

Wall

CHOICE OF WALLING TYPE The choice of walling type is influenced by:

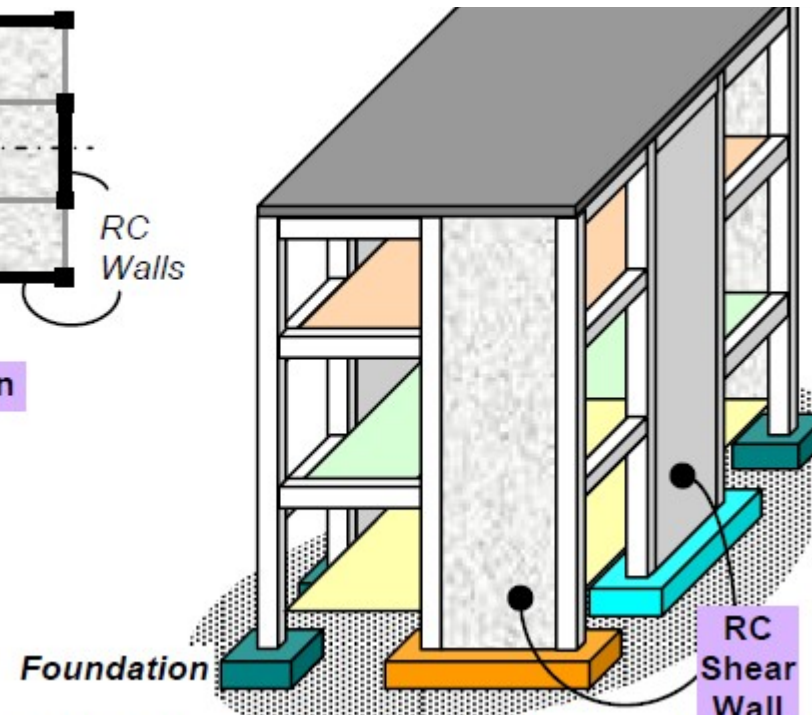
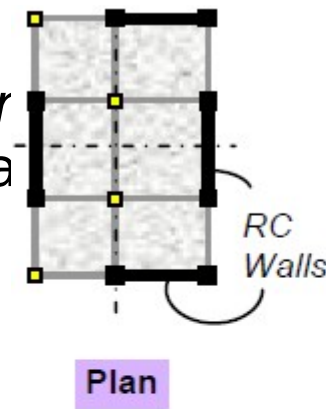
- the design of the building,
- technical considerations (whether the wall is load bearing or non-load bearing),
- its location,
- site exposure,
- aesthetic considerations.

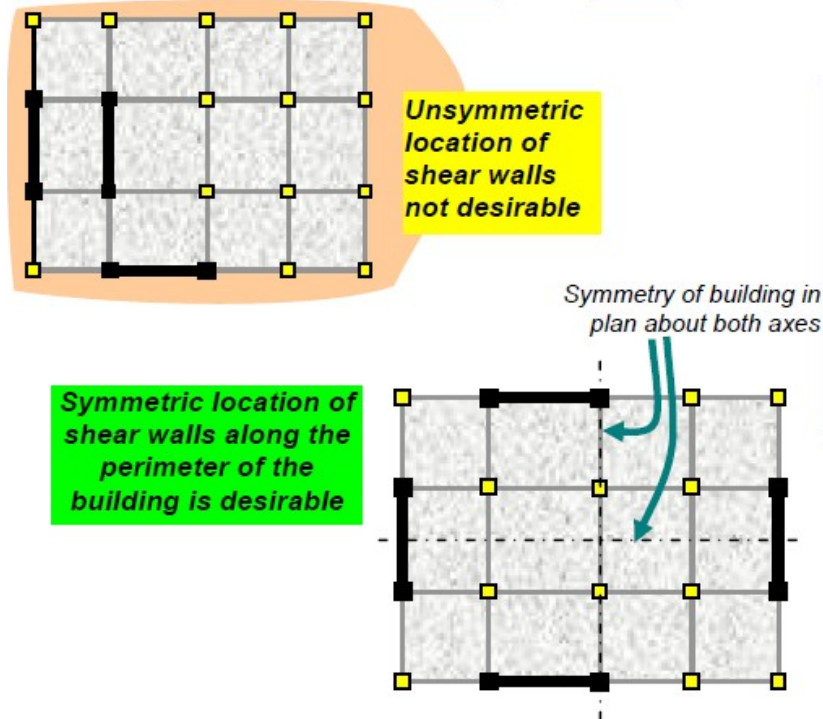
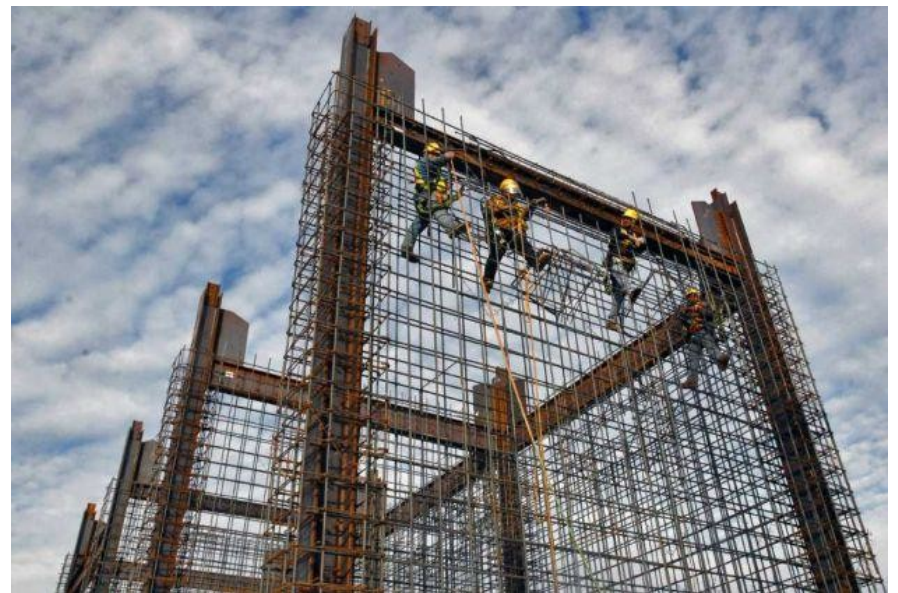
Masonry wall

Shear wall

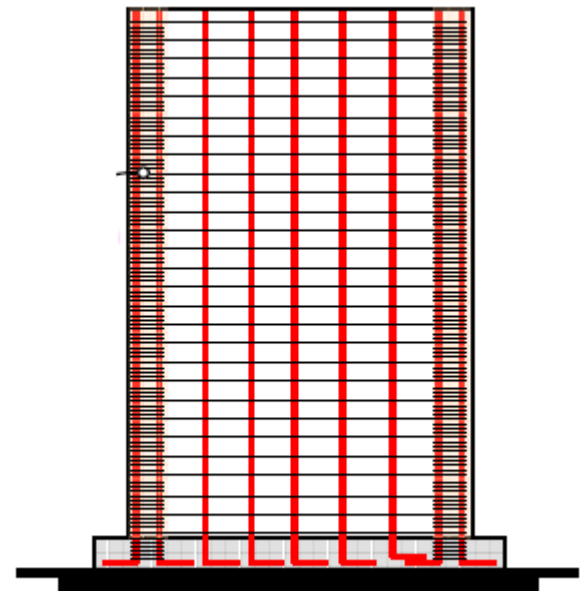
- Reinforced concrete (RC) buildings often have *vertical plate-like* RC walls called *Shear Walls*
- These walls generally start at foundation level and are continuous throughout the building height. Their thickness can be as low as 150mm, or as high as 400mm in high rise buildings.

Door or window openings can be provided in shear walls, but their size must be small to ensure least interruption to force flow through walls.

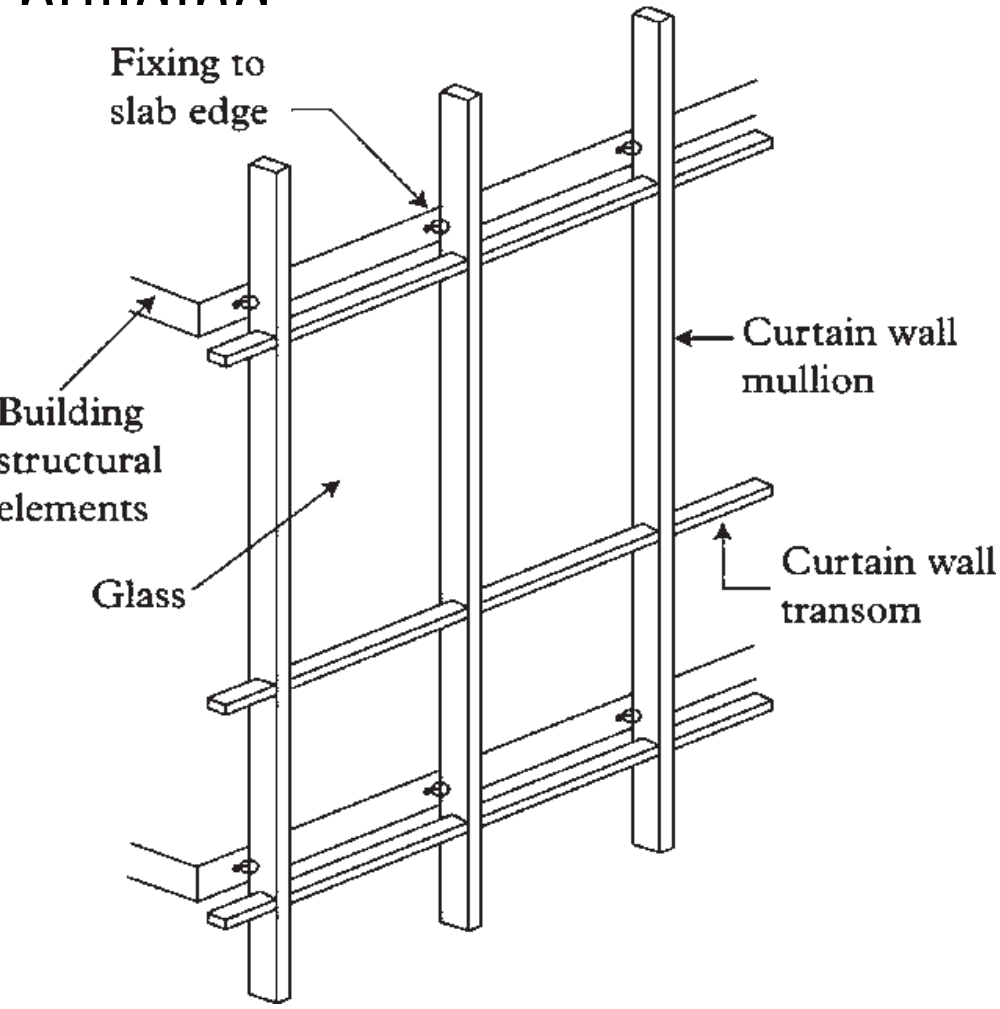




Shear walls must be symmetric in plan layout – twist in buildings can be avoided.



