



TENSION MEMBERS



SNS COLLEGE OF TECHNOLOGY

AN AUTONOMOUS INSTITUTION

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COIMBATORE

DEPARTMENT OF CIVIL ENGINEERING

19CET3042-DESIGN OF STEEL STRUCTURES

III YEAR / VI SEMESTER

Unit 2 : TENSION MEMBERS



Definition : A structural member subjected to two pulling (tensile) force is called tension member.

Types of Tension Members

The tension members may be made of single structural shapes.

The standard structural shapes of typical tension members are:

- Angle section • Tee section
- Channel section • Box section
- I section • Tubular section

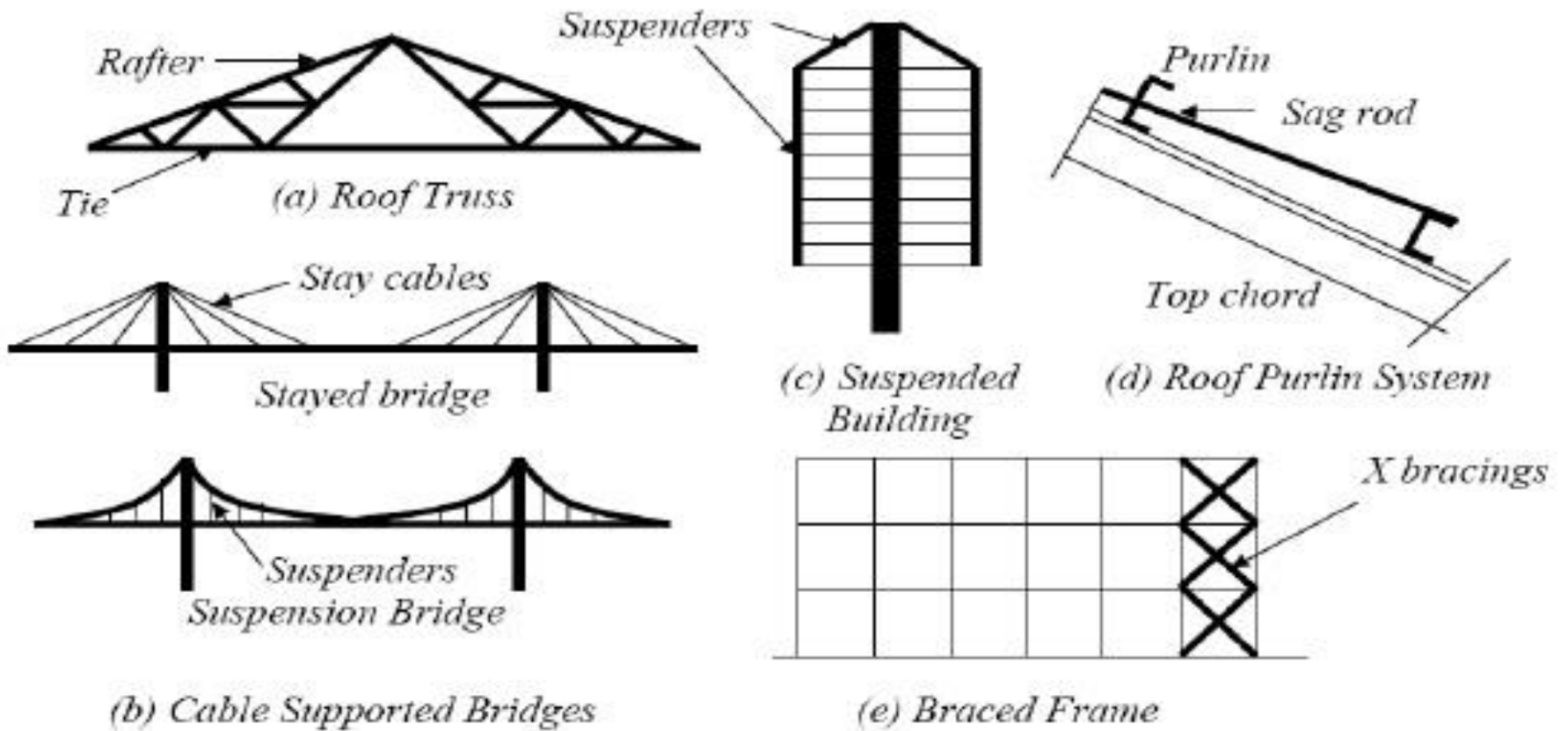
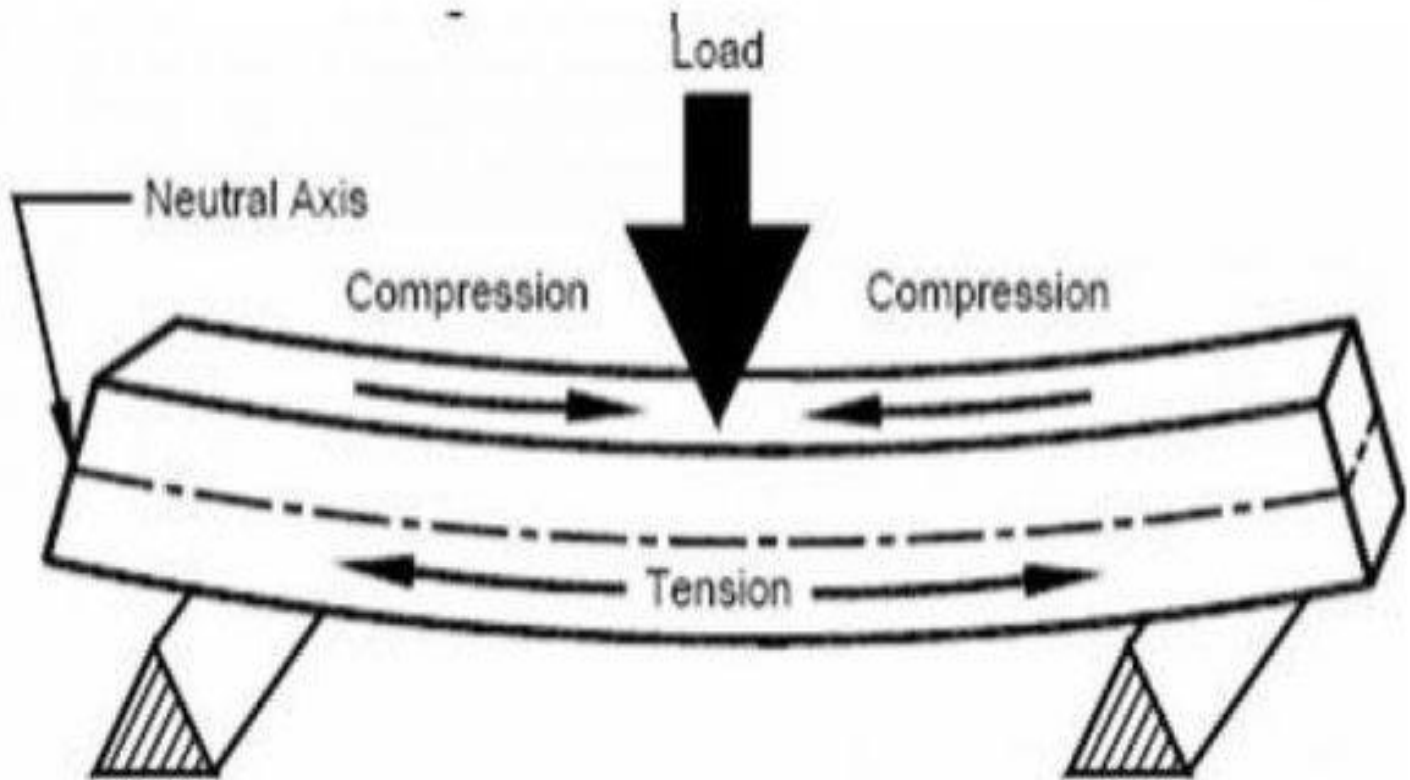


Fig. 1.1 Tension members in buildings and bridges





1. Single angle members are economical but the connection produces eccentric force in the member. These are generally used in towers and in trusses.
2. Double angle members are more rigid than single angle members. They are used in roof trusses.
3. In the members of bridge trusses structures single channel, single I-section, built-up channels, or built-up I-sections will be generally used.



