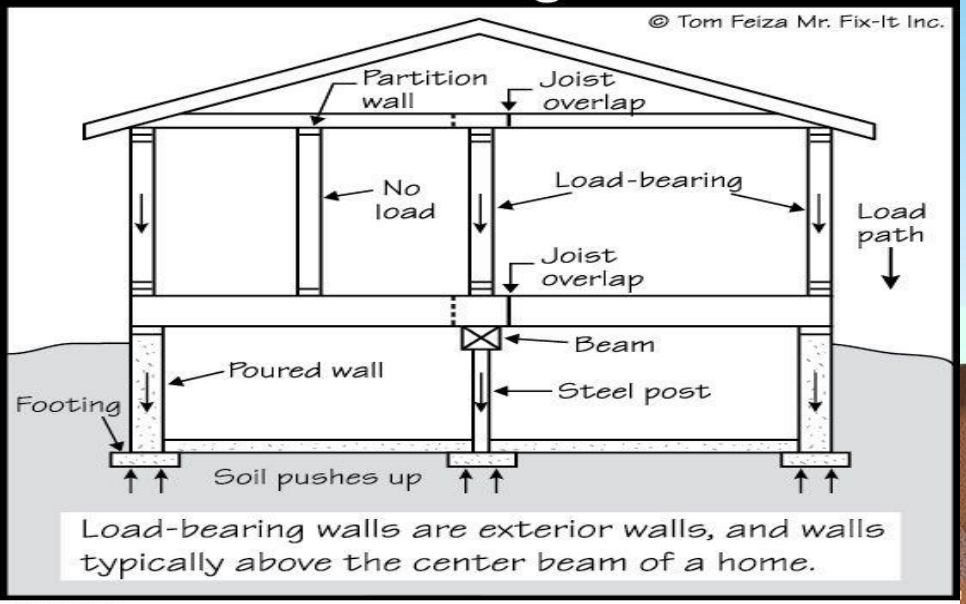
MASONRY WALLS

- A wall may be defined as a vertical load – bearing member, the length of which exceeds four times the thickness.
- Wall is one of the most essential components of a building. The primary function of a wall is to enclose or divide space of the building to make it more functional and useful.
- Walls provide privacy, afford security and give protection against heat, cold, sun and rain. Walls provide support to floors and roofs.
- Walls may be basically divided into two types : Load – bearing walls, and Non – load bearing walls.
- Load – bearing walls are those which are designed to carry super – imposed loads(transferred through roofs etc.,) in addition to their own weight.
- Non – load bearing walls carry their own load only. They generally serve as divide walls or partition walls.

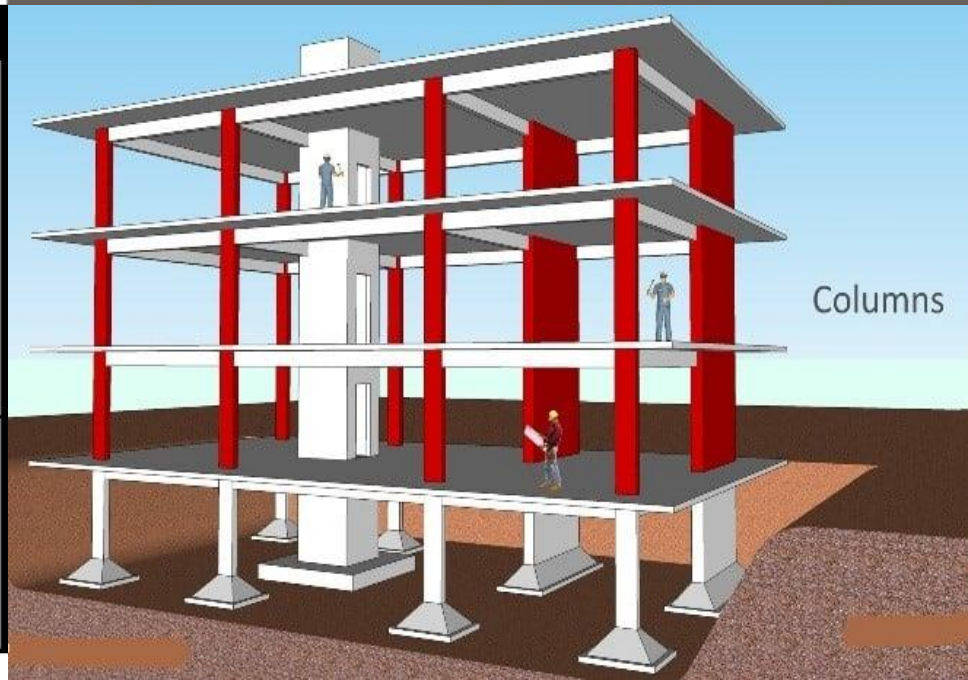




Load-Bearing Walls



Load-bearing walls are exterior walls, and walls typically above the center beam of a home.



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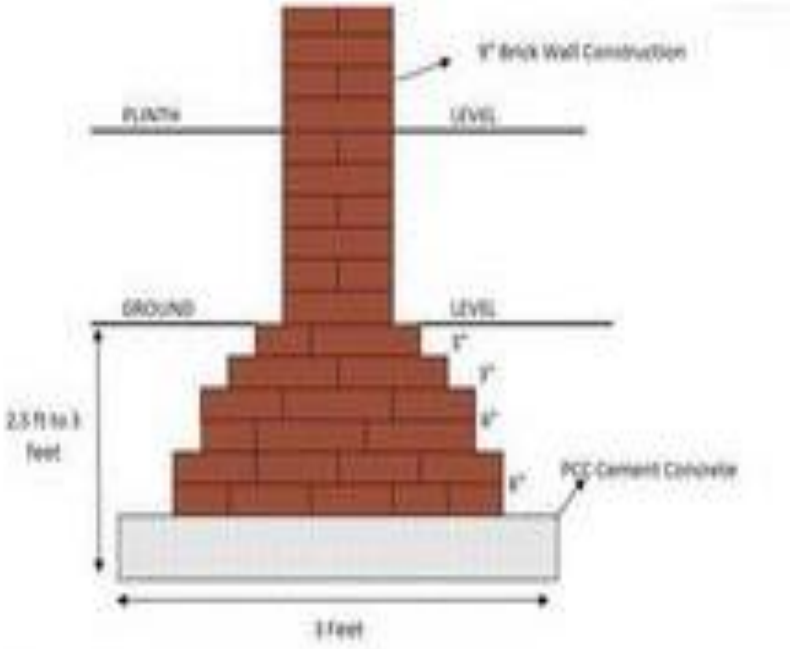
DIFFERENCE

LOAD BEARING STRUCTURE	FRAMED STRUCTURE
• Cost is less	• Cost is more.
• Suitable up to three stories.	• Suitable for any numbers of stories.
• Walls are thicker , hence floor area is reduced.	• Walls are thinner hence more floor area available for use.
• Slow construction	• Speedy construction.
• Not possible to alter position of walls after construction.	• Position of walls may be changed , whenever necessary.
• Resistance to earthquake is poor	• Resistance to earthquake forces is good.

LOAD BEARING STRUCTURE & FRAME STRUCTURE

Load Bearing Structure

- Almost all the wall should be provided with foundation



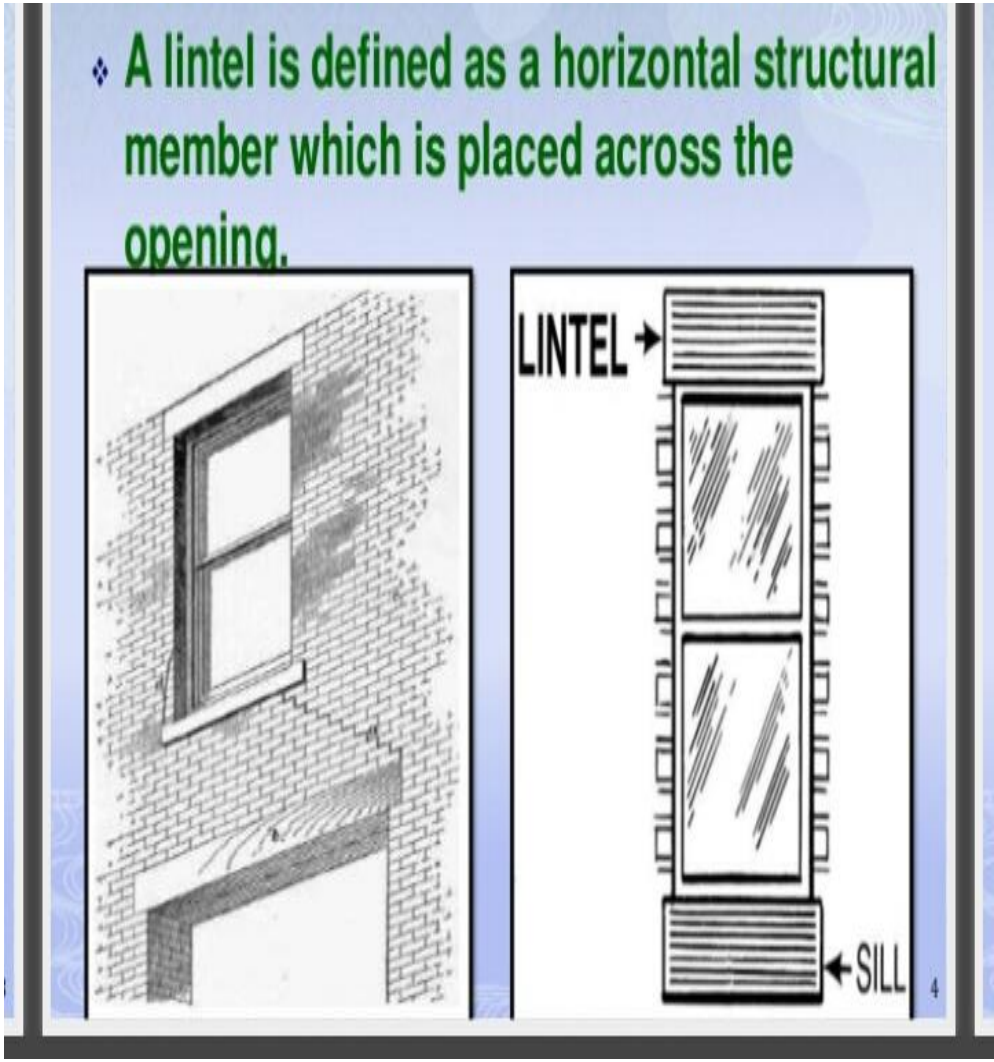
FOUNDATION FOR 9" THICK LOAD BEARING BRICK WALL STRUCTURE

Framed Structure

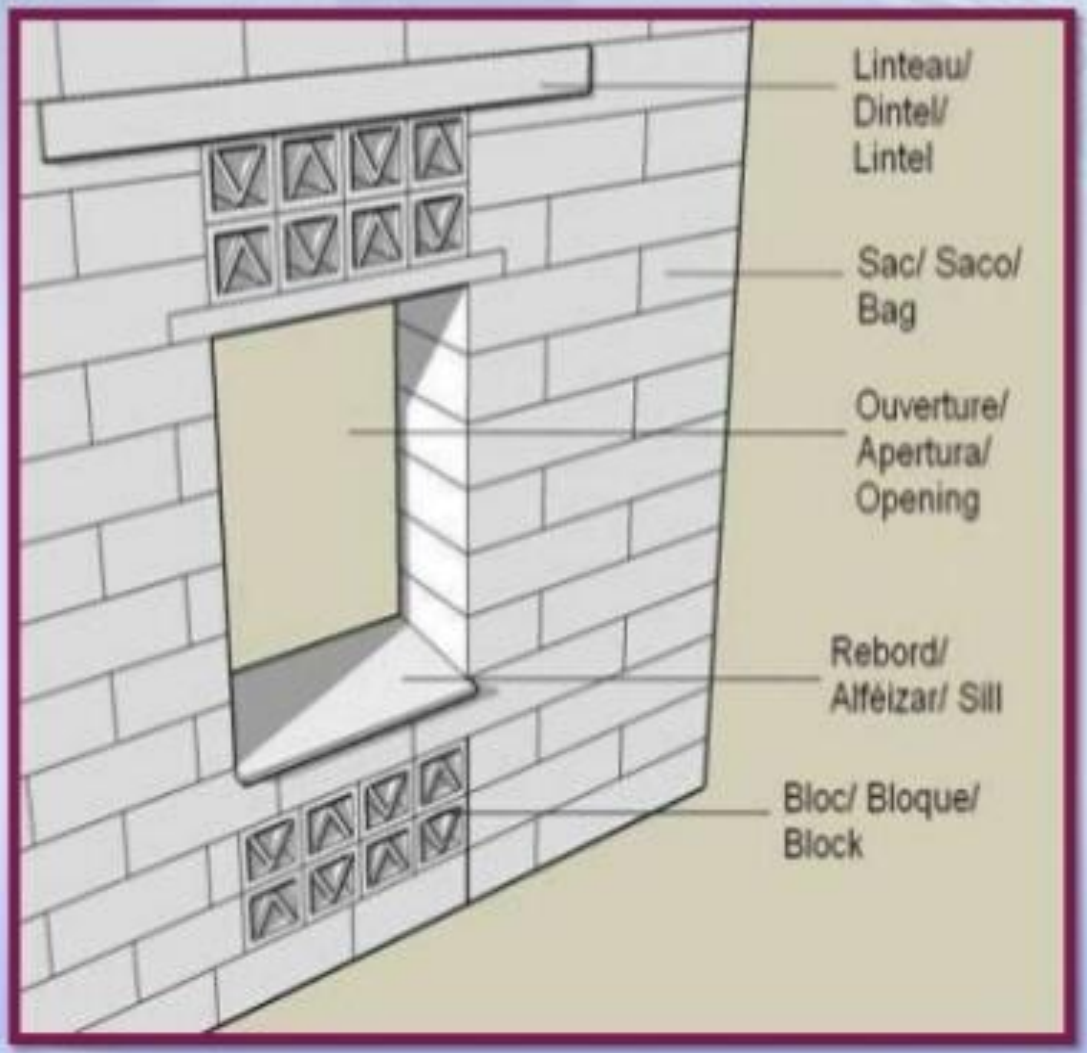
- None of the walls are provided with any type of foundation. Walls do not go below the plinth beam.