A **curtain wall** is usually aluminum-framed **wall**, containing in-fills of glass, metal **panels**. The framing is attached to the building structure and does not carry the floor or roof loads of the building.



Name

Type

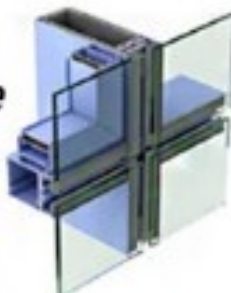
Picture

Detail

*Visible
Curtain
Wall*



*Invisible
Curtain
Wall*



*Unitized
Curtain
Wall*



*Spider
Curtain
Wall*



Retaining wall

are relatively rigid walls used for supporting soil laterally so that it can be retained at different levels on the two sides. Retaining walls are structures designed to restrain soil to a slope that it would not naturally keep to (typically a steep, near-vertical or vertical slope). They are used to bound soils between two different elevations often in areas of terrain possessing undesirable slopes or in areas where the landscape needs to be shaped severely and engineered for more specific purposes like hillside farming or roadway overpasses.

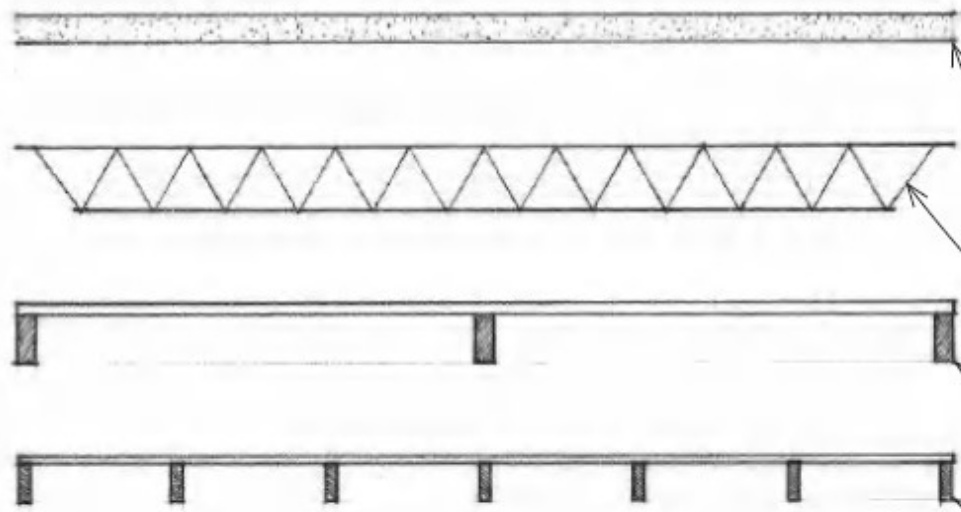
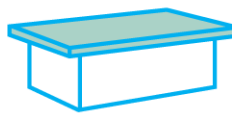
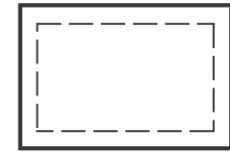


ROOFING

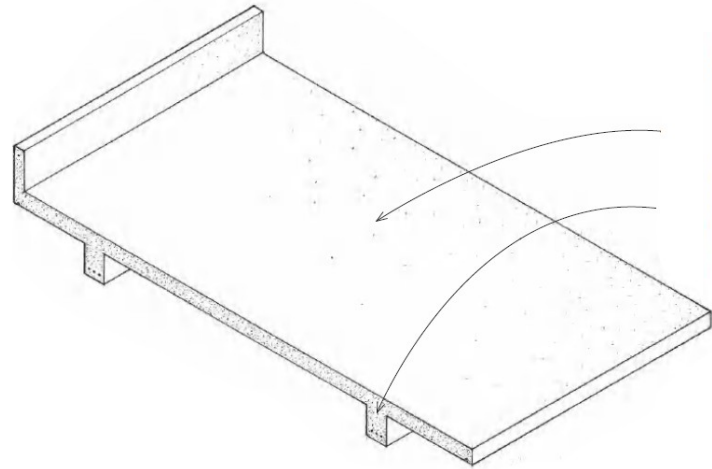
- The roof system functions as the primary sheltering element for the interior spaces of a building.
- The functional requirements of the roof are as follows.
 - i) Strength and stability- strong and stable enough to take up anticipated loads
 - ii) Weather resistance – resistance to wind, rain, sun, snow etc
 - iii) Heat insulation - should provide adequate insulation against heat
 - iv) Sound insulation – should provide adequate insulation against sound from external sources.
 - v) Fire resistance – Should offer the adequate fire resistance.
 - vi) Day lighting – The provides day light in buildings with large floor area i.e., industrial buildings through window in the roof.

- the upper cover of a building is called roof cover
- A structure which prepared to hold the cover is called roof structure
- Like -truss ,girder ...etc.
- Roof can be classified
 - 1.Flat roof
 - 2.Pitch roof
 3. Curved roofs

Flat roof: roof having a slop not more than 2 degree



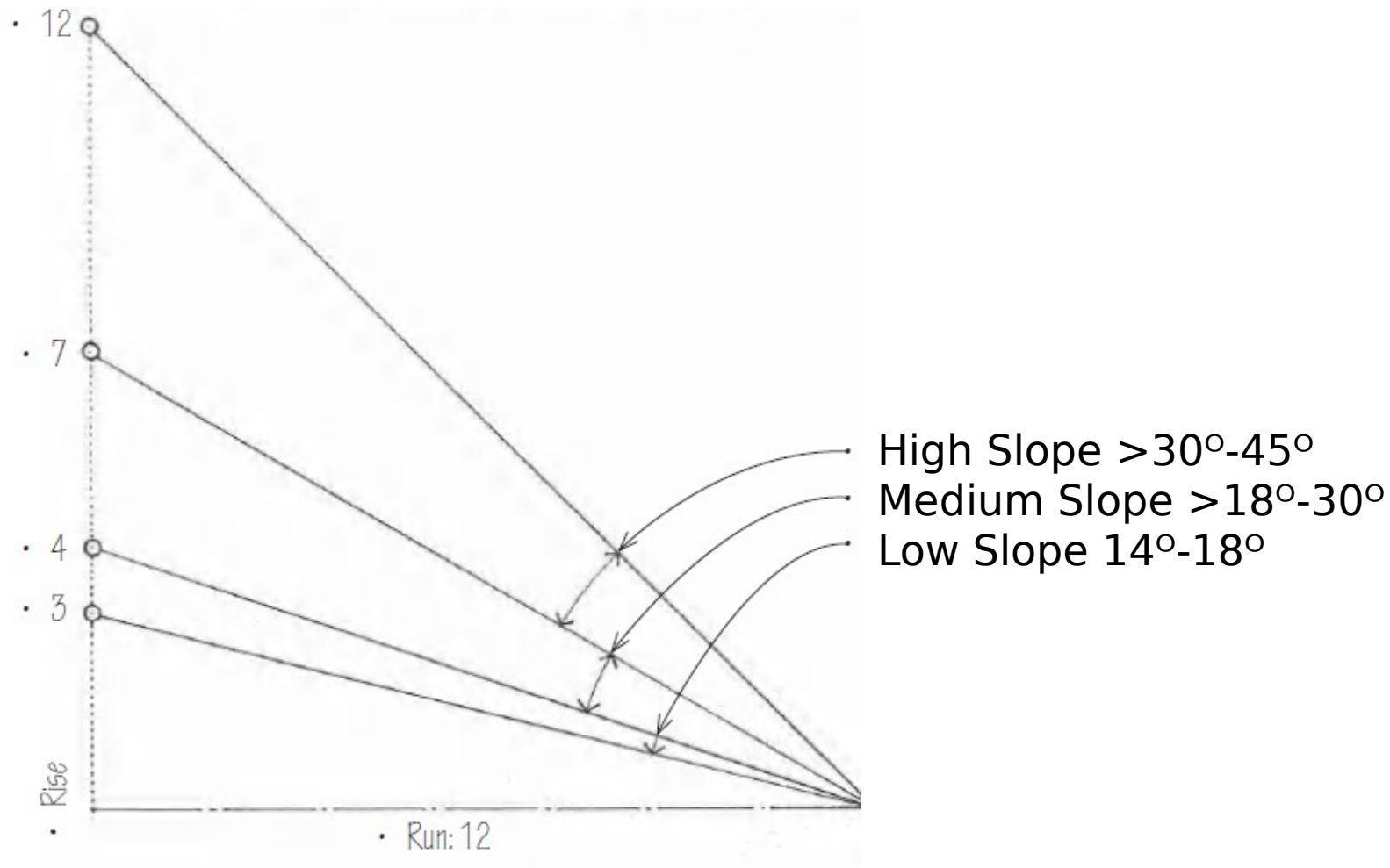
- The structure of a flat roof may consist of:
- Reinforced concrete slabs
- Flat timber or steel trusses
- Timber or steel beams and decking
- Wood or steel joists and sheathing

