

Introduction.

Common steel structures -

Steel has high strength per unit mass. Hence it is used in constructing large column-free structures.

The following are the common steel structures in use.

- 1) Roof trusses for factories, Cinema halls, Auditoriums etc...
- 2) Trussed bents, Crane jibs, columns etc... in industrial structures.
- 3) Roof trusses & columns to cover platforms in Railway stations & bus stands.
- 4) Single layer or double layer domes for Auditoriums, exhibition halls, indoor stadiums etc.
- 5) Plate girder & truss bridges for railways & roads.
- 6) Transmission towers for microwave & electric power.
- 7) Water tanks, chimneys etc...

Advantages of steel structures -

1) High strength

Steel members have high strength per unit weight.

A steel member of a small section with little self weight is able to resist heavy loads which results in use of smaller sections & fewer columns in buildings.

2) Steel is a ductile material -

It is the property of steel which enables it to withstand extensive deformation without failure under high tensile stresses. Due to this property steel does not fail suddenly but gives evidence by large deflections.

3) Steels are tough -

They have both strength & ductility, thus there will be no visible damage even after fabrication & erection.

4) Steel is light in weight -

Steel can be easily handled & transported. Also pre-fabricated members can be frequently provided.

5) Steel is environment friendly -

It can be used for longer duration without the need of recycling resulting in saving of energy & avoidance of CO_2 [carbon dioxide] emitted during production process.

6) Steel can be transported easily due to its less self weight.

7) Steel provides gas & water tight structures.

8) Steel has long life if properly maintained.

9) Steel can be easily fabricated & erected. Additions & alterations can be done easily.

10) Steel has highest scrap value. Thus steel can be reused after dismantling.

- 11) Steel is the ultimate recyclable material.
- 12) Saving Space in Construction & Improving Aesthetic View
- 13) Speed of Construction.
- 14) Steel structures can be strengthened at any later time, if necessary, & it needs 'just welding' additional sections.
- 15) Additions & alterations can be made easily to steel structures.
- 16) Steel is the ultimate recyclable material.

Disadvantages of steel structures -

- 1) It is susceptible to corrosion.
- 2) Maintenance cost is high, since it needs painting to prevent corrosion.
- 3) Steel members are costly.
- 4) Steel structures need fire proof treatment, which increases cost.

Properties of structural steel.

The properties of steel required for engineering design may be classified as.

i) Physical properties.

ii) Mechanical properties.

i) Physical properties - P.No \rightarrow [12] IS 800-2007
[Clause 2.2.4 of IS 800-2007]

- a) Unit mass of steel $\rho = 7850 \text{ kg/m}^3$
- b) Modulus of elasticity $E = 2.0 \times 10^5 \text{ N/mm}^2$
- c) Poisson's Ratio, $\mu = 0.3$
- d) Modulus of Rigidity $G = 0.769 \times 10^5 \text{ N/mm}^2$
- e) Co-efficient of thermal expansion $\alpha_t = 12 \times 10^{-6} / ^\circ\text{C}$.

ii) Mechanical properties - P.No \rightarrow 12 [2.2.4.2]
 \rightarrow 13 & 14

- a) Yield stress $[f_y]$
- b) Ultimate stress $[f_u]$
- c) The max percentage elongation on a standard gauge length ϵ
- d) Notch toughness.