LINTEL

- A lintel is a horizontal member which is placed across the opening.
- A lintel is thus a sort of beam, the width of which is equal to the width of the wall, and the ends of which are built into the wall.
- These structural members are designed to support the loads of the portion of the wall situated above the openings, and then transmit the load to the adjacent wall portions(jambs) over which these are supported.



Structure of lintel



CLASSIFICATION OF LINTEL

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

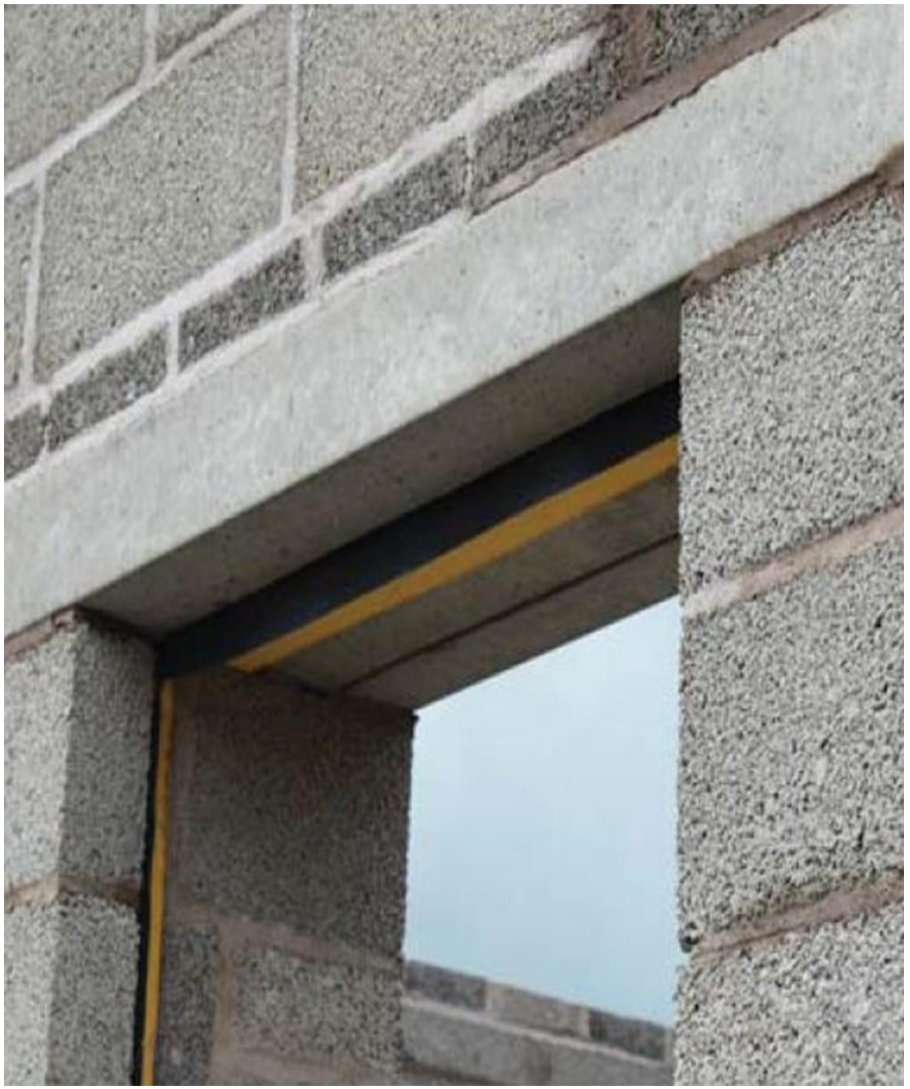
STONE LINTELS

Timber Lintels

Reinforced Brick Lintel

Steel Lintel

Reinforced Cement concrete Lintel



Functions of Lintels

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

ARCHES

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.

- An arch is normally a curved member comprising of a mechanical arrangement of wedge shaped building units upholding each other by mutual pressure of their own weight and maintained in equilibrium by reaction from supports called abutment**.**
- Arches are constructed where (i) loads are heavy, (ii) Span is more, (iii) Strong abutment are available, and (iv) Special architectural appearance is required.
- An arch is a structure constructed of wedge – shaped units(bricks or stone), jointed together with mortar and spanning an opening to support the weight of the wall above it along with other super – imposed loads.
- Due to wedge – like form, the units support each other, the load tends to make them compact and enables them to transmit the pressure downwards to their supports.

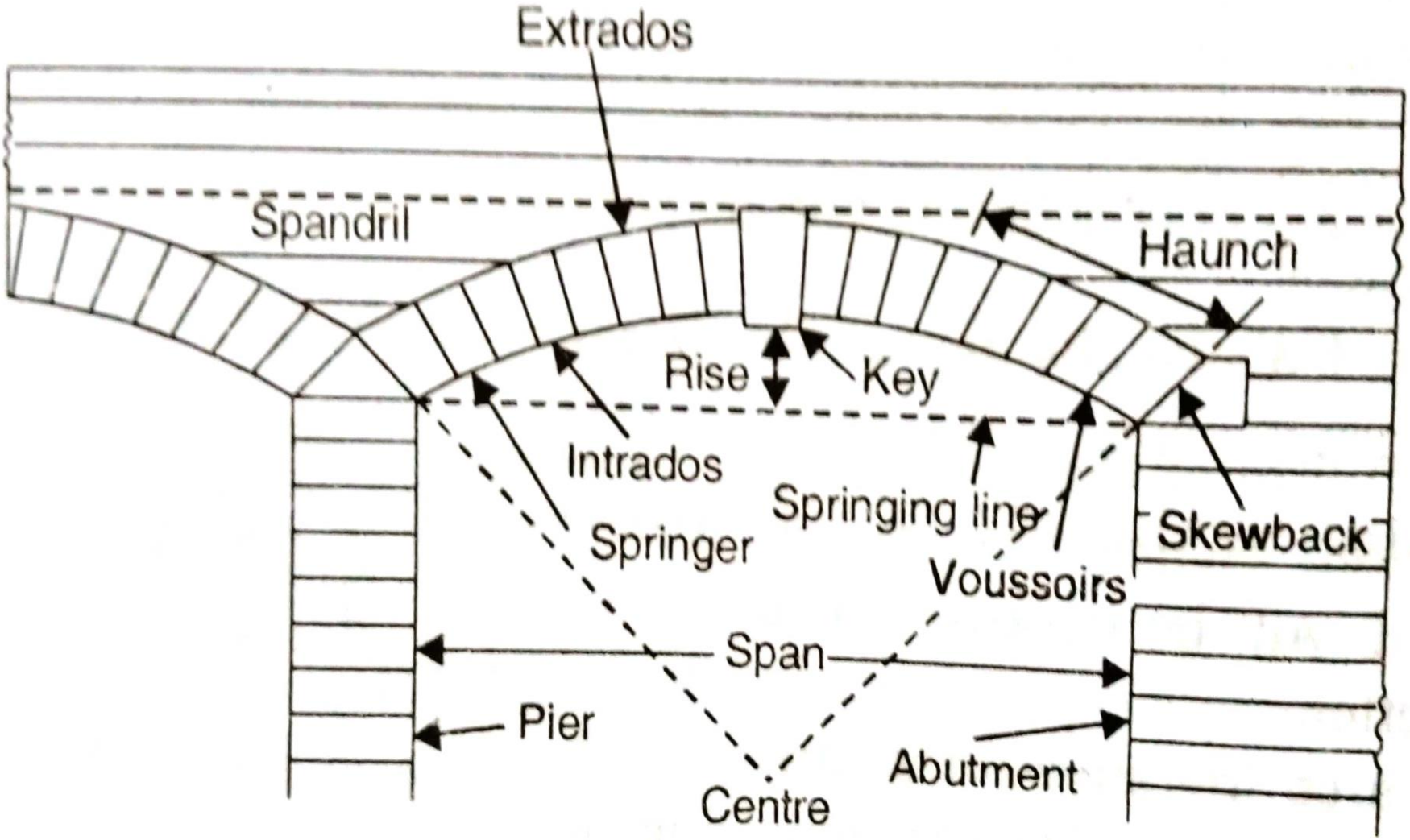


FIG 13.15. ELEMENTS OF A SEGMENTAL ARCH

ELEMENTS OF ARCH

1. *Intrados* : This is the inner curve of an arch.
2. *Soffit:* It is the inner surface of an arch. Sometimes, intrados and soffit are used as synonymously.
3. *Extrados* : It is the outer curve of an arch.
4. *Voussoirs* : These are wedge – shaped units of masonry, forming an arch.
5. *Crown* : It is the highest part of extrados.
6. *Key* : It is the wedge – shaped unit fixed at the crown of the arch.
7. *Spandril* : This is a curved – triangular space formed between the extrados and the horizontal line through the crown.
8. *Skew Back* : This is a inclined or splayed surface on the abutment, which is so prepared to receive the arch and from which the arch springs.
9. *Springing points* : These are the points from which the curve of the arch springs.
10. *Springing line* : It is an imaginary line joining the springing points of either end.

11. *Springer :* It is the first voussoir at springing level; it is immediately adjacent to the skewback.
12. *Abutment :* This is the end support of an arch.
13. *Pier* : This is an intermediate support of an arcade.
14. *Arcade* : It is a row of arches in continuation.
15. *Haunch* : It is the lower half of the arch between the crown and skew back.
16. *Ring* : It is a circular course forming an arch. An arch may be made of one ring or more than one ring.
17. *Bed Joints* : These are the joints between the voussoirs which radiate from the centre.
18. *Centre or striking point* : This is the geometrical centre point from where the arcs forming the extrados, arch rings and intrados are described or struck.
19. *Span* : It is the clear horizontal distance between the supports.
20. *Rise* : It is the clear vertical distance between the highest point on the intrados and the springing line.
21. *Depth or height* : It is the perpendicular distance between the intrados and extrados.
22. *Thickness (or breadth of soffit)* : This is the horizontal distance, measured perpendicular to the front and back faces of an arch.

CLASSIFICATION OF ARCHES

An arch may be classified according to their:

1) Material of construction and workmanship
2) Shape of curve formed by their soffit or intrados
3) Number of centers.

CLASSIFICATION BASED ON MATERIAL AND WORKMANSHIP

- BRICK ARCHES

*Rough brick arches
*Axed brick arches
*Gauged brick arches

- STONE ARCHES

*Rubble arches
*Ashlar arches

- GAUGED ARCHES

*Precast concrete block arches
*Monolithic concrete arches

ROUGH BRICK ARCHES

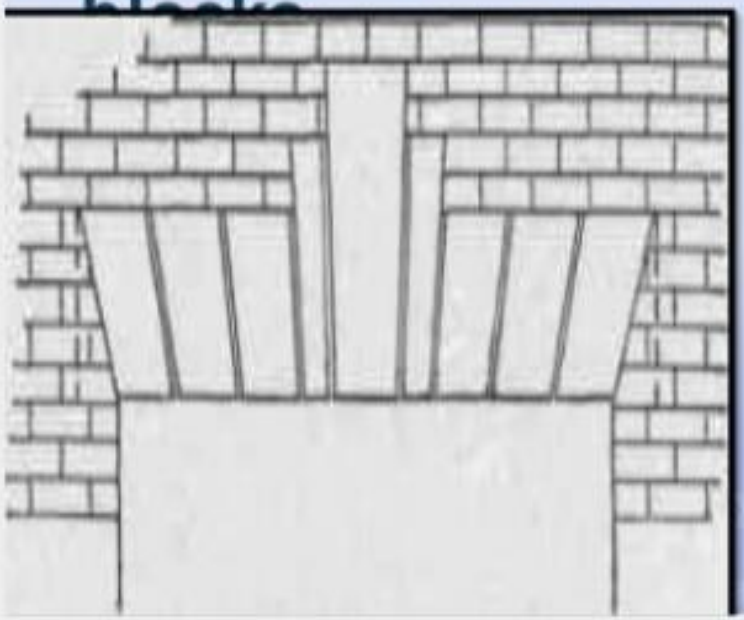
- These arches are built with ordinary bricks, which are not in wedge shape .
- Also known as "RELIEVING ARCHES".
- Made up of rectangular brick that are not cut into wedge shape. Curvature are obtained by mortar.