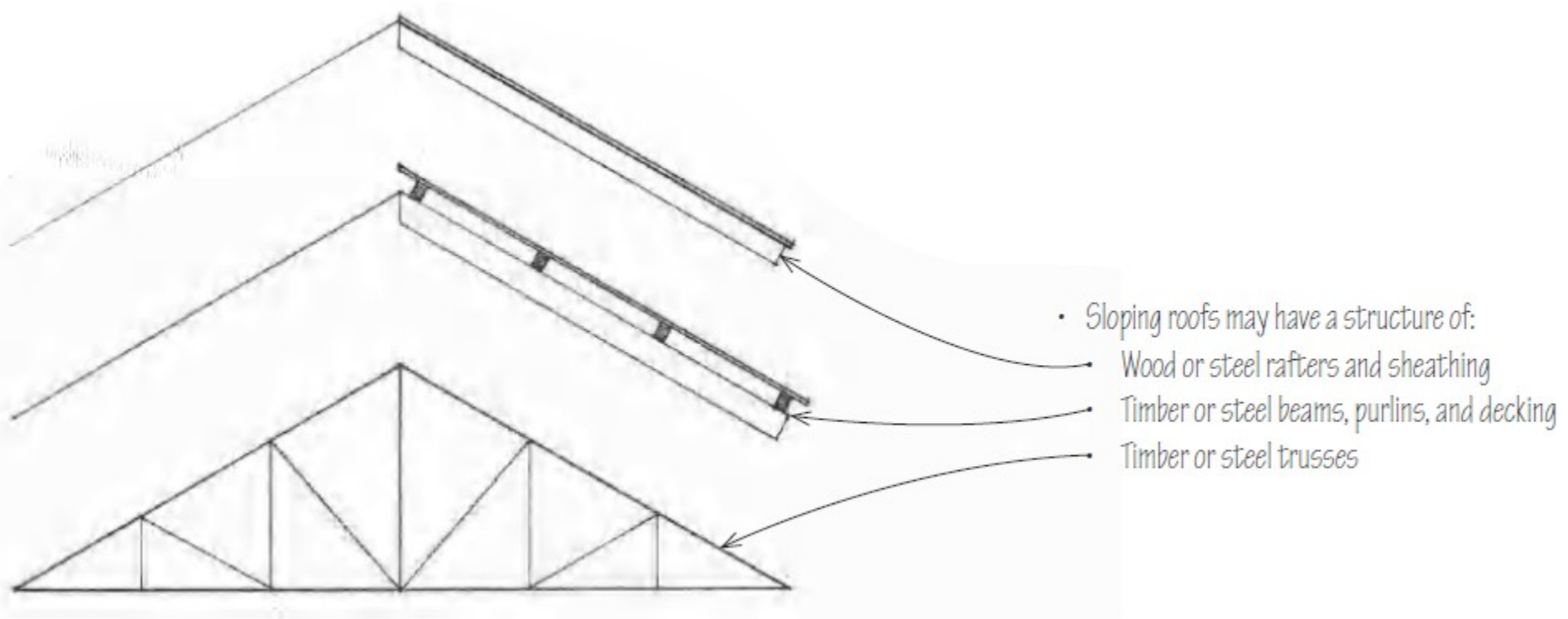


Slope top of slab or layer of roof insulation for roof drainage;
1/4" per foot (1:50) minimum recommended.

Roof slabs may be supported by reinforced concrete columns,
reinforced concrete frames, or bearing walls of reinforced
concrete or masonry.

Sloping /Pitched roofs





- Roof types

- Gable – Most common, built with “common” rafters

- Hip – Provides overhang on all four sides

- Gambrel – Provides more space on second floor

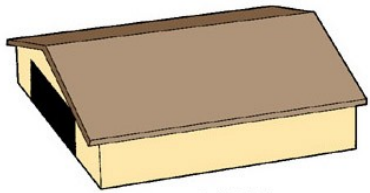
- Mansard – Combination of Hip and Gambrel

- Shed- Frequently used to attach one structure to another

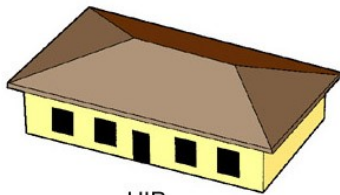
- Butterfly roof: is not widely used. It provides plenty of light and ventilation, but drainage is a problem.

- winged gable is essentially a gable roof, extended at the peak.

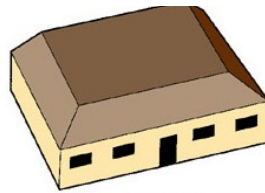
- A-Frame Roof-provides a roof and walls for the structure. Is popular for cottages, homes, churches, and other structures



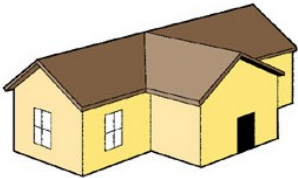
GABLE



HIP



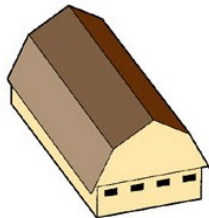
MANSARD



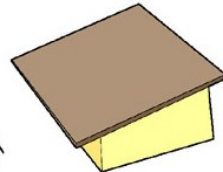
GABLE AND VALLEY



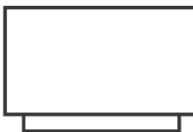
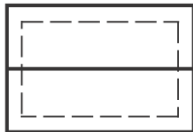
HIP AND VALLEY



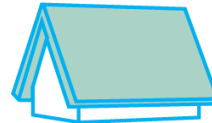
GAMBREL



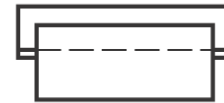
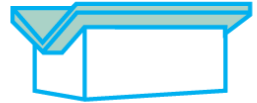
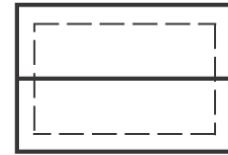
SHED



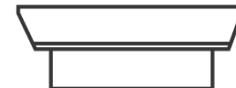
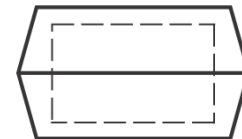
A-Frame Roof



BUTTERFLY



Butterfly roof



winged gable

Mixed Roof Styles

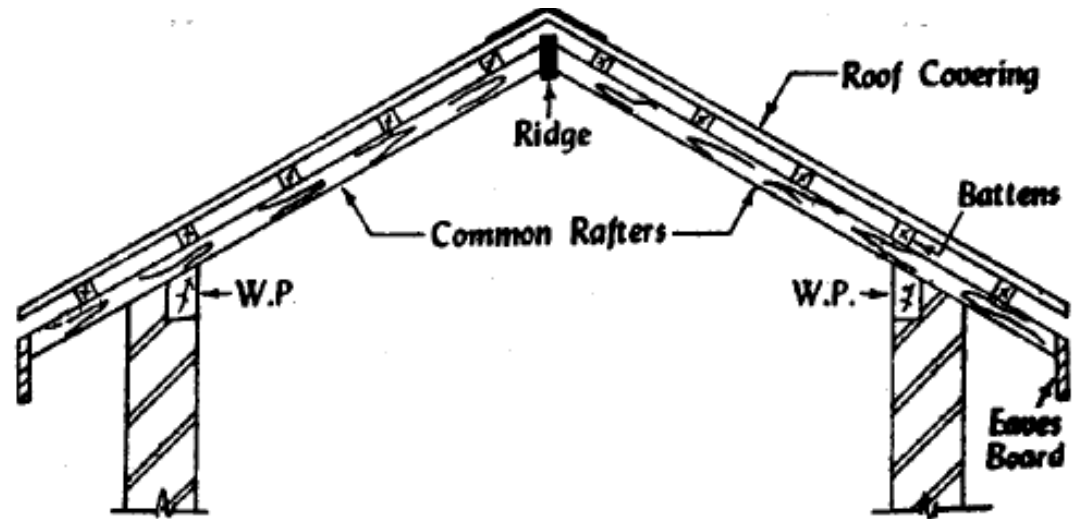
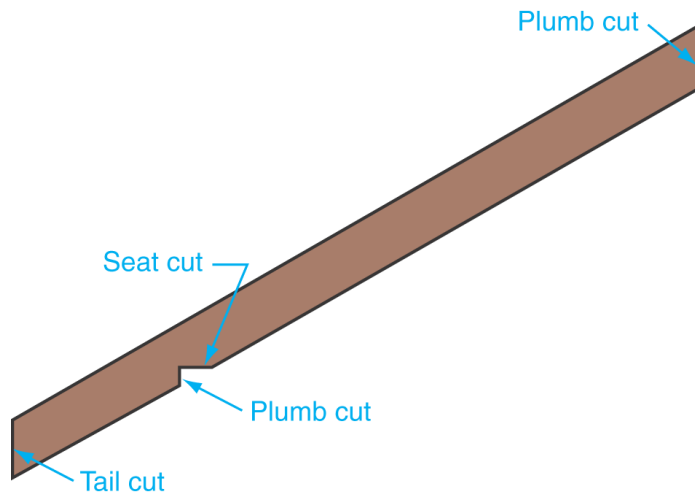


Frame Roof Construction

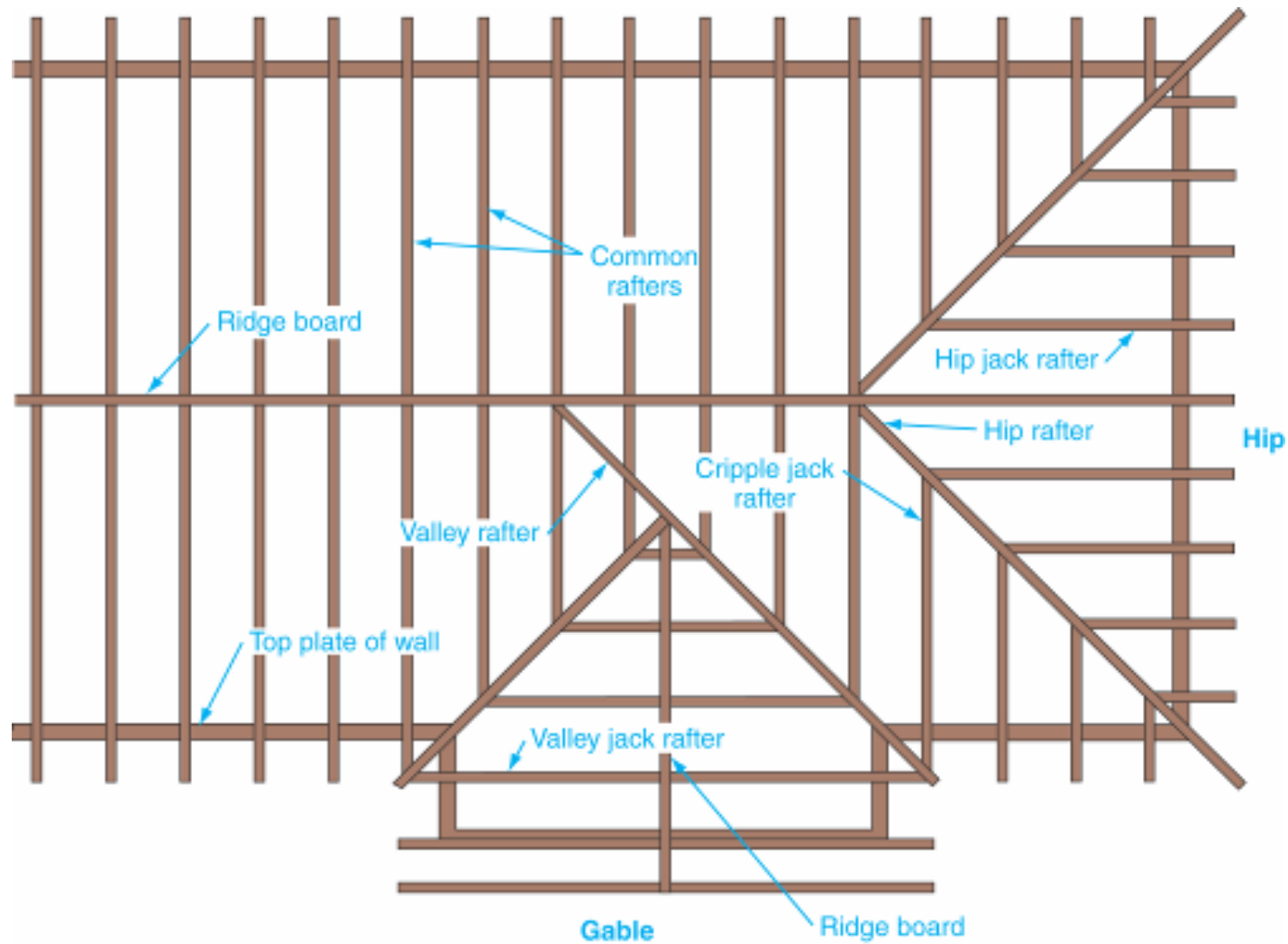
- The roof framing is designed to support the roof covering materials.
- Framing must be strong and rigid.
- Roof framing consists of several distinct structural elements.

