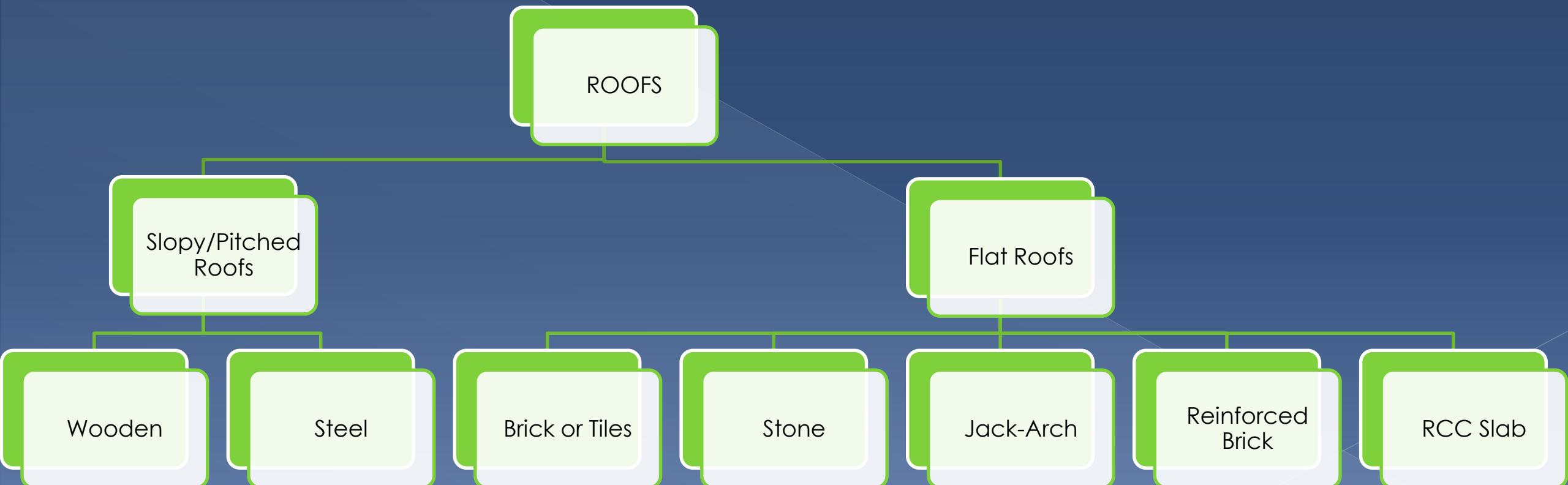


ROOFS

Surabhi (Assistant Professor)
Course Instructor
Building Planning and Construction (CE-404)
Dept. of Civil Engineering
JNGEC Sundernagar

TYPES OF ROOFS



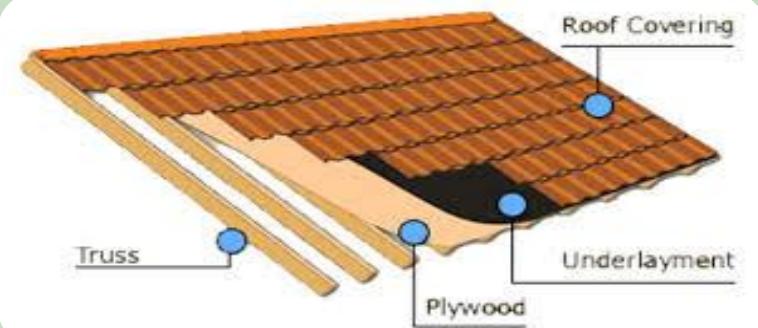
SLOPY/PITCHED ROOFS

SLOPY /PITCHED ROOFS

- Used in workshops, factories, industries, warehouses, godowns, huts etc.
- Used in houses situated in areas of heavy rainfall or snowfall



COMPONENTS OF SLOPY /PITCHED ROOFS



Roof Structure

- Timber
- Steel
- GI Pipes
- RCC
- Angle Iron (mild steel)
- Bamboo

Roof Covering

- Slate
- Shingles (wood, asbestos or stone)
- Ceramic tiles (Dutch roof, Mangalore)
- GI Sheets

TYPES OF ROOFS

Slopy/Pitched
Roofs

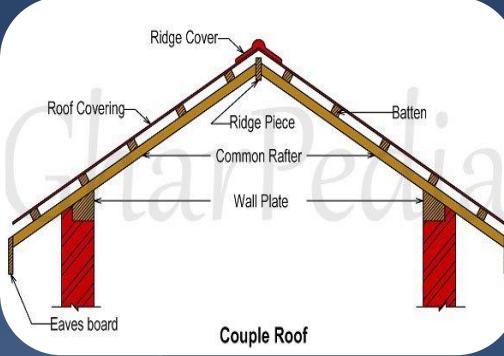
Wooden

Steel

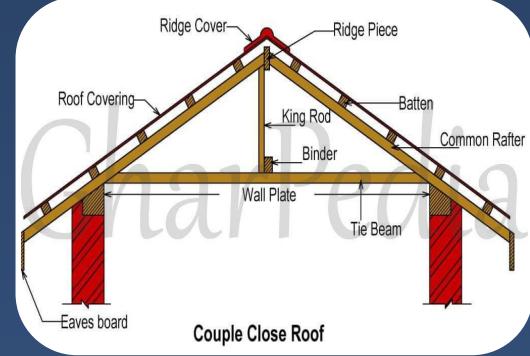
TYPES OF WOODEN PITCHED ROOFS



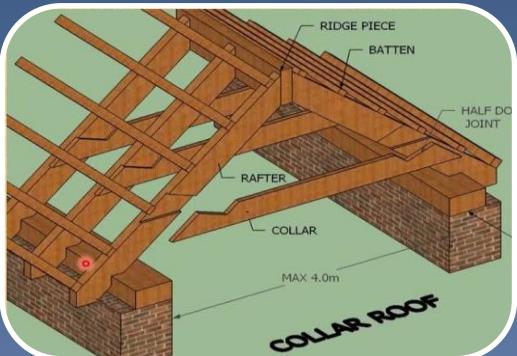
Verandah
Roof



Couple Roof



Couple-
Close Roof



Collar Roof



King Post
Truss



Queen Post
Truss

TIMBERPE

VERANDAH ROOF

- › Slope towards one side only
- › Used for construction of verandahs, store room, animal shelter etc
- › Recommended for a span of 3.5 m



PARTS OF VERANDAH ROOF

Rafter

- Inclined member

WALL PLATE

- Horizontal beam which supports the rafter

CORBEL

- Wall plate fixed to the wall with projections



POST PLATE

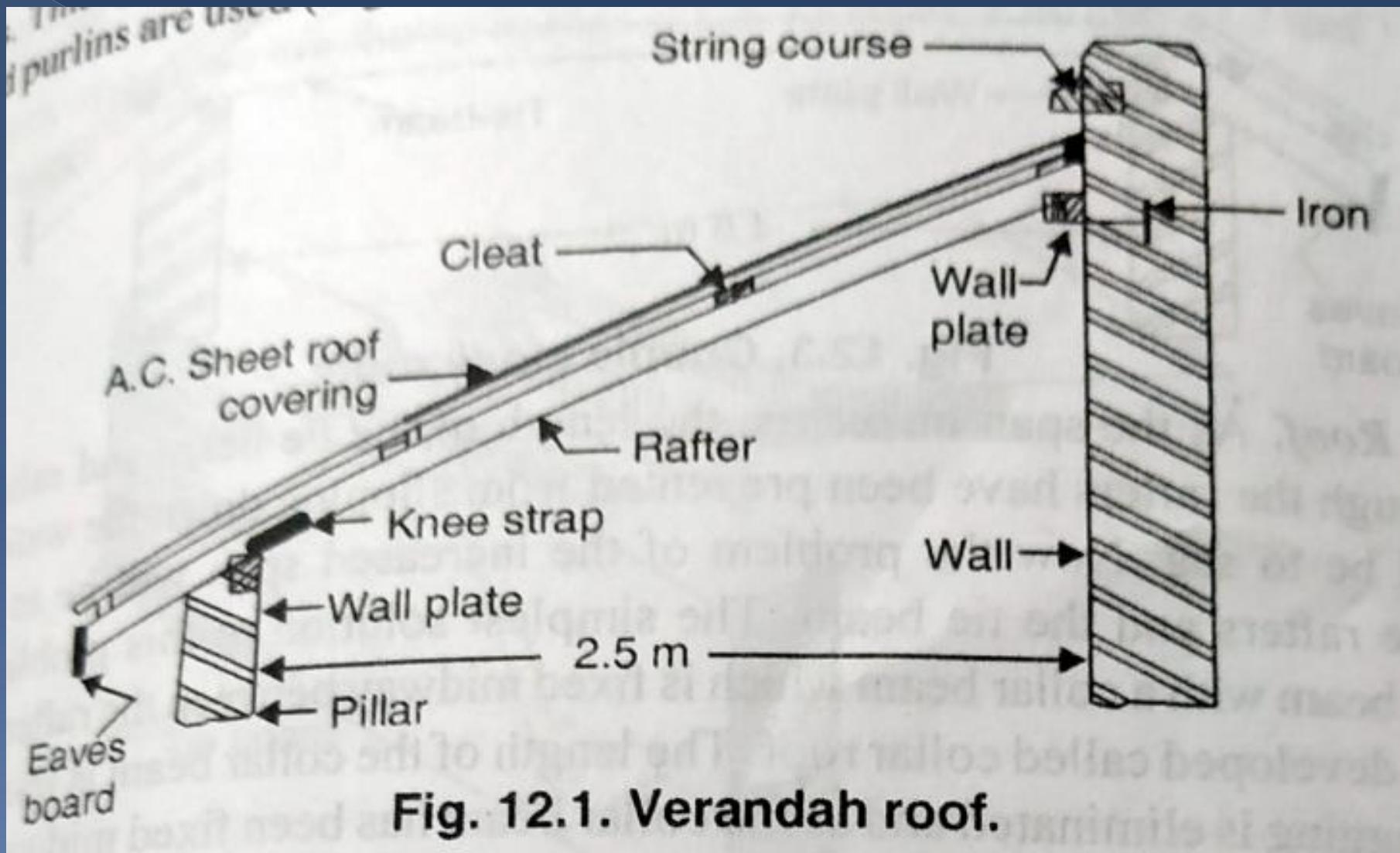
- Horizontal beam on which lower end of rafter is supported

PURLINS

Horizontal members supported over rafters to support the roof covering

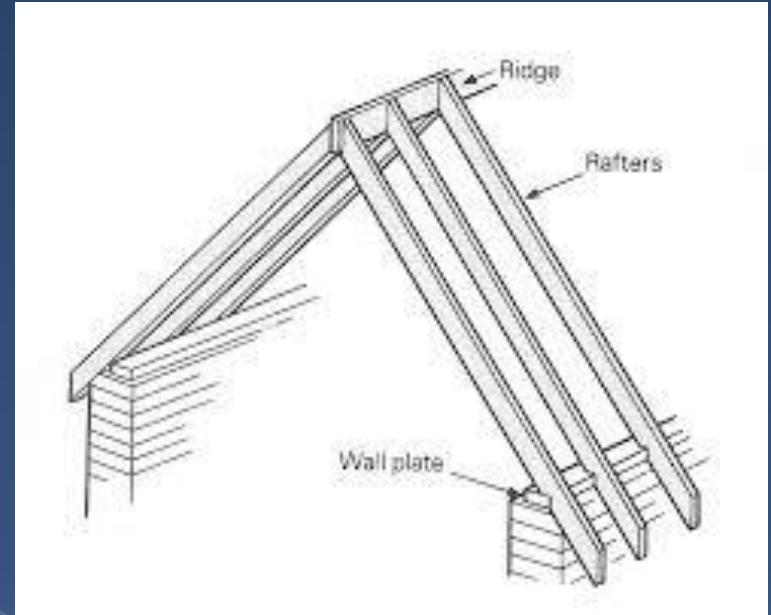
KNEE STRAPS

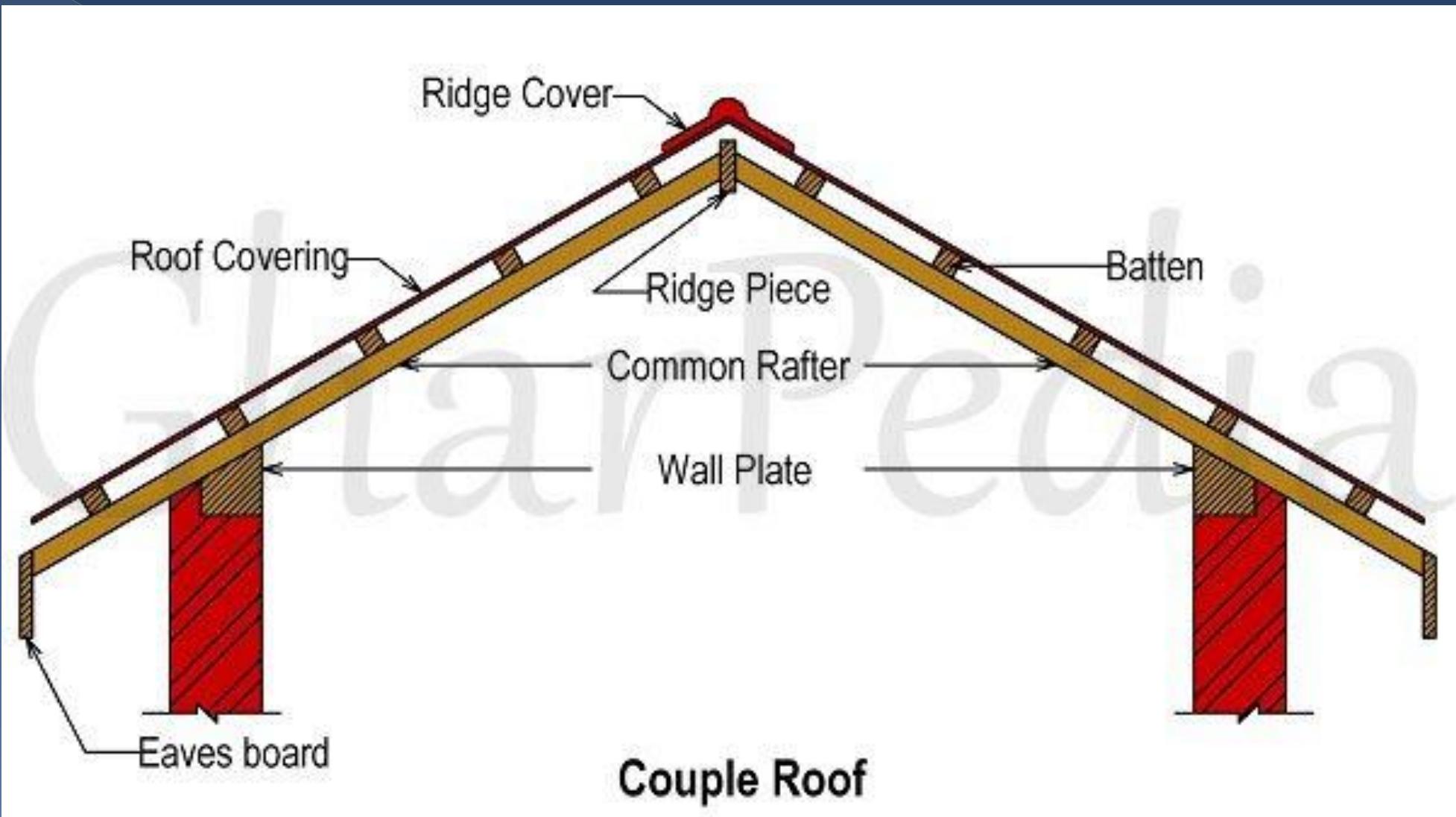
Fixations of rafter with post plate

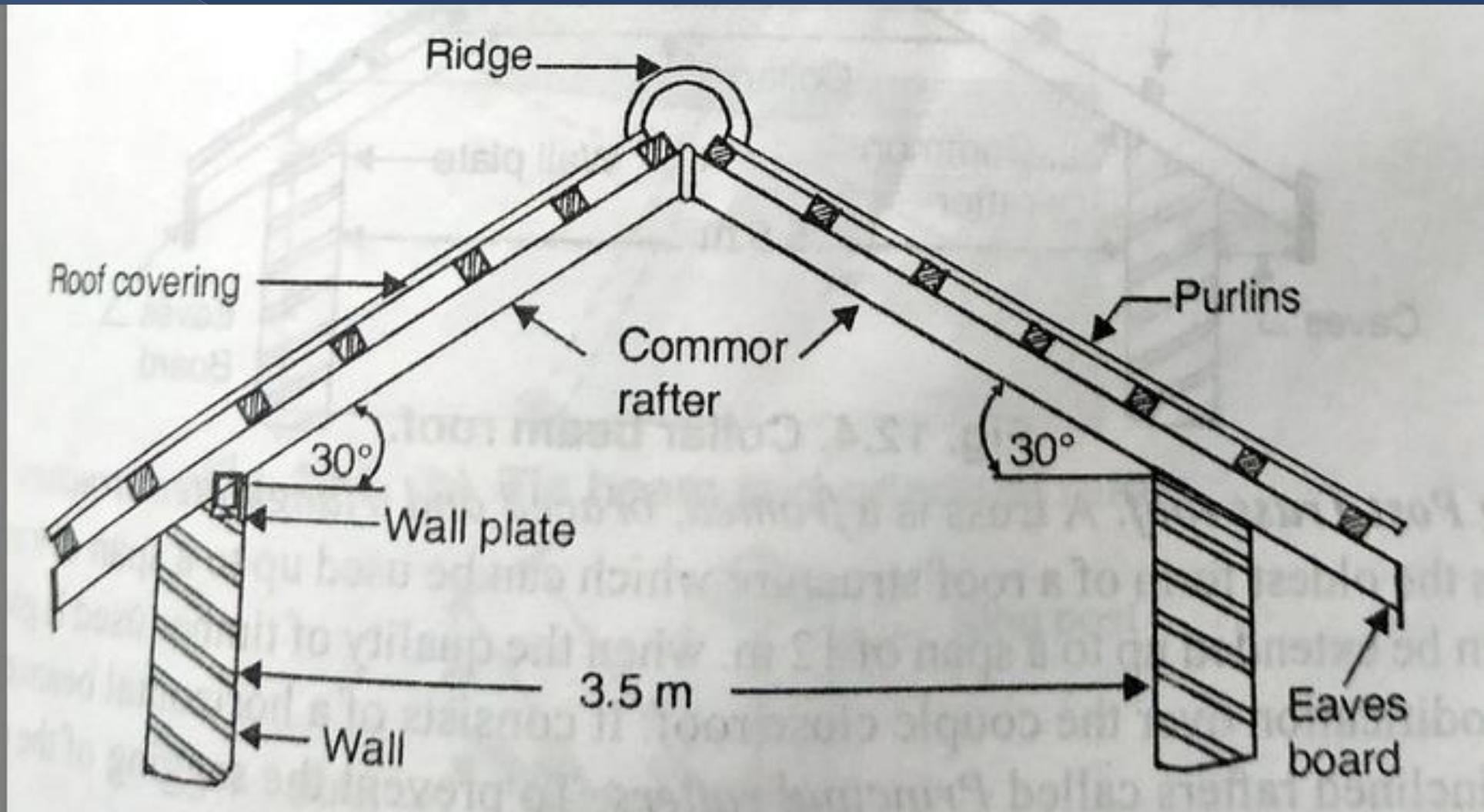


COUPLED ROOF

- › Having slope on both sides
- › Consists of two rafters abutting against each other with the help of a horizontal beam called ridge
- › Lower end nailed to horizontal beams called wall plates placed on the walls
- › Purlins/battens laid to support the roof covering
- › Used for span of 3.5 m

