Industrial Building

* Required knowledge for planning & structured 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 back

* Factors to be considered on the basis of functional requirements:
  - Wide clear 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 the site.
- Soil condition.
- Waste disposal facilities.
- Accessibility of site.
- Transportation facility.
- Space for storage.
- Space for expansion.

Major Components of Industrial Building:
- Roof truss.
- Girts.
- Gable rafter.
- Gable column.
- Main column.
- Braced column.
- Purlins.
- Vertical bracings.
- Eave girders.
Types of Roof Trusses:

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

1. King Post (Span < 9m)
2. Queen Post (Span 6 to 9m)
3. Fan Type (Span 9 to 12m)
4. Fink Type (Span 6 to 9m)
5. How Type (Span 6 to 24m)
6. North Light Type (Span 5 to 8m)
7. Triangular (Span 6 to 30m)
8. Compound Fink (Span 12 to 18m)
9. Warren Type (Span 6 to 30m)
10. How Type (Flat) (Span 6 to 24m)
* Components of Roof Truss:

- Span.
- Spacing of roof truss.
- Principle Rafter.
- Main tie.
- Sag tie.
- Ridge line.
- Purlin
- Panel
- Panel points.
- Web members.
- Wind Bearings.
- 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 (\( \alpha \)):

\[ \tan \alpha = \frac{R}{L/2} \quad R = \text{Rise} \quad L = \text{Span} \]

→ Length of Principle Rafters:

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

→ Half Plan area = \( \frac{\text{Span}}{2} \times \text{Spacing of Roof truss} \)

→ Half Slope area = \( \text{Length} \times \text{P.R.} \times \text{Spacing of R.T.} \)

* Loads on Roof Truss:

→ Dead loads (CIS: 875-1987, Part-1)
→ Live loads (CIS: 875-1987, Part-2)
→ Wind loads (CIS: 875-1987, Part-3)
→ Snow loads (CIS: 875-1987, Part-4)
→ Earthquake loads (CIS: 1993-2002)
→ Erection loads
→ Loads due to temperature, creep, shrinkage, etc.
Calculation of O.L. as per IS: 875-1987, Part-1:

(i) Weight of roof coverings:
- Roofing material
  - G.I. sheet: 120 to 130 N/m²
  - A.C. sheet: 120 to 150 N/m²

(ii) Weight of Purlins:
- Weight of purlin = 60 to 90 N/m² on plan area.

(iii) Self weight of roof truss:
- Self weight of R.T. = \[10 \left(\frac{\text{Span}}{3} + 5\right)\] N/m² on plan area.

(iv) Weight of wind bracings:
- 12 to 13 N/m² on plan area.

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

- L.L. on purlin = 750 - 20 (\alpha - 10) N/m² for \(\alpha > 10°\)
  on plan area
- L.L. on purlin should not be less than 400 N/m².
- For \(\alpha < 10°\), L.L. = 750 N/m² 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 \( V_b \): 

(ii) Design wind speed \( V_z \):
\[ V_z = V_b \times k_1 \times k_2 \times k_3 \text{ m/sec} \quad \text{IS:875, Page-5, Pg-11.} \]

(iii) Design wind pressure \( p_z \):
\[ p_z = 0.6 \times (V_z)^2 \]

(iv) Wind load \( F \):
\[ F = C_{pe} - C_{pi} \times A \times p_z \quad \text{IS:875, Pg-13, Pg-16, Table-5} \]

\[ C_{pe} = \text{external pressure coefficient depends on } \Theta \text{ and } \frac{h}{d} \text{ ratio.} \]

\[ C_{pi} = \text{internal pressure coefficient depends on percentage of opening.} \quad \text{Pg-36, Ch.6.2.3.2.} \]