Rafters

- The rafter is a structural element of the roof that supports the sheathing.
- Common rafters are perpendicular to the wall plate and extend from the ridge.
- Rafters are often shown on a roof framing plan.



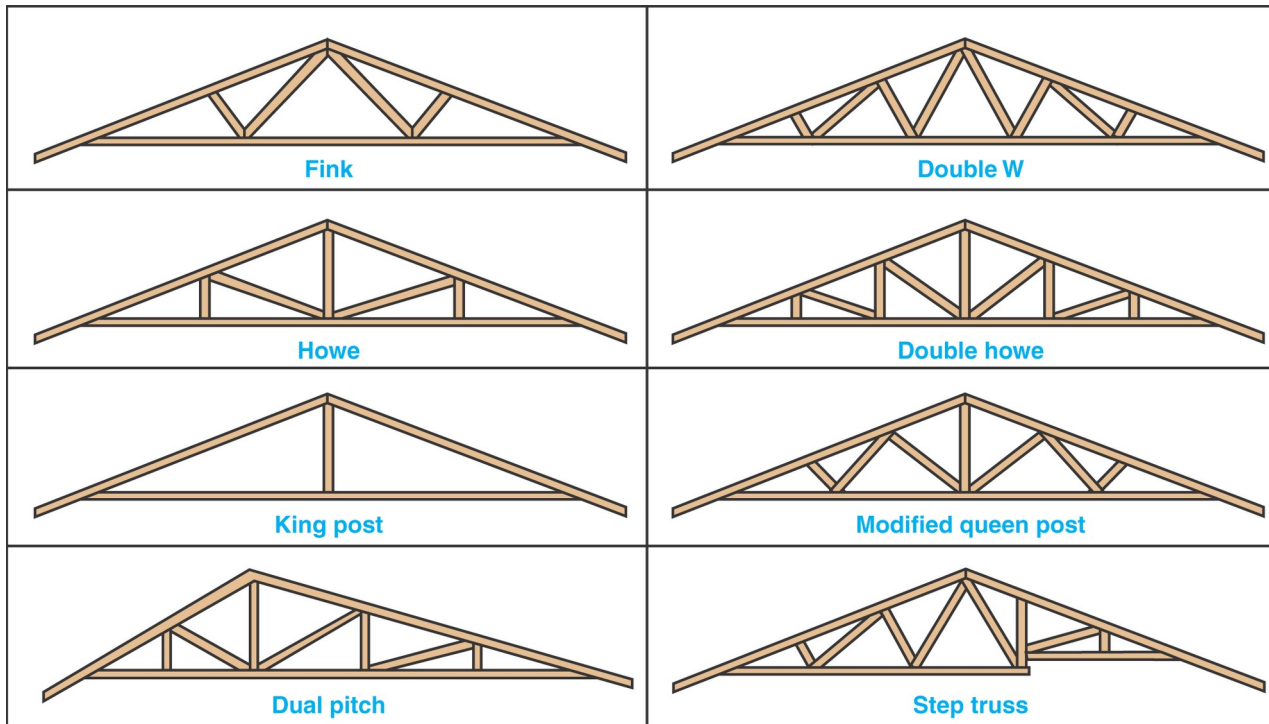
A common rafter with the cuts labeled



Roof framing plan with structural members identified

Roof Trusses

- Truss – roof structure which distribute a load in to triangulated members.
- The roof truss is an assembly of members that form a rigid framework.
- Information needed to construct a truss includes the span, roof pitch, spacing of trusses, and roof load.



Common Roof
Truss Designs

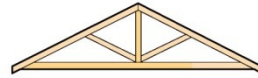
- The vast majority of new construction uses trusses for the roof framing. Each truss is designed for the individual characteristics of the job, and delivered to the site ready to be erected.



SINGLE-SLOPE



KINGPOST



QUEEN



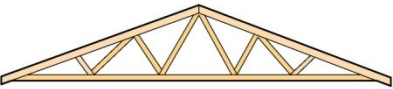
SCISSORS



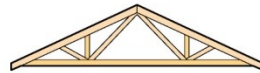
HOWE



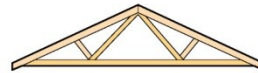
PRATT



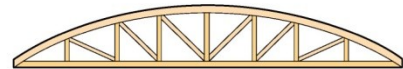
WW / DOUBLE FINK



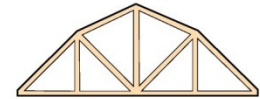
FAN



FINK



BOWSTRING



GAMBREL



BROKEN PITCH





Two operatives carrying truss



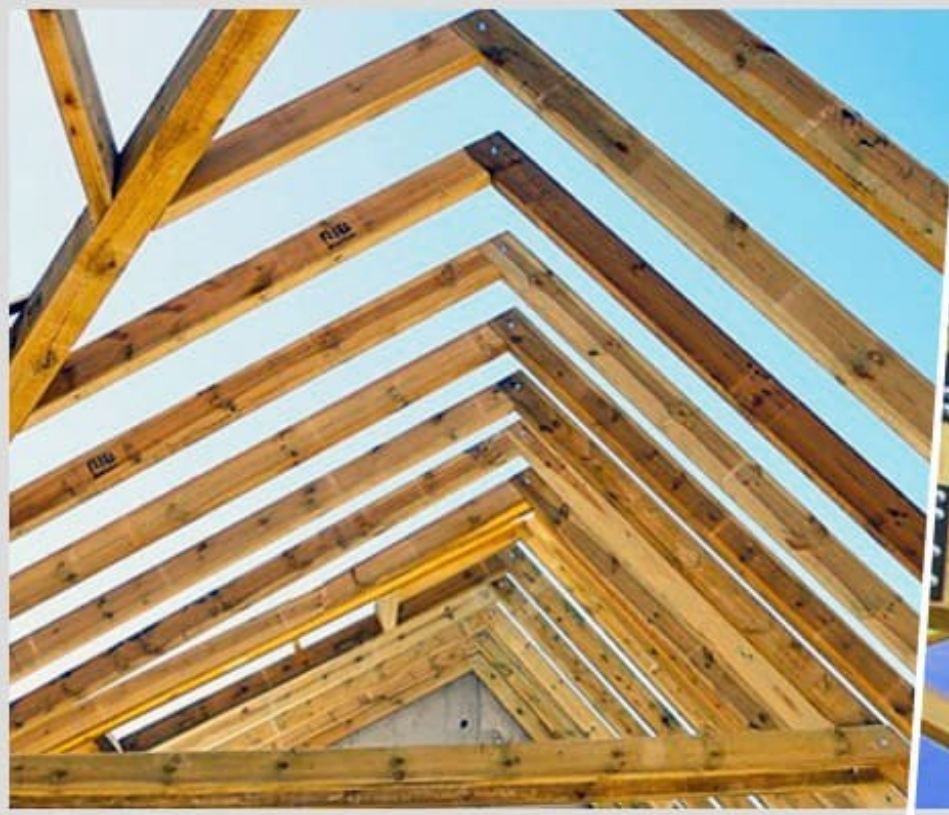
Lifting truss into position using manhandling method



Lifting truss into position using a crane and a guide rope

TRUSSED RAFTER ROOFS



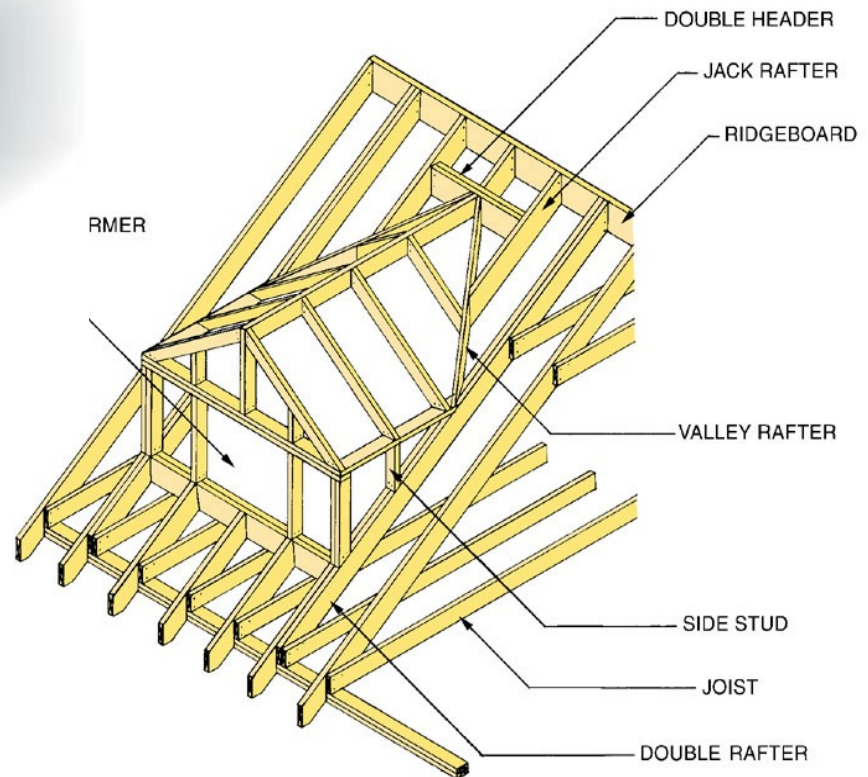
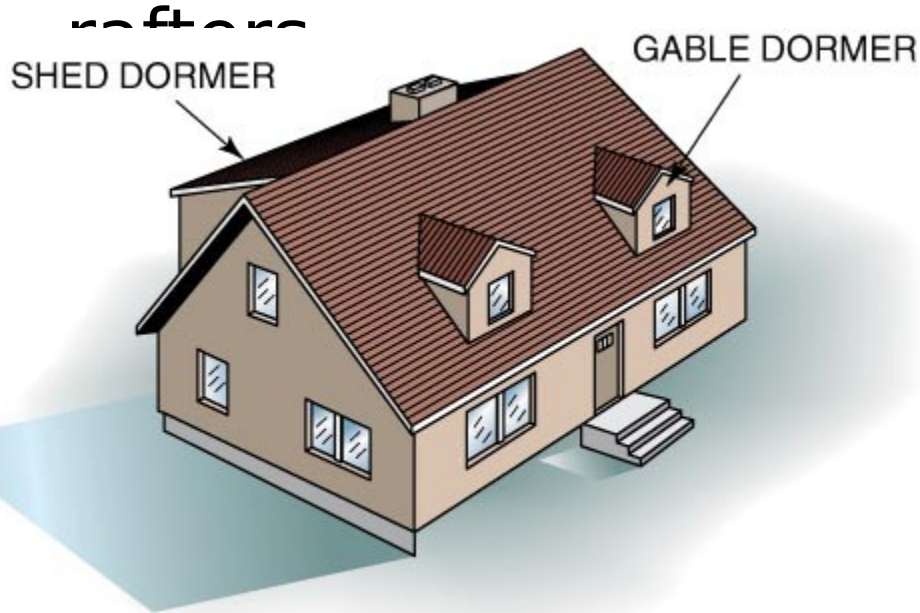


