Industrial Building

* Required knowledge for Planning & structural framing :-
- Site information
- Soil condition.
- Availability of Raw materials.
- Future expansion plans
- Plan layout
- Crane type & capacity.
- Parking facilities
- Availability of waste disposal.
- Budget of Project.
- Heating, Ventilation, air conditioning equipments locks.

* Factors to be considered on the basis of Functional Requirements :
- Wide area free of columns.
- Large height.
- Large door & window
- Large span of truss.
- Minimum weight of trusses, purlins, beams, columns, etc.
- Lightning.
- Sanitary arrangements.
- Fire safety.

* Factors to be considered while site selection:

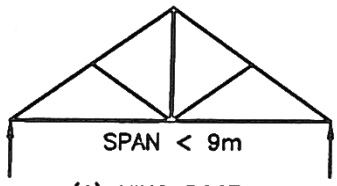
- Location of site.
- Availability of materials.
- Availability of water & electricity.
- Topography of that site.
- Soil condition.
- Waste disposal facilities.
- Accessibility of site.
- Transportation facity.
- Space for storage.
- Space for expansion.

* Major Components of Industrial Building :-

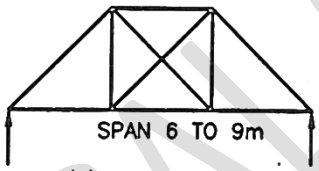
→ Roof truss.
→ Girts.
→ Gable rafter
→ Gable column
→ Main column.
→ Bracket column.
→ Purlins
→ Vertical bracings
→ Eaves girder.

* Types of Roof Trusses :.

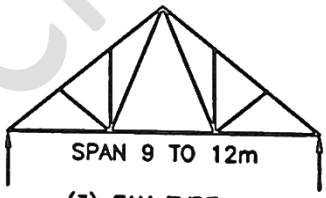
-> King post.
-> Queen post.
-> Fan type.
-> Fink type.
-> How type.
-> Warren type.