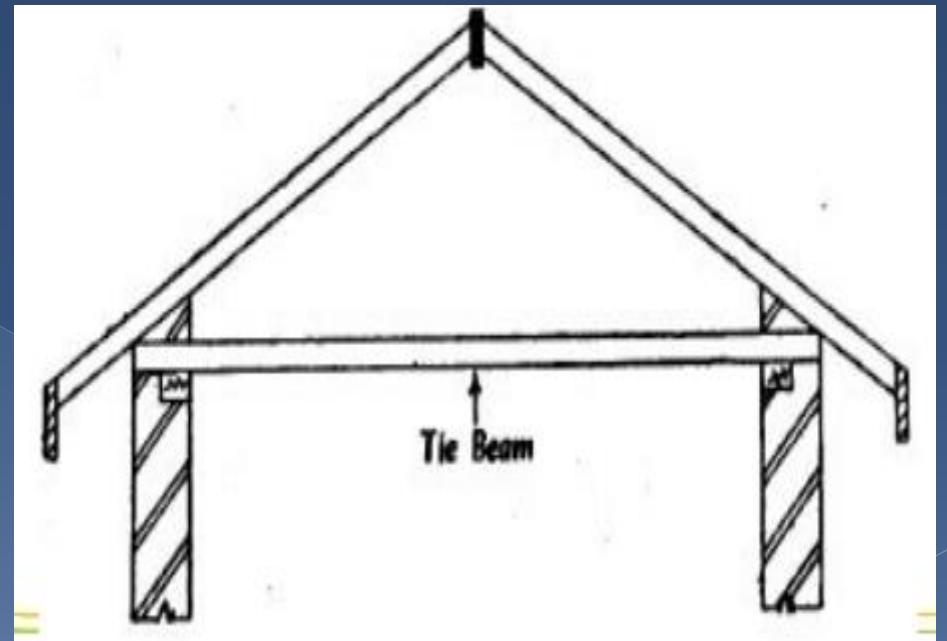


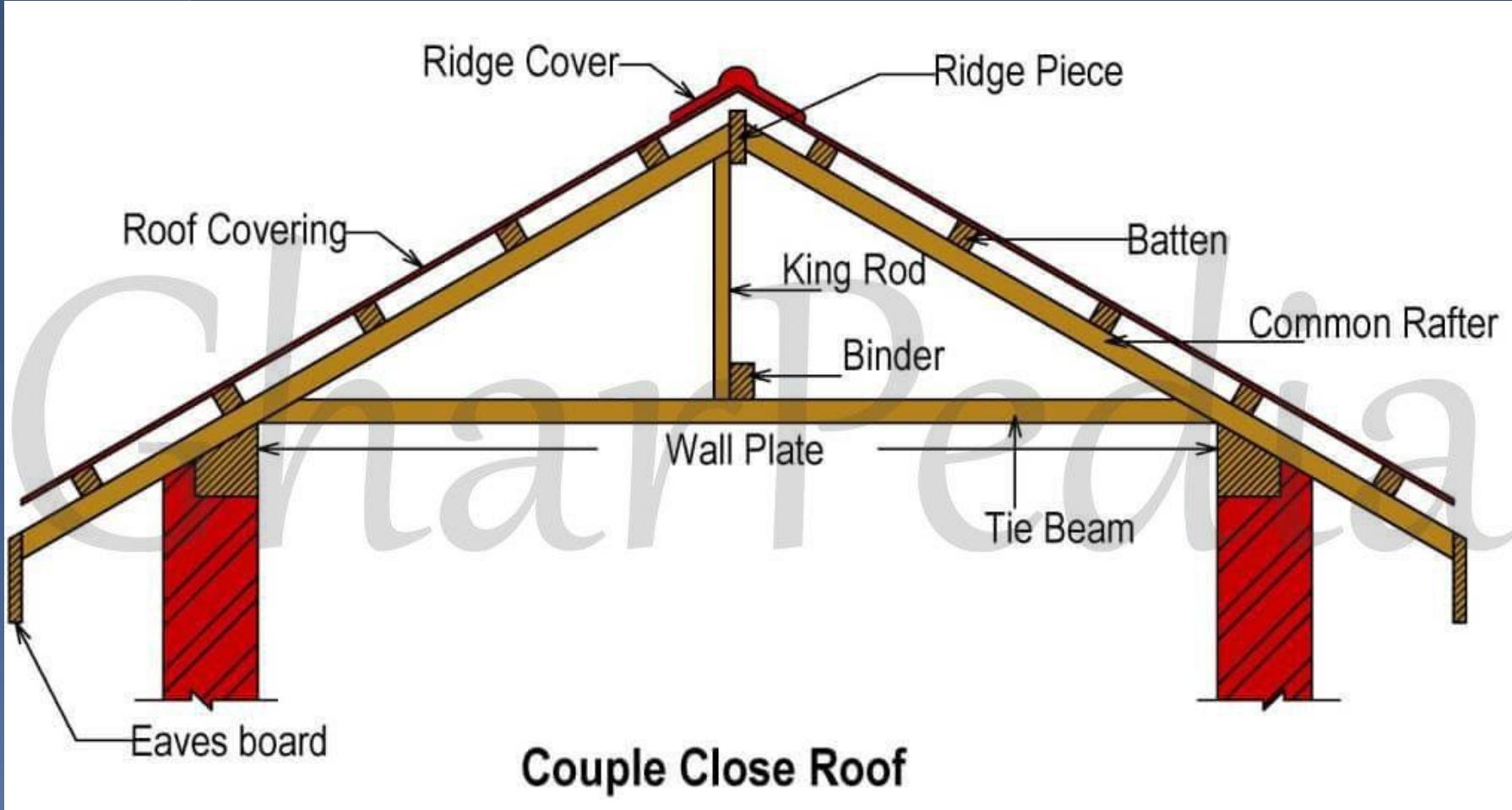




COUPLED CLOSE ROOF

- > As span increases length and weight of rafters increase
- > This can lead to slipping down and spreading of rafters
- > To prevent this, lower ends of rafters are connected together with a horizontal beam called Tie Beam
- > Rafter purlins also provided
- > Used over a span of 4.5 m





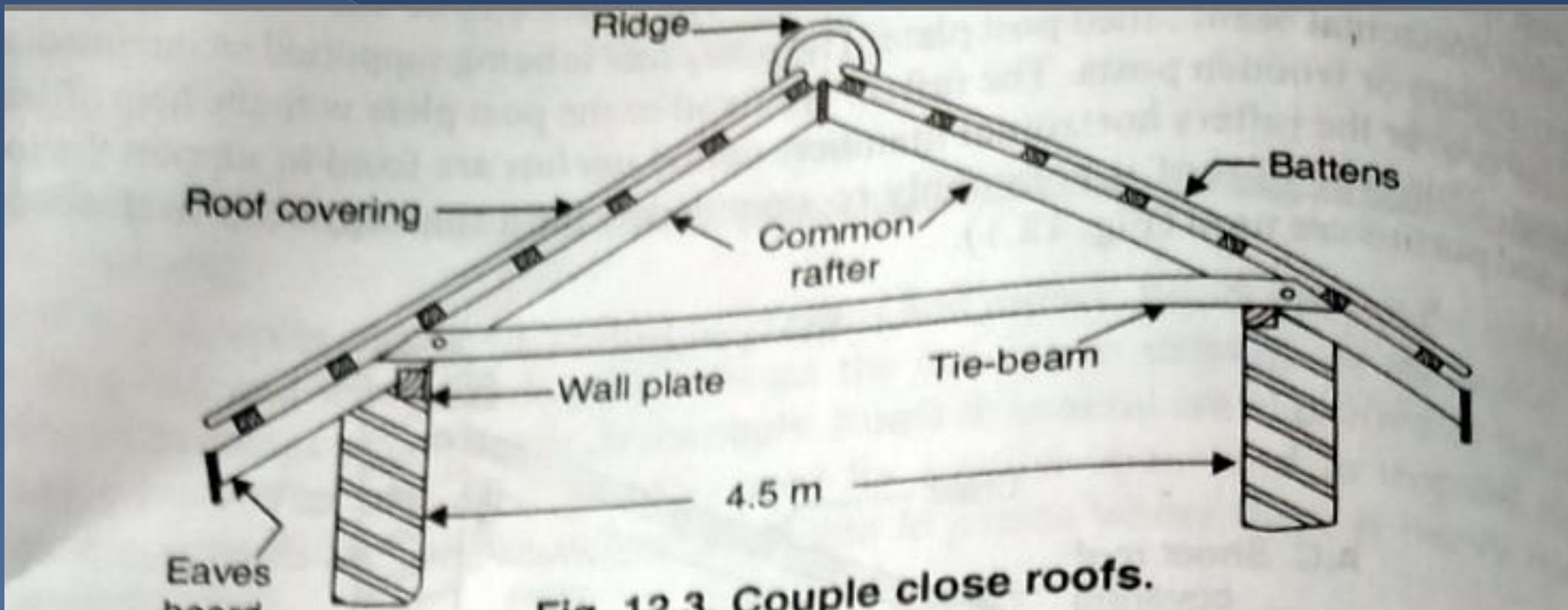
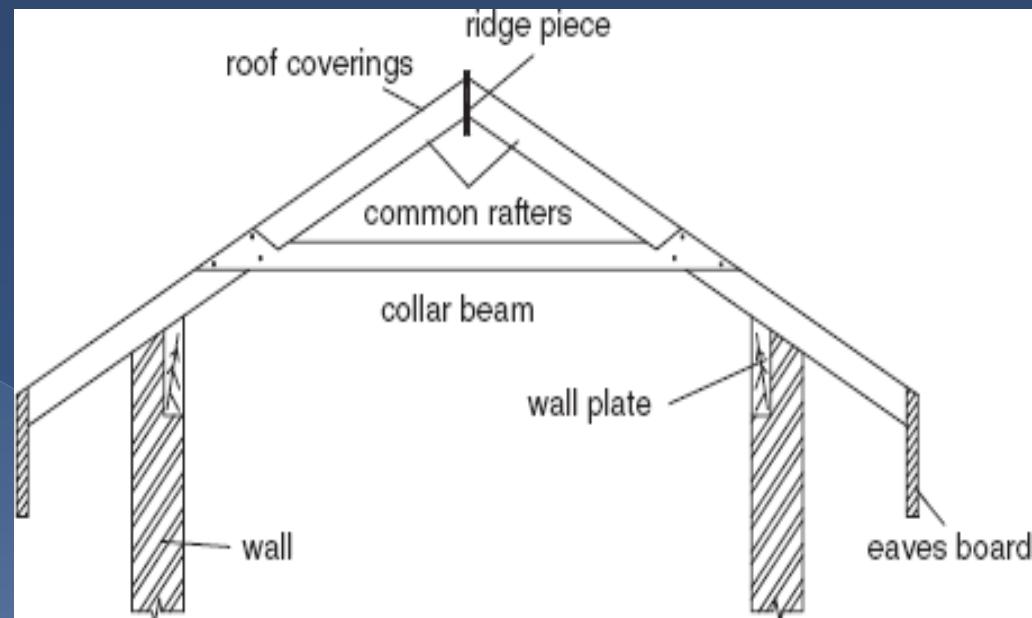
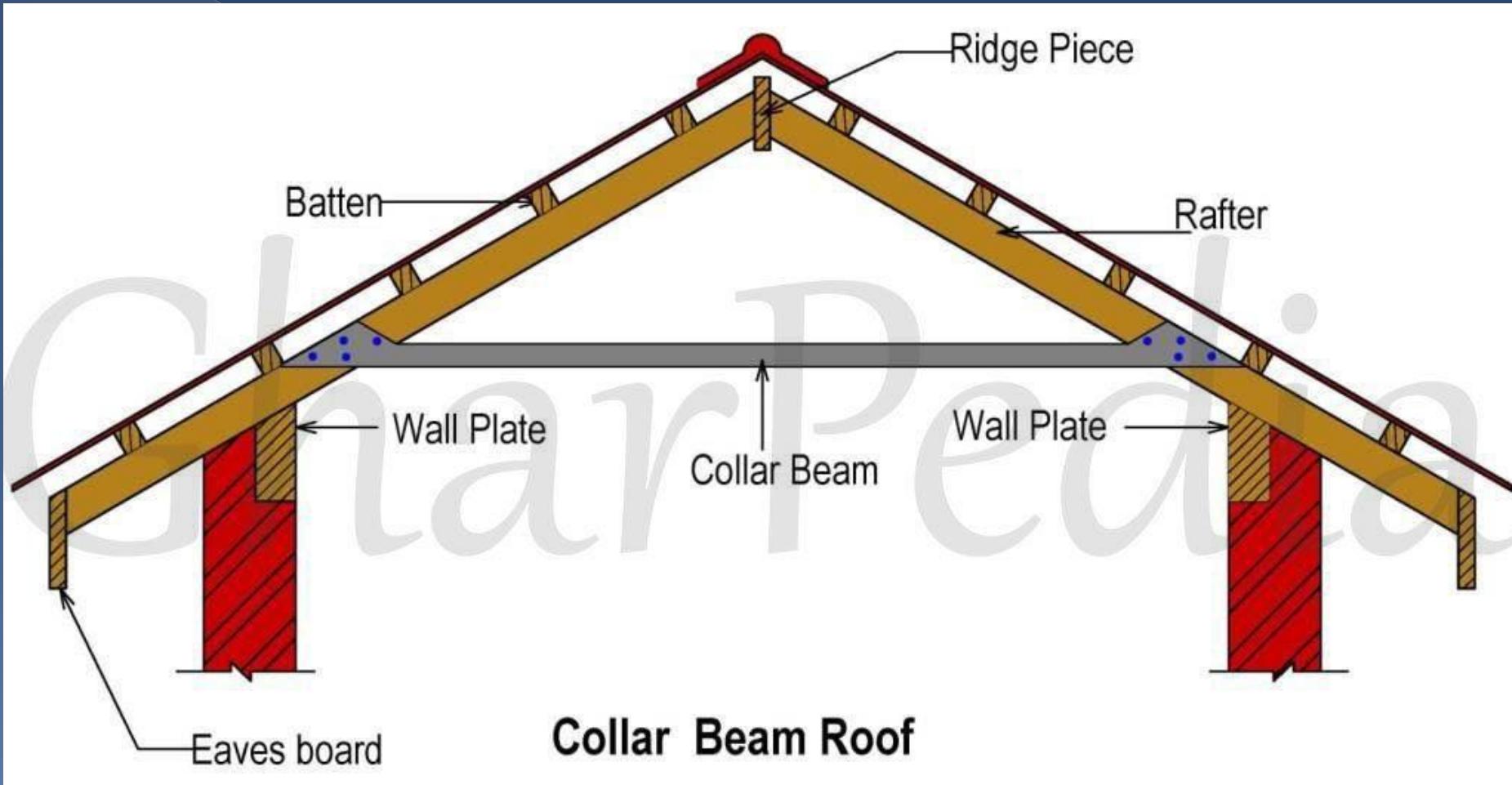


Fig. 12.3 Couple close roofs.

COLLAR ROOF

- > As span increases length and weight of tie beams will also increase
- > Tie beams and rafters may sag
- > Tie beams are replaced with a **collar beam**, fixed midway between the rafters
- > Length of collar beam is less than tie beam, which prevents sagging
- > As collar beam is fixed midway between rafters, sagging in rafters is also prevented
- > Used for upto a span of 5.5 m





hence the sagging or...
n of 5.5 m. (Fig. 12.4).

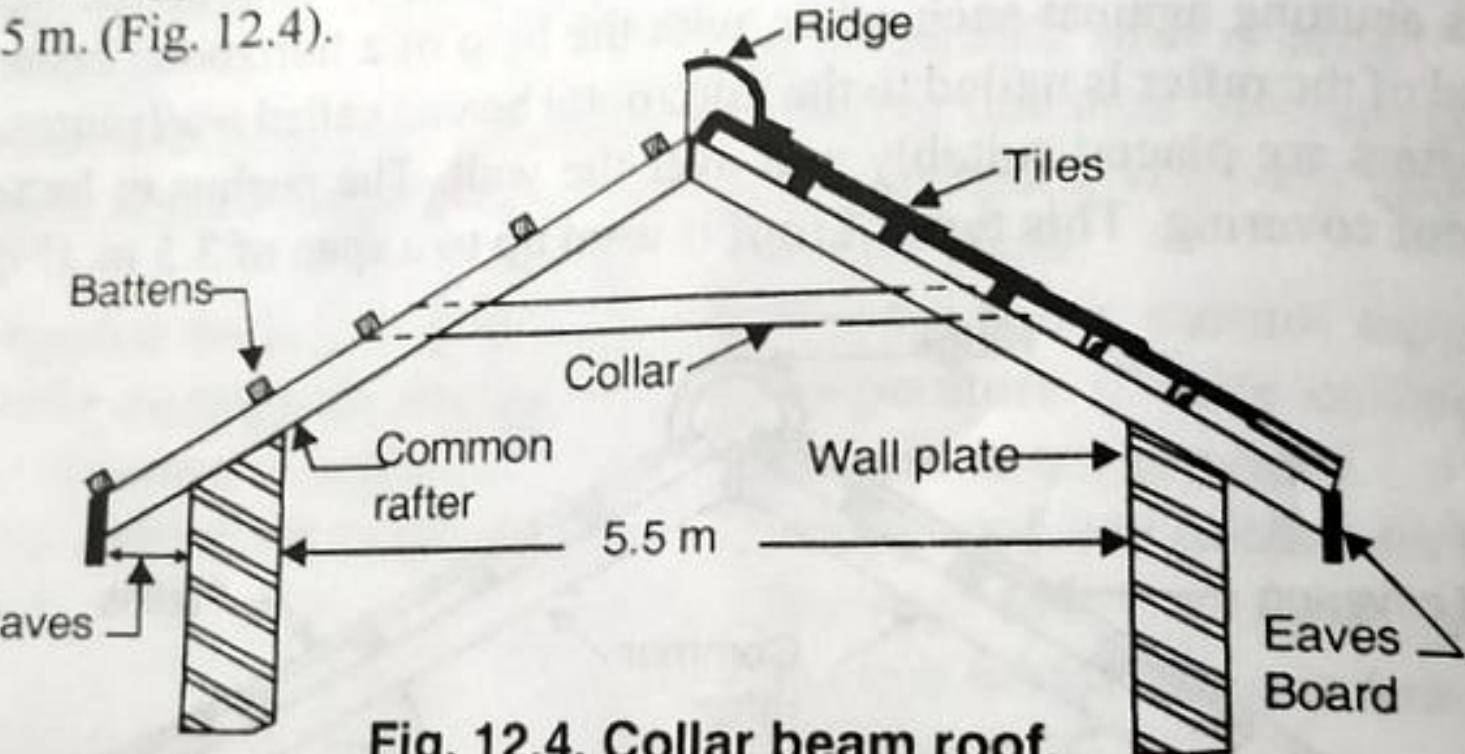
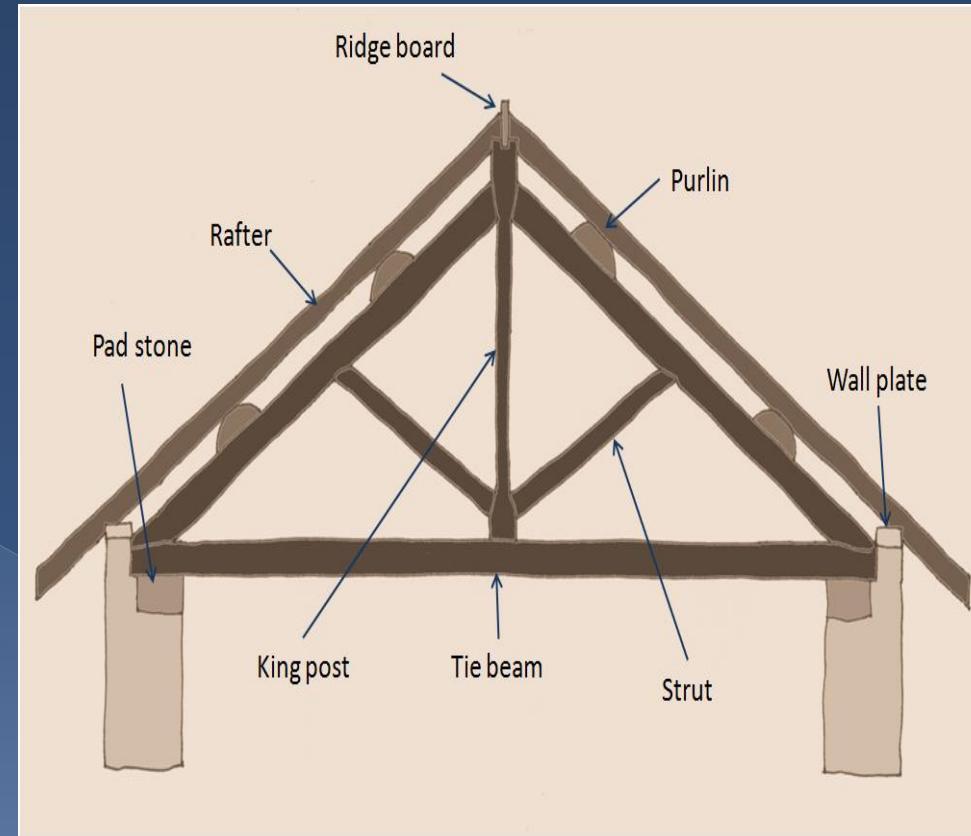
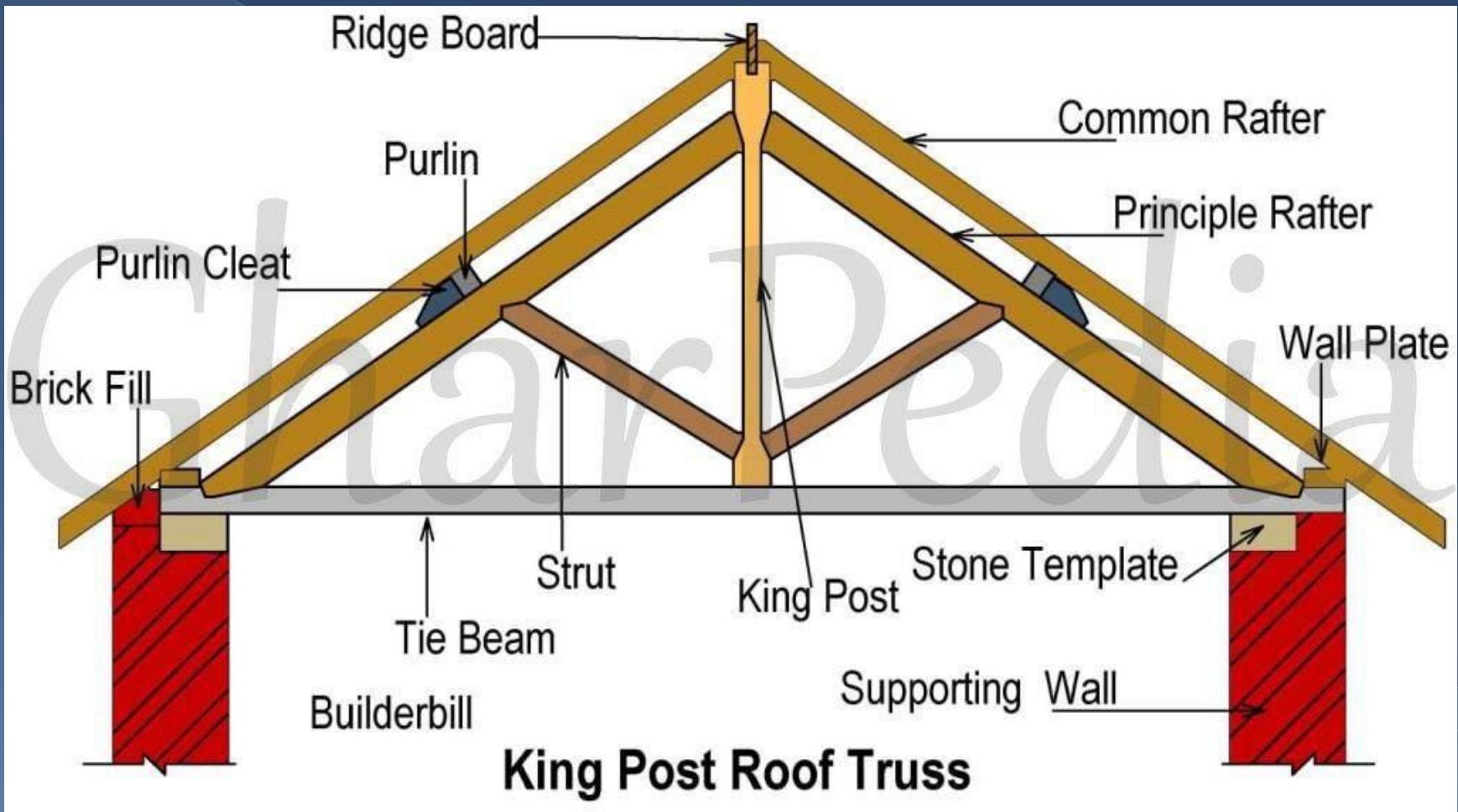