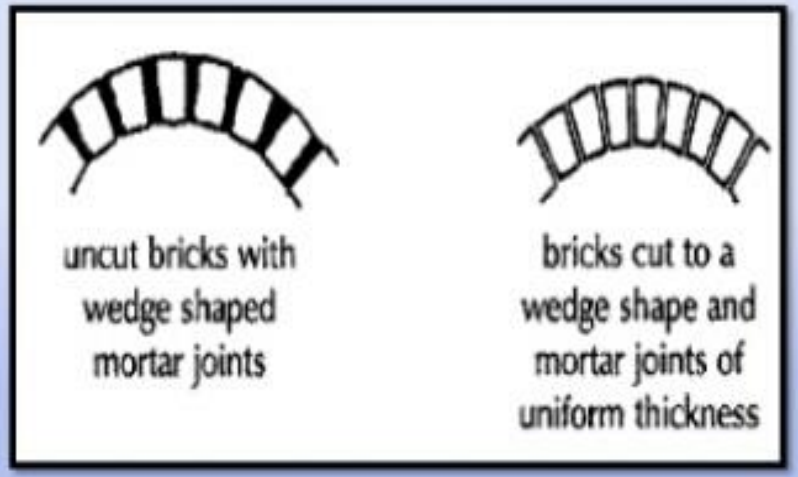
AXED BRICK ARCHES

- Bricks are cut to wedge-shape.
- Joints of arches are of uniform thickness.
- Not dress finely so it does not give much attractive appearance.

GAUGED BRICK ARCHES

- Accurately prepared to wedge shape.
- Specially shaped bricks known as "RUBBER BRICKS" are used .
- The lime putty is used for binding the



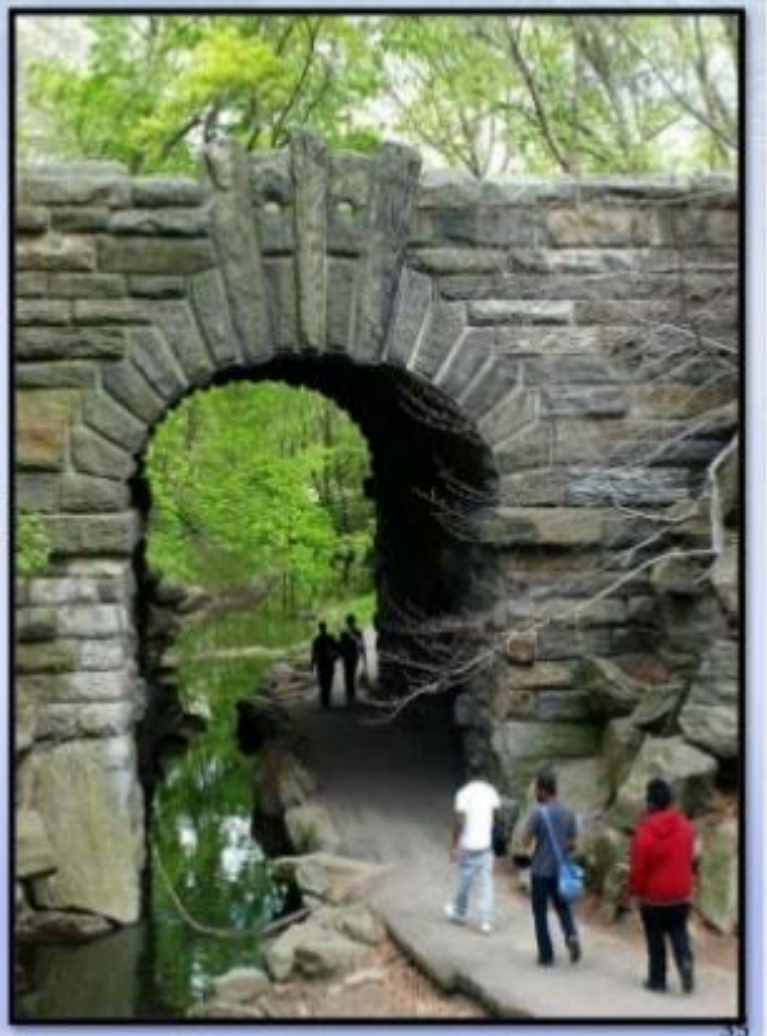


RUBBLE ARCHES

- Made of rubble stones, which are hammer dressed, roughly to the shape and size of voussoirs of the arch and fixed in cement mortar.
- These arches are used for small span upto 1 m.

ASHLAR ARCHES

- Stones are cut to proper shape of voussoirs and are fully dressed, properly joint with cement or lime.
- The voussoirs made of full thickness of the arch.



PRECAST CONCRETE BLOCK ARCHES

- Used for small openings in building.
- The voussoirs, in the form of cement concrete blocks are prepared in special moulds .
- Generally , the concrete blocks are used without reinforcement.

MONOLITHIC CONCRETE ARCHES

- Constructed from cast-in-situ concrete ,either plain or reinforced , depending upon the span and magnitude of loading.
- Quit suitable for larger span (3.0 m).
- The curing is done 2 to 4 weeks.

CLASSIFICATION ACCORDING TO SHAPE

- Flat arch
- Segmental arch
- Semi-circular arch
- Relieving arch
- Dutch or French arch

FLAT ARCH

- Acts like a lintel, when it provided over the opening .
- Joints radiated to center.
- Used only for light loads only.
- Span up to 1.50 m.

SEGMENTAL ARCH

- Segmental in shape and provided over the openings .
- Joints radiate from a center of arch, which lies below the springing line.
- Provided over lintel.

SEMI-CIRCULAR ARCH

- The shape of the curve given to the arch soffit is semi-circular.
- The center of the arch lies on the springing line.

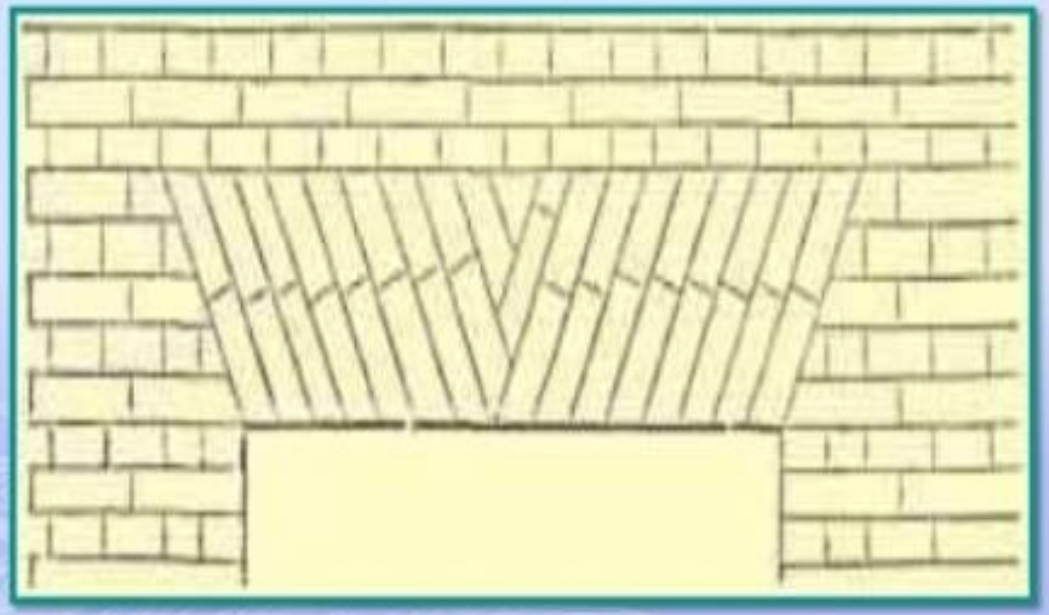
SEMI-CIRCULAR ARCH

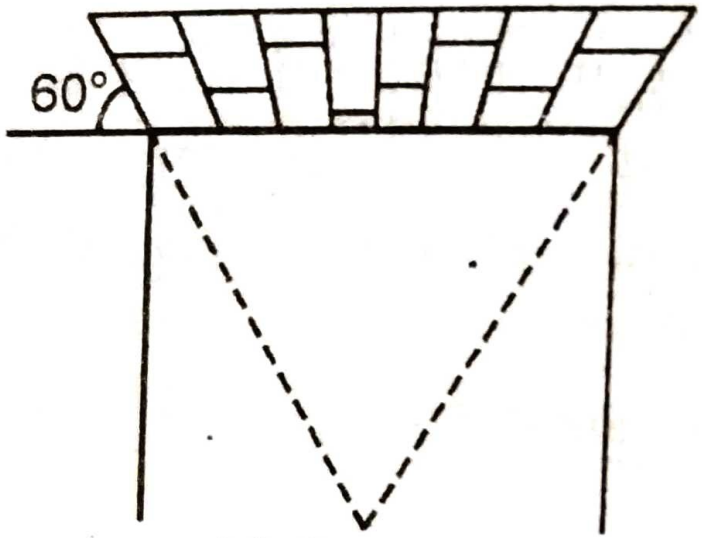
RELIEVING ARCH

- When wooden lintel is provided over the wider opening, a brick relieving arch is constructed above the lintel.
- Relieving the load of masonry over lintel.

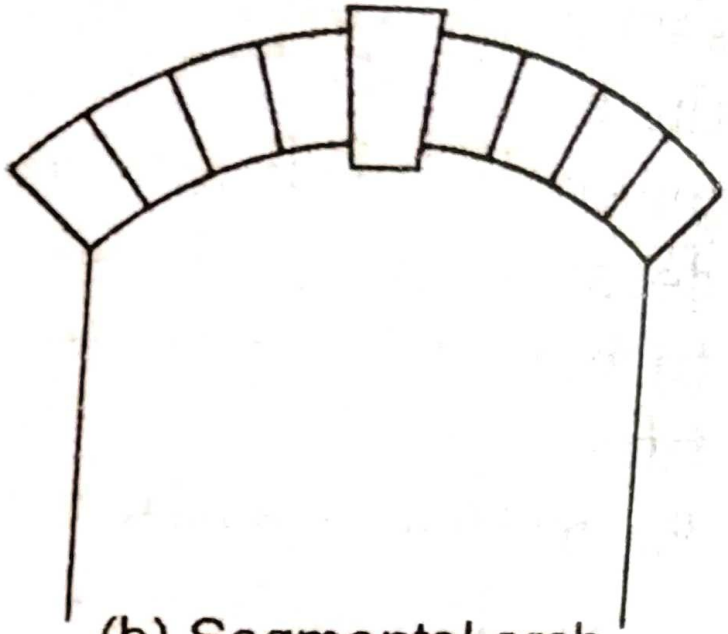
DUTCH OR FRENCH ARCH

- Similar to the flat arch in design, but differs in shape and method of construction.
- Suitable for small opening.