SHEAR LAG

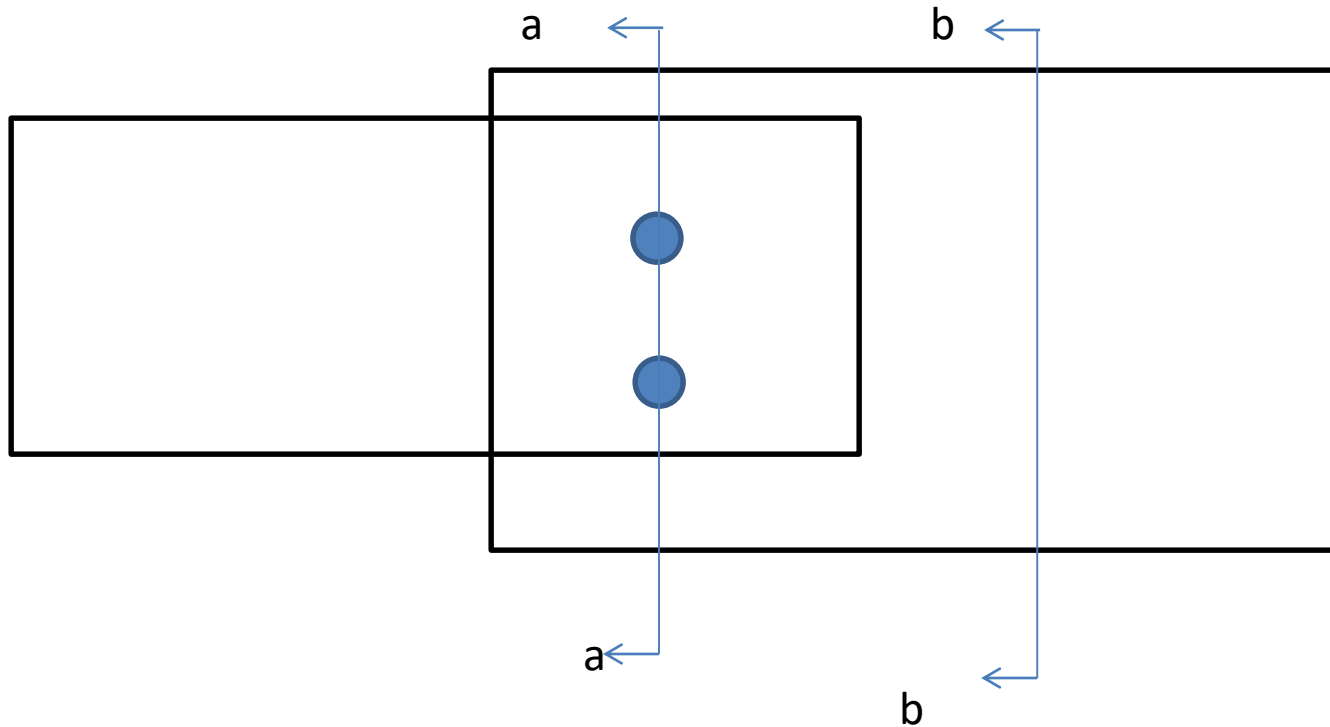
On account of shear strain, the longitudinal tensile or compressive bending stress in wide beam flanges diminishes with the distance from the web or webs; this stress diminution is called shear lag.



Modes of Failure (Pg 4)



Definition



A structural member subjected to two pulling (tensile) force is called tension member.

Net area (A_n)

Reduced area at a-a

Net area = Gross area - area of max no.holes

Gross area - unreduced area at b-b

Chain bolting – number of bolts in each row more , reduction in gross area more (less net area , reduces strength)

$$A_n = (b - nd_h)t$$

staggered bolting – number of bolts in each row reduced , reduction in gross area less (more net area , more strength)

$$A_n = (b - nd_h +)t$$

Types of tension members

1. Wires & cables

– Used as guy wires in steel stacks & tower

- Strand – It consists of individual wires wound helically around a central core.
- Wire rope – made of several strands laid helically around core.