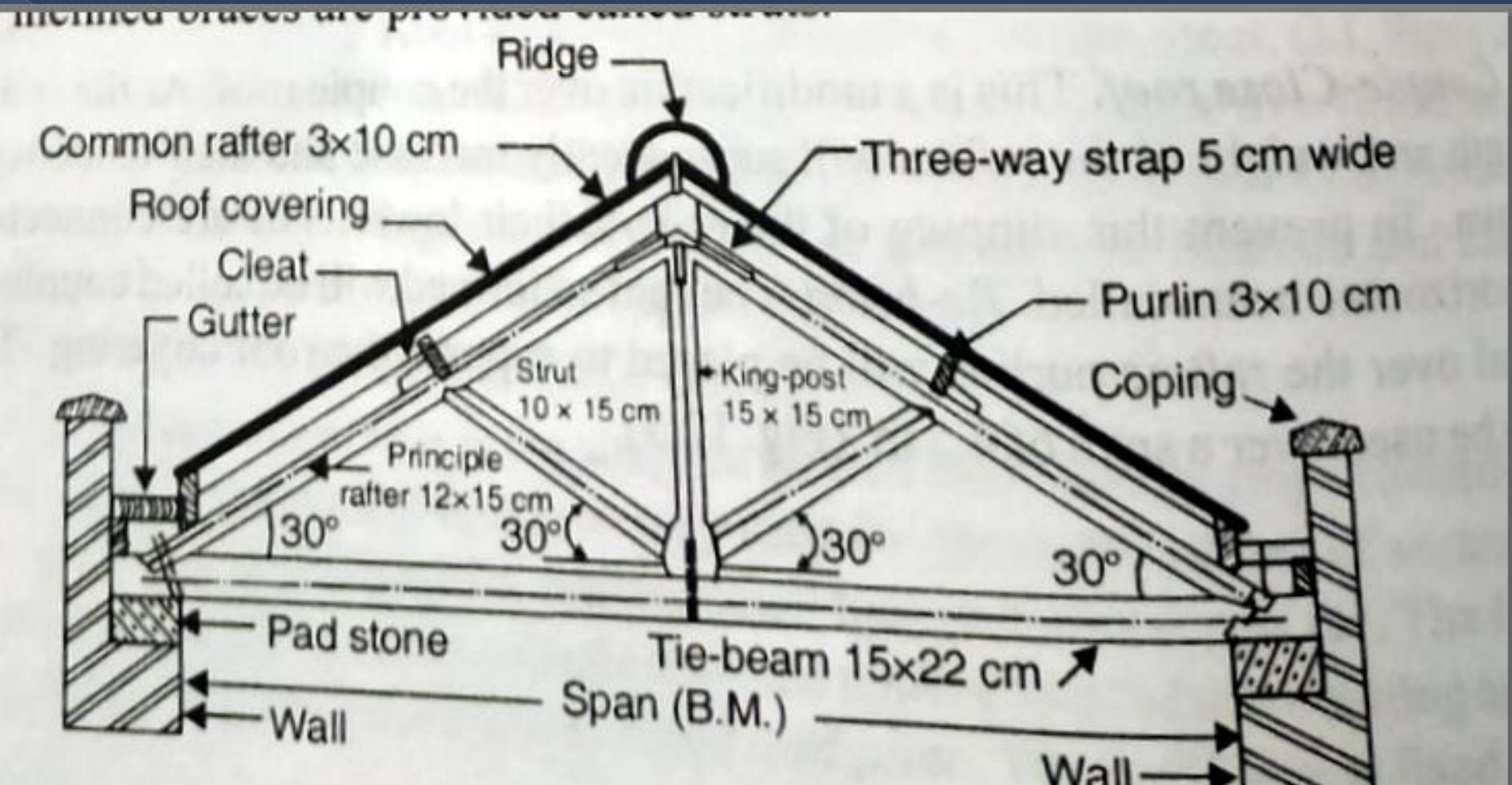
Fig. 12.4. Collar beam roof.

KING POST TRUSS ROOF

- > A truss is a framed, braced and triangulated structure
- > It consists if a horizontal beam called tie beam , two inclined rafters called principal rafters
- > To prevent sagging of rafters, two inclined braces are provided called struts
- > To prevent sagging of tie beam, a central vertical member connecting the centre of tie beam with the ridge is provided, called **King Post**
- > Trusses are spaced 3 m and connected by purlins and ridges
- > Over the purlins another series of rafters are used called **common rafters**, placed at a distance of 1 m for supporting roof covering.
- > Used for upto a span of 9 m

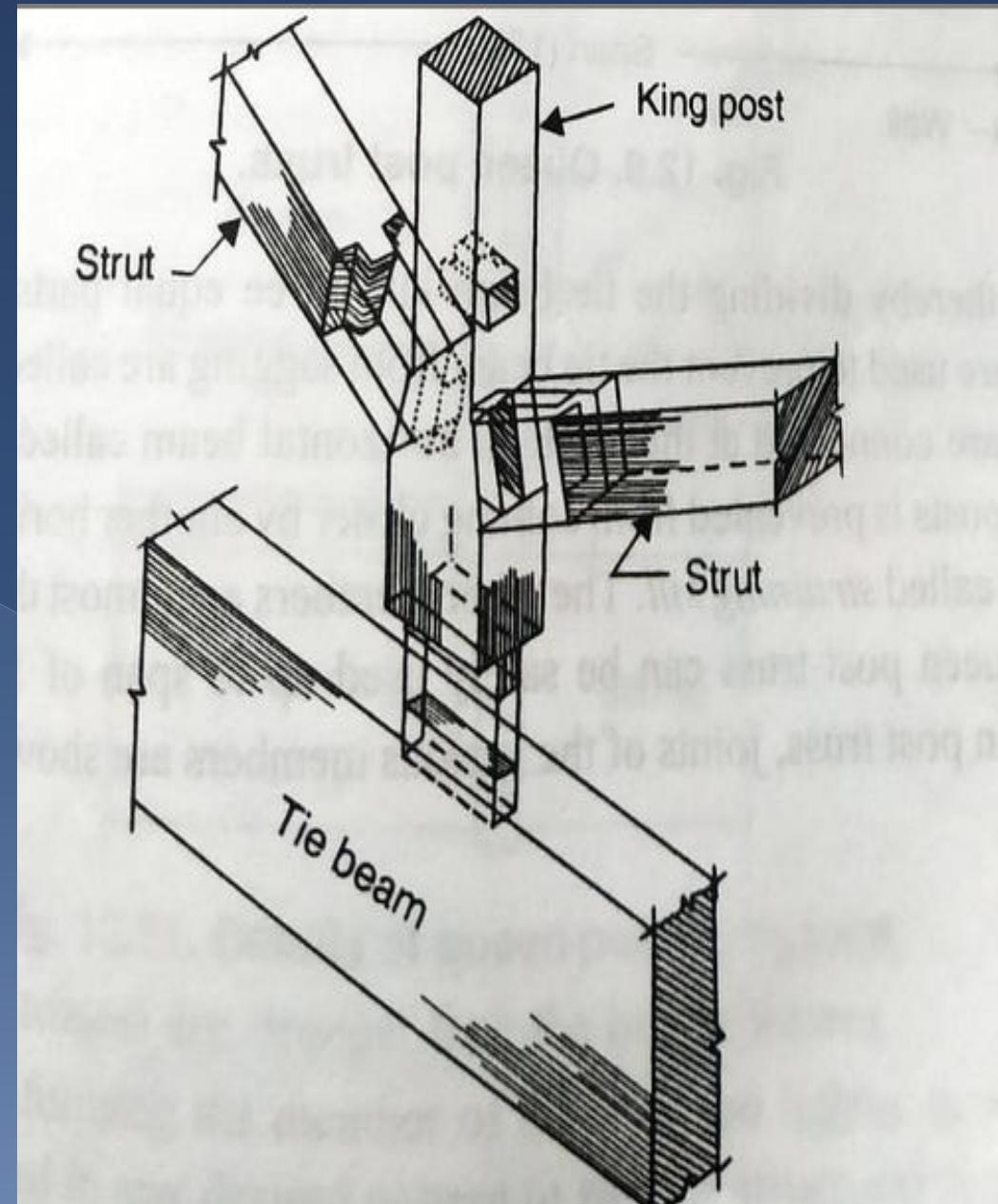
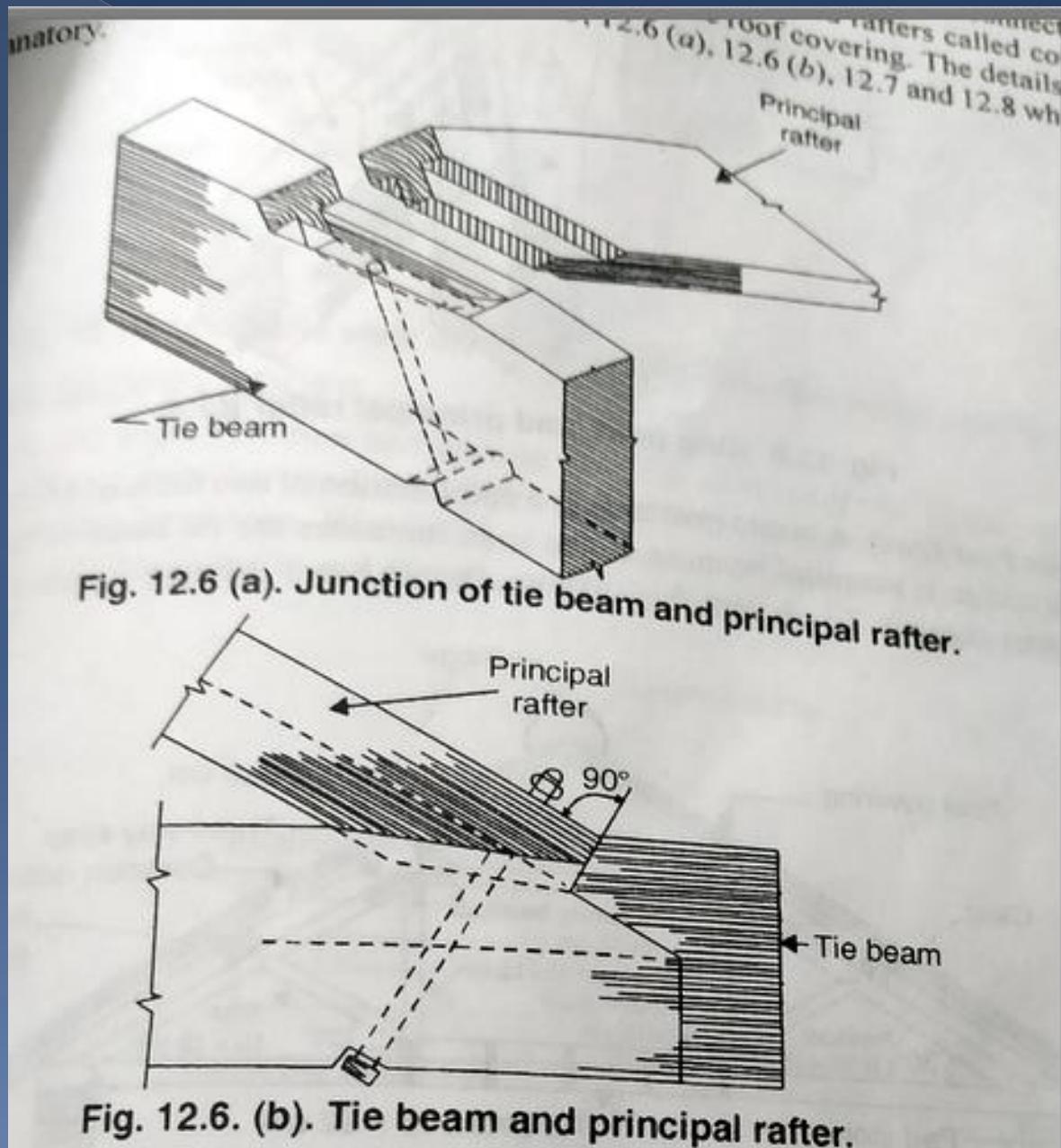






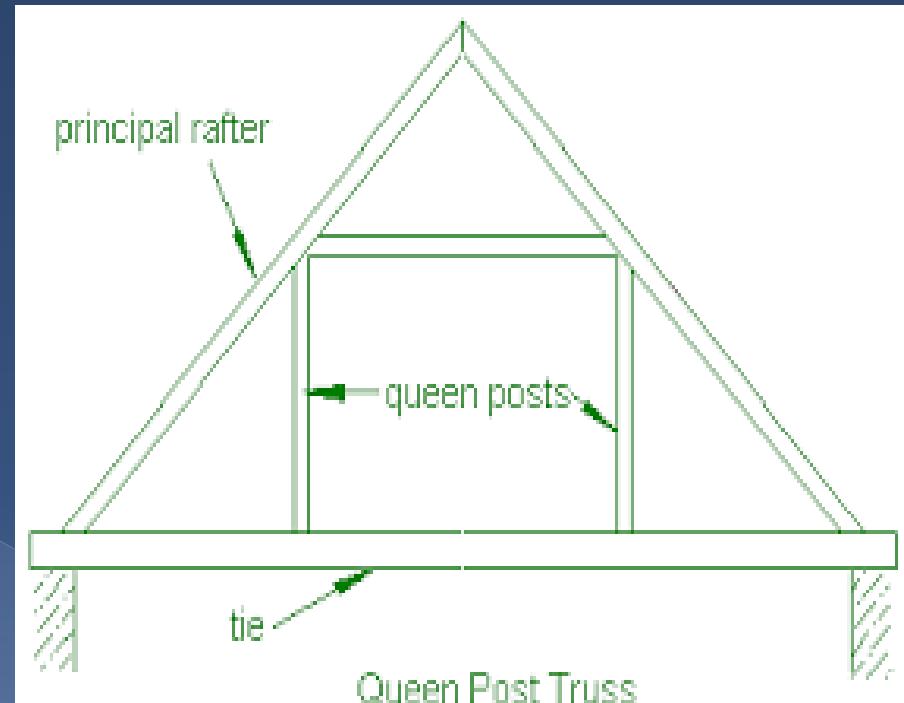


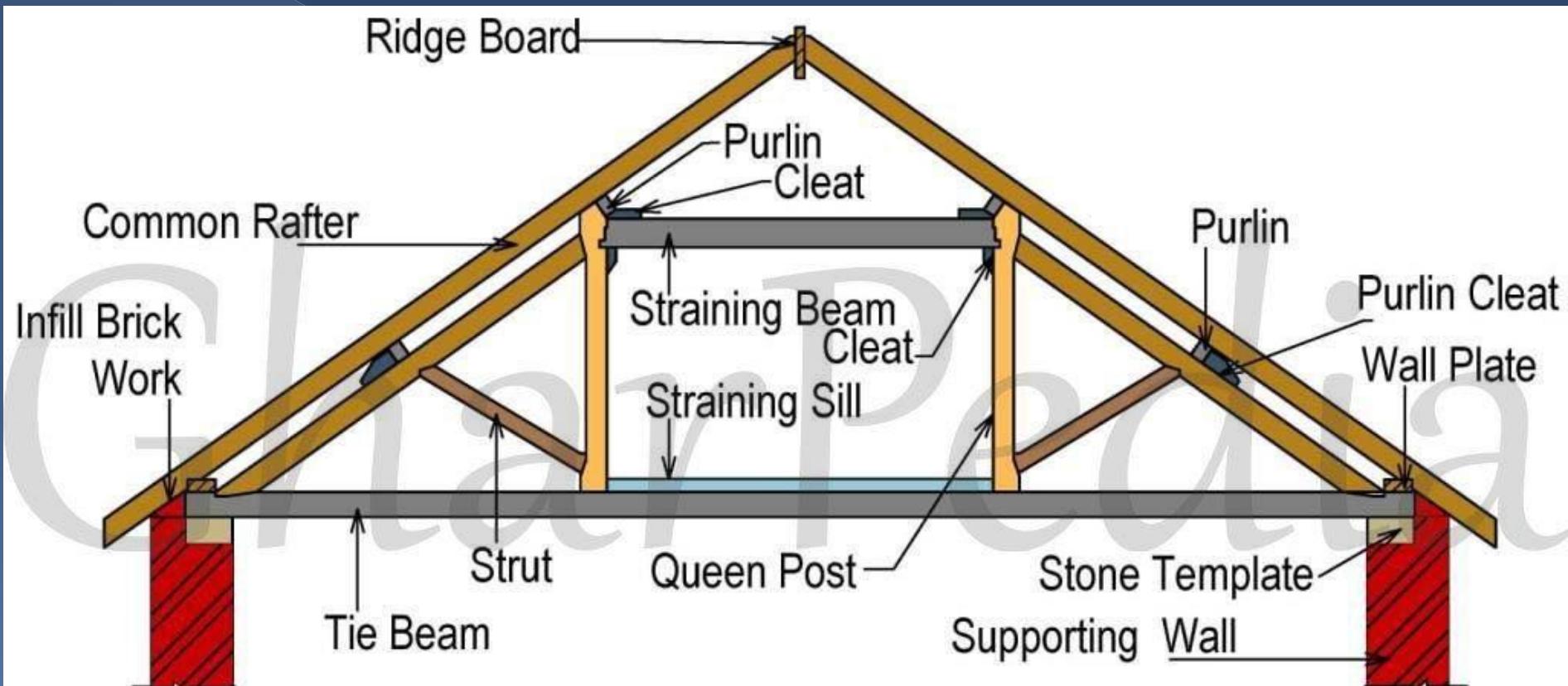
JOINTS IN KING POST TRUSS



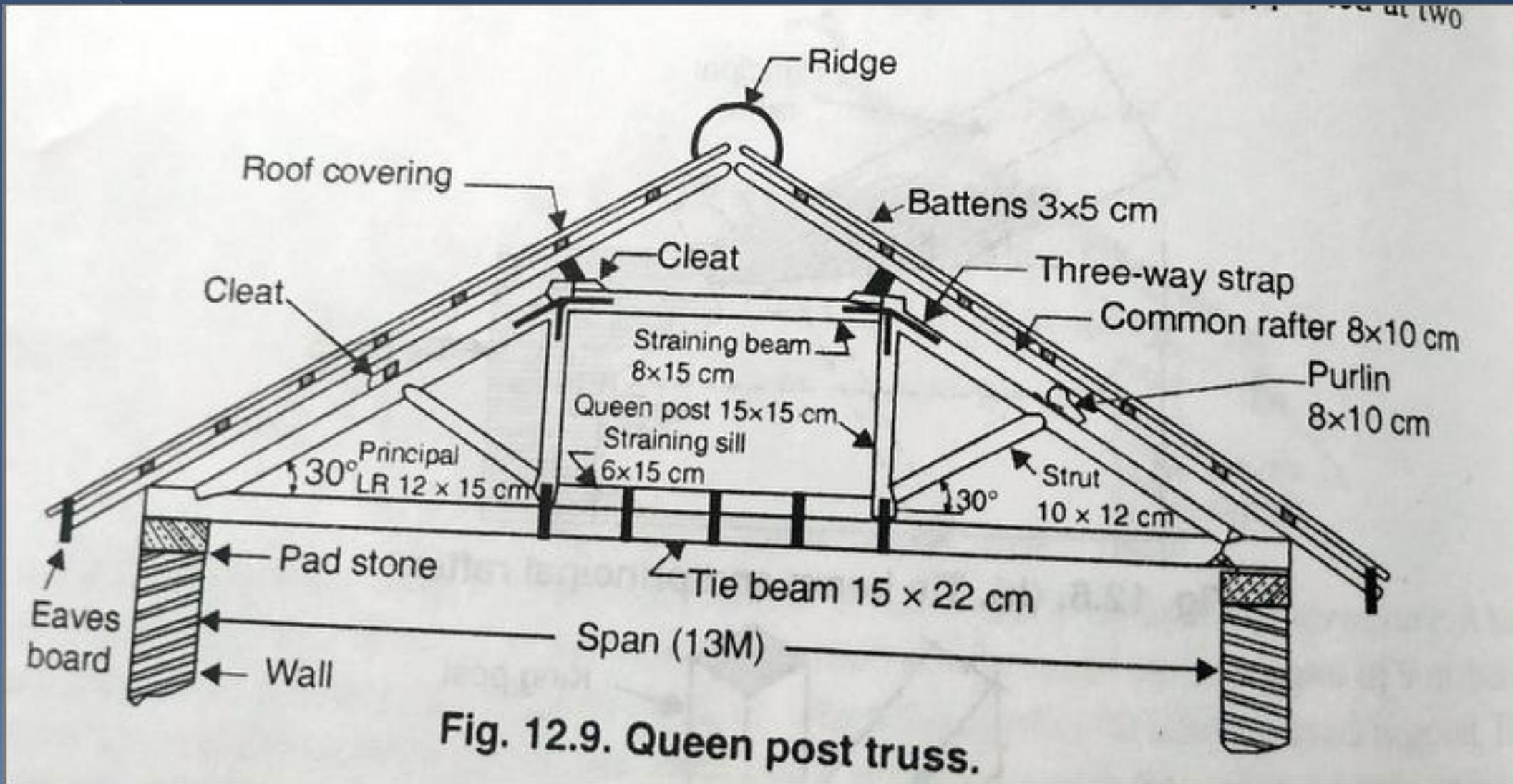
QUEEN POST TRUSS ROOF

- › Combination of two halves of King post truss
- › As the span increases king post truss may sag
- › To prevent sagging, tie beam is supported at two different points (divides tie beam into 3 parts) with the help of vertical members called **Queen Posts**
- › Queen posts are connected at the top by a horizontal beam called **straining beam**
- › Foot of Queen posts are prevented from coming closer by a horizontal beam provided over tie beam called **straining sill**
- › Used for spans of 14-18 m