Gusset Plates



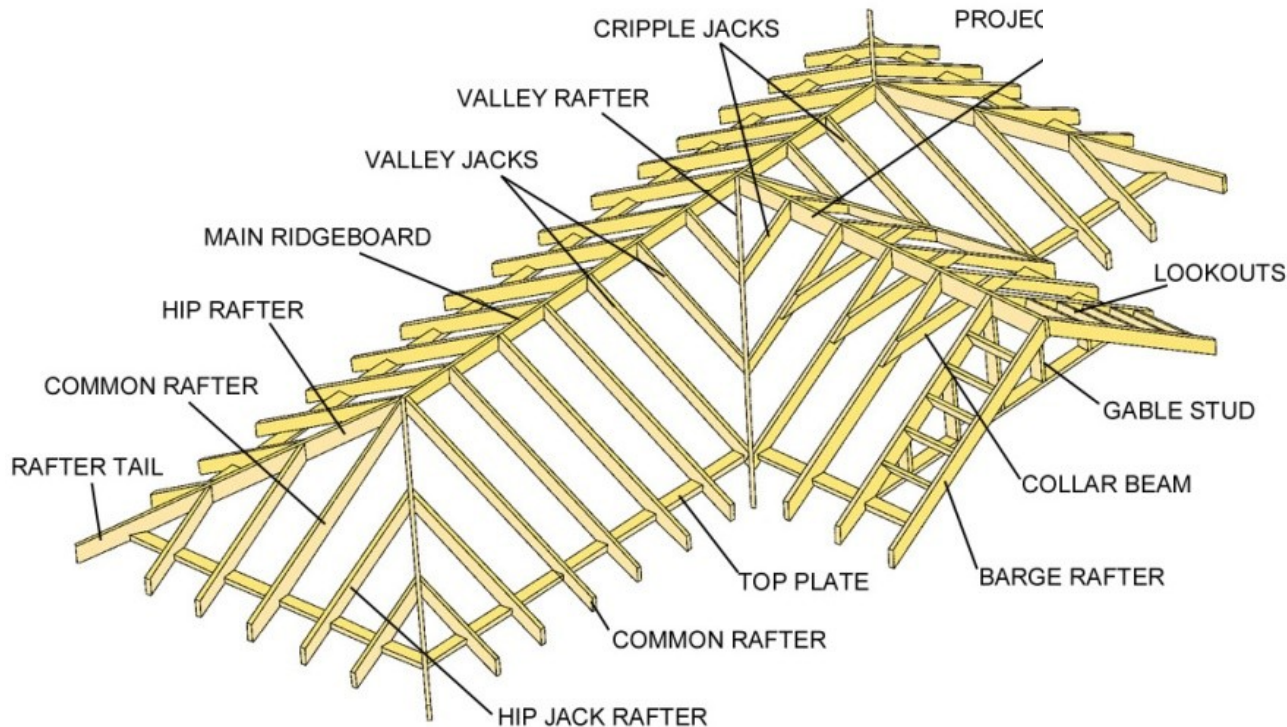
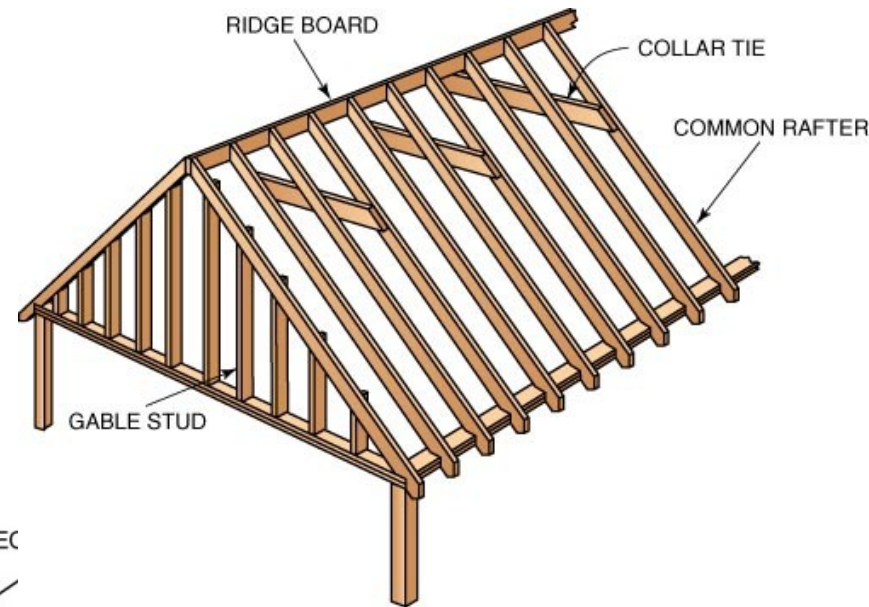
- Gussets are frequently used to fasten the members of a wood truss together. They are generally made from metal.

- Dormers – Most dormers are either shed or gable dormers. They are framed with common



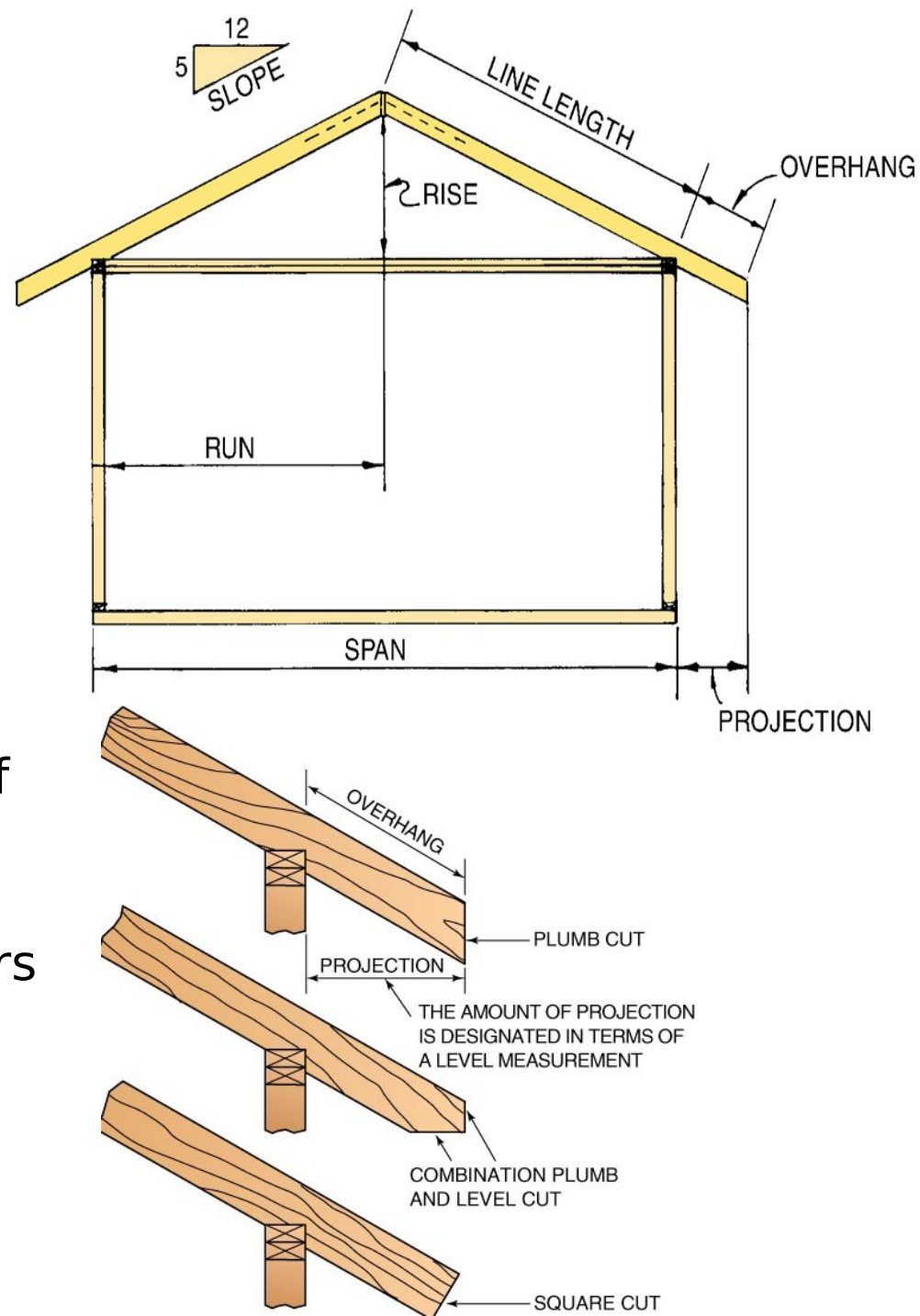
• Definitions

- Common rafter – Runs from top plate to ridge board of a gable roof
- Hip rafter – Runs from corner of top plates to ridge board on a hip roof
- Jack rafter – any rafter which does not run the full length from plate to ridge (e.g. – Hip jack, Valley jack)



• Roof Geometry Definitions

- Span - Measurement from outside of wall to outside of opposite wall
- Run - One half of span (for symmetric roofs)
- Rise - The total vertical distance that the roof projects above the top plate
- Slope - The rise divided by the run, always given in terms of 12 over run (e.g. 5 over 12 written as 5/12)
- Overhang - The section of the rafter (12) extending past the edge of the wall. The rise over the span
- Projection - The horizontal distance that the overhang covers
- Rafter tail cuts - Cuts made to form the overhang



Roof Terminology

- Hip is the inclined projecting angle formed by the junction of two adjacent sloping sides of a roof.