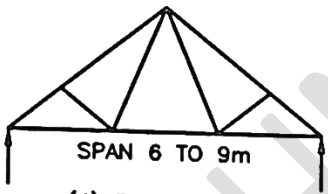
(1) KING POST



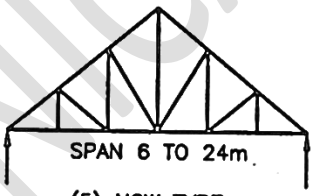
(2) QUEEN POST



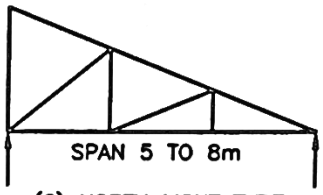
(3) FAN TYPE



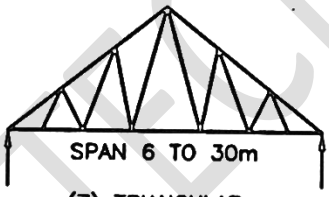
(4) FINK TYPE



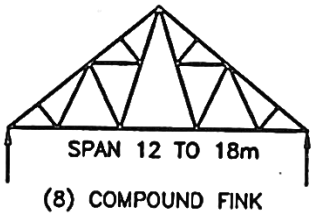
(5) HOW TYPE



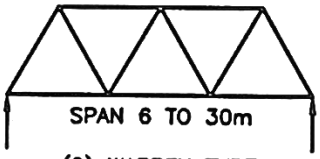
(6) NORTH LIGHT TYPE



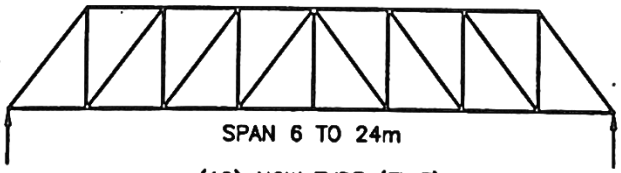
(7) TRIANGULAR



(8) COMPOUND FINK



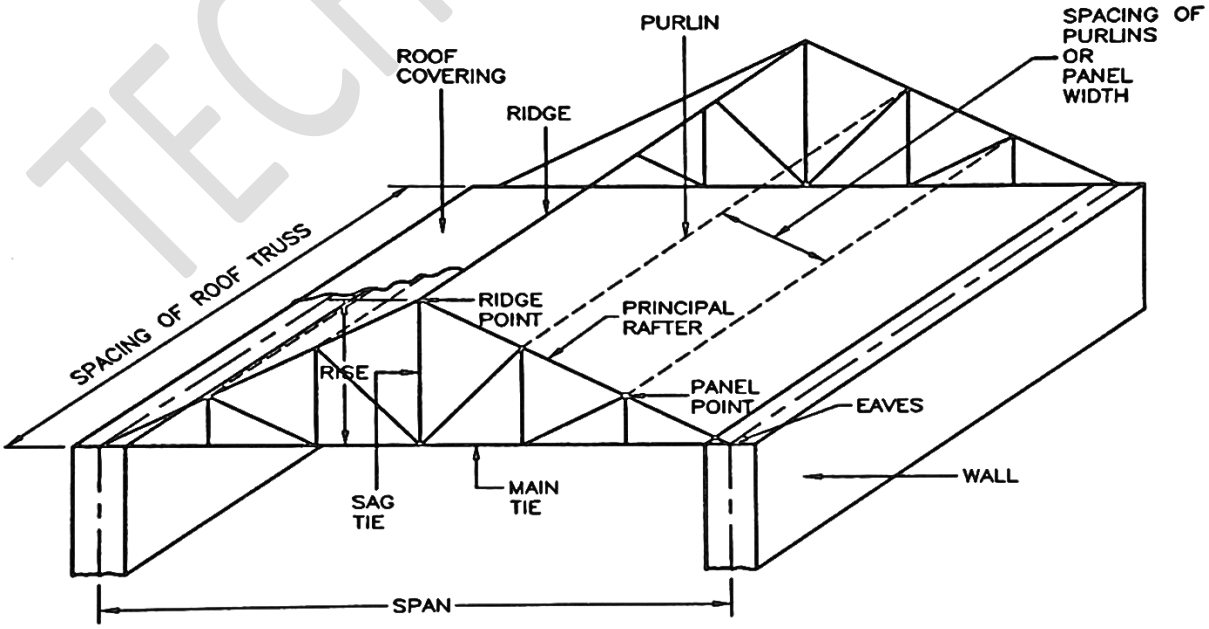
(9) WARREN TYPE



(10) HOW TYPE (FLAT)

* Components of Roof Truss :-

-> Span.
-> Spacing of roof truss.
-> Principle Rafter.
-> Main tie.
-> Sag tie
-> Ridge line.
-> Purlin
-> Panel
-> Panel points.
-> Web members.
-> Wind Bracings.
-> Roofing materials.
-> Pitch = Rise/Span
-> Eaves line



* Preliminary Calculations:-

→ Pitch = $\frac{\text{Rise}}{\text{Span}} = \frac{1}{3}$ to $\frac{1}{5}$

→ Angle of Roof truss (α):

$$\tan\alpha = \frac{R}{L/2}, \quad R = \text{Rise}, \; L = \text{Span}$$

→ Length of Principle rafter:

$$= \sqrt{R^2 + (L/2)^2}$$

→ Half Plan area = $\frac{\text{Span}}{2}$ × Spacing of Roof truss.

→ Half Slope area = length of P.R. × Spacing of R.T.

* Loads on Roof Truss:

→ Dead loads (IS: 875-1987, Part-1)
→ Live loads (IS: 875-1987, Part-2)
→ Wind loads (IS: 875-1987, Part-3)
→ Snow loads (IS: 875-1987, Part-4)
→ Earthquake loads (IS: 1893-2002)
→ Erection loads.
→ Loads due to temperature, creep, shrinkage, etc.

* Calculation of D.L. as per IS:875-1987, Part-1 :

(i) Weight of roof coverings :

Roofing material	Weight on slope area.
G.I. sheet	120 to 130 N/m^2
A.C. sheet	120 to 150 N/m^2

(ii) Weight of Purlins :

- weight of purlin = 60 to 90 N/m^2 on plan area.

(iii) Self weight of roof truss :

- Self weight of R.T. = $10\left[\frac{Span}{3}+5\right]$ N/m^2 on plan area.

(iv) Weight of wind bracings :

= 12 to 13 N/m^2 on plan area.

* Calculation of L.L. as per IS:875-1987, Part-2 :

→ L.L. on purlin = $750-20(\alpha-10)$ N/m^2 for $\alpha > 10^\circ$ on plan area

→ L.L. on purlin should not be less than 400 N/m^2.

→ For $\alpha < 10^\circ$, L.L. = 750 N/m^2 on plan area.

→ L.L. of roof truss = $\frac{2}{3}$ x L.L. on purlin.

* Calculation of W.L. as per IS:875-1987, Part-3 :

(i) Basic wind speed (V_b) :

- Given on Page-53 (IS: 875, 1987, Part-3)

(ii) Design wind speed (V_z) :

$V_z = V_b \times k_1 \times k_2 \times k_3$ m/sec. IS:875, Page-8. Pg-11.

(iii) Design wind pressure (p_z) :

$p_z = 0.6 (V_z)^2$

(iv) Wind load (F) :

$F = (C_{pe} - C_{pi}) \times A \times p_z$ → IS:875, Pg-13. Pg-16, Table-5

∴ C_{pe} = external pressure coefficient depends on θ and $\frac{h}{w}$ ratio.

∴ C_{pi} = internal pressure coefficient depends on percentage of opening. Pg-36, cl.6.2.3.2.