Queen Post Truss

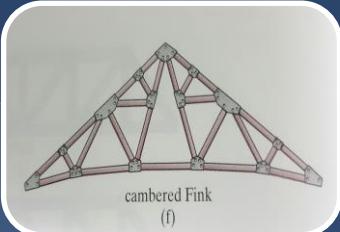




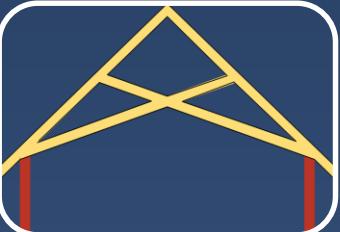
TYPES OF STEEL PITCHED ROOFS



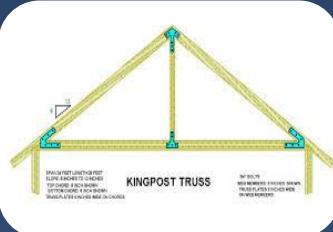
Raised Chord Truss



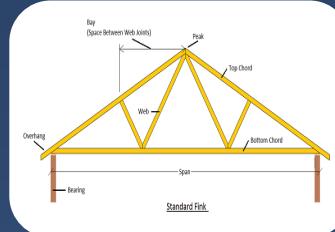
Chambered Fink



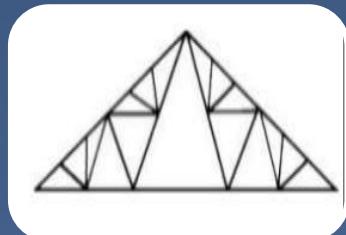
Scissor Truss



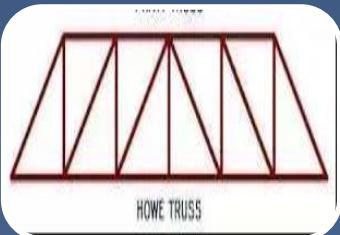
King Post Truss



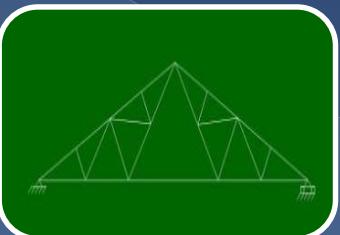
Simple Fink Truss



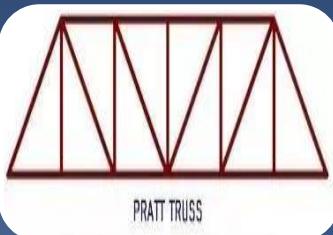
Fan Fink Truss



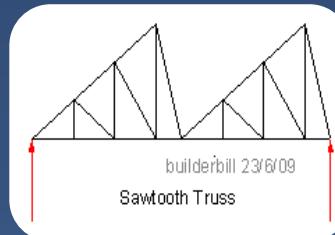
Howe Truss



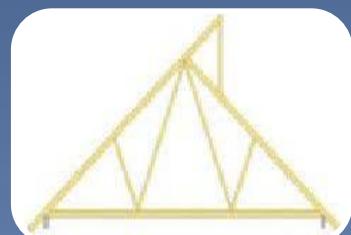
Compound Fink



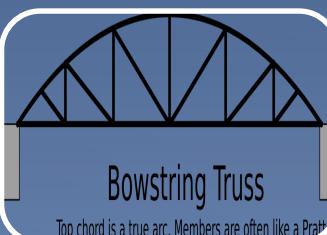
Pratt Truss



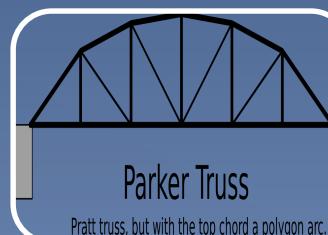
Saw Tooth/
North Light Truss



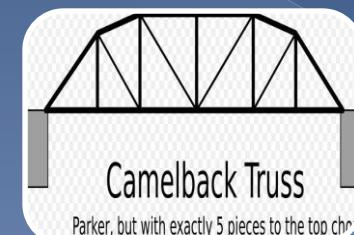
Modified North
Light Truss



Bow String Truss



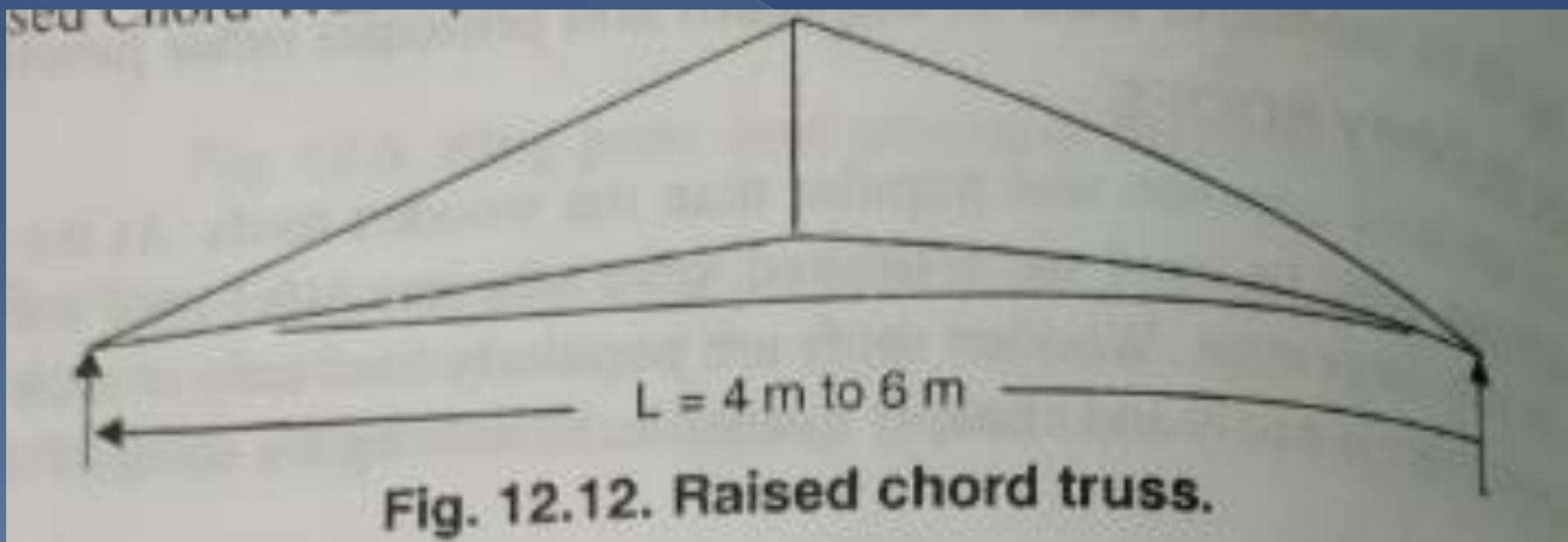
Parker Truss



Camel Back

RAISED CHORD TRUSS

- Span upto 6 m



CHAMBERED FINK TRUSS

- Span upto 15 m

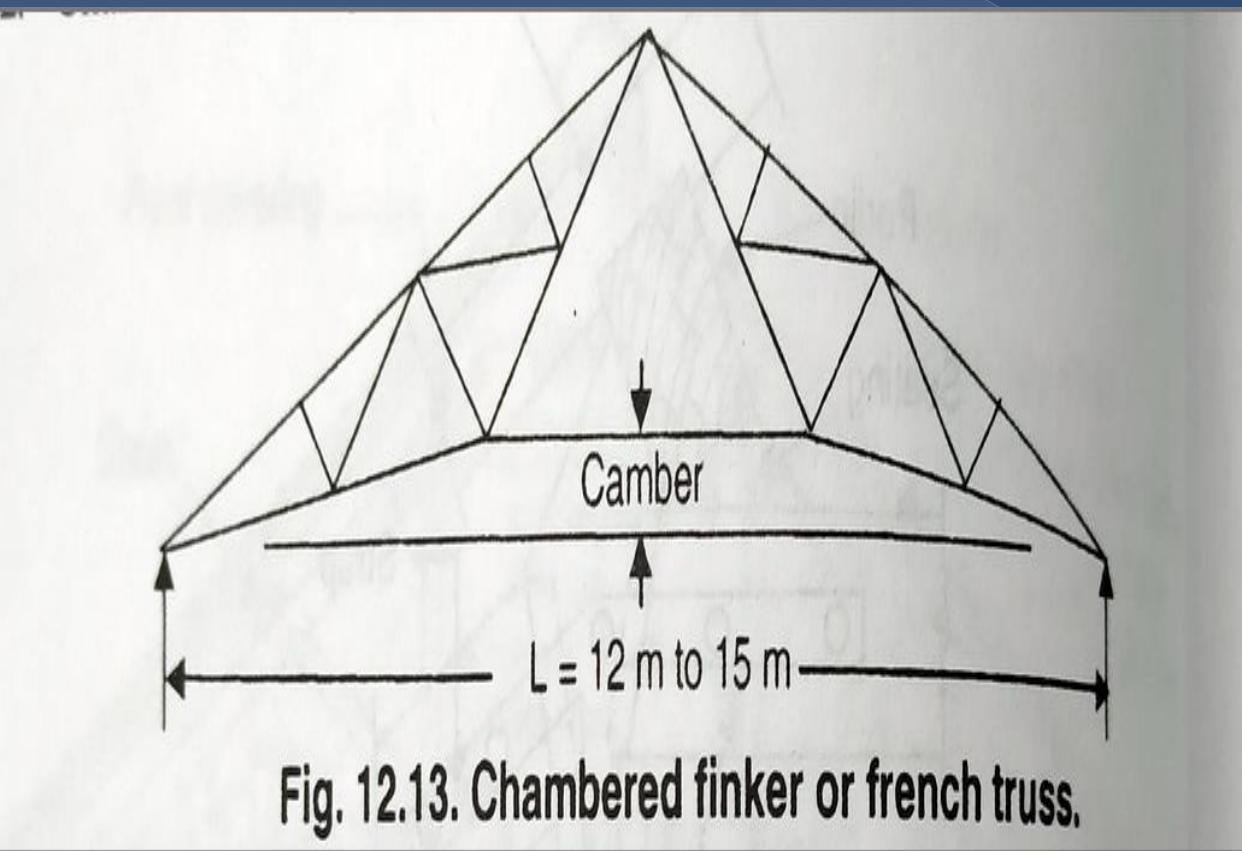
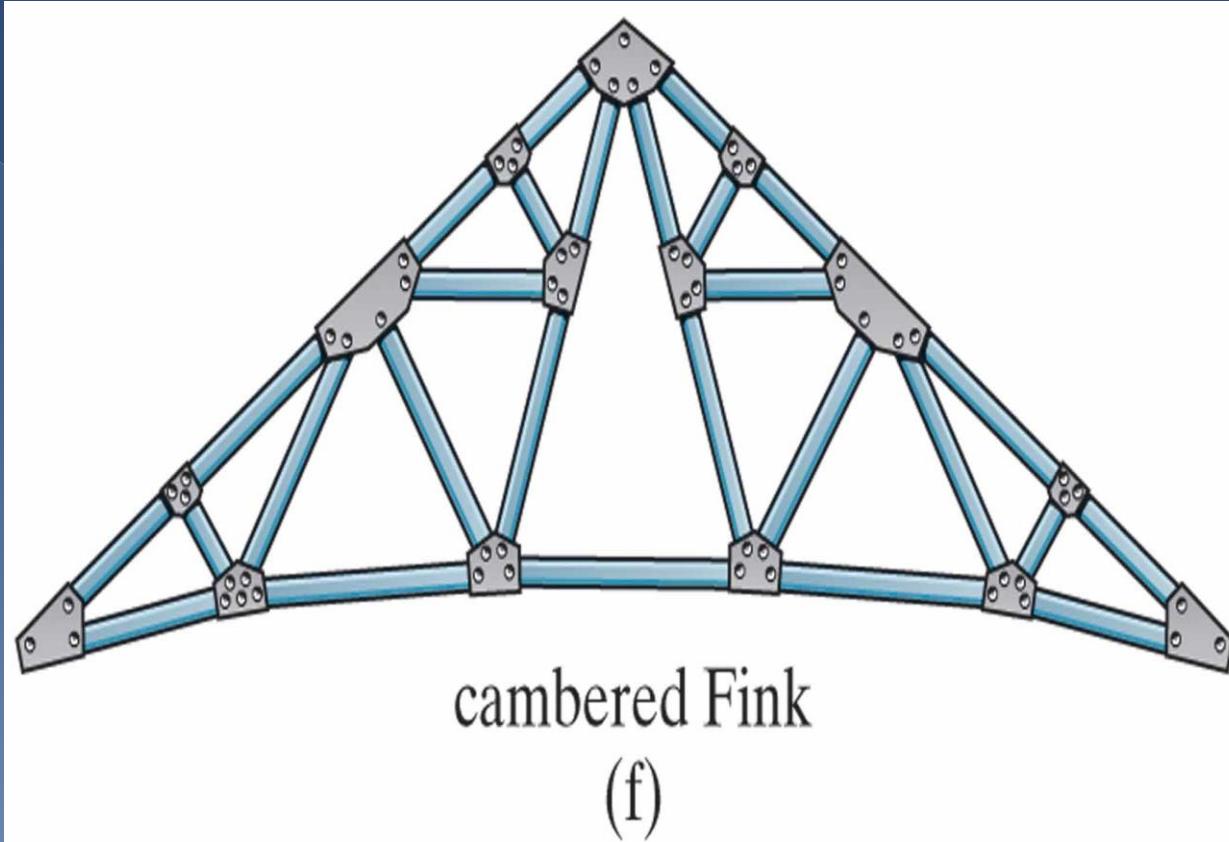


Fig. 12.13. Chambered finker or french truss.



cambered Fink
(f)

SCISSOR TRUSS

- Span upto 9 m
- A **scissors truss** is a kind of truss used primarily in buildings, in which the bottom chord members cross each other, connecting to the angled top chords at a point intermediate on the top chords' length, creating an appearance similar to an opened pair of scissors.
- Used where here a sloping or raised ceiling surface is desired.

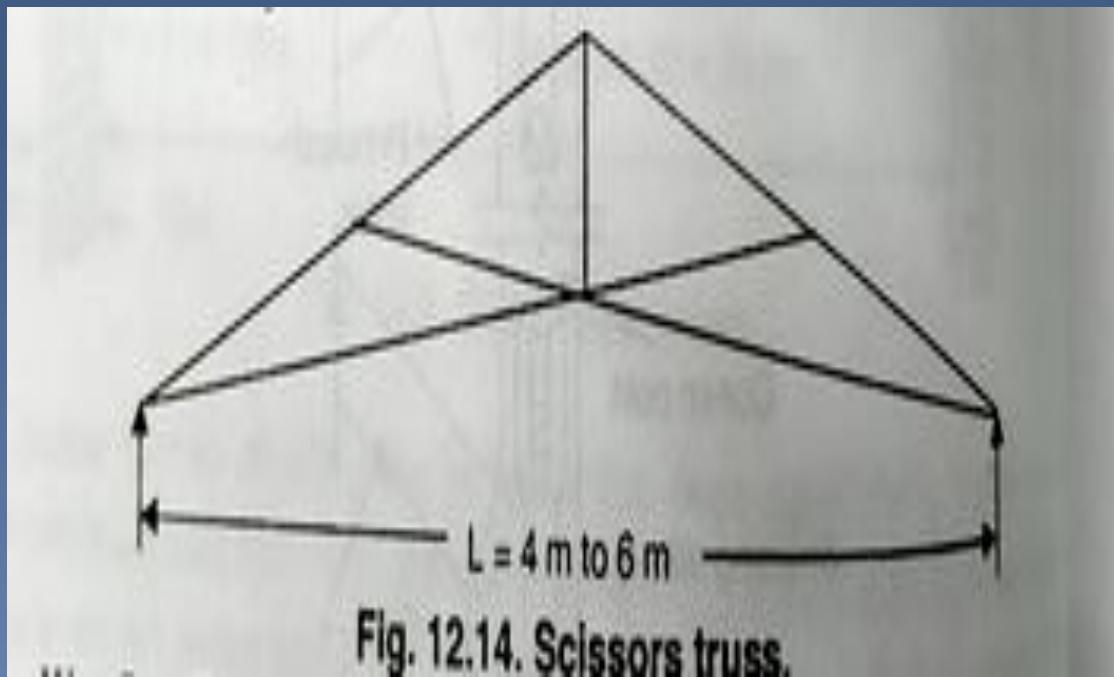
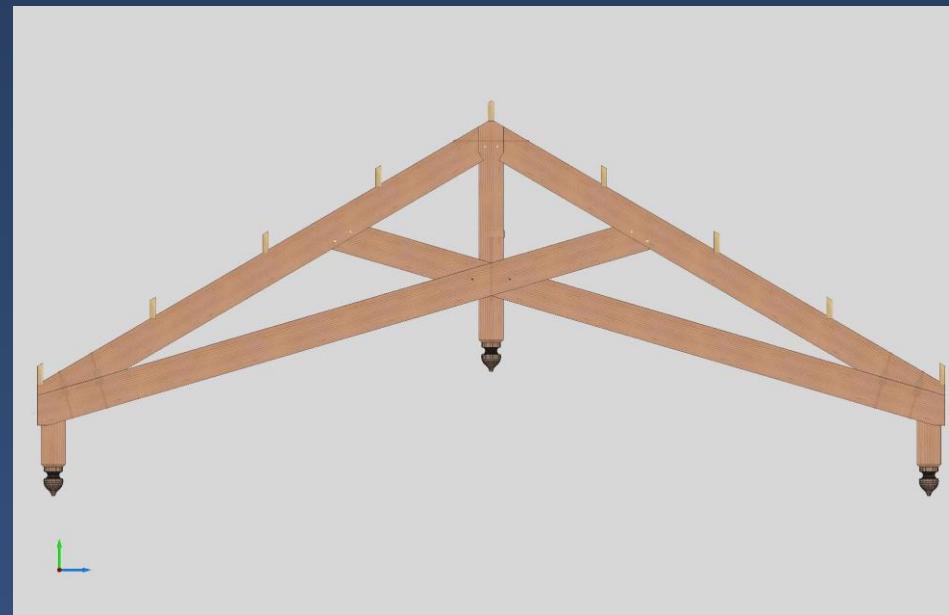
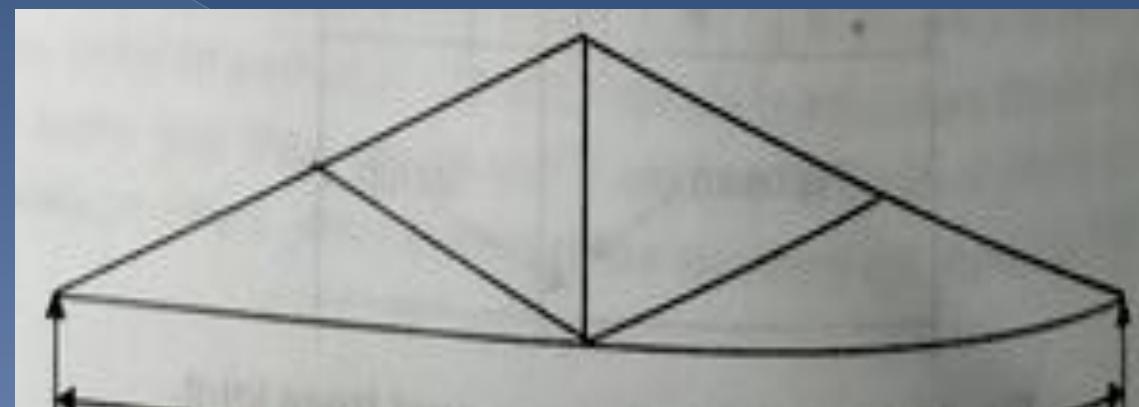
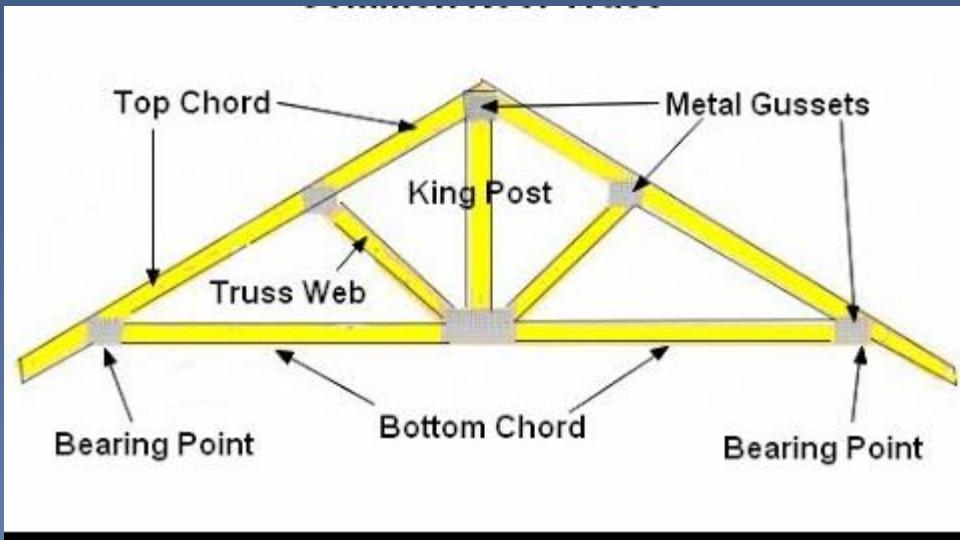
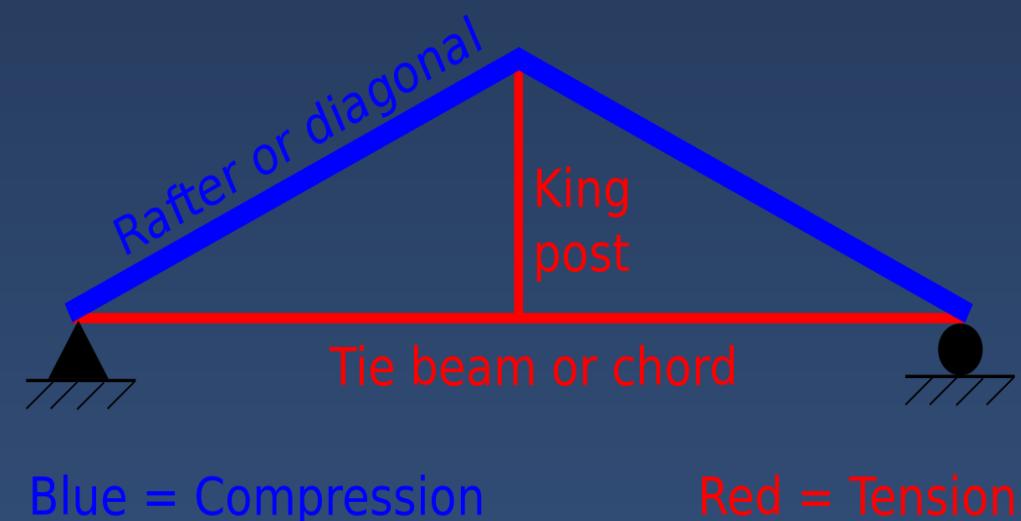


Fig. 12.14. Scissors truss.