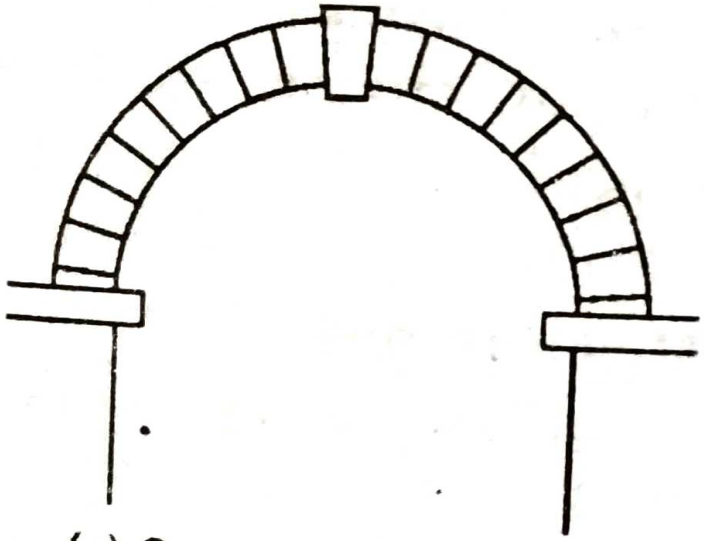




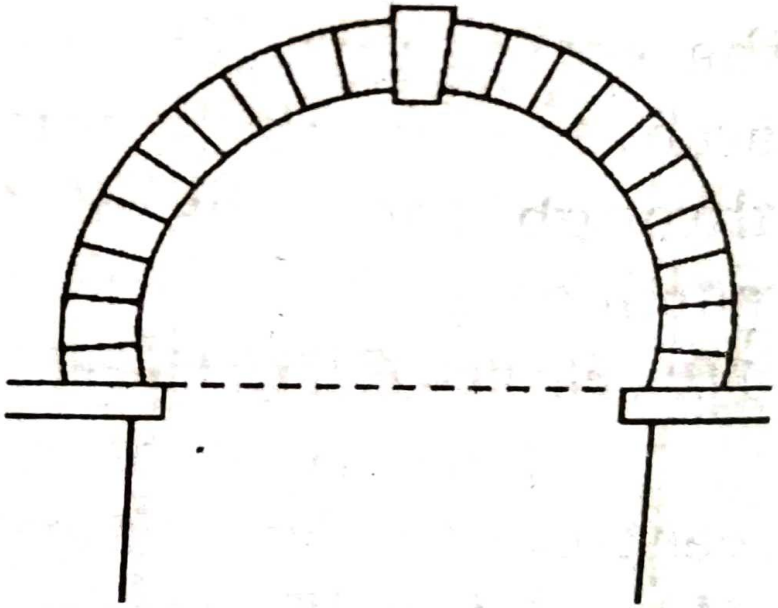
(a) Flat arch



(b) Segmental arch



(c) Semi - circular arch



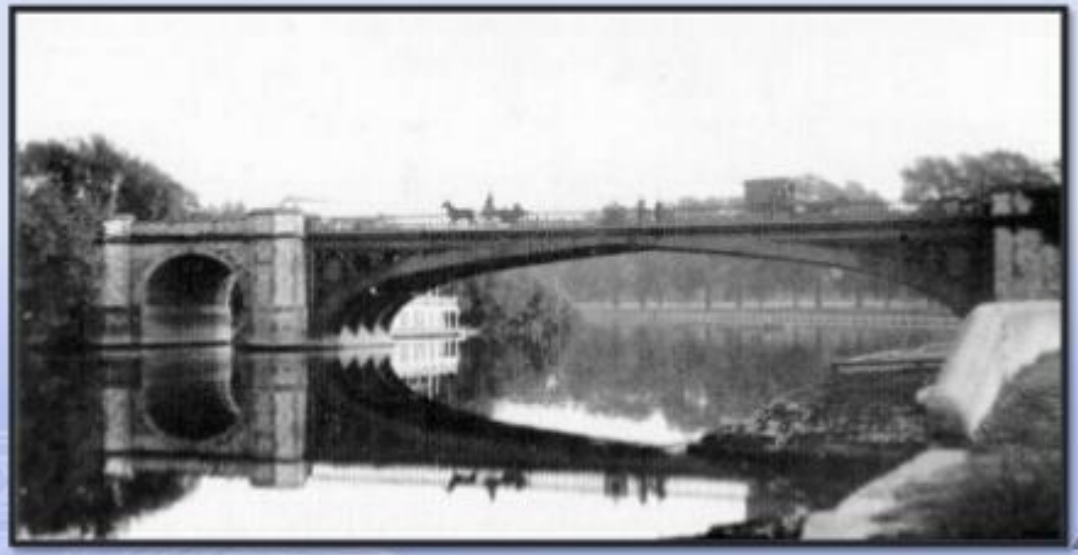
(d) Horse shoe arch

CLASSIFICATION BASED ON NUMBER OF CENTRES

- One centred arch.
- Two centred arch.
- Three centred arch.
- Four centred arch.
- Five centred arch.

ONE CENTRED ARCH

- Segmental, semi circular, flat arches come under this category.
- Sometime , a perfectly circular arch known as bull's eye arch ,provided for circular window.

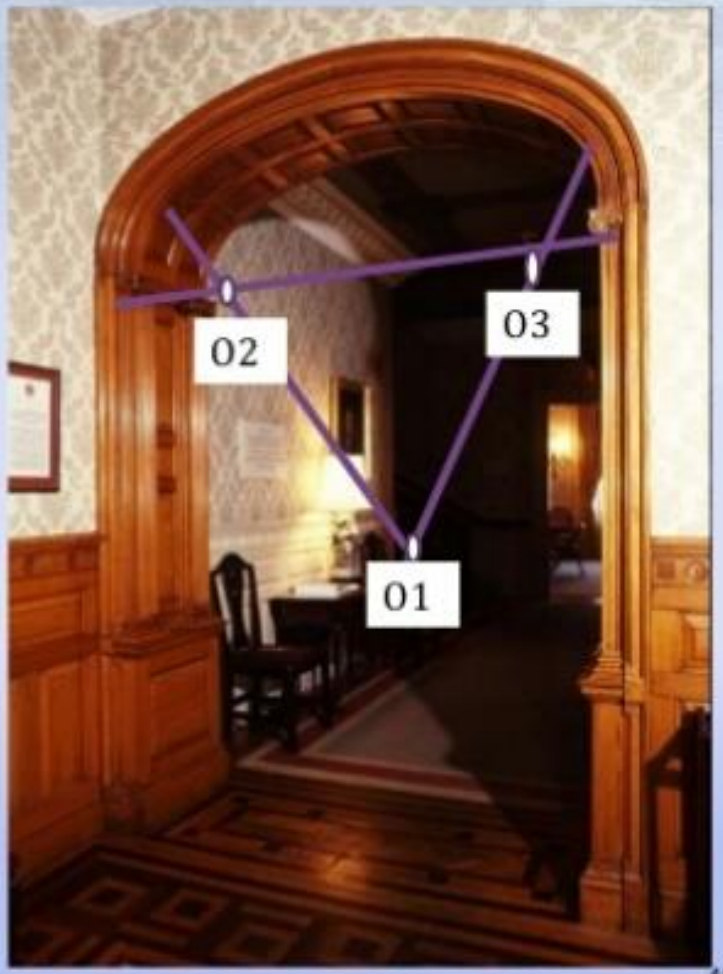


TWO CENTRED ARCH

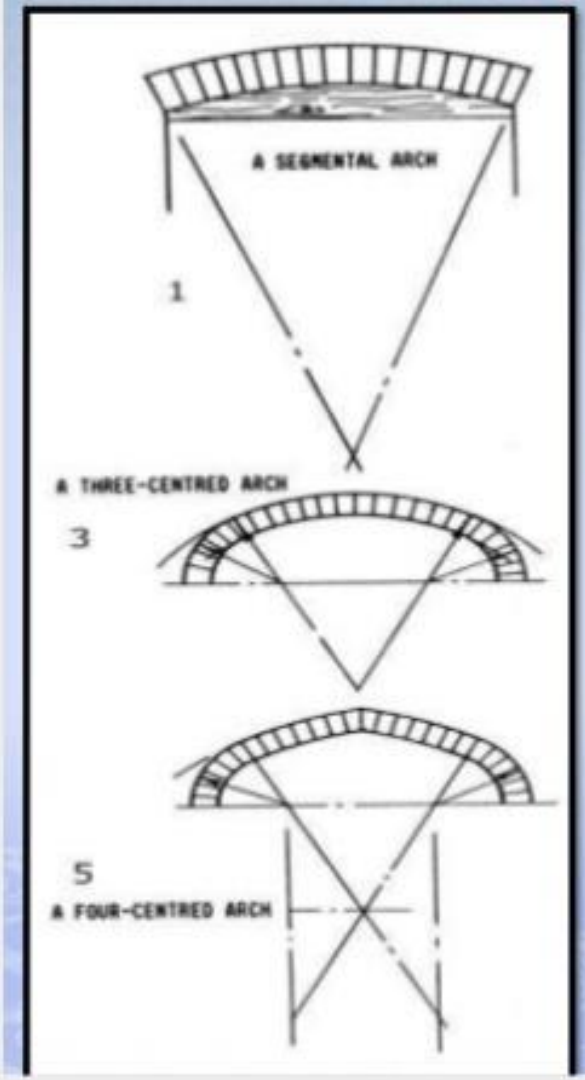
- Pointed, semi-elliptical arches come under this category.

THREE CENTRED ARCH

- Elliptical arches come under this category.
- O1,O2 and O3 are the center.



FOUR CENTRED ARCH



- It has four center.
- Venetian arch is typical example of this type.

FIVE CENTRED ARCH

- This type of arch ,having five centre's ,gives good semi-elliptical shape.

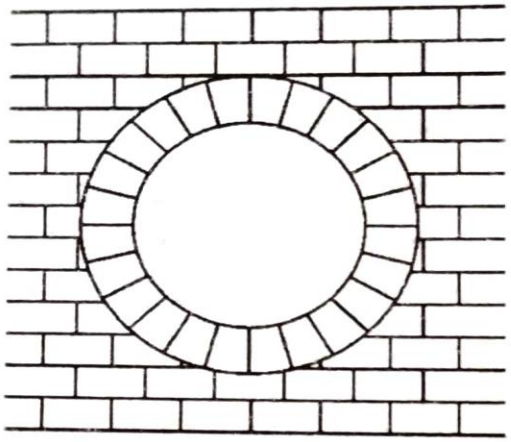


FIG. 13.18. BULL'S EYE ARCH

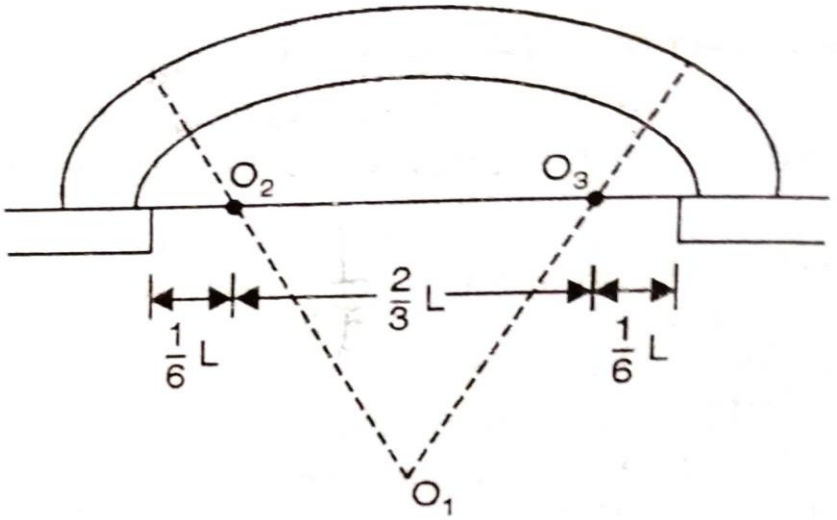


FIG. 13.19. THREE-CENTRED ARCH (ELLIPTICAL)

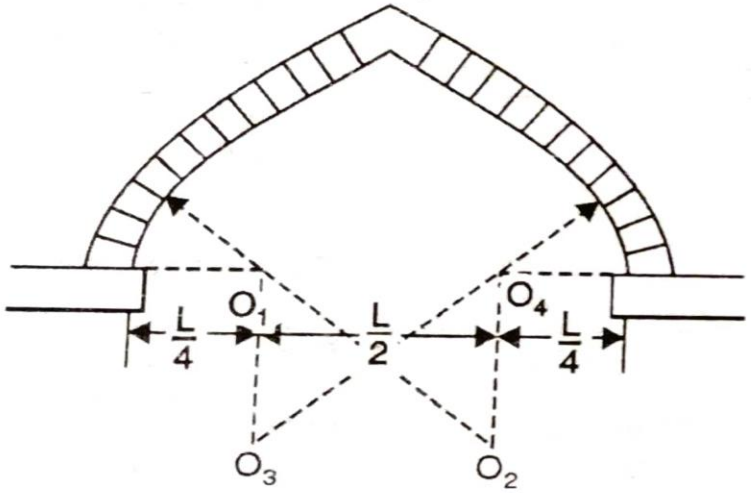


FIG. 13.20. FOUR-CENTRED ARCH (TUDOR ARCH)

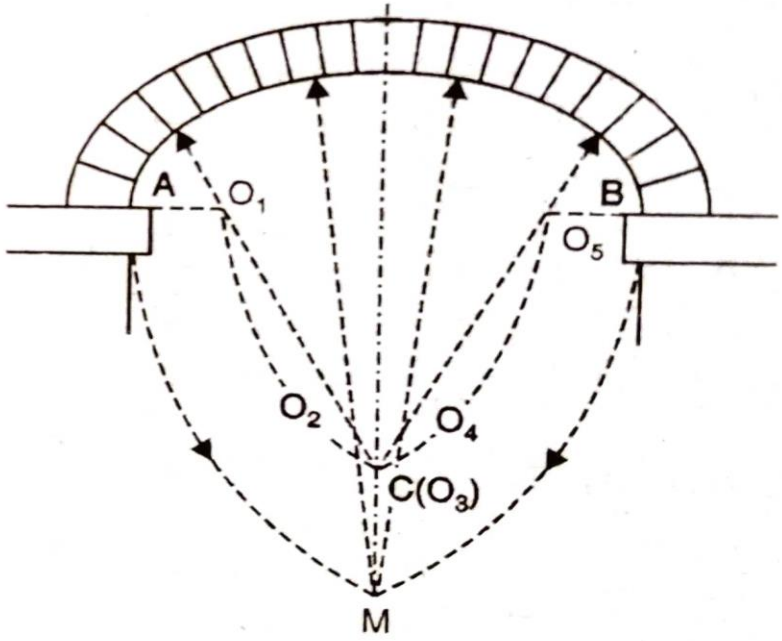


FIG. 13.21. FIVE-CENTRED ARCH (SEMIL-ELIPTICAL ARCH)

STABILITY OF AN ARCH

- An arch transmits the super – imposed load to the side walls (or abutments) through friction between the surfaces of voussoirs and the cohesion of mortar.
- Every element of arch remains in compression. It has also to bear transverse shear.
- An arch may therefore fail in the following ways :

(i) Crushing of the masonry

(ii) Sliding of voussoirs

(iii) Rotation of some joint about an edge

(iv) Uneven settlement of abutment/pier

- If the compressive stress exceeds the safe crushing strength of the materials, the arch will fail in crushing.
- Hence, the material used for construction should be of adequate strength, and the size of voussoirs should be properly designed to bear the thrust/stress transmitted through them.

- The height of voussoirs should not be less than 1/12 th the span.
- To safe guard against sliding of voussoirs past each other due to transverse shear, the voussoirs of greater height should be provided.
- Rotation can be prevented if the line of resistance is kept within intrados and extrados.
- The uneven settlement of abutment may cause secondary stresses in the arch.
- Hence the abutment, which has ultimately to bear all the loads transferred to it through the arch, should be strong enough.
- Also, the arch should be symmetrical. So that unequal settlements of the two abutments is minimised. Also the abutment should be strong enough to take the thrust.