Ridge is the horizontal line of intersection at the top between two sloping planes of a roof.

Dormers are projecting structures built out from a sloping roof and housing a vertical window or ventilating louver.

Gable is the triangular portion of wall enclosing the end of a pitched roof from ridge to eaves.

Rake is the inclined, usually projecting edge of a sloping roof.

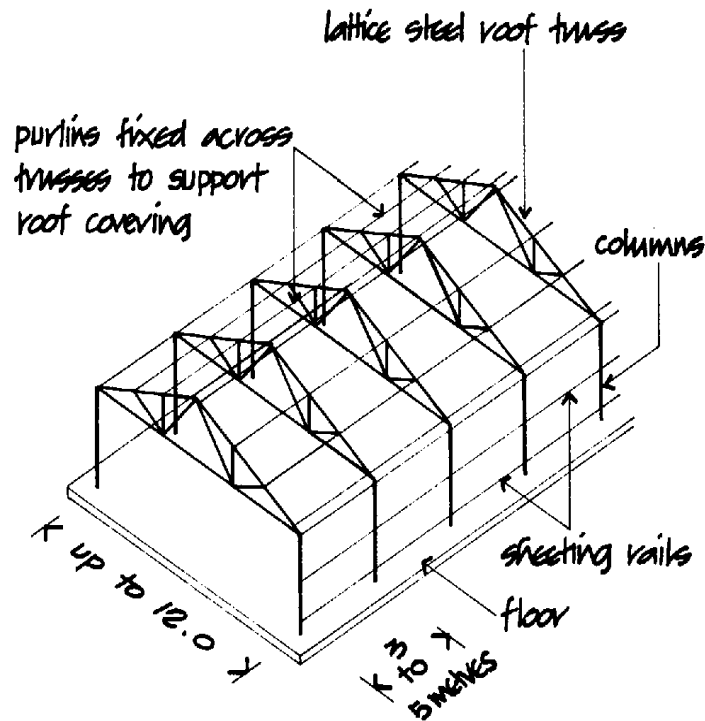
Shed is a roof having a single slope.

Eave is the overhanging lower edge of a roof.

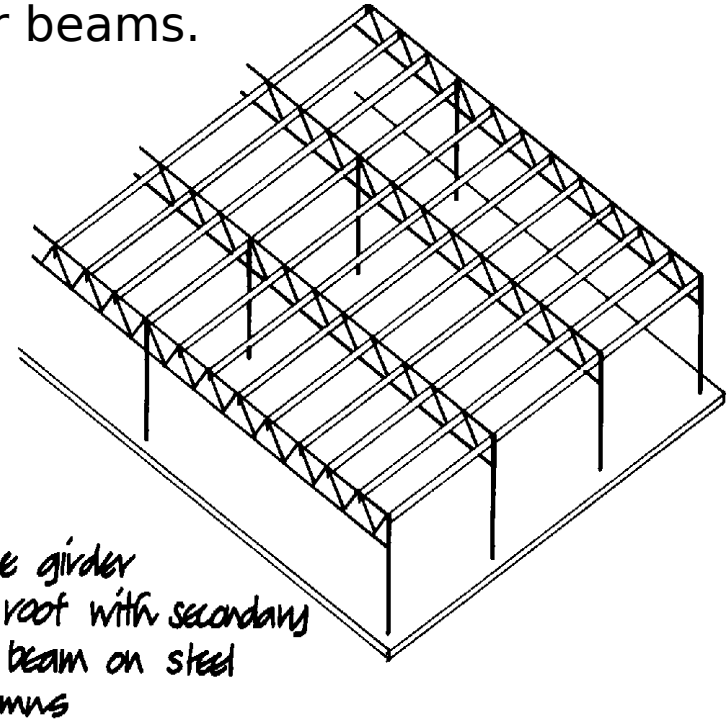
- Soffit is the underside of an overhanging roof eave.

- Valley is an intersection of two inclined roof surfaces toward which rainwater flows.

Roof structure

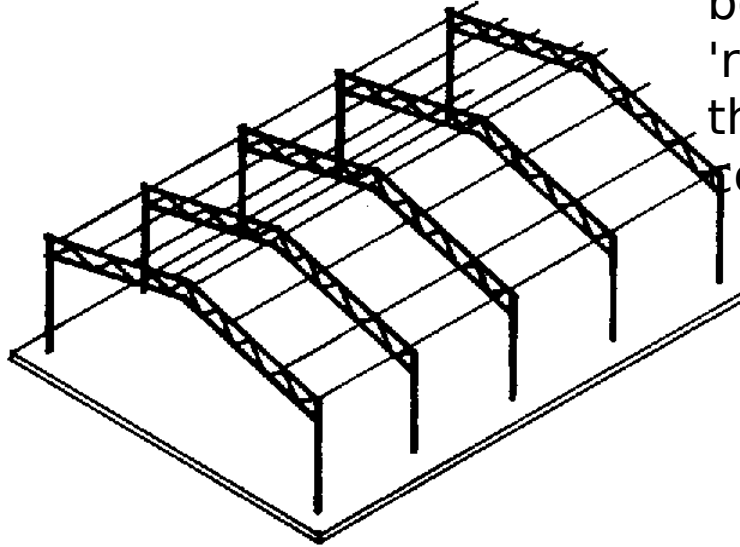


A girder is a support beam used in construction. It is the main horizontal support of a structure which supports smaller beams.

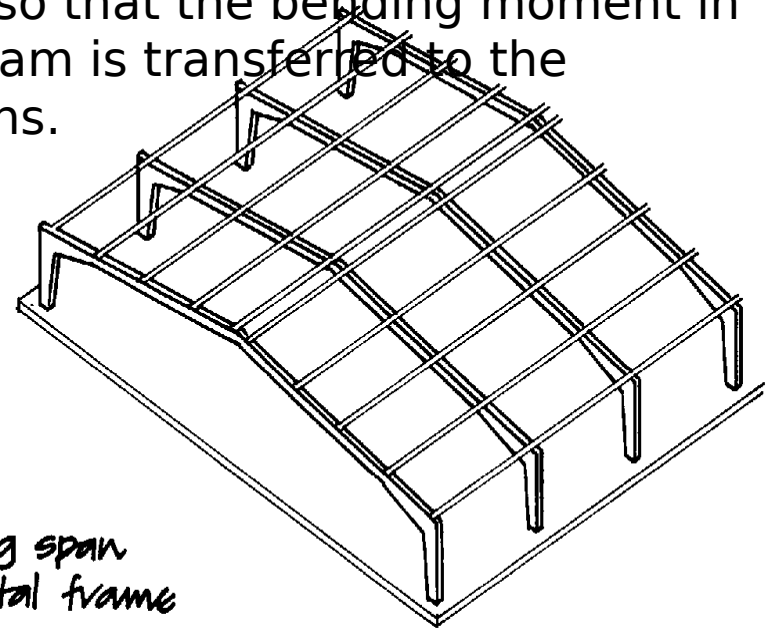


Roof structure

Portal frames are a type of **structural frame**, that, in their simplest form, are characterized by a beam (or rafter) supported at either end by columns, however, the joints between the beam and columns are 'rigid' so that the bending moment in the beam is transferred to the columns.