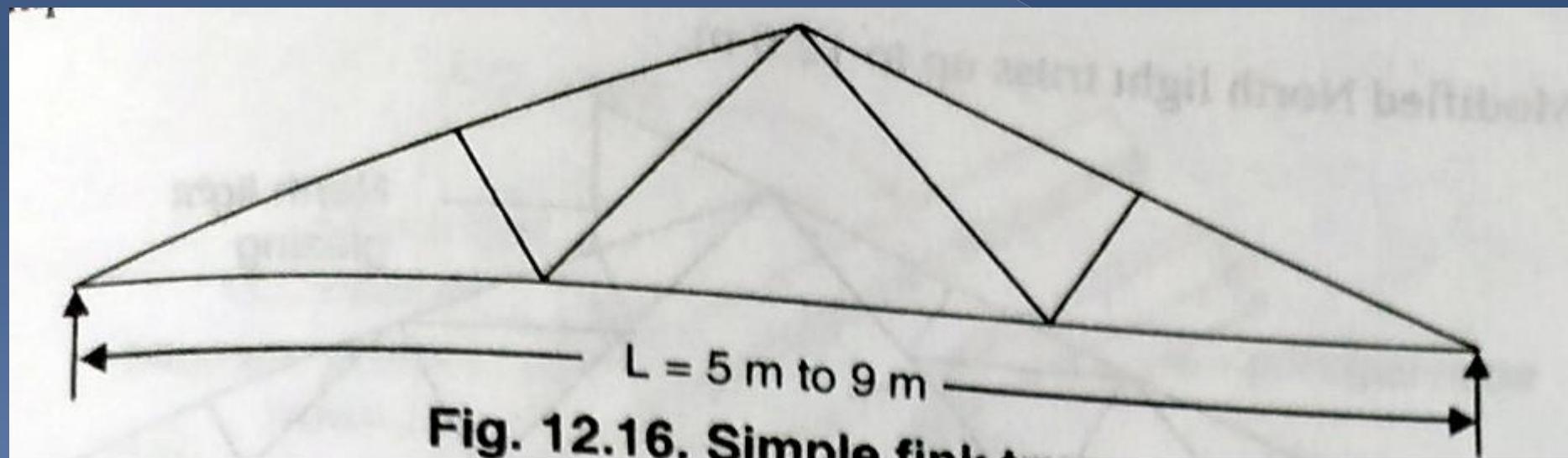
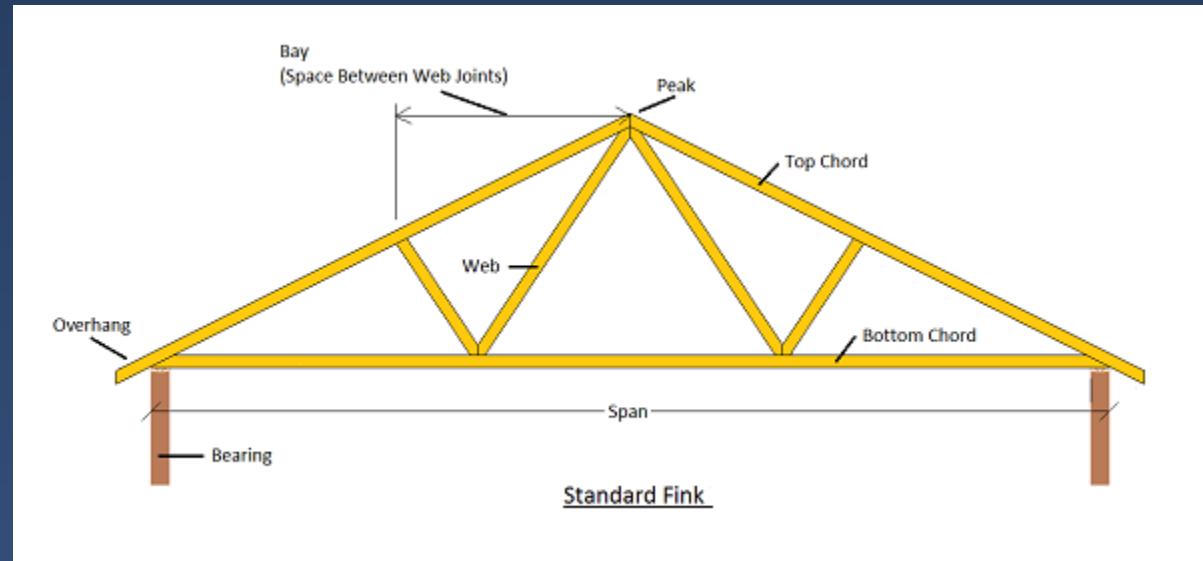
KING POST TRUSS

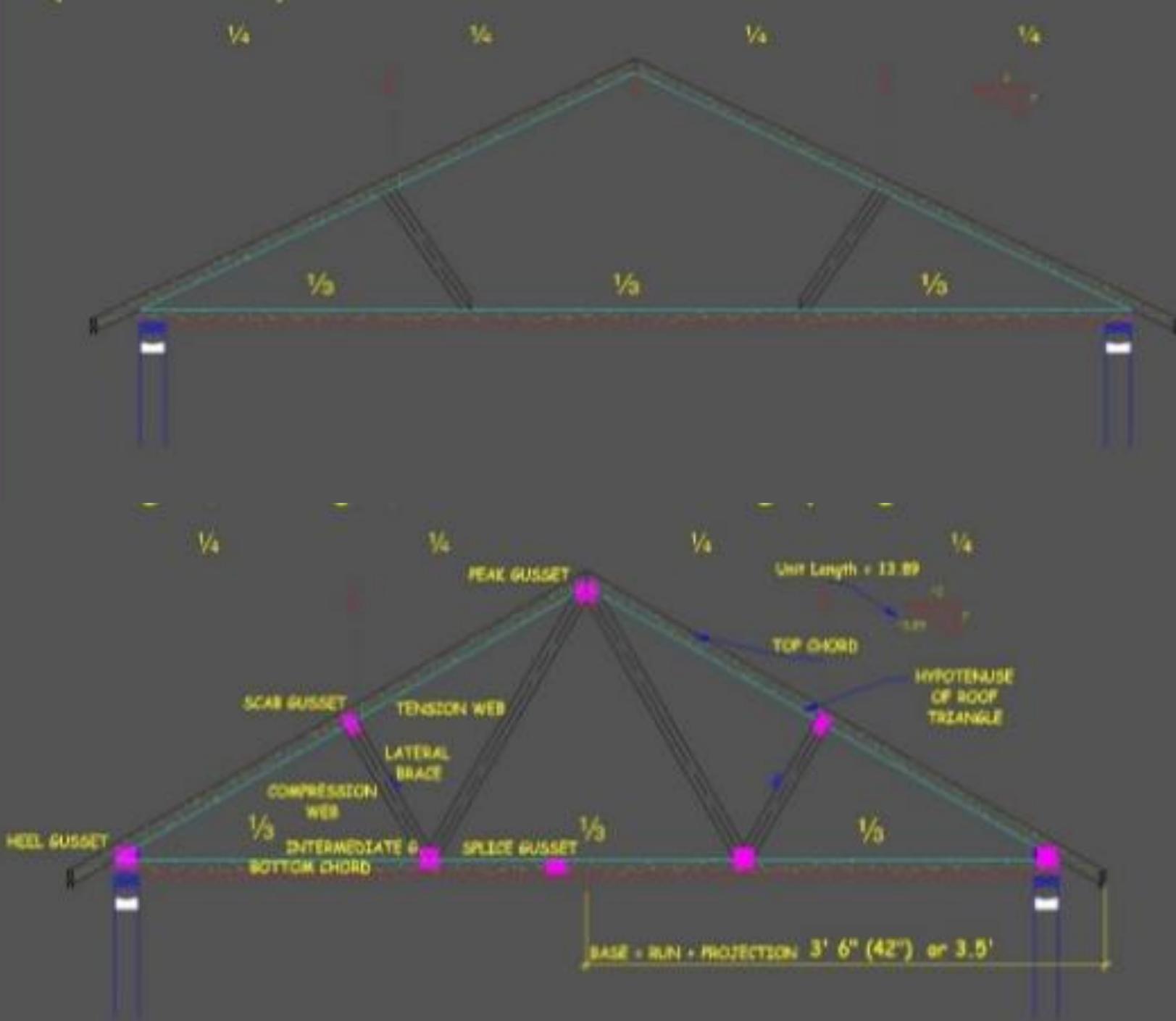
- Span upto 6 m
- A king post extends vertically from a crossbeam (the tie beam) to the apex of a triangular truss.
- Usually made of wood or wood and steel



SIMPLE FINK TRUSS

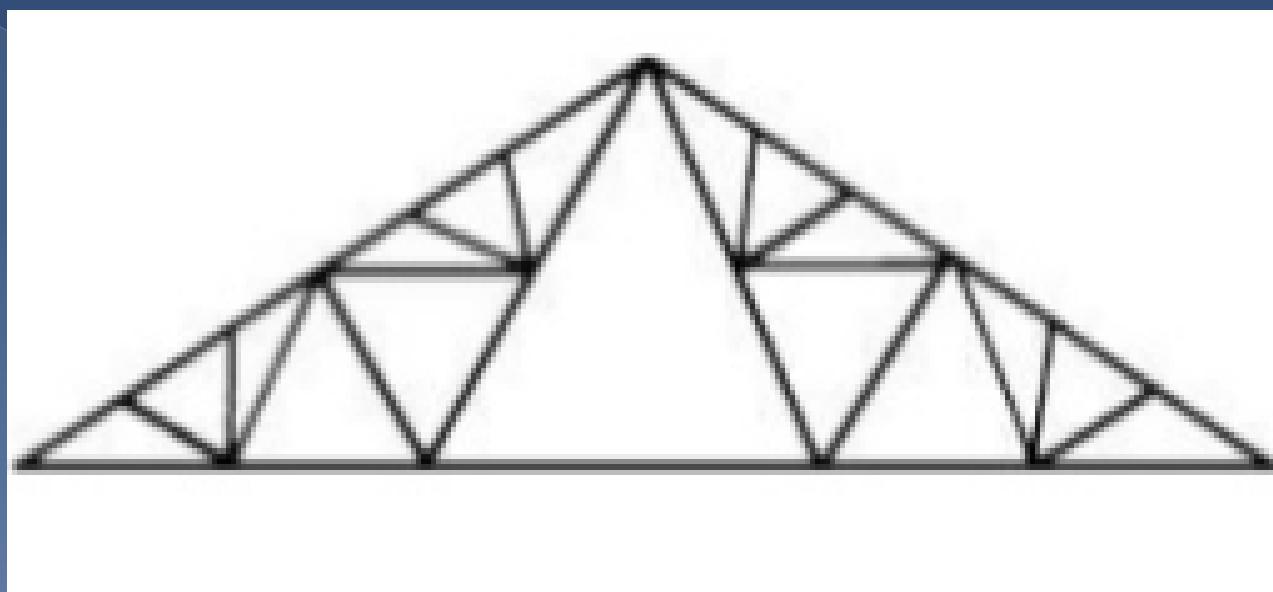
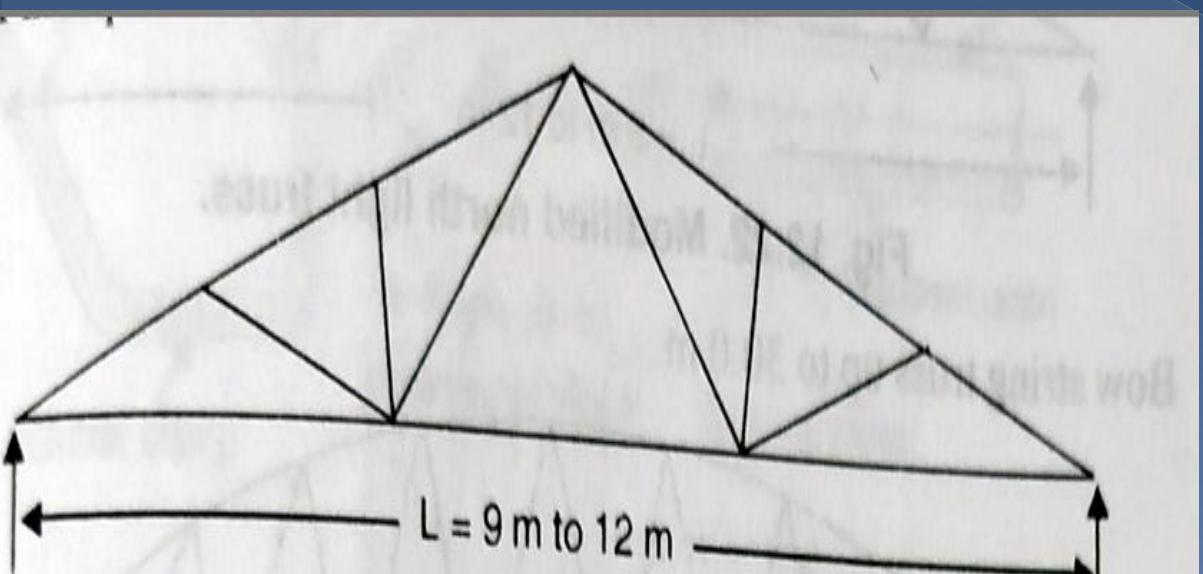
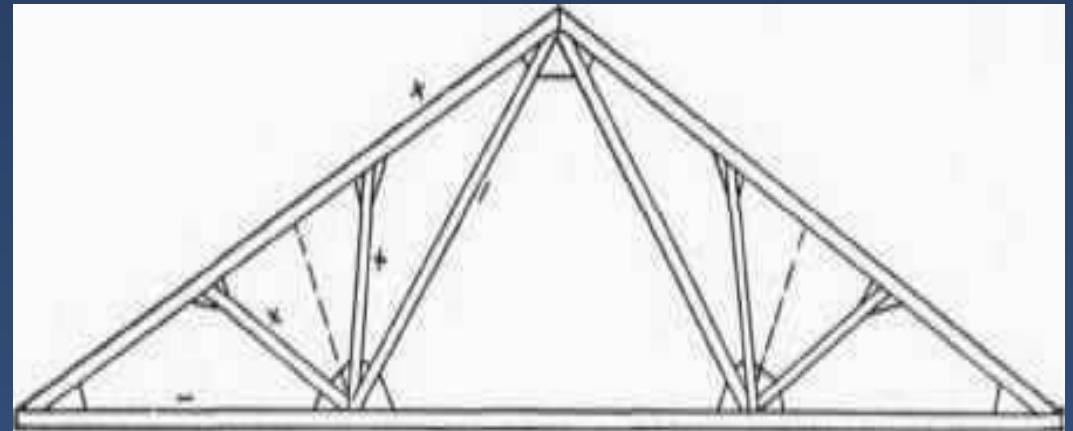
- Span upto 10 m





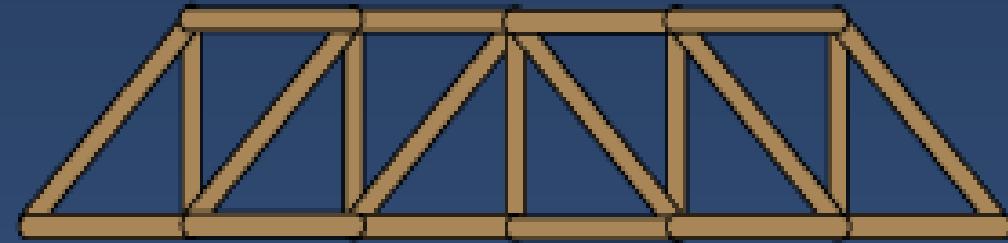
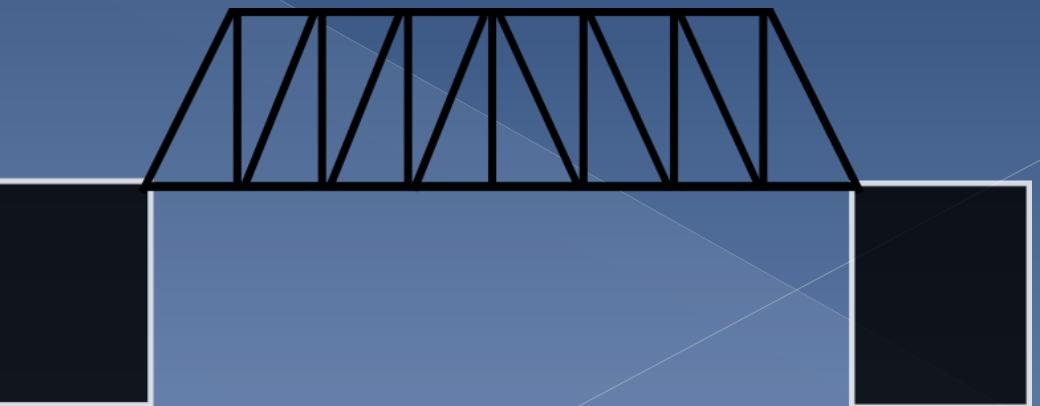
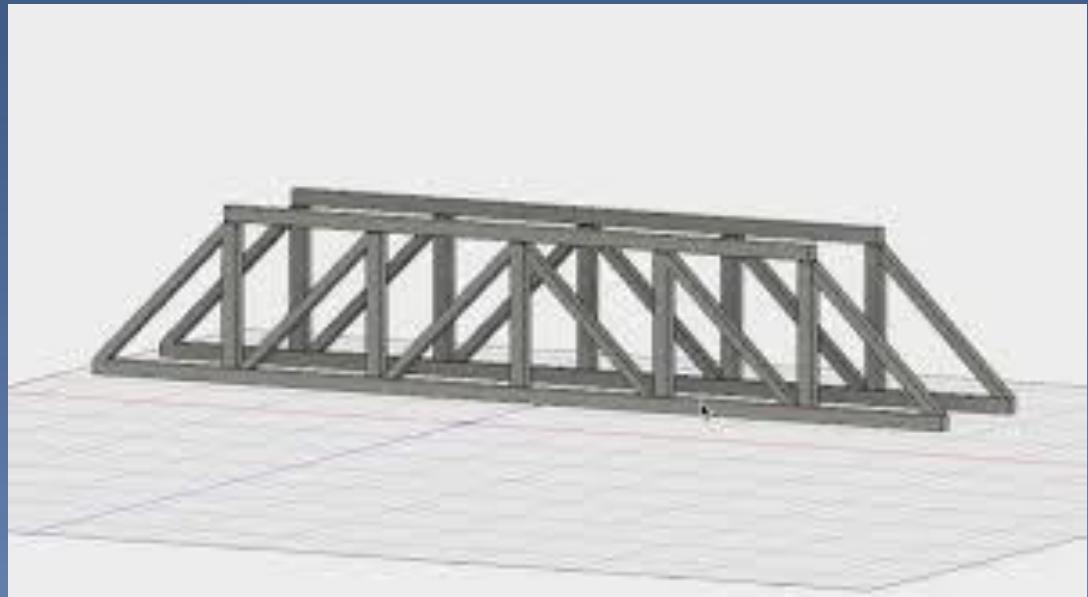
FAN FINK TRUSS

- Span upto 12 m



HOWE TRUSS

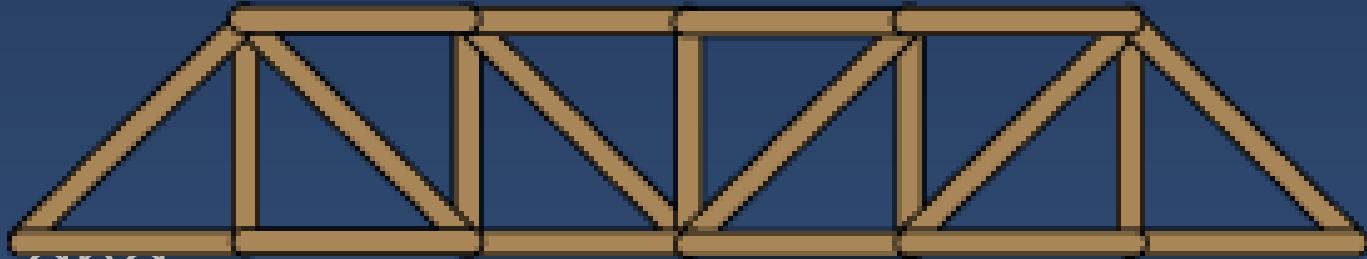
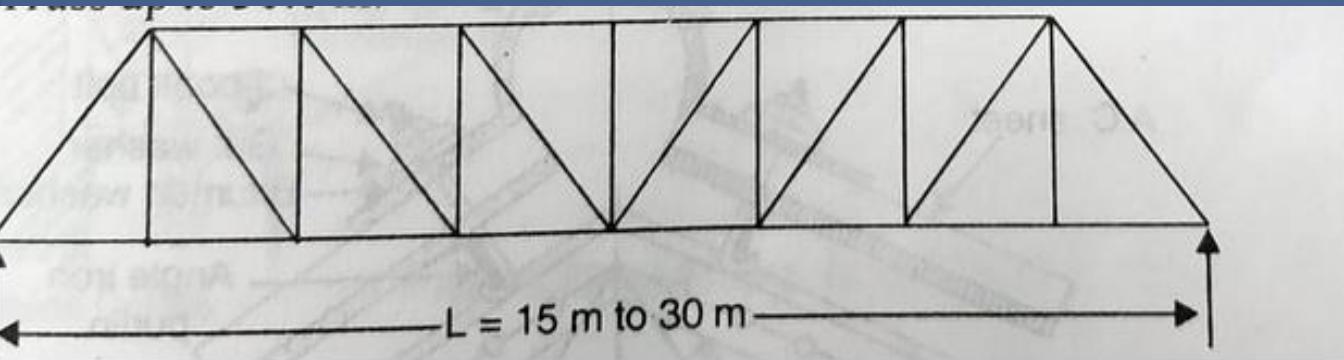
- Span upto 15 m
- The diagonal structural beams slope toward the bridge center,. This approach makes diagonal members of Howe truss bridge in compression, while vertical web members are in tension.