BALCONIES

- It is a platform projecting from the wall of a building with a balustrade or railing along its outer edge, often with access from a door or window

CHEJJA/SUNSHADE

- A ***chejja*** is the projecting or overhanging channel or cover of a roof, usually supported on large carved brackets.

CANOPY

- A **canopy** is an overhead roof structure that has open sides. Canopies are typically intended to provide shelter from the rain or sun, but may also be used for decorative purposes, or to give emphasis to a route or part of a building.

Flooring

- The purpose of floor is to provide a level surface capable of supporting the occupants of a building, furniture, equipment and sometimes, internal partitions.
- A floor must satisfy the requirements of (a) Adequate strength and stability. (b) Adequate fire resistance, (c)Sound insulation, (d) Damp resistance, (e) Thermal insulation, (f) Durability and free from maintenance and (g) Resistance to weather and ground moisture.
- The floor resting directly on the ground surface are known as ground floors, while the other floors of each storey, situated above the ground level are known as upper floors.
- The problems of strength and stability are usually minor ones at ground and basement levels since full support from the ground is available at all points. However, major problem of ground floors is damp exclusion and thermal insulation. Moisture is generally present in the ground, which may pass into the building through the floor unless measures are taken to check it.
- The upper floors have the major problems of strength and stability since they are supported only at their ends, on walls, beams, etc., These do not have problems of damp resistance, though sound insulation is generally an important factor. The problem of fire resistance does not arise for the lowest floor of a building but is often important for upper floors.

Components of a Floor

- A floor is composed of two essential components

(i) Sub – floor, base course or floor base

(ii) Floor covering or simply, flooring

- The floor base is a structural component, which supports the floor covering.
- For ground floors, the object of floor base is to give proper support to the covering so that it does not settle, and to provide damp resistance and thermal insulation.
- Ground floors may either rest directly on the ground, or may be supported a little distance above the ground.
- The floors supported directly on the ground are known as **solid floors** while the floors supported above the ground level are called **suspended floors.**
- Suspended floors are generally made of timber.

Concrete Flooring

- This is commonly used for residential, commercial and even industrial building, since it is moderately cheap, quite durable and easy to construct.
- The floor consists of two components : (i) base concrete, and (ii) topping or wearing surface.
- The two components of the floor can be constructed either monolothically(i.e. Topping laid immediately after the base course is laid) or non – monolithically.
- When the floor is laid monolithically, good bond between the two components is obtained resulting in smaller over all thickness.
- There are disadvantages with monolithical construction. Hence in most of the cases, non – monolithic construction is preferred.

Mosaic Flooring

- Mosaic flooring is made of small pieces of broken tiles of china glazed or of cement, or of marble, arranged in different pattern.
- These pieces are cut to desired shapes and sizes.
- A concrete base is prepared as in the case of concrete flooring, and over it **5 to 8 cm thick lime – surkhi mortar** is spread and levelled.
- On this, a **3 mm thick cementing material**, in the form of paste of two parts of slaked lime, one part of powdered marble and one part of pozzolana material, is spread and is left to dry for about 4 hours.
- Thereafter, **small pieces of broken tiles or marble pieces** of different colours are arranged in definite patterns and hammered into the cementing layer.
- The surface is gently rolled by a stone roller, sprinkles water over the surface, so that cementing material comes up through the joints, and an even surface is obtained.
- The surface is allowed to dry for 1 day, and is, thereafter, rubbed with a pumice stone fitted with a long wooden handle, to get smooth and polish surface.
- The floor is allowed to dry for two weeks before use.

Marble Flooring

- It is a superior type of flooring, used in bath – rooms and kitchens of residential buildings, and in hospitals, temples etc., Where extra cleanliness is an essential requirements.
- The **base concrete** is prepared in the same manner as that for concrete flooring.
- Over the base concrete, 20 mm thick **bedding mortar** of **either 1:4 cement : sand mix or 1(lime putty) : 1 (Surkhi): 1 coarse sand mix** is spread under the area of each individual slab.
- The marble slab is then laid over it, gently pressed with wooden mallet and levelled.
- The marble slab is then again lifted up, and fresh mortar is added to the hollows of the bedding mortar.
- The mortar is allowed to harden slightly, cement slurry is spread over it, the edges of already laid slabs are smeared with cement slurry paste, and then the marble slab is placed in position.
- It is gently pushed with wooden mallet so that cement pastes oozes out from the joint which should be as thin as possible(paper thick).
- The oozed out cement is cleaned with cloth. The paved area is properly cured for about a week.

Tiled Flooring

- Tiled flooring is constructed from square, hexagonal or other shapes, made of clay(pottery), cement concrete.
- These are commonly used in residential houses, offices, schools, hospitals and other public buildings, as an alternative to terrazzo flooring, specially where the floor is to be laid quickly.
- Greater care is required for tiled flooring.
- Over the concrete base, a 25 to 30 mm thick layer of lime mortar 1:3 (1 lime and 3 sand or surkhi) is spread to serve as bedding.
- This bedding mortar is allowed to harden for 12 to 24 hours.

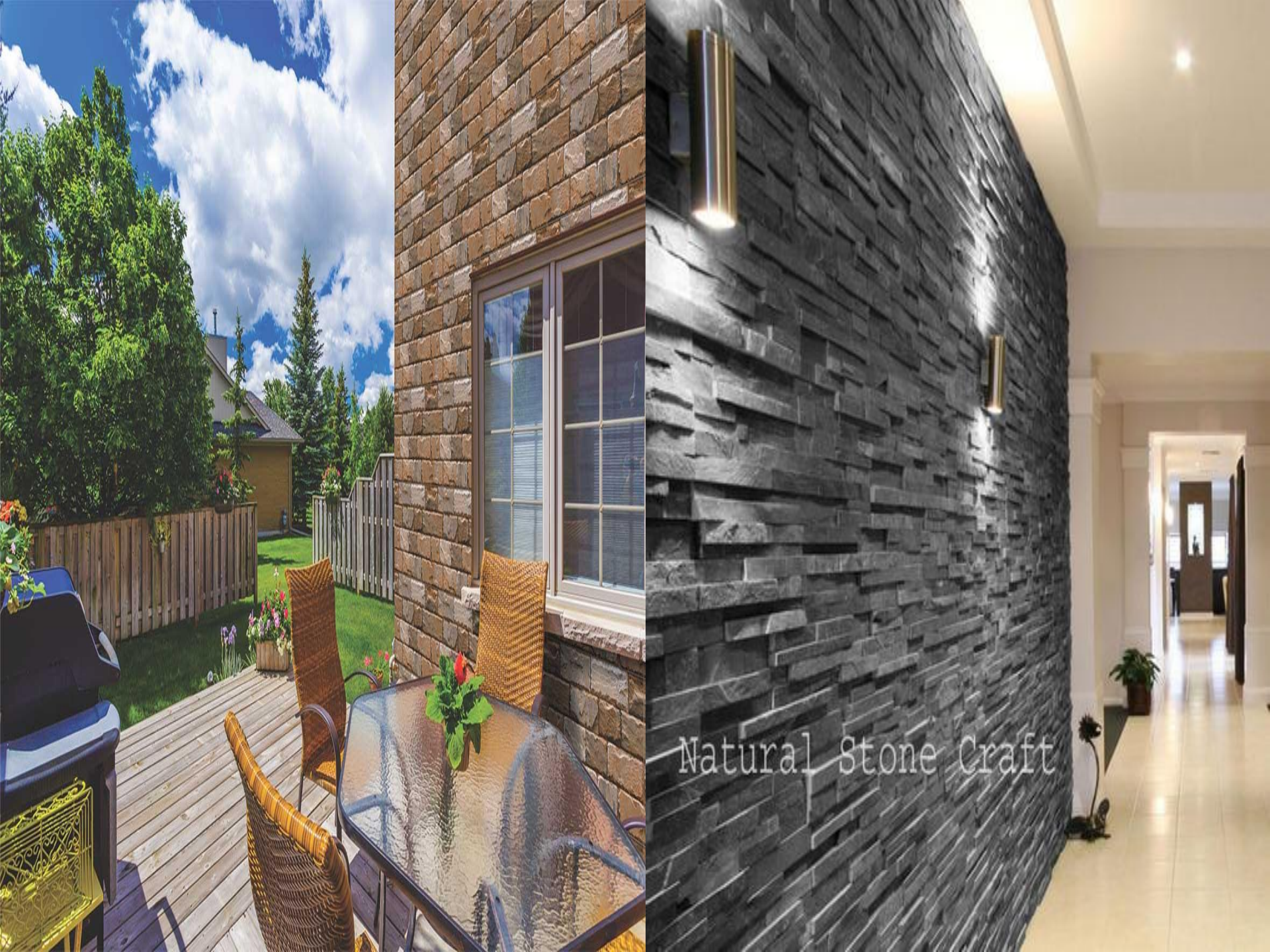
- Before laying the tiles, neat **cement slurry** is spread over the bedding mortar and the tiles are laid flat over it, gently pressing them into the bedding mortar with the help of wooden mallet, till levelled surface is obtained.
- Before laying the tiles, **thin paste of cement is applied on their sides**, so that the tiles have a thin coat of cement mortar over the entire perimeter surface.
- Next day, the joints between adjacent tiles are cleaned of loose mortar using wire brush, and then grouted with cement slurry of the same colour shade as that of the tiles.
- The slurry is also applied over the flooring in thin coat.
- The flooring is then cured for 7 days, and then grinding and polishing is done.

Granite Flooring

- Granite is one of the popular flooring material in recent decade with its beauty, granite has several benefits to homeowners.
- Granite gives an aura of richness and its beauty surpasses most of the other flooring materials.
- Granite is quite expensive and heavy, so must be installed by professional.
- Being a natural stone product it is biodegradable.
- It is not too porous as marble and sealing is not required if used in moisture proof area.
- It is harder and stain resistant than any other flooring material such as marble.

Cladding of Tiles

- **CLADDING** is the covering of one material with another. It has different meanings depending on the context.
- In BUILDING CONSTRUCTION, cladding may refer to the application of one material over another to provide a weather-proof layer intended to control the infiltration of weather elements.
- Cladding does not necessarily have to provide a water-proof condition but is instead a control element. This control element may only serve to safely direct water or wind in order to control run-off and prevent infiltration into the building structure.


Natural Stone Craft

Selection of Flooring Material

- Following are the factors that affect the choice of a flooring materials:

1. **Initial Cost :** The cost of the material should be in conformity with the type of building, and its likely use. Floor coverings of marble are very costly and may be used only for residential buildings.
2. **Appearance :** Covering should give pleasing appearance, i.e., it should produce a desired colour effect and architectural beauty. Flooring of terrazzo, mosaic, tiles and marble give good appearance.
3. **Cleanliness :** The flooring should be capable of being cleaned easily, and it should be non – absorbent. It should have effective resistance against absorption of oil, grease etc.,
4. **Durability :** The flooring should have sufficient resistance to wear, temperature changes, disintegration with time and decay, so that long life is obtained.
5. **Damp resistance :** Flooring should offer sufficient resistance against dampness, so that healthy environment is obtained in the building.

6. **Sound Insulation :** Flooring should insulate the noise. Also, it should not be such that noise is produced when users walk on it.
7. **Thermal Insulation :** The flooring should offer reasonably good thermal insulation so that comfort is imparted to the residents of the building.
8. **Fire Resistance :** This is more important for upper floors. Flooring material should offer sufficient fire resistance so that fire barriers are obtained between different levels of a building.
9. **Smoothness :** The flooring material should be smooth, and should have even surface. However, it should not be slippery.
10. **Hardness :** It should be sufficiently hard so as to have resistance to indentation marks, imprints etc., likely to be caused by shifting of furniture, equipment etc.,
11. **Maintenance :** The flooring material should require least maintenance. However, whenever repairs are required, it should be such that repairs can be done easily, with least possible expenditure.

ROOFS

- A roof may be defined as the uppermost part of the building, provided as a structural covering, to protect the building from weather(i.e., from rain, sun, wind, etc.,).
- Basically, a roof consists of structural elements which support roof coverings. The structural element may be trusses, portals, beams, slabs, shells or domes.
- Roof and roof coverings receive rain and snow more directly and in much greater quantity than do the walls.
- It must therefore, provide a positive barrier to the entry of rain, and vigorous weather proofing is most important.
- At the same time, the roof structure, which support the roof coverings must have adequate strength and stability. Apart from these, a roof must have thermal insulation, fire resistance and sound insulation.
- The roof coverings may be Asbestos Cement sheets(A.C. Sheets), Galvanised Corrugated Iron sheets(G.I. Sheets), wooden shingles, tiles, slates or slab itself.

Requirements of a Roof

- The requirements of a good roof are summarised below:

1. It should have adequate strength and stability to carry the super – imposed dead and live loads.
2. It should effectively protect the building against rain, sun, wind, etc., and it should be durable against the adverse effects of these agencies.
3. It should be water – proof, and should have efficient drainage arrangements.
4. It should provide adequate thermal insulation.
5. It should be fire resistant.
6. It should provide adequate insulation against sound. Most forms of roof construction provide for majority of buildings an adequate insulation against sound from external sources.

