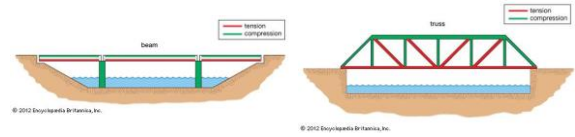


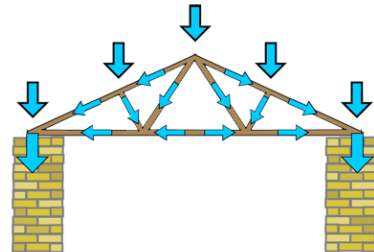
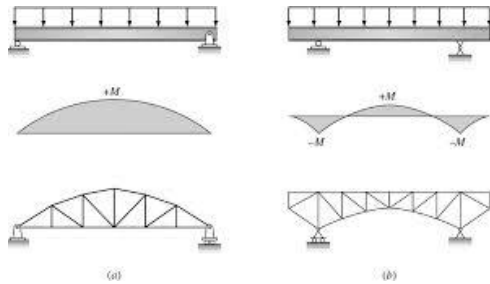
CE 320 : Steel Structures Design Sessional

Why Truss ?

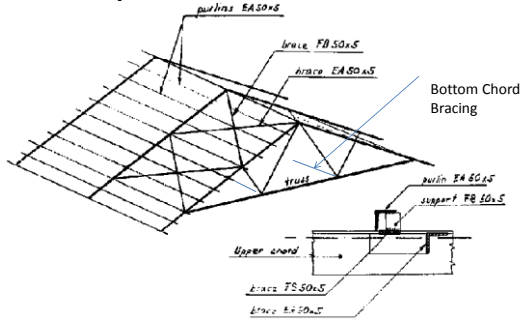
- Computer based analysis of steel structures
- roof truss and bridge truss :
 - design of members
 - design of joints



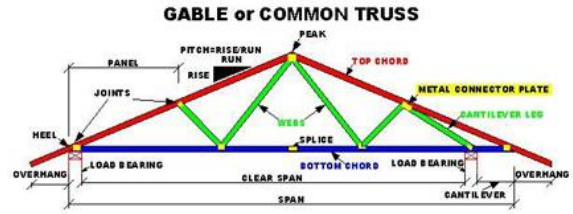
Bending Vs. Axial Load



System of Roof Truss

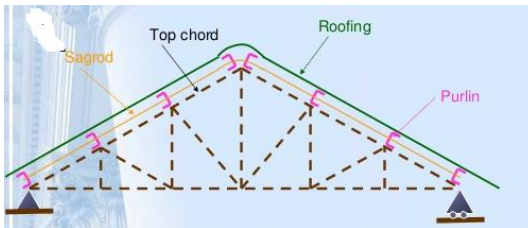


Components of Truss

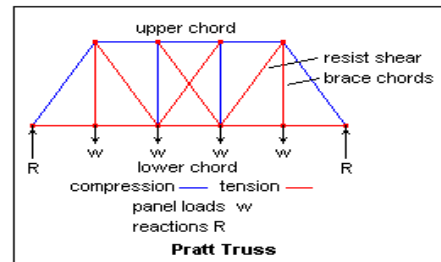


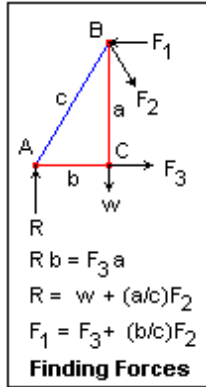
Bay ?