Howe Truss

PRATT TRUSS

- Span upto 30 m
- It includes vertical members and diagonals that slope down towards the center
- It is statically determinate



Pratt Truss



COMPOUND FINK TRUSS

- Span upto 12 m

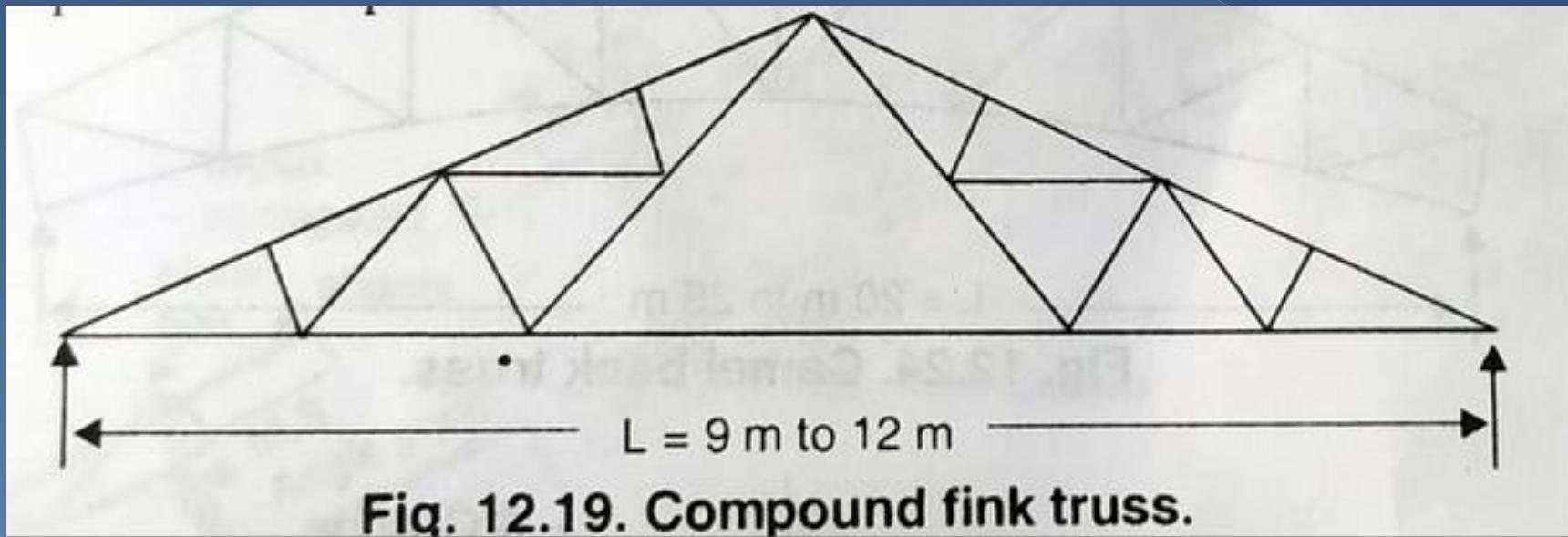
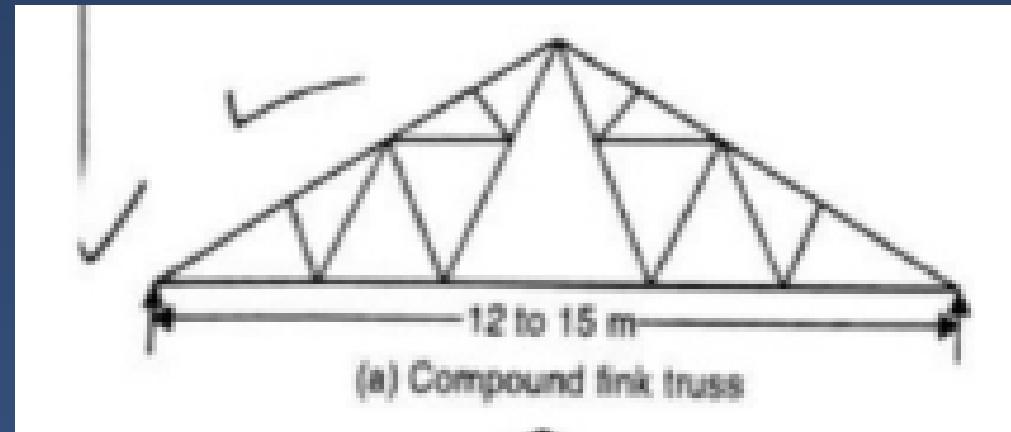
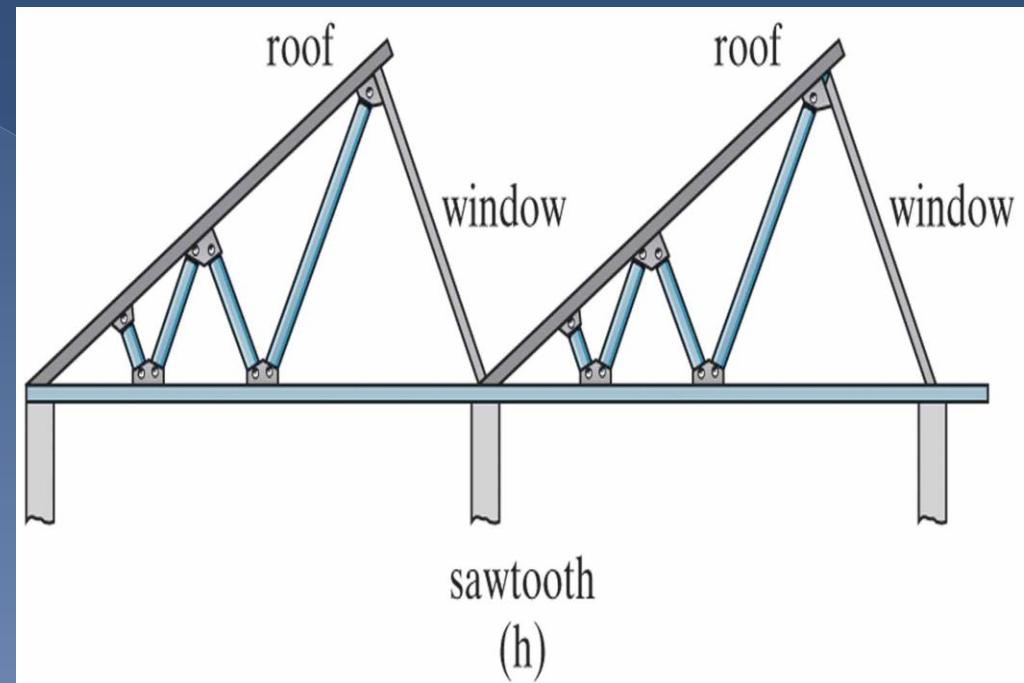
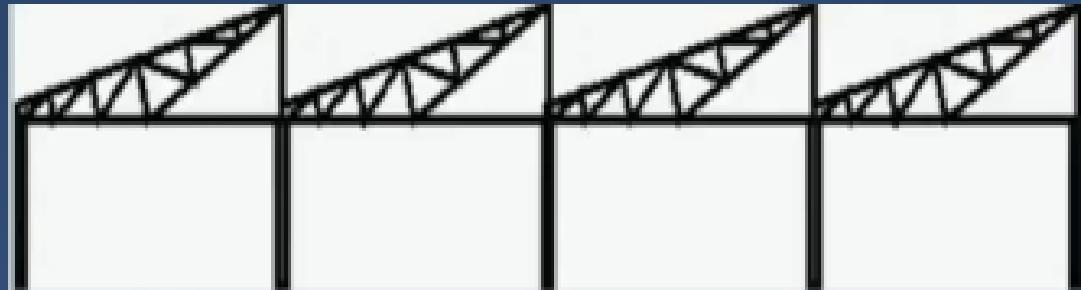
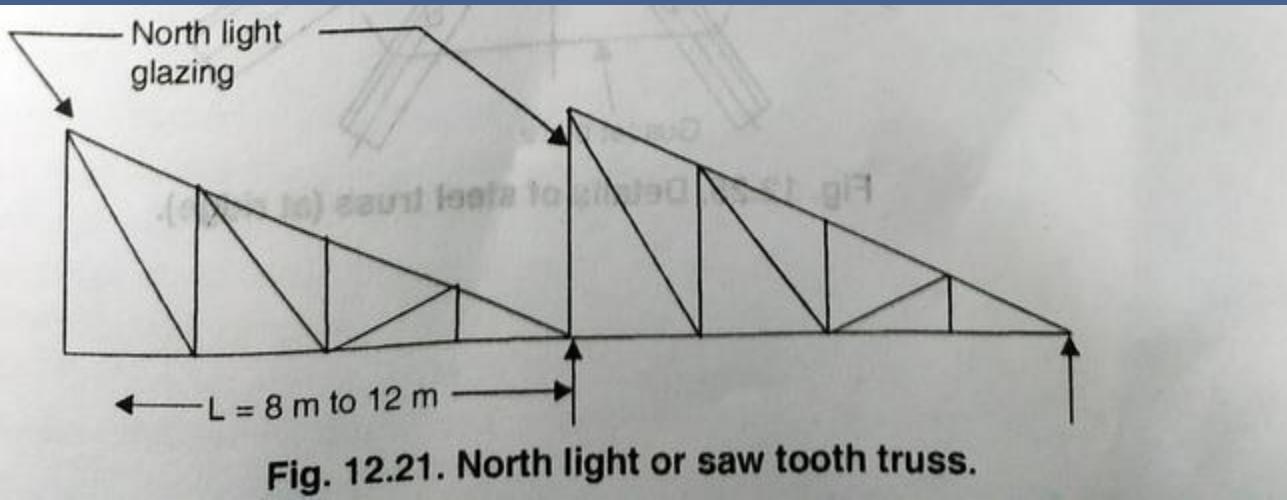


Fig. 12.19. Compound fink truss.

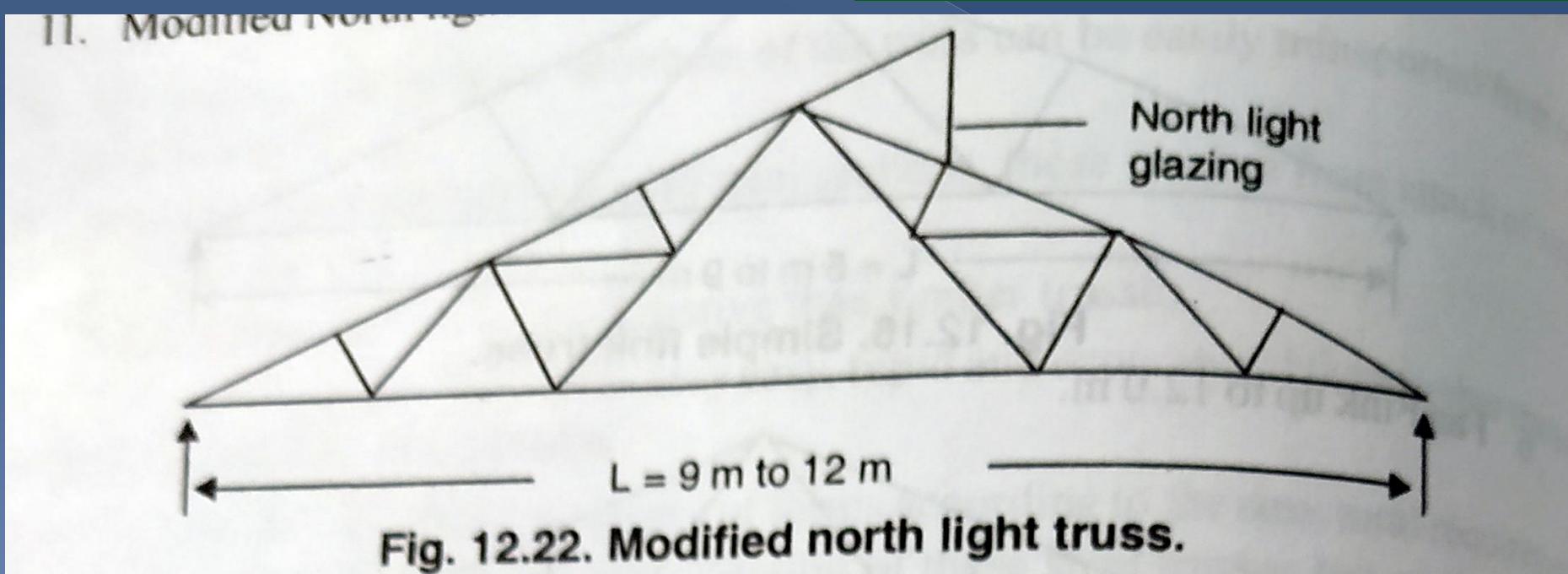
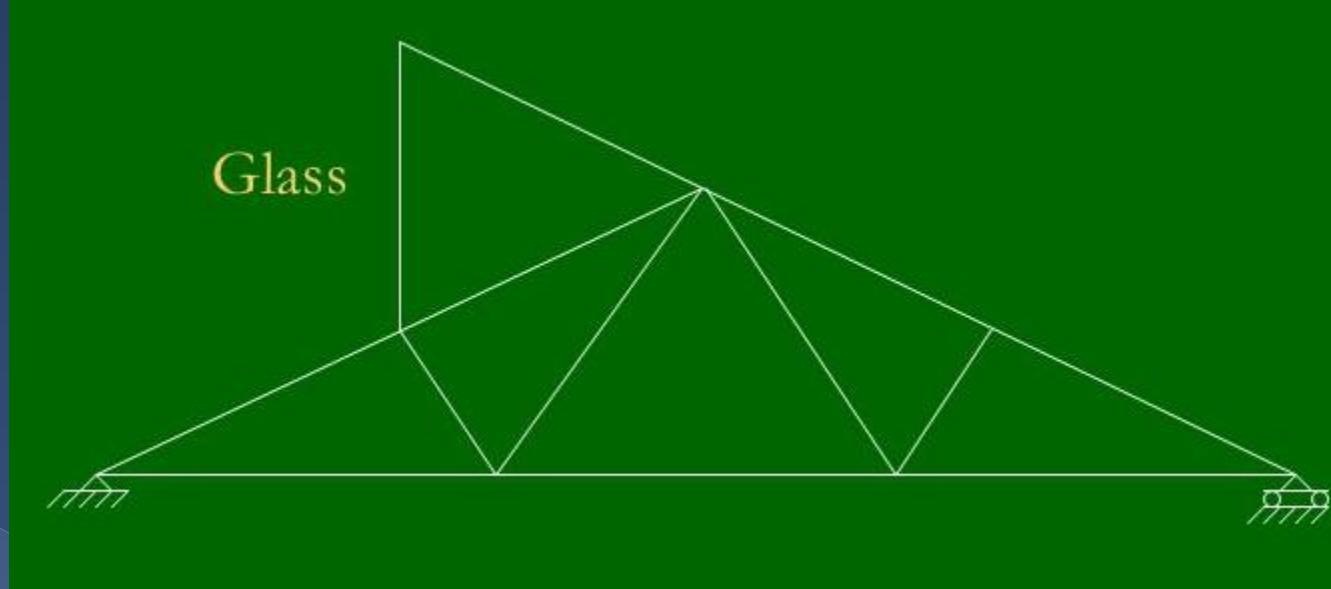
SAW TOOTH / NORTH LIGHT TRUSS

- Span upto 12 m
- They allow maximum benefit to be gained from natural **lighting** by the use of glazing on the steeper pitch which generally faces **north** or **north-east** to reduce solar gain.



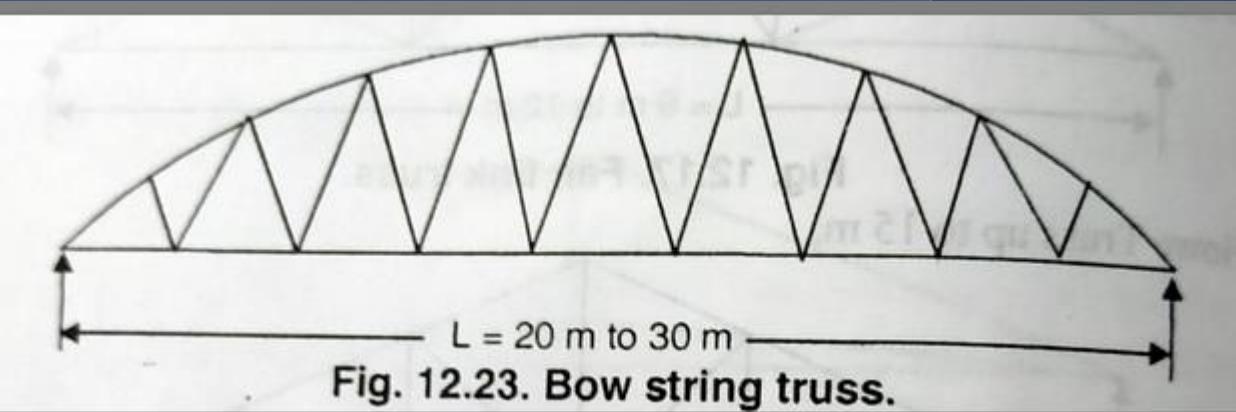
MODIFIED NORTH LIGHT TRUSS

- Span upto 12 m



BOWSTRING TRUSS

- Span upto 30 m



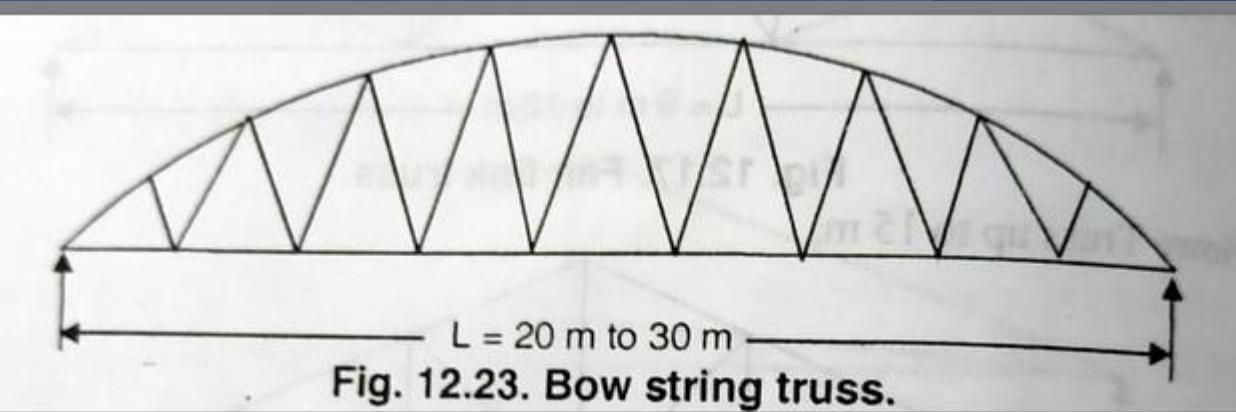
Bowstring Truss

Top chord is a true arc. Members are often like a Pratt



BOWSTRING TRUSS

- Span upto 30 m



Top chord is a true arc. Members are often like a Pratt



PARKER TRUSS

- Span upto 30 m



Parker Truss

Pratt truss, but with the top chord a polygon arc.