Types of Roofs

- Roof may be divided into three categories :

1. Pitched or sloping roofs,
2. Flat roofs or terraced roofs, and
3. Curved roofs.

- The selection of the type of roof depends upon the shape or plan of the building, climatic conditions of the area and type of constructional materials available.
- **Pitched roof** have sloping top surface.
- These are suitable in those areas where rainfall/snowfall is very heavy.
- Buildings with limited width and simple shape can generally be covered satisfactorily by pitched roofs.
- Buildings of large area, such as factories, when covered by a series of parallel pitched roofs, require internal guttering in the valleys.

- **Flat roofs** are considered suitable for buildings in plains or in hot regions, where rainfall is moderate, and where snowfall is not there.
- Flat roofs are equally applicable to buildings of any shape and size.
- **Curved roofs** have their top surface curved.
- Such roofs are provided to give architectural effects.
- Such roofs include cylindrical and parabolic shells and shell domes, doubly curved shells such as hyperbolic paraboloids and hyperboloids of revolution, and folded slabs and prismatic shells.
- Such roofs are more suitable for public buildings like libraries, theatres, recreation centres etc.

Pitched Roof

Flat Roof

Curved Roof

Elements of Pitched Roof

- A roof with sloping surface is known as a pitched roof. Pitched roofs are basically of the following forms :

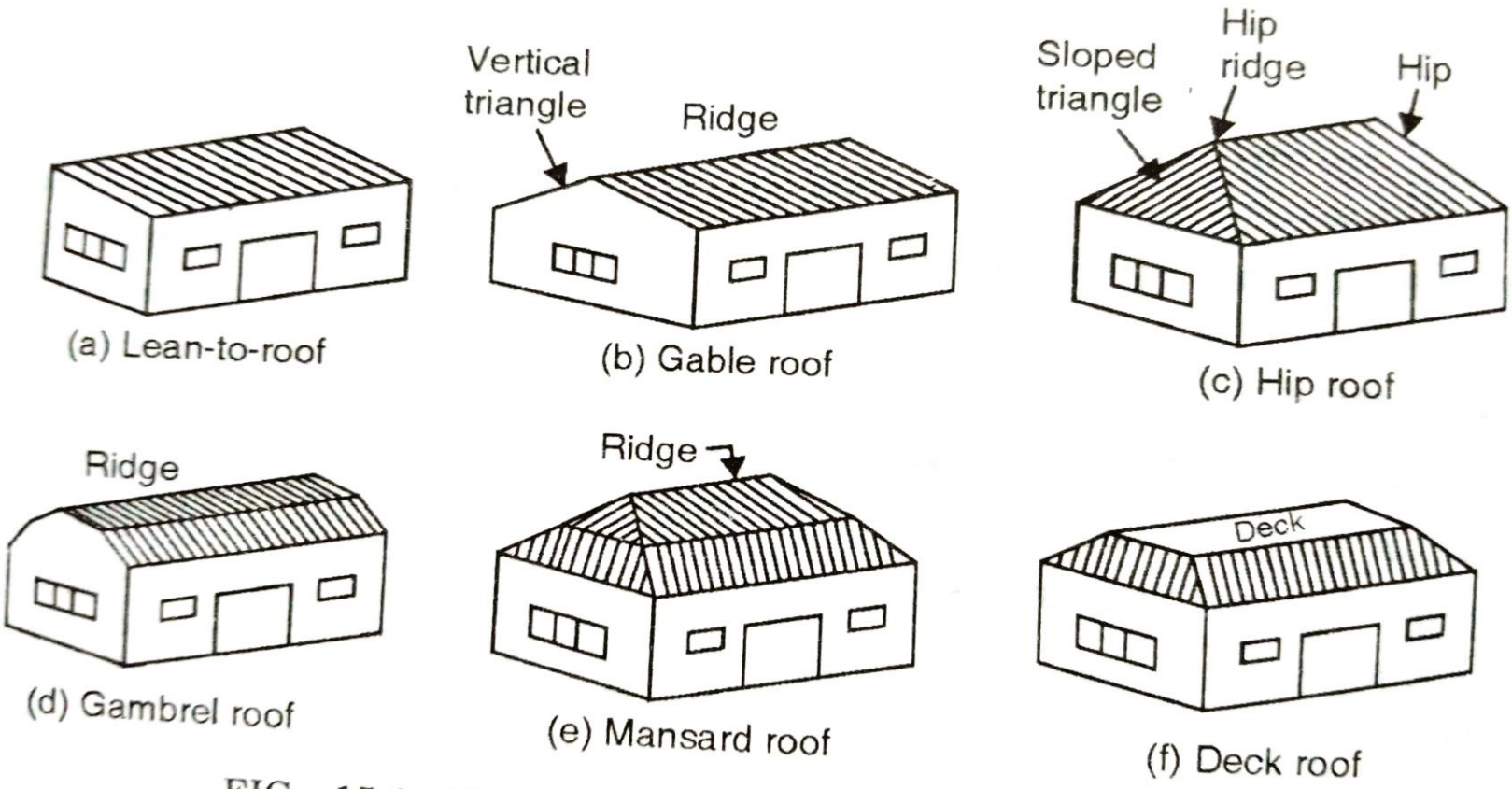
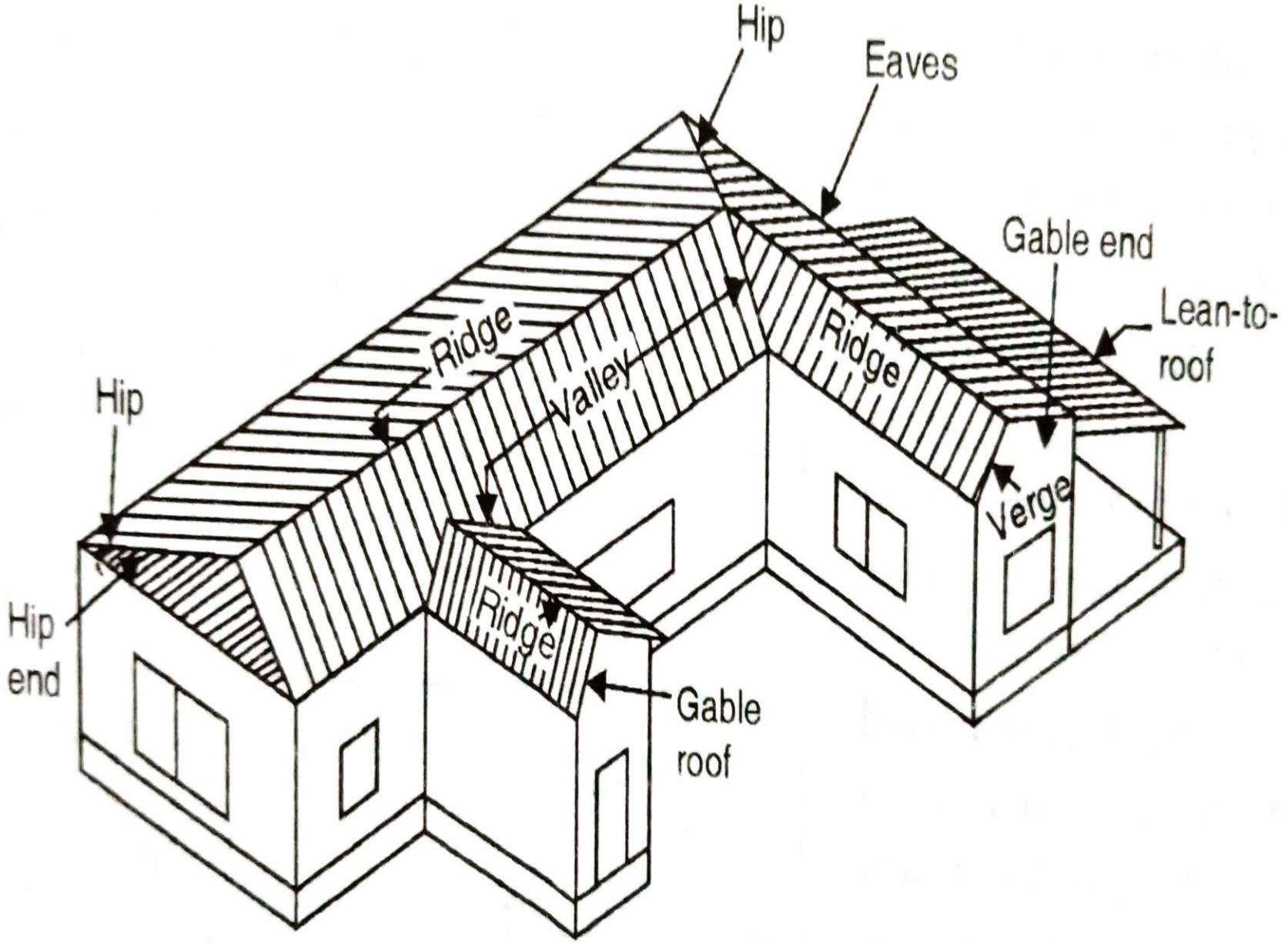


FIG. 15.1. VARIOUS FORMS OF SLOPING ROOFS

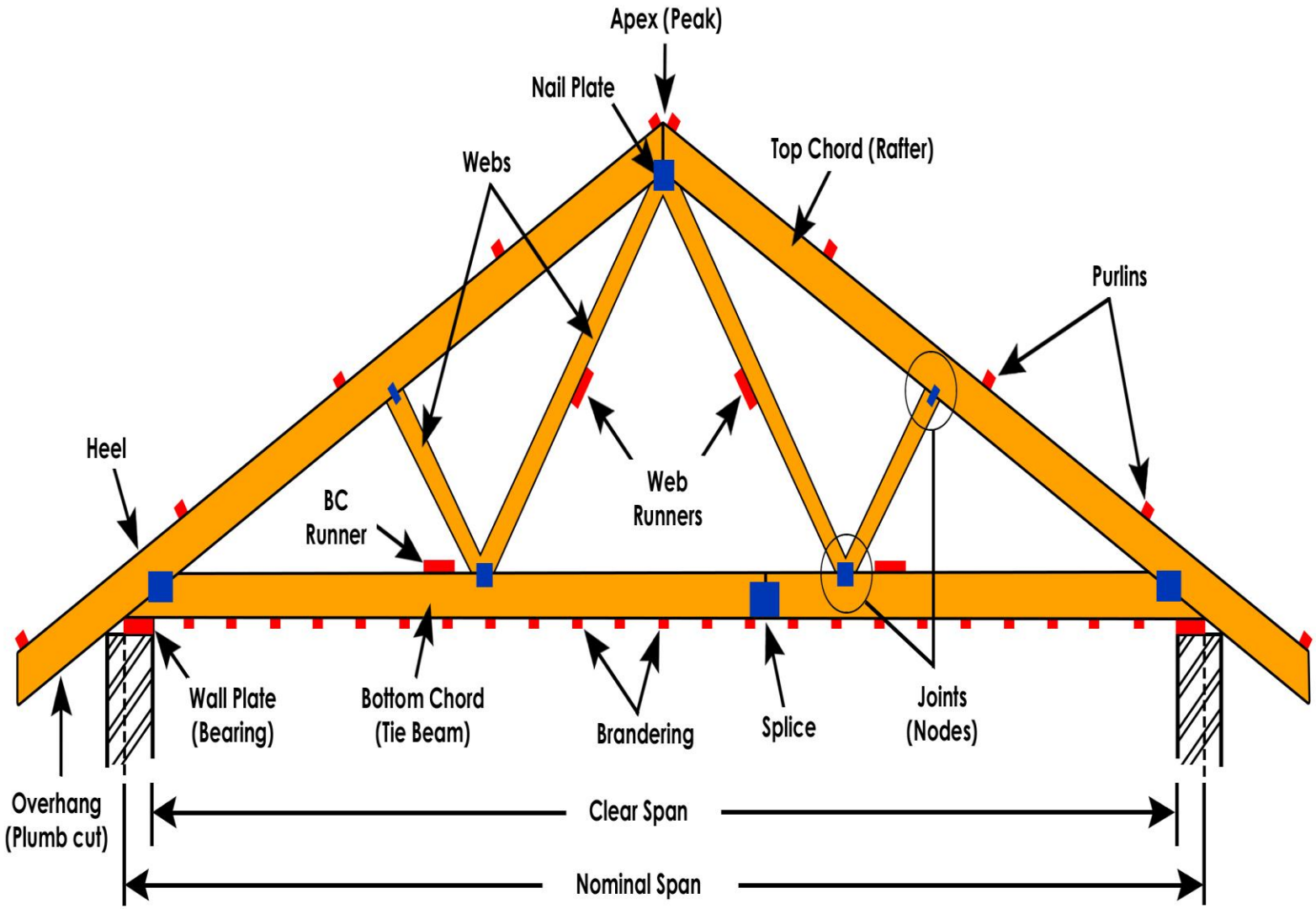
- Various elements of Pitched Roof are defined below :

1. **Pitch :** It is the inclination of the sides of a roof to the horizontal plane. It is expressed either in terms of degrees(angle) or as a ratio of rise to span.
2. **Ridge :** It is defined as the apex line of the sloping roof. It is thus the apex of the angle formed by the termination of the inclined surface at the top of a slope.
3. **Eaves :** The lower edge of the inclined roof surfaces is called eaves. From the lower edge(eaves), the rain water from the roof surface drops down.
4. **Hip :** It is the ridge formed by the intersection of two sloping surface, where the exterior angle is greater than 180 degrees.
5. **Valley :** It is a reverse of a hip. It is formed by the intersection of two roof surfaces, making an external angle less than 180 degrees.
6. **Hipped End :** It is the sloped triangular surface formed at the end of a roof.
7. **Verge :** The edge of a gable, running between the eaves and ridge, is known as a verge.