Components Truss System

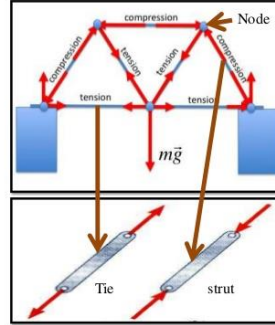


Force Transfer



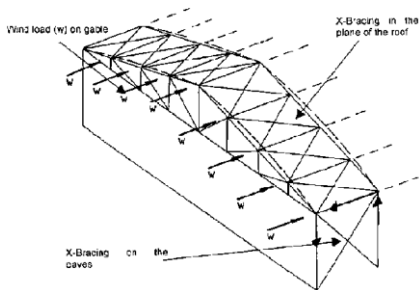


TRUSS – INTRODUCTION CONTINUE

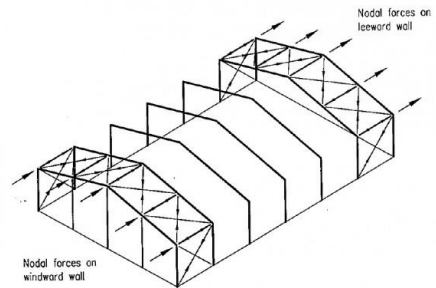


- External forces and reactions to those forces are considered to act only at the nodes.
- Moments (torques) are explicitly excluded because, and only because, all the joints in a truss are treated as pin joint or hinge joint .
- Result in forces in the members which are either tensile or compressive forces.

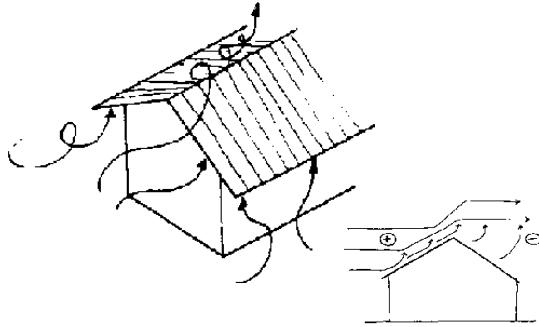
Bracing for Stability against Parallel Wind



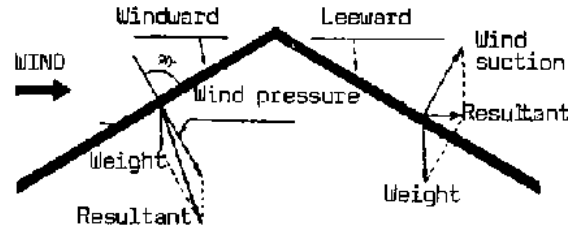
Effect of Parallel Wind



Wind Effect on Pitched Roof Structure



(Normal) Wind + Gravity



Steps for Truss Design

- a) Select general layout of truss members and truss spacing
- b) Estimate external loads to be applied including self weight of truss, purlins and roof covering, together with wind loads.
- c) Determine the critical (worst combinations) loading. It is usual to consider dead loads alone, and then dead and imposed load combined.

Member Design Chart

Member Type	Member	Length (ft)	Member Forces (kips)			Design Force (kips)	
			Dead Load	Wind Load (->)	Wind Load (<-)	Tension	Compression
Bottom Cord Members	L ₁ L ₁	20.00	30.69	-79.51	-90.93	30.69	-60.24
	L ₁ L ₂	20.00	30.69	-79.51	-90.93	30.69	-60.24
	L ₂ L ₃	20.00	24.55	-61.10	-68.49	24.55	-43.94
	L ₃ L ₄	20.00	24.55	-65.15	-64.44	24.55	-40.60
	L ₄ L ₅	20.00	30.69	-87.59	-82.85	30.69	-56.90
	L ₅ L ₆	20.00	30.69	-87.59	-82.85	30.69	-56.90
Top Cord Members	L ₆ U ₁	21.54	-33.05	91.96	97.68	64.63	-33.05
	U ₁ U ₂	21.54	-26.44	77.61	80.17	53.73	-26.44
	U ₂ U ₃	21.54	-19.83	63.27	62.66	43.44	-19.83
	U ₃ U ₄	21.54	-19.83	62.66	63.27	43.44	-19.83
	U ₄ U ₅	21.54	-26.44	80.17	77.61	53.73	-26.44
	U ₅ L ₆	21.54	-33.05	97.68	91.96	64.63	-33.05
Vertical Members	U ₁ L ₁	8.00	1.00	0.00	0.00	1.00	4
	U ₂ L ₂	16.00	3.46	-7.36	-8.98	3.46	-5.52
	U ₃ L ₃	24.00	10.82	-32.68	-32.68	10.82	-21.86
	U ₄ L ₄	16.00	3.46	-8.98	-7.36	3.46	-5.52
	U ₅ L ₅	8.00	1.00	0.00	0.00	1.00	4
Diagonal Members	U ₁ L ₂	21.54	-6.61	19.82	24.17	17.56	-6.61
	U ₂ L ₃	25.61	-7.86	23.57	28.74	20.88	-7.86
	U ₃ L ₄	25.61	-7.86	28.74	23.57	20.88	-7.86
	U ₄ L ₅	21.54	-6.61	24.17	19.82	17.56	-6.61