CAMELBACK TRUSS

- Span upto 20 m



Camelback Truss

Parker, but with exactly 5 pieces to the top chord

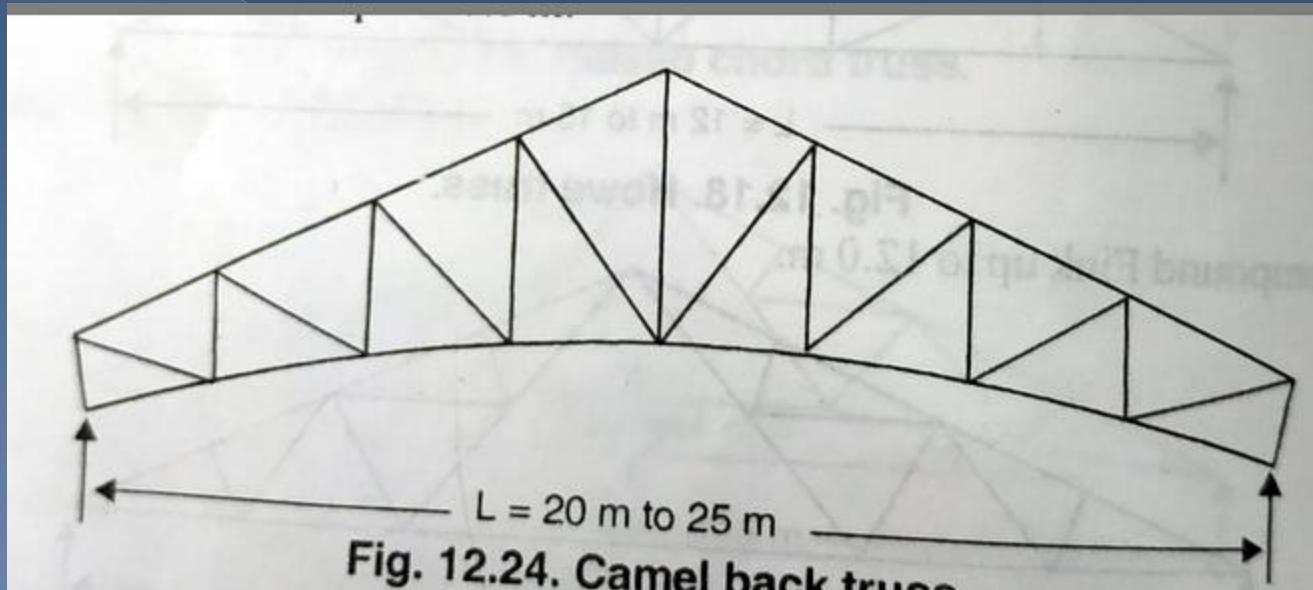
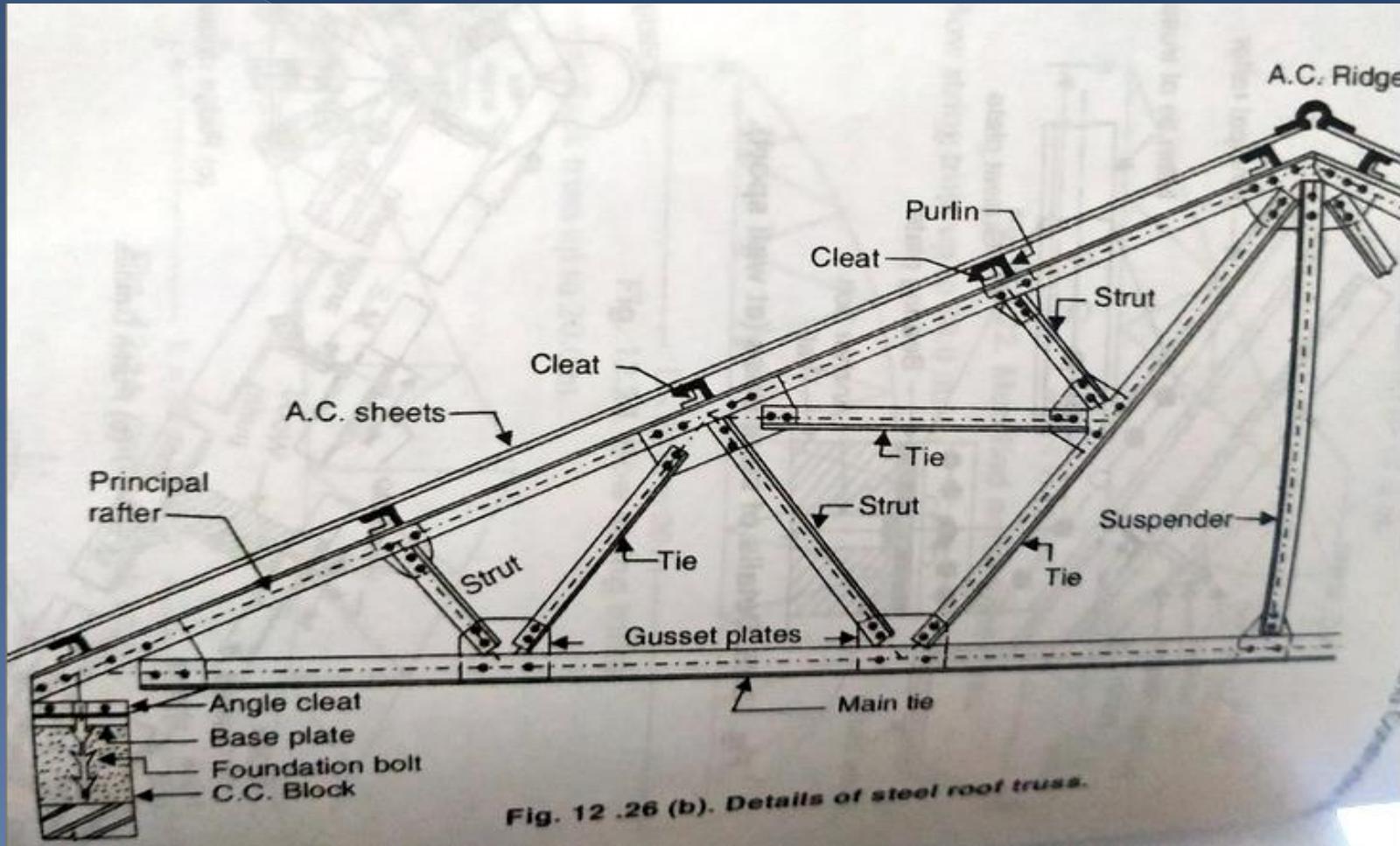


Fig. 12.24. Camel back truss.

PARTS AND DETAILS OF STEEL TRUSS CONNECTIONS



PARTS AND DETAILS OF STEEL TRUSS CONNECTIONS

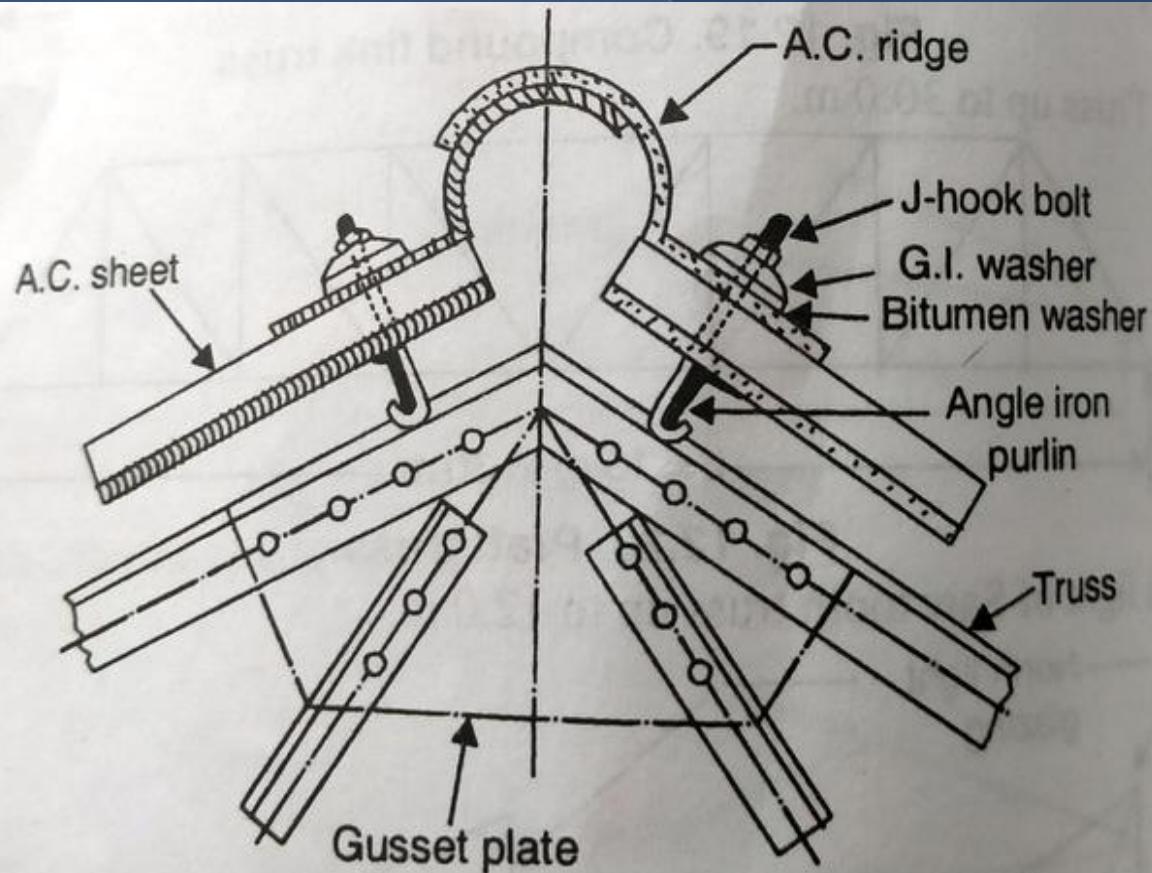


Fig. 12.25. Details of steel truss (at ridge).

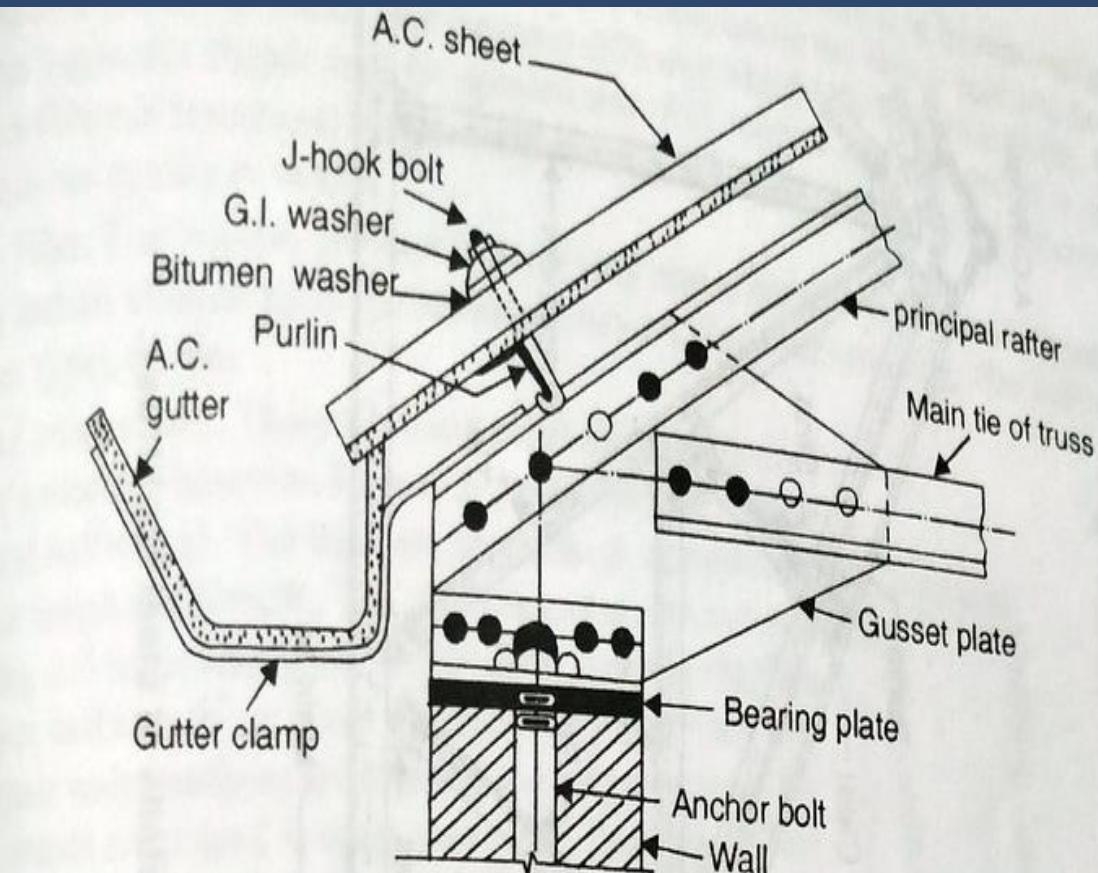


Fig. 12.26. Details of steel truss (at wall sport).

ROOF COVERINGS



THATCH



TILES



SLATE



ASBESTOS
CEMENT
SHEET



GALVANIZED
IRON SHEET

THATCH

- This roofing consists thatch (dried grass with minimum thickness 15 cm) laid over a network of bamboos spaced at 30 cm apart , placed over roof skeleton (structure). Can be made water-tight by plastering with mud from time to time.
- Cheapest, easily available, cooler in summer, warmer in winter
- Not durable, highly combustible, need replacement frequently
- Used generally in cow sheds, animal shelters or inferior quality of works



TILES

- Clay tiles



- › COUNTRY TILES



- › ALLAHBAD TILES

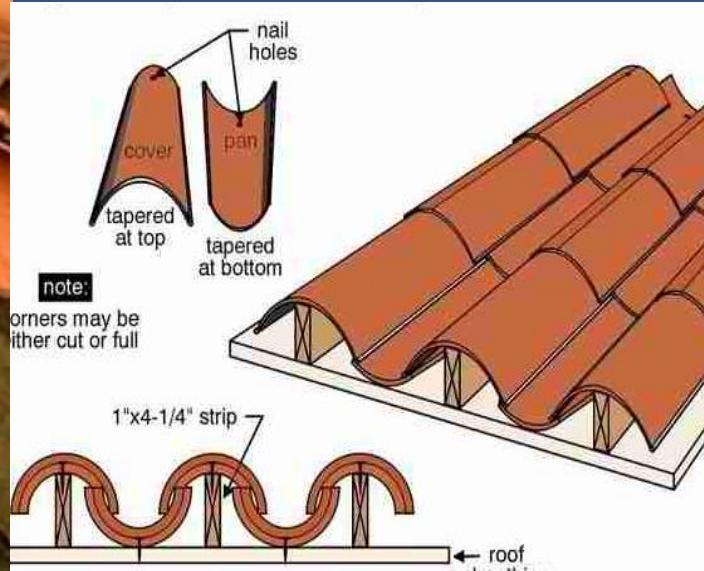
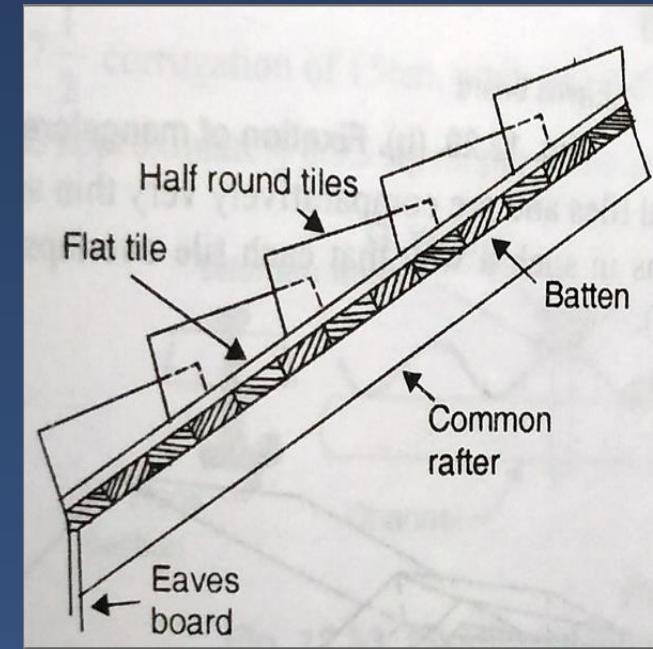
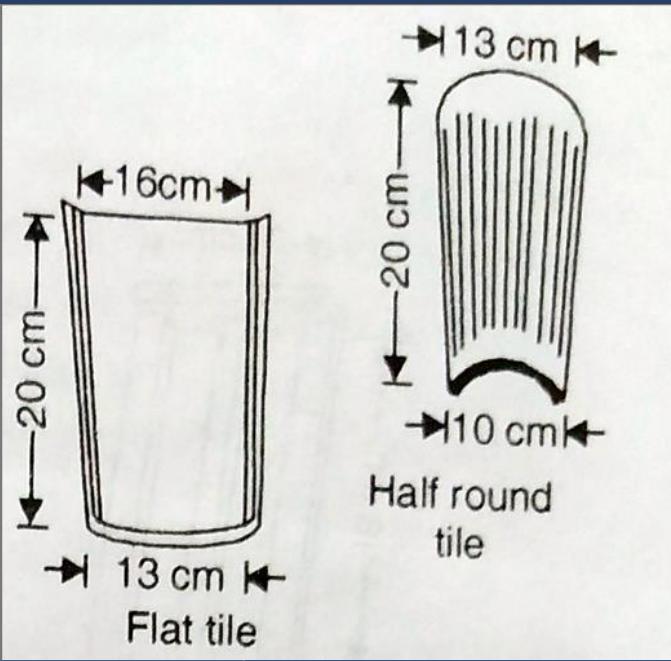
- › MANAGALORE TILES

- › PAN TILES



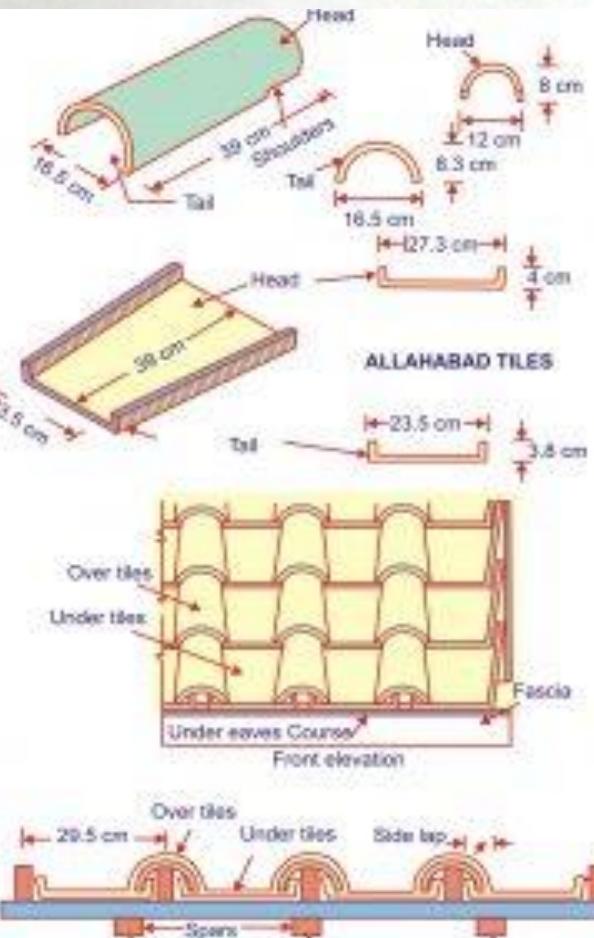
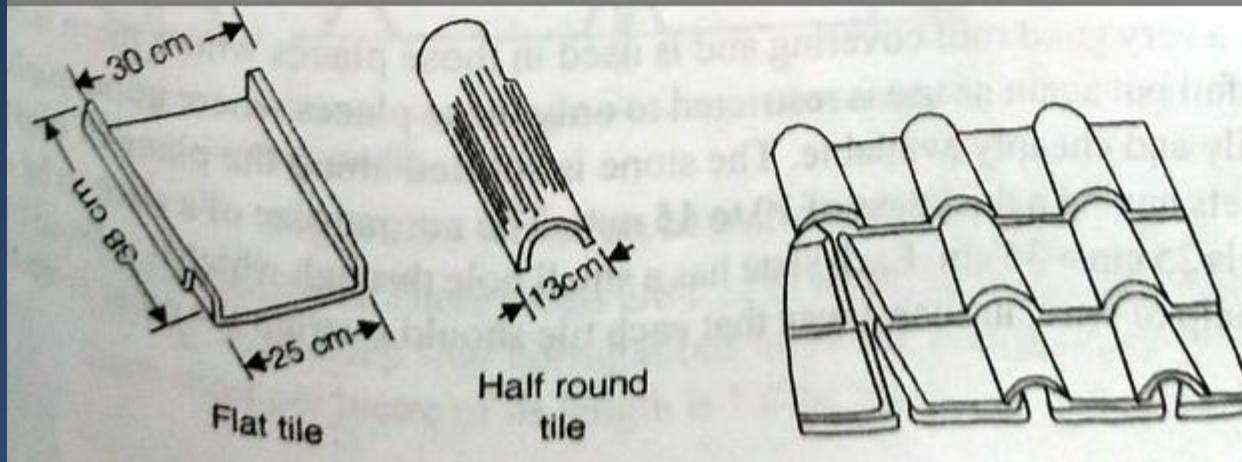
COUNTRY TILES