Hip
Eaves
Gable end
Lean-to-roof
Ridge
Valley
Ridge
Hip
Verge
Hip end
Ridge
Gable roof

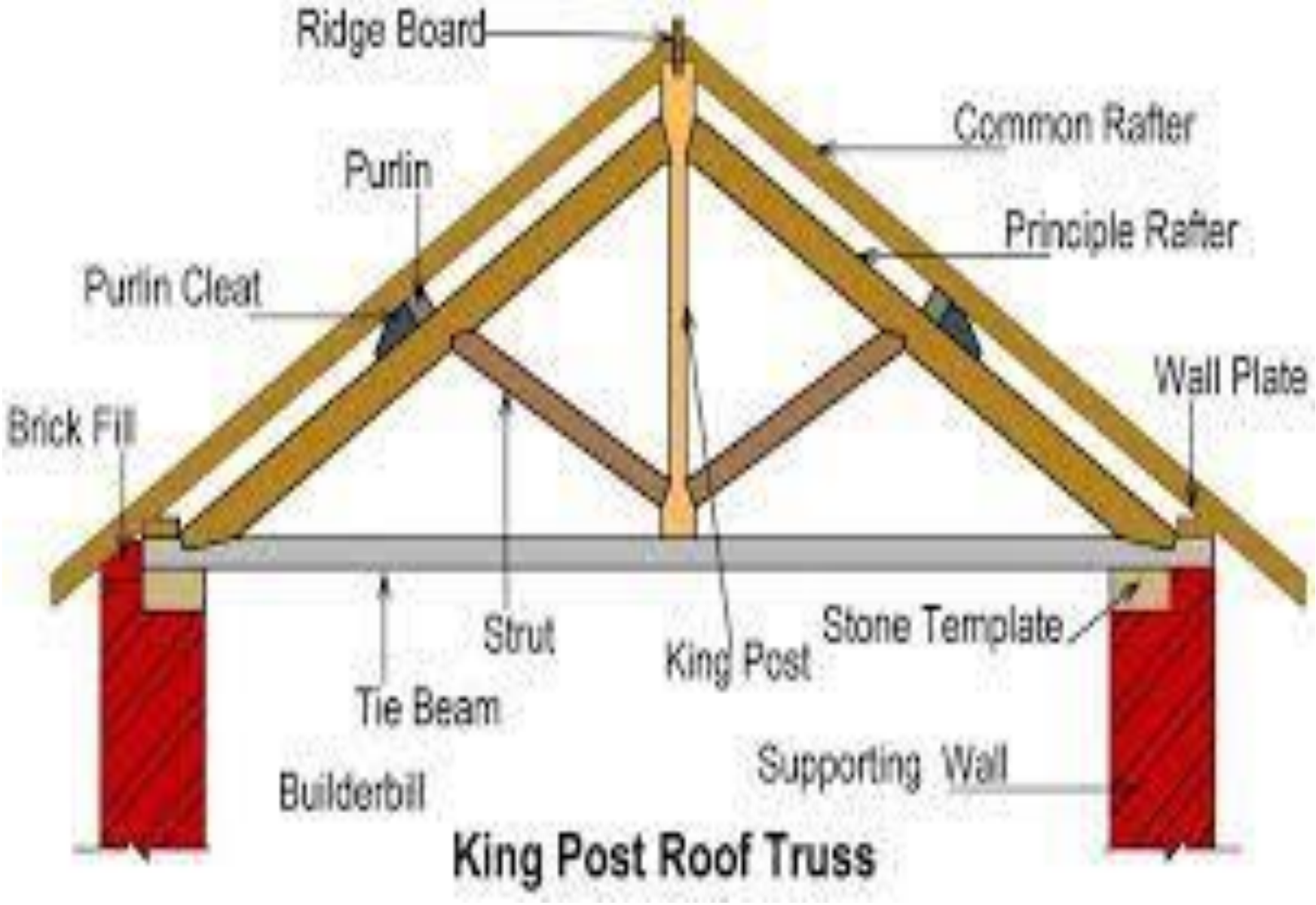
Truss Roof

- When the span of the roof exceeds 5 m and where there are no inside walls to support the purlins, framed structures, known as trusses are provided at suitable interval along the length of the room.
- Spacing is gernerally limited to 3 metres for wooden trusses.
- There are several types of trusses in use.


Apex (Peak)
Nail Plate
Webs
Top Chord (Rafter)
Purlins
Heel
BC
Runner
Web
Runners
Wall Plate
(Bearing)
Bottom Chord
(Tie Beam)
Brandering
Splice
Joints
(Nodes)
Overhang
(Plumb cut)
Clear Span
Nominal Span

King Post Truss

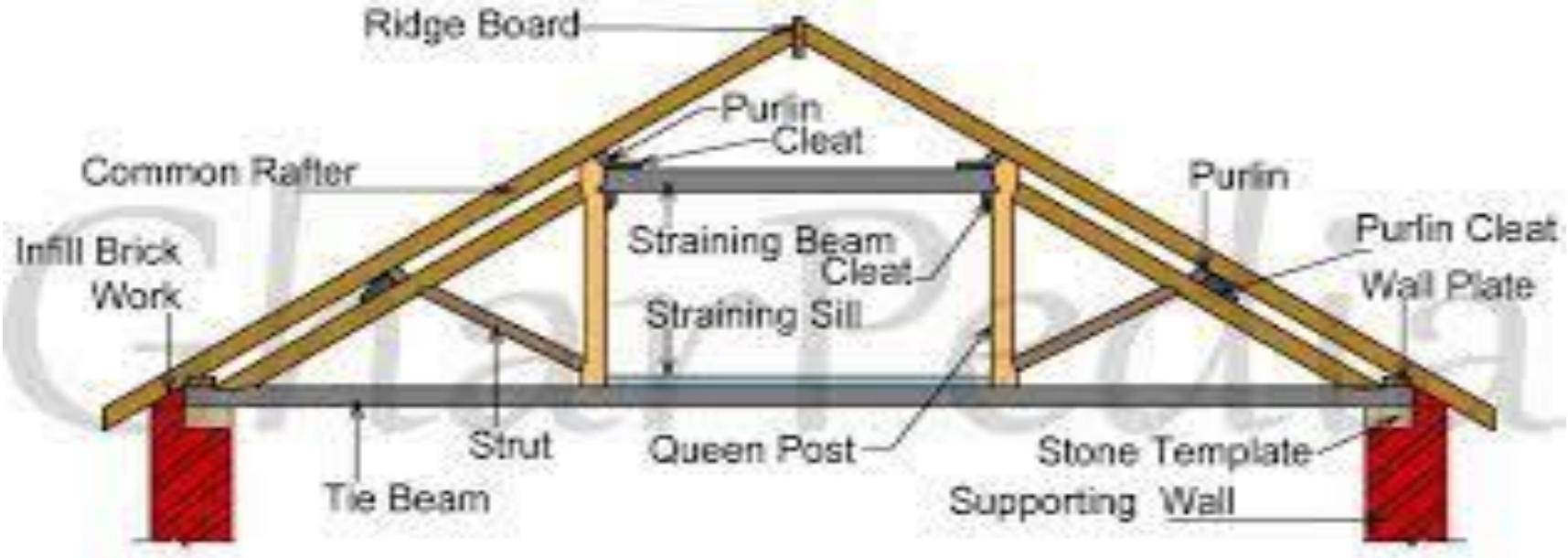
- A king – post truss consists of the following components :
- (i) Lower tie beam,
- (ii) Two inclined principal rafters,
- (iii) Two struts, and (iv) a king post.
- The principal rafters support the purlins.
- The purlins support the closely – spaced common rafters which have the same slope as the principal rafters. The common rafters support the roof covering as usual.
- The spacing of the king – post truss is limited to 3m centre to centre.
- The truss is suitable for spans varying from 5 to 8 meters.
- The king – post prevents the tie – beam from sagging at its centre of span.
- Struts connected to the beams and the principal rafters in the inclined direction, prevent the sagging of principal rafters.



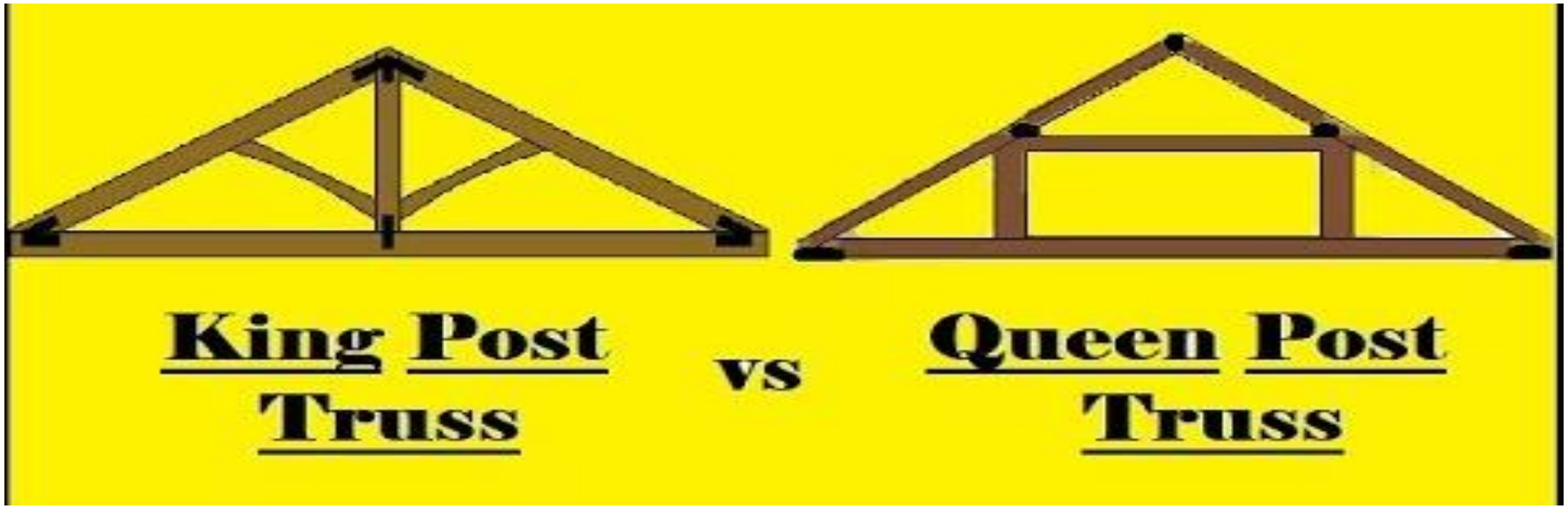
King Post Roof Truss

Queen Post Truss

- A queen – post truss differs from a king – post truss in having two vertical posts, rather than one.
- The vertical posts are known as queen – posts, the tops of which are connected by a horizontal piece, known as straining beam.
- Two struts are provided to join the feet of each queen – post to the principal rafter.
- The queen posts are the tension members.
- These trusses are suitable for spans between 8 to 12 meters.
- As span increases the tie beam of the queen post truss will start sagging.



Queen Post Truss



Steel Roof Trusses

- When the span exceeds 10 m, timber trusses become heavy and uneconomical.
- Steel trusses are more economical for large spans.
- However, steel trusses are more commonly used these days, for all spans – small or large, since they are : (i) More economical, (ii) Easy to construct or fabricate, (iii) Fire – proof, (iv) More rigid, and (v) Permanent.
- Most of the roof trusses are fabricated from angle – sections because they can resist effectively both tension as well as compression, and their jointing is easy.
- In India, where timber has become very costly (except in hilly regions), steel trusses have practically superseded timber trusses.