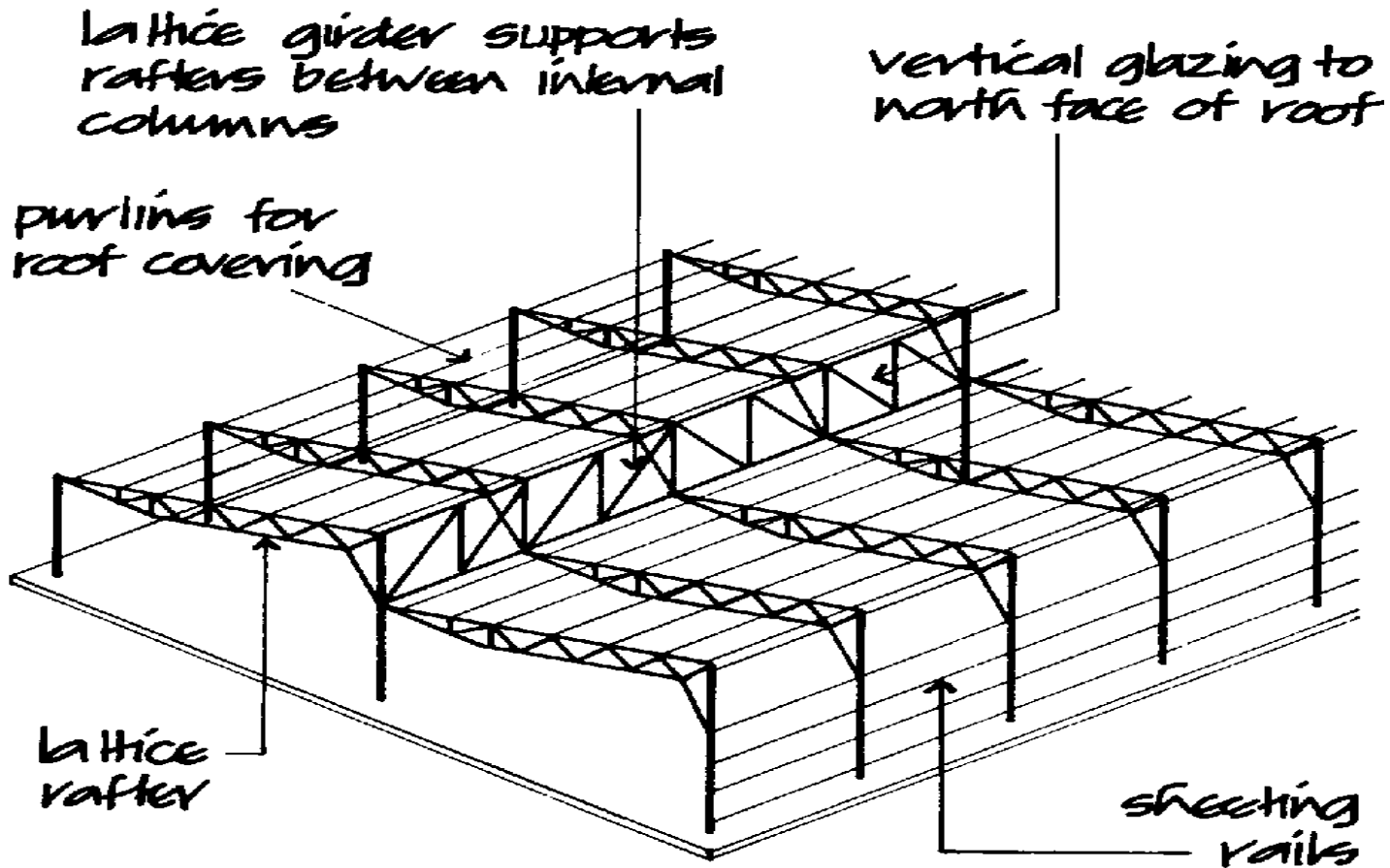


Symmetrical pitch lattice beam roof on columns



long span portal frame

Roof structure



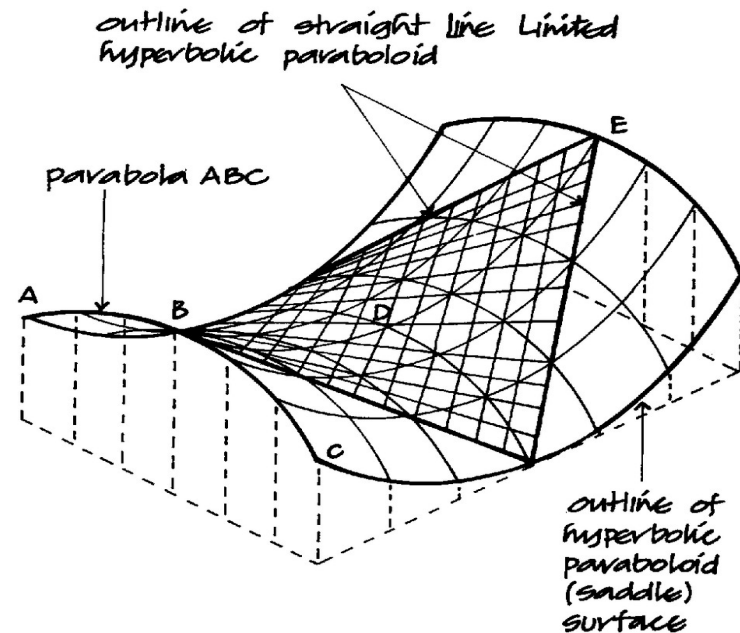
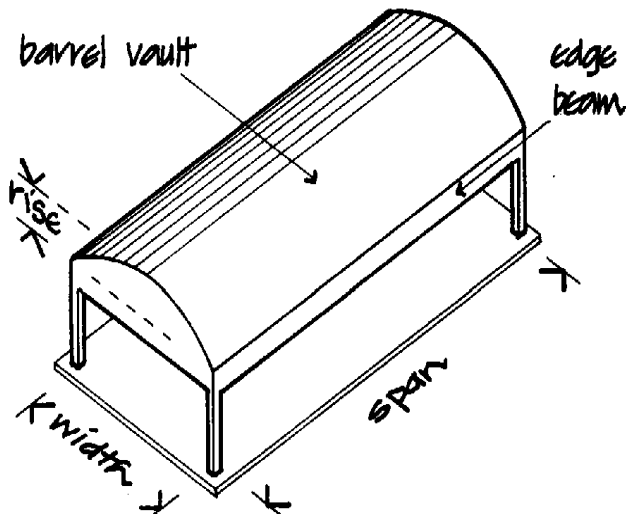
Curved roof

These are just the modifications of pitched roofs and frequently employed in modern age to cover large areas Shell roof and domes are the varieties of curved roofs.

- They are useful for big structures such as factories, monumental works etc
- curved roofs may be constructed of timber or R.C.C.

Roof structure

- Barrel vault roof (shell roof)



• **hyperbolic paraboloid shell**

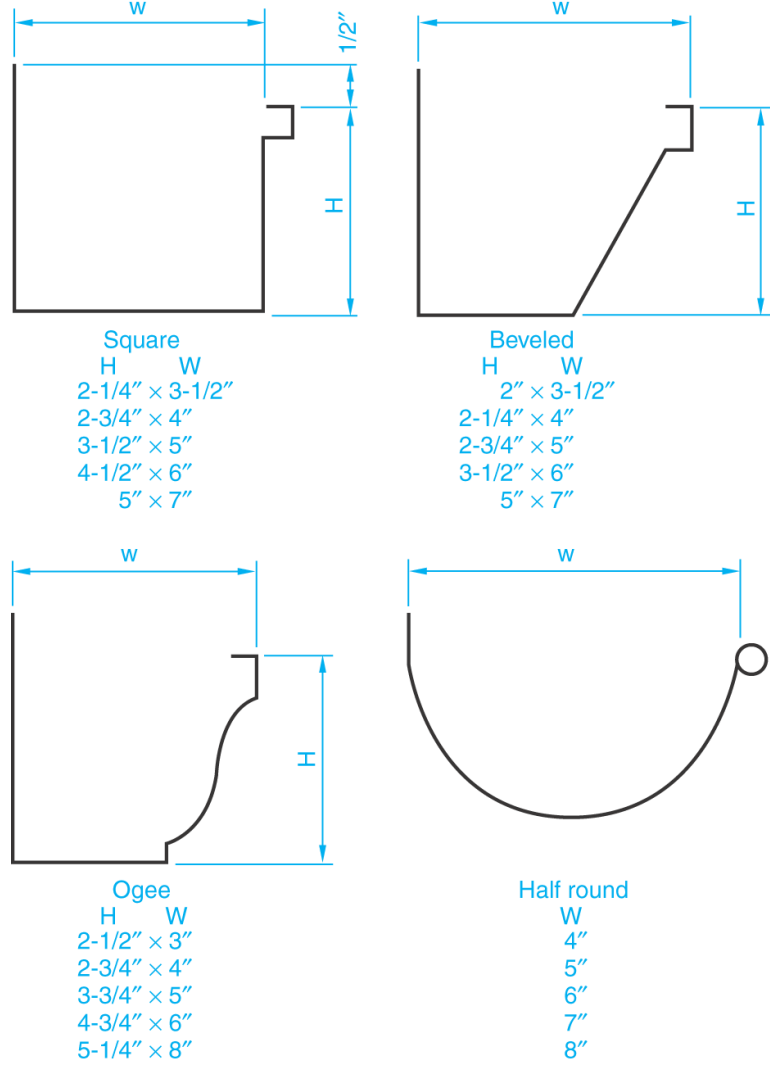
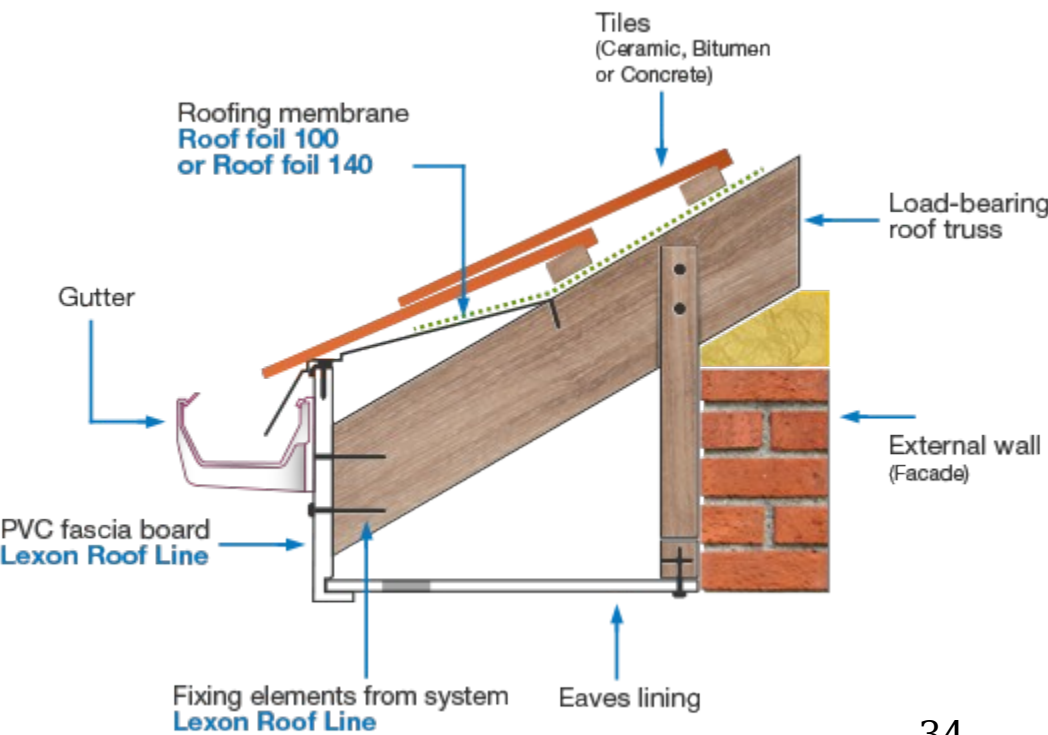
Flashing

- **Roof flashing** is a thin material, usually galvanized steel, that professional roofers use to direct water away from critical areas of the **roof**, wherever the **roof** plane meets a vertical surface like a wall or a dormer. **Flashing** is installed to surround **roof** features, such as vents, chimneys and skylights.