2. Bars & rods

Simplest form of tension member used in bracing system

3. Plates & flat bars

used in transmission towers & foot bridges.

Used in column to keep members in their correct position eg lacing, battes, end plates.

4. Single & built up structural shapes

open sections – angles, channels and I section

built up section – double angle & channels joined with or without plates.

Closed section – circular, square, rectangular or hollow section.

Types of failures

1. Gross section yielding

Design strength due to yielding of gross section , $T_{dg} = \frac{A_g f_y}{\gamma_{m0}}$ (IS 800:32)

$$\gamma_{m0} = 1.1$$

2. Design strength due to rupture of critical section

for plates, $T_{dn} = 0.9 \frac{A_n f_y}{\gamma_{m1}}$, $\gamma_{m1} = 1.1$ (IS 800:32)

For single angles, $T_{dn} = 0.9 \frac{A_{nc} f_y}{\gamma_{m1}} + \beta \frac{A_{go} f_y}{\gamma_{m0}}$ (IS 800:33)

3. Design strength due to block shear

For plates & angles,

$$T_{db} = 0.9 \frac{A_{vg} f_y}{\sqrt{3} \gamma_{m0}} + 0.9 \frac{A_{tn} f_u}{\gamma_{m1}}$$

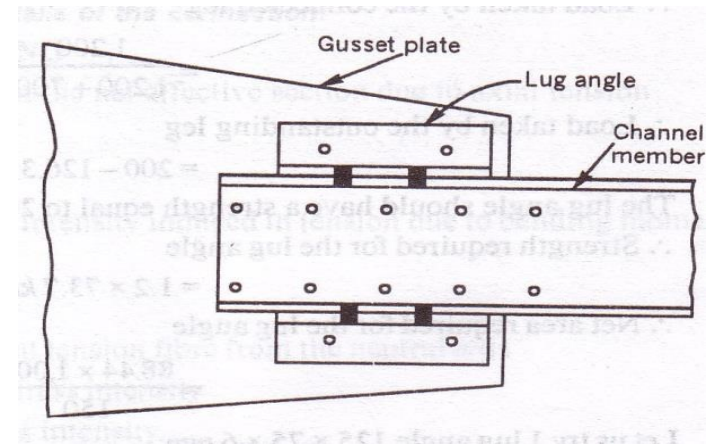
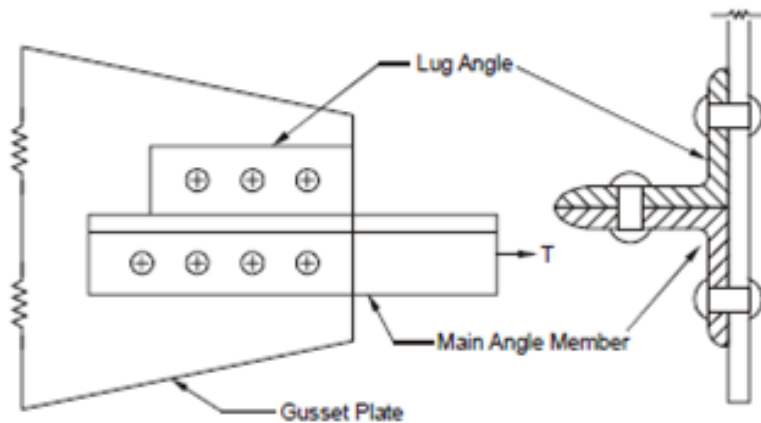
$$T_{db} = 0.9 \frac{A_{vn} f_y}{\sqrt{3} \gamma_{m1}} + 0.9 \frac{A_{tg} f_y}{\gamma_{m0}}$$

take lesser of two

LUG ANGLES

Definition of lug angles - To make the connection at joints, a certain length of tension members and that of the gusset plate is utilized.

Definition of gusset plate – It is a plate provided to make the connections at the place where more than one member is to be joined, eg joints of truss,



Tension splices

- Splices in tension are used to join two sections when a joint is to be provided i.e. these replace the members at the joint where it is cut.