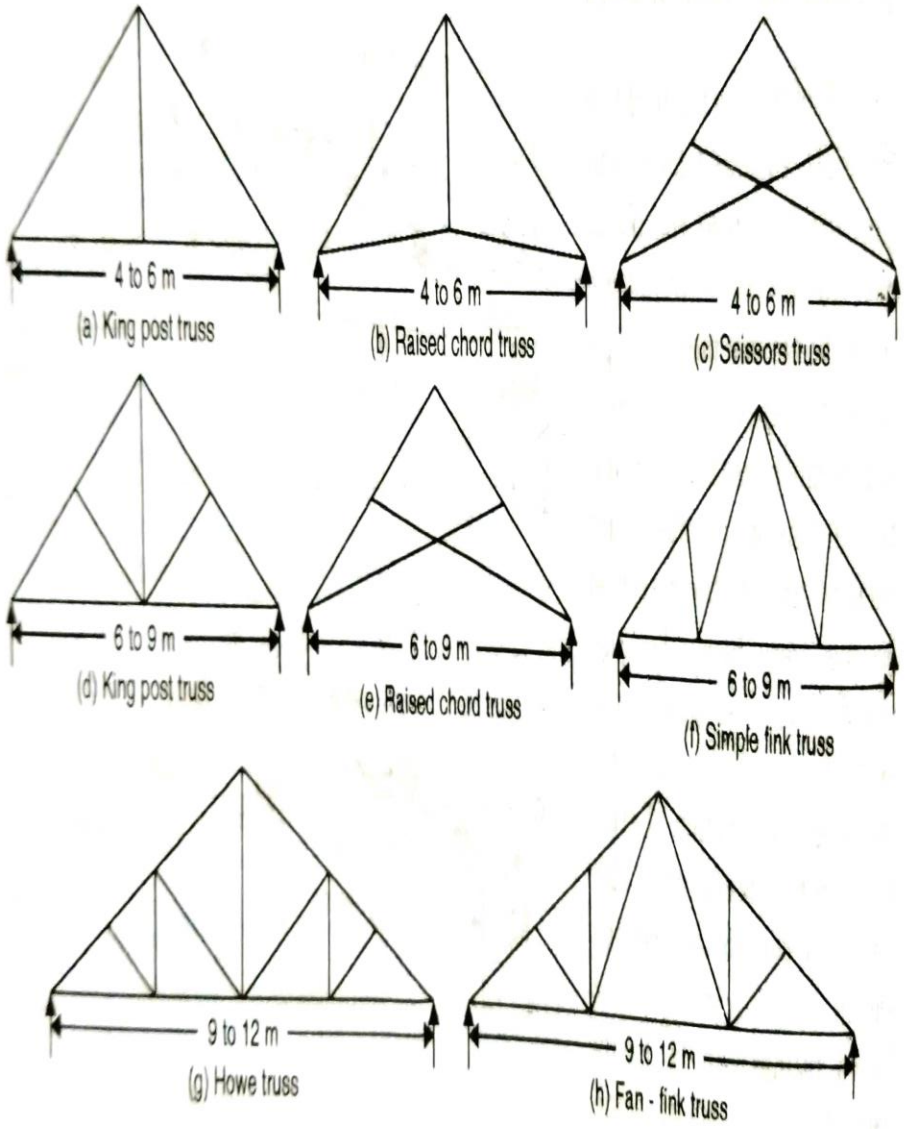


FIG. 15.19. STEEL TRUSSES.

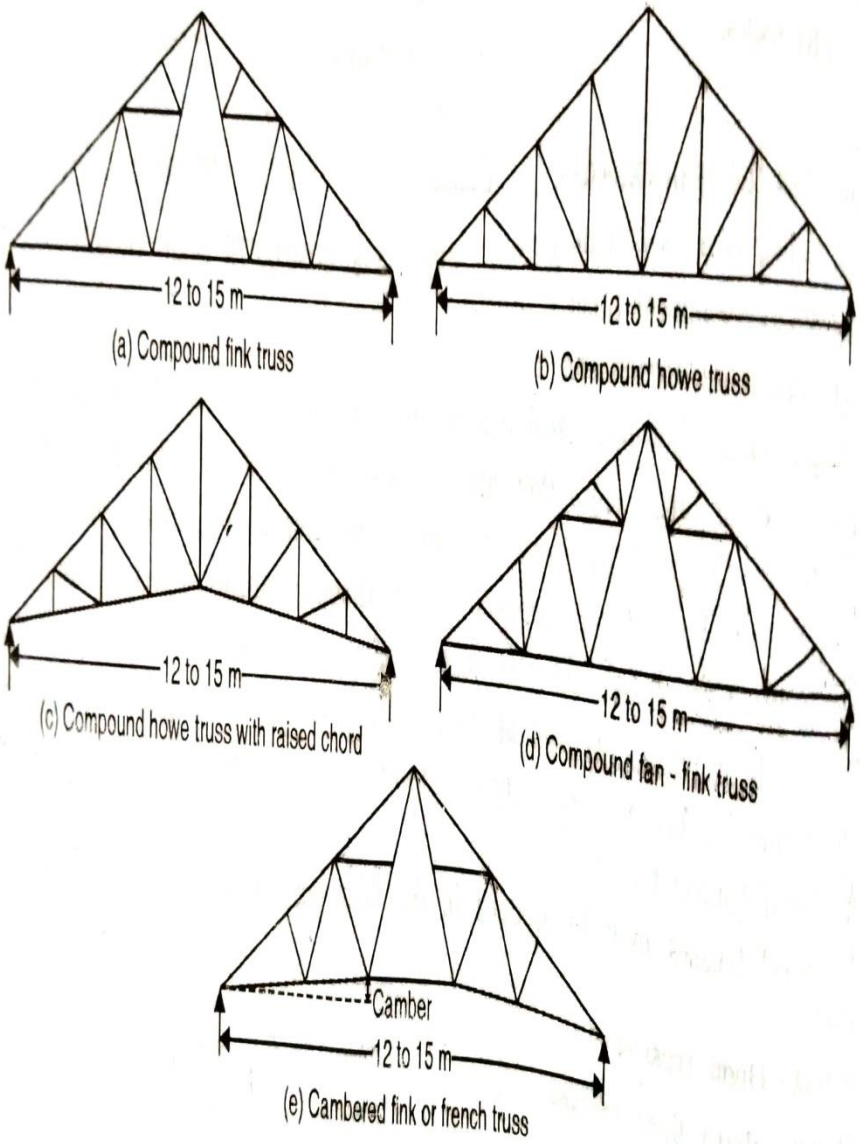
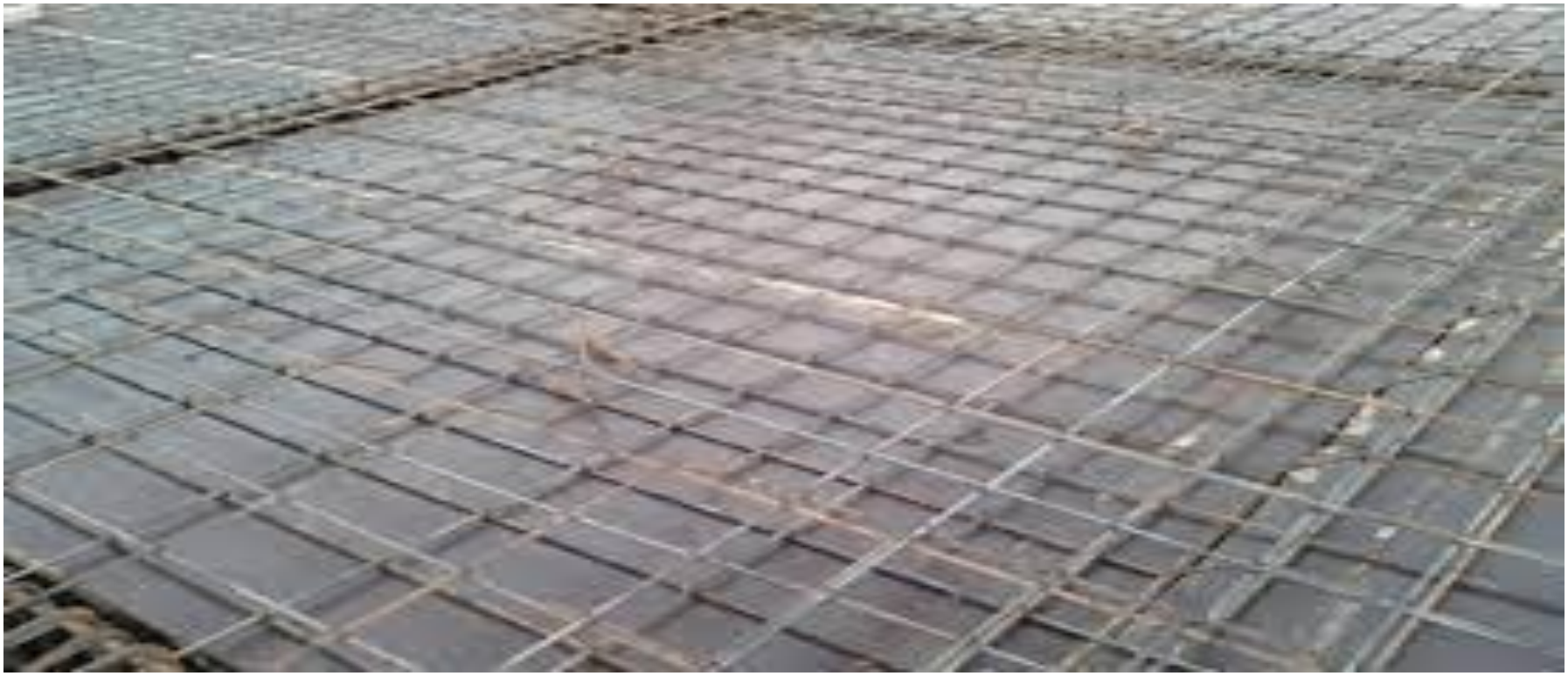


FIG. 15.20. STEEL TRUSSES.

R.C.C. Roof

- The reinforced concrete features combined the strength of cement and steel bars which are the basic components of a modern structural design.
- These are energy efficient, does not catch fire, provides solid and durable roofing, very versatile and provides greater protection.



Roof Coverings

- Roof covering is an essential component of pitched roof, to be placed over the roof frame work, to protect it from rain, snow, sun, wind and other atmospheric agencies.
- Various types of roofing materials are available, and their selection depends upon (i) Type of building, (ii) Type of roof framework, (iii) Initial cost, (iv) Maintenance requirements, (v) Fabrication facilities, (vi) appearance and special features of the locality, (vii) durability, (viii) availability of the material itself, and (ix) Climate of the locality.
- The following are the roof – covering materials commonly used for pitched roofs :

1. Thatch covering
2. Wood shingles
3. Tiles
4. Asbestos cement sheets(A.C. Sheets)
5. Galvanised corrugated iron sheets (G.I.sheets)
6. Eternit slates
7. Light weight roofing

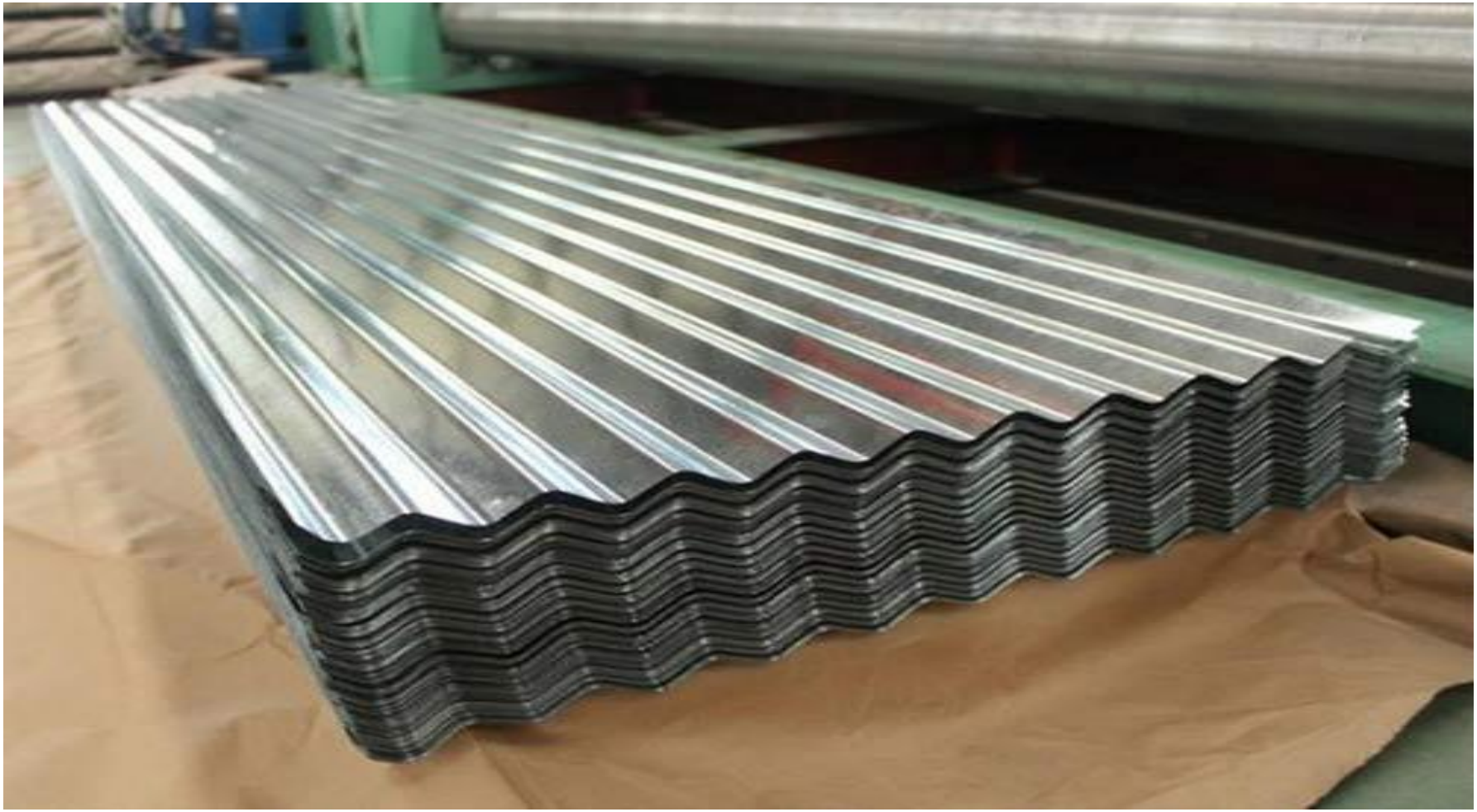
1. Thatch Covering

2. Wood shingle Roofing

3. Tile roofing

4. Asbestos Cement Sheets(A.C. Sheets)

5. Galvanised Iron Corrugated Sheets(G.I. Sheets)



5. Light weight Roofing

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