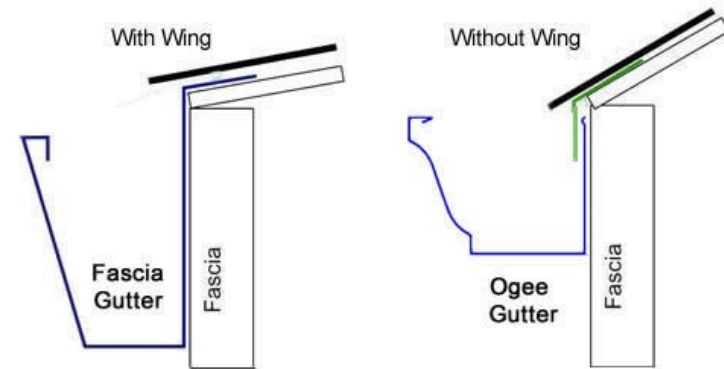
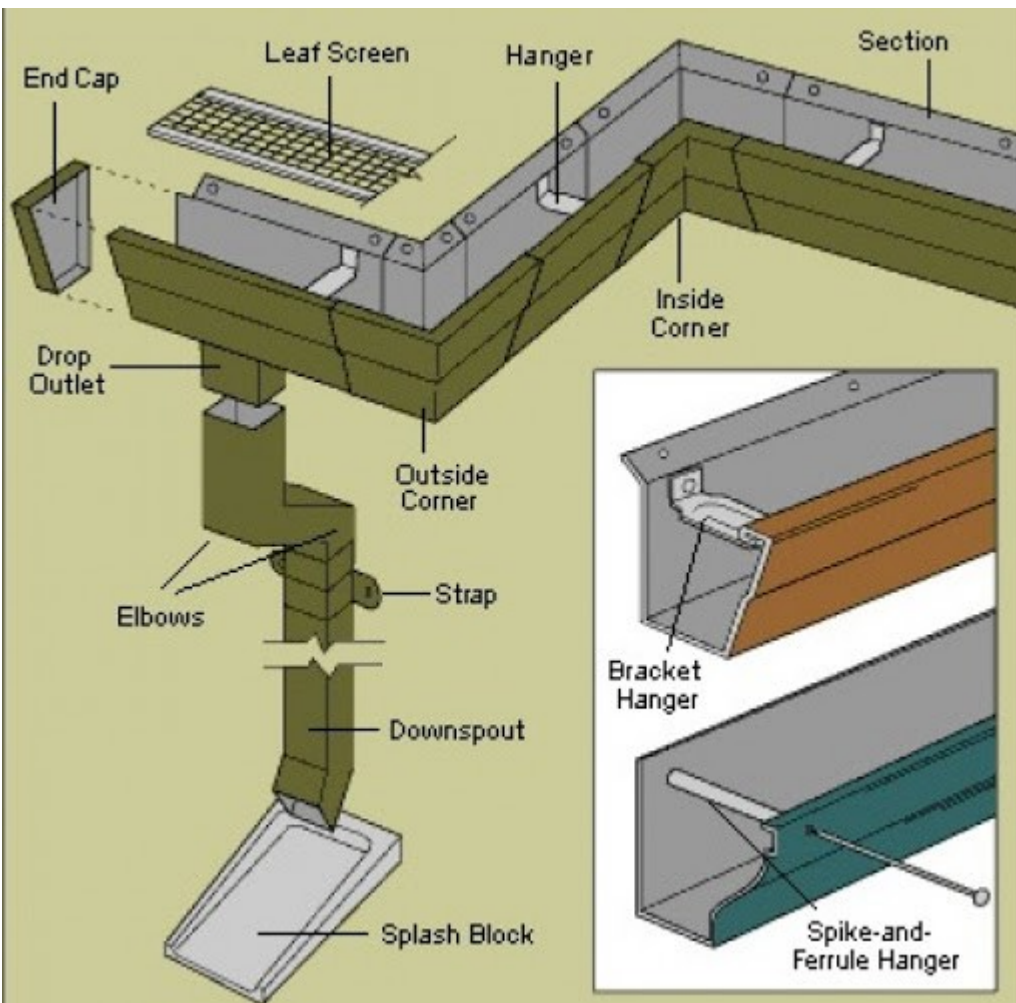
Gutters and Downspouts

- Gutters collect water from the roof and direct it to a downspout.
- Gutters prevent water from running directly off the eaves and splattering the house. Several styles are available in copper, aluminum, and galvanized steel.

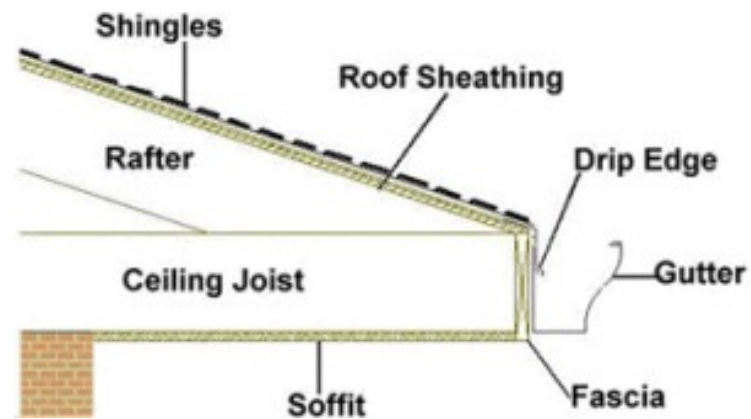


Gutter Designs and Sizes

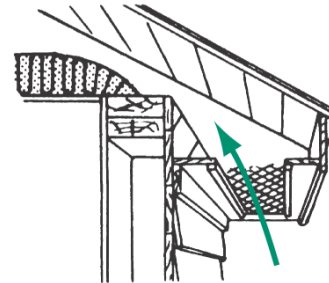
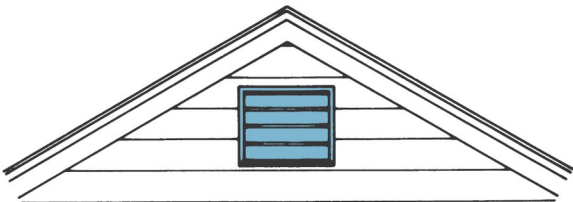
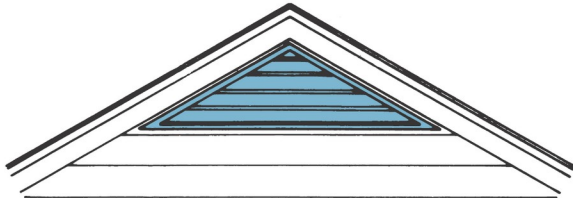




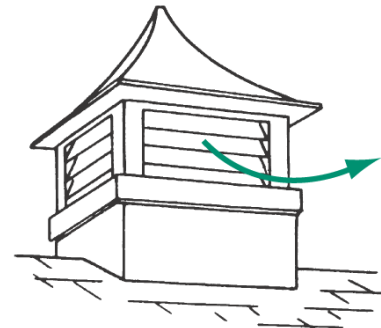
With Fascia Boards



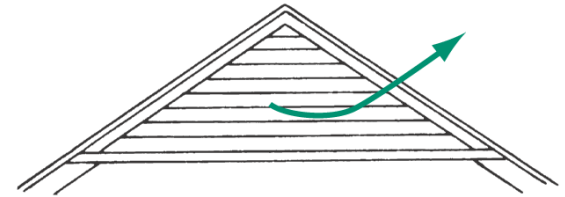
Roof Ventilation Methods



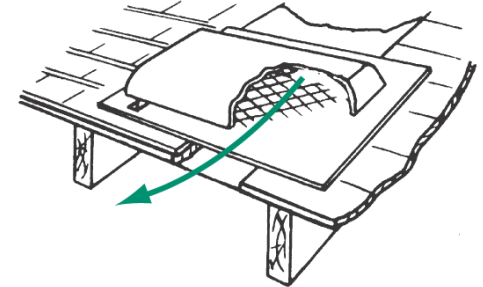
Eaves vent



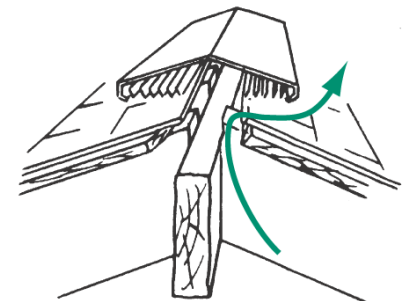
Cupola vent



Gable vent



Roof vent



Ridge vent

ROOF COVERINGS

- Is a materials which gives a protective surface to the roofing structure
- The function is only to prevent ingress or egress of heat & moisture into the building
- Various types of coverings depending on :-
 - ✓ *The character of the building*
 - ✓ *The type of the roofing structure*
 - ✓ *Local conditions, cost, etc.*



Types of Roof Coverings

1. **Thatch**- is the craft of building a roof with dry vegetation such as straw, water reed, sedge, rushes, or heather. Now become choice for rustic look and more ecologically friendly roof.



2. **Wood**- thin, tapered pieces of wood primarily used to cover roofs and walls of buildings to protect them from the weather



3. **Shingles**- roof covering consisting of individual overlapping elements. Can be made of various materials such as wood, composite or ceramic.



4. **Tiles**-made of a ceramic material and is hard and brittle, poorly suited for places where tree limbs can fall on a house's roof.



5. **Slates** - is a fine-grained, foliated, homogeneous metamorphic rock derived from an original shale-type sedimentary rock composed of clay or volcanic ash



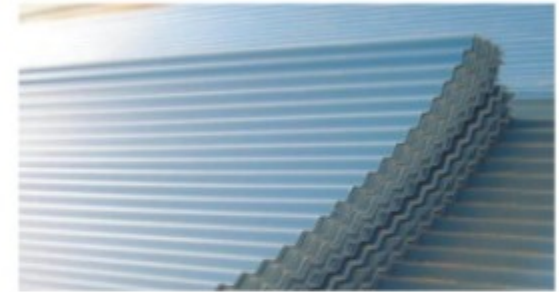
6. **Asphalt** — known as bitumen, viscous liquid or semi solid form of petroleum.



7. **Asbestos cement sheets**-known as fibre cement sheet. It is a building material in which asbestos (silicate mineral) fibres are used to reinforce thin rigid cement sheets.



8. **Corrugated iron sheets**-The corrugations increase the bending strength of the sheet. Normally each sheet is manufactured longer in its strong direction.



9. **Bituminous felt**-bitumen mixed with a filler component such as limestone or sand or polymers to gives rigidity and tear resistance.



10. **Sheet metal roof coverings (copper, zink, etc.)**-roofing system made from metal piece, or tiles.



Definitions of Terms

Battens: Thin strips of wood which are fixed on rafters or ceiling to support the roof ceiling.

Eaves: The lower edge of a roof which are resting upon or projecting beyond the supporting walls are known as eave

Gable: The triangular upper part of a wall formed at the end of a pitched roof is known as gable.

Hip: The angle formed at the intersection of two roof slopes is known as hip.

Pitch: The inclination of sides of a roof to the horizontal plane is known as pitch, expressed in degrees or as a ratio of rise to span.

Purlins: The wooden pieces which are placed horizontally on principal rafters to carry the common rafters are known as purlins.

Rafters: A rafter is one of a series of sloped structural members such as wooden beams that extend from the ridge or hip to the wall plate, downslope perimeter or eave, and that are designed to support the roof shingles, roof deck and its associated loads. A pair of rafters is called a couple.

Ridge: A wooden piece provided at the ridge line of a sloping roof is known as ridge or ridge board or ridge piece

Span: The horizontal distance between the internal faces of walls or supports is known as span or clear span.

Template: A bidding block generally provided at the end of a truss. This block is known as template and it helps in spreading load over a large area. A template may be of wood or stone or R.C.C.

Verge: The edge of a gable, running between the eaves and ridge is known as a verge

Valley: When two roof surfaces meet together and form an internal angle, a valley is formed

Wall-plate: These are long wooden members which are embedded on top of walls to receive the common rafters