Bridge Truss



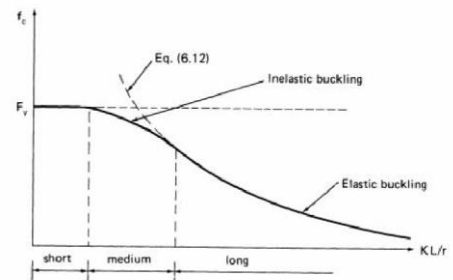
Member Design Tension

Member Design for Compression

$$F_a = \frac{F_y \left[1 - \frac{1}{2} \left(\frac{KL}{r} \right)^2 \right]}{\frac{5}{3} + \frac{3}{8} \left(\frac{KL}{r} \right) - \frac{1}{8} \left(\frac{KL}{r} \right)^3} \quad \text{if } \frac{KL}{r} \leq C_c$$

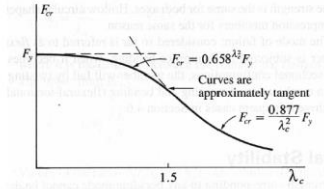
$$C_c = \pi \sqrt{\frac{2E}{F_y}} \quad P_a = F_a \times A$$

Compression member capacity



Compression Member
Design as per AISC LRFD

$$F_{cr} = \begin{cases} 0.658^{\lambda_c^2} F_y & \text{for } \lambda_c < 1.5 \quad \text{AISC EQ. (E2-2)} \\ \frac{0.877}{\lambda_c^2} F_y & \text{for } \lambda_c \geq 1.5 \quad \text{AISC EQ. (E2-3)} \end{cases}$$



Slender ness ratio
 $= \frac{kL}{r} \leq 200$ for comp. member
 $= \frac{kL}{r} \leq 300$ for tension member
 & bracings

Effective length factor, k=1

UNIT WEIGHT, DIMENSIONS, AND LENGTH WEIGHT OF EQUAL LEG STEEL AS PER BDS ISO 657-1:

LEG LENGTH (mm)	THICKNESS (mm)	AREA (mm ²)	UNIT MASS (Kg. / M)	LENGTH (Meter / Ton)	LENGTH (Feet / Ton)
25	3	141	1.11	903.46	2963.4
25	4	184	1.44	692.33	2270.8
30	3	171	1.34	744.96	2443.5

SECTIONAL PROPERTIES OF EQUAL LEG ANGLES AS PER BDS ISO 657-1:2008



Designation	Mass kg/m	Sectional Area cm ²	Dimensions			Distances of Centre of gravity			X-X=Y-Y	
			A mm	t mm	r root mm	Cx=Cy cm	Cu cm	Cv cm	Ix=Iy cm ⁴	Ixy cm ⁴
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
25 x 25 x 3	1.12	1.42	25	3	3.5	0.723	1.77	1.02	0.803	0.751
25 x 25 x 4	1.45	1.85	25	4	3.5	0.762	1.77	1.08	1.02	0.741
30 x 30 x 3	1.35	1.74	30	3	5	0.835	2.12	1.18	1.40	0.899
30 x 30 x 4	1.78	2.27	30	4	5	0.878	2.12	1.24	1.80	0.892