- Hand made, made on Potter's wheel
- Two components: Flat tile or Pan and half-round tile or pot
- Very thin as compared to length and breadth
- Flats are laid on bamboo matting
- Longitudinal joints of flat tiles are covered with half round tiles
- Wider surface of flat kept towards ridge whereas wider surface of half-round tiles are used towards the lower side of roof
- Laid together with mud mortar



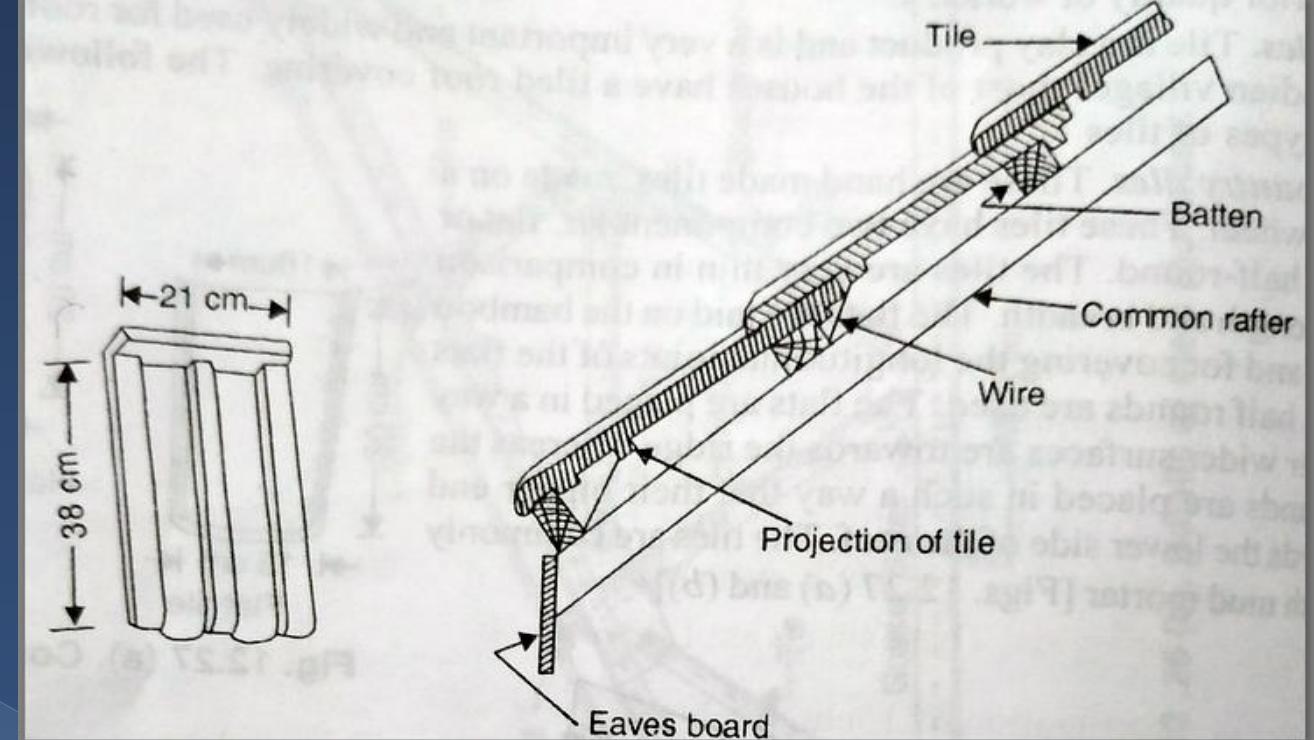
ALLAHBAD TILES

- Similar to Country tiles, but bigger in size
- Two components: Flat tile or Pan and half-round tile or pot
- Flats are laid edge to edge overlapping one another with wider edge towards the ridge. Pot tiles are laid over longitudinal joints with broader edges downwards.
- Tiles are laid on wooden battens with the help of lime mortar



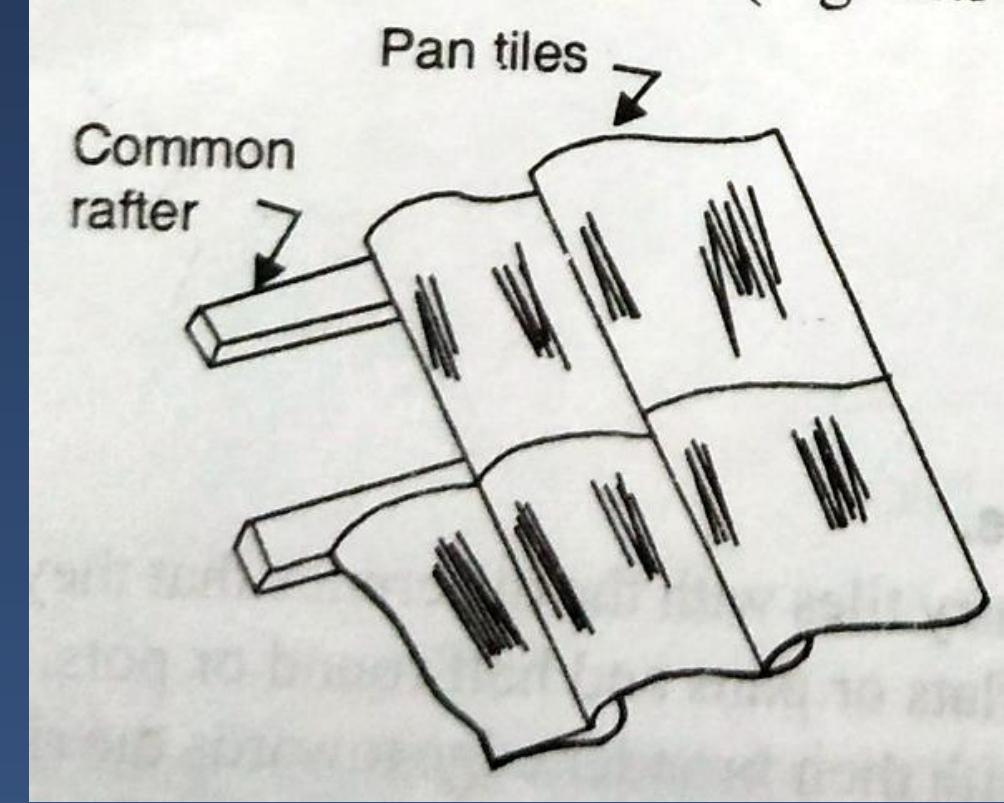
MANGALORE TILES

- These are flat tiles with projections for holding these tiles with each other.
- Each tile has a hole through which tile is joined to batten (purlin) with the help of G.I. wire.
- The tiles overlap each other in longitudinal direction and the other tile overlapping will cover the hole.



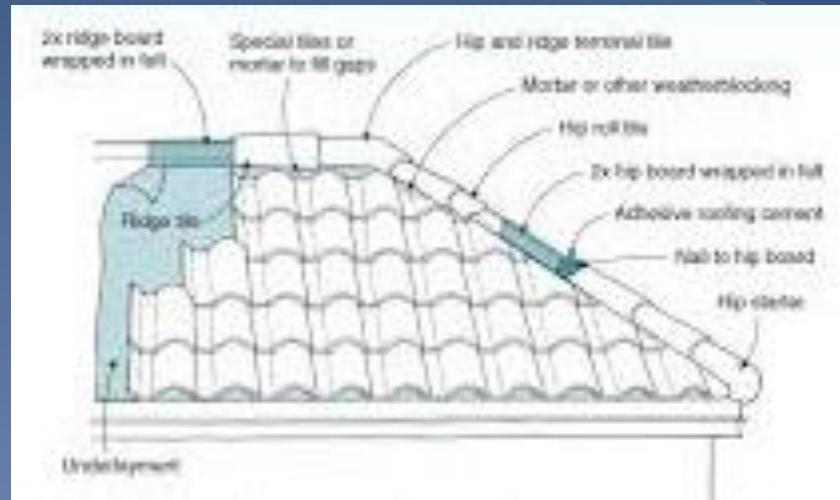
PAN TILES

- These are flat but curved tiles
- Very thin and light
- There are placed over battens such that they overlap the other longitudinally and cross-wise



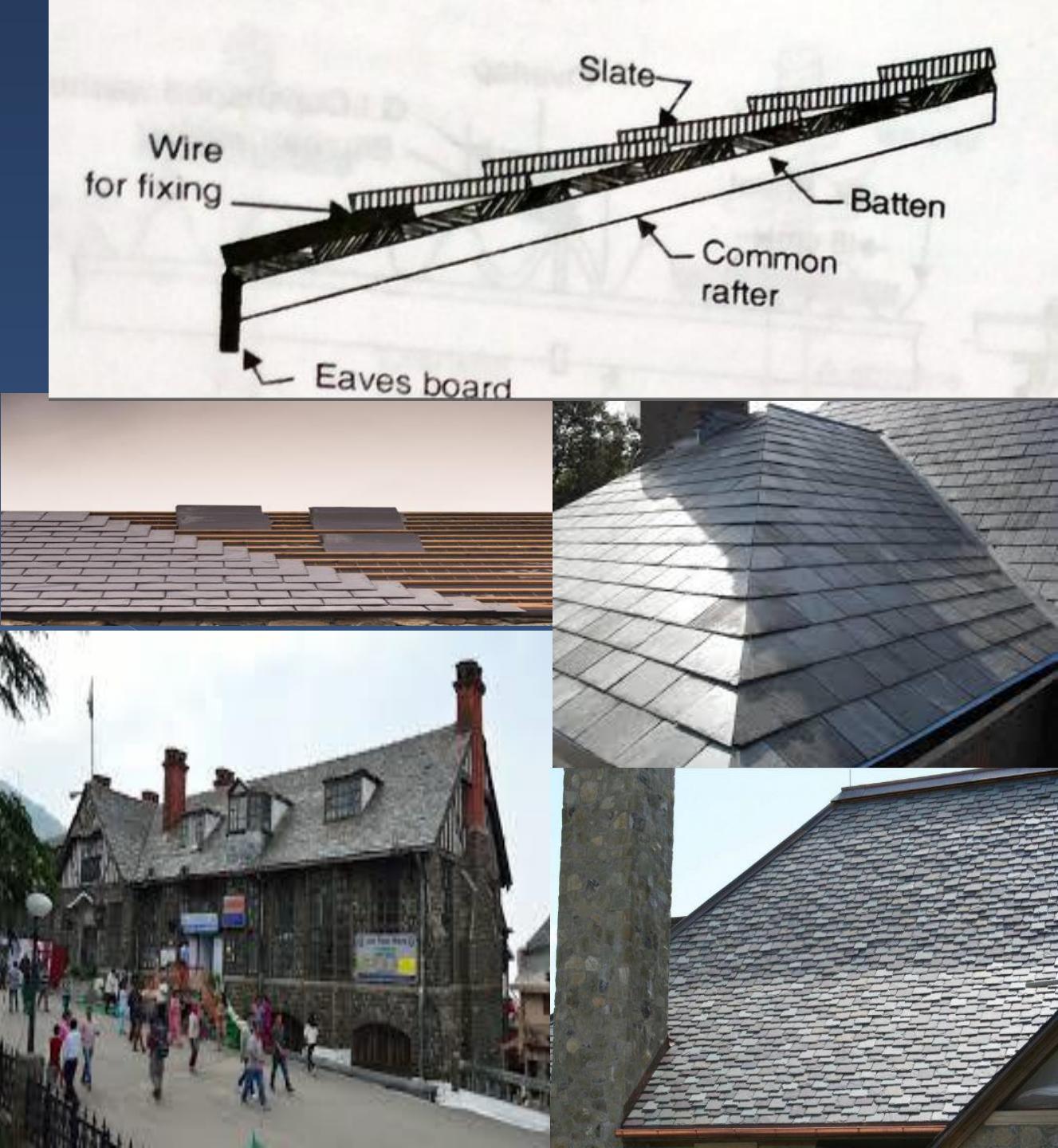
RIDGE TILES

- ◎ At the ridge and hips of roof, ridge or hip tiles are used



SLATE

- Used in areas of heavy rainfall and snowfall, where slates are easily available.
- Normal size of slate for roof: 25 cm x 35 cm
- Each slate has a small roof through which it is fixed to the battens with the help of wire
- Each slate overlaps the other from both sides

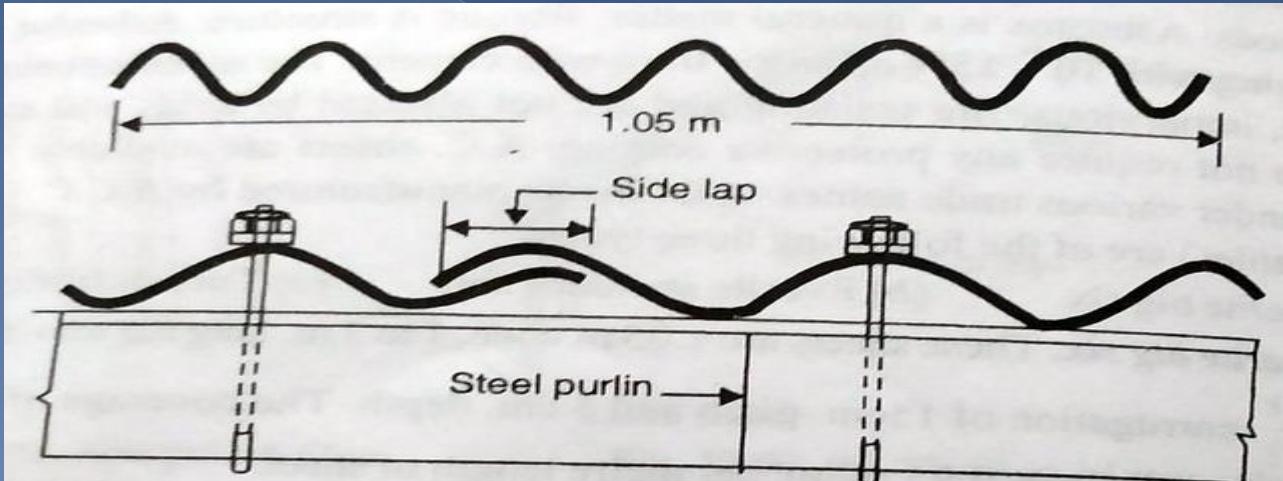
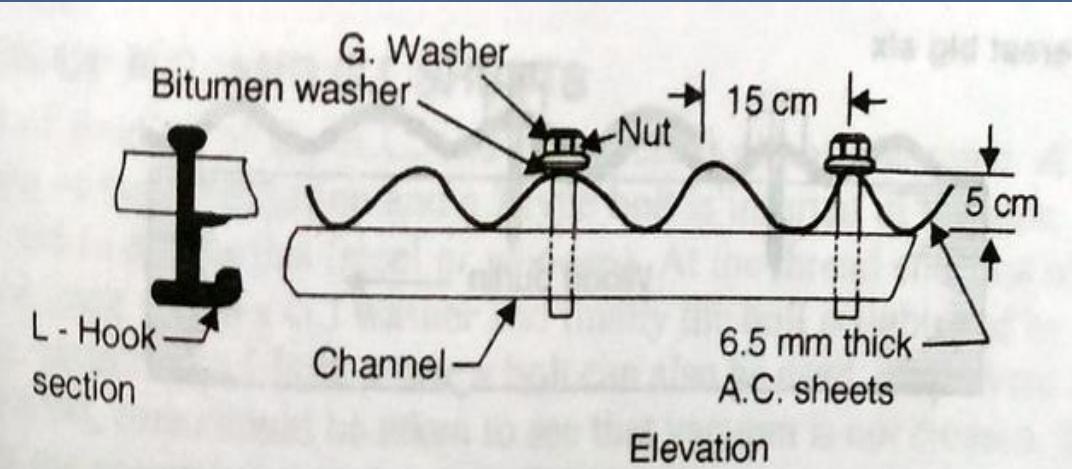


ASBESTOS CEMENT

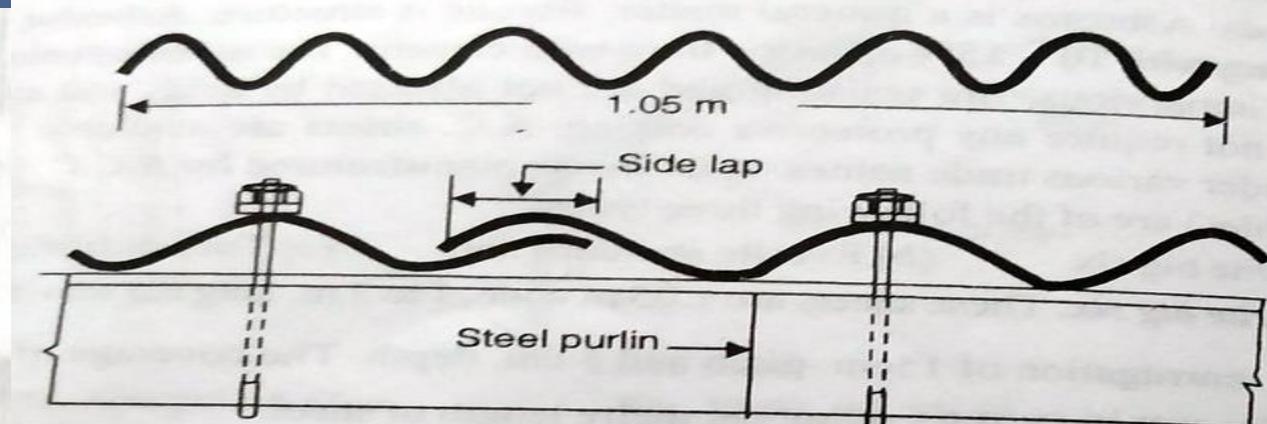
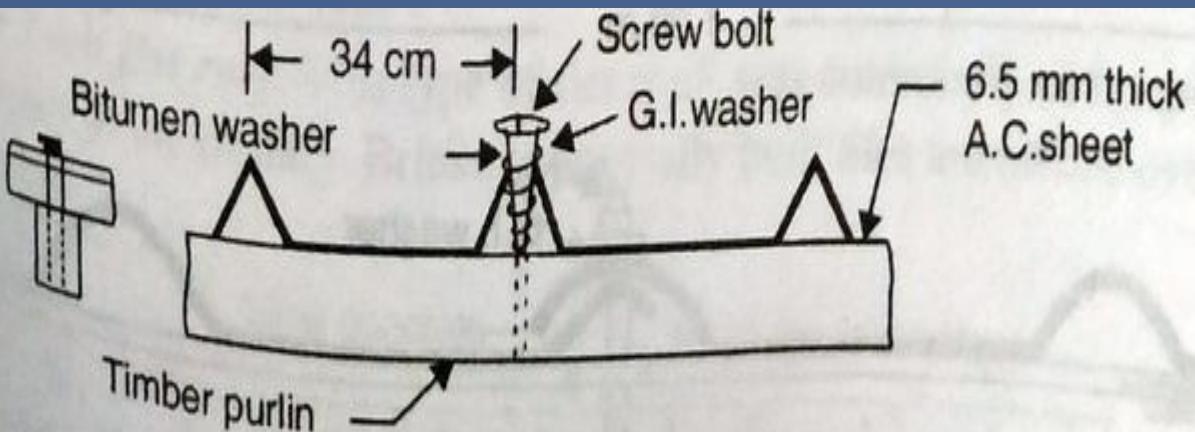
- Asbestos is mineral matter, fibrous
- AC = 10-15% asbestos fibre + cement
- AC sheets are cheap, fire resistant, resistant to acid attacks and environment
- Used in industrial sheds, stores usually
- Three types:
 - > Everite Big Six
 - > Everite Standard
 - > Turnall Trafford



	Width (m)	Length (m)	Thickness (mm)	No. of corrugation s	Pitch of corrugation s (cm)	Depth of corrugations (cm)	Average coverage (sqm per metre length of sheet)
Everite Big Six	1.05	1-3	6.5	7.5	15	5	0.95



	Width (m)	Length (m)	Thickness (mm)	No. of corrugation s	Pitch of corrugation s (cm)	Depth of corrugations (cm)	Average coverage (sqm per metre length of sheet)
Everite Standard	0.76	1.1 - 3	6.5	10.5	5.4	2.56 or 2.85	0.7



	Width (m)	Length (m)	Thickness (mm)	No. of corruga- tions	Pitch of corruga- tions (cm)	Depth of corruga- tions (cm)	Average coverage (sqm per metre length of sheet)
Turnall Trafford	1.12	1.3 - 3	6.5	4	34	5	1

GALVANIZED IRON SHEETS

- Used in temporary structures
- Made of wrought iron and zinc by electroplating (galvanizing)
- 60 – 37 cm wide, 1.35 – 3.60 m long, 1 – 2 mm thick
- Pitch of corrugations is 8 cm and depth of corrugations is 3 cm



FIXATION OF AC AND GI SHEETS

- Hole is drilled through the crest of corrugation and J-bolt is inserted. The other end of the bolt is fixed to purlins
- At the thread end, bitumen washer is placed over which a G.I. washer is placed and finally bolt is tightened by G.I. nut
- For wooden purlins, a screw bolt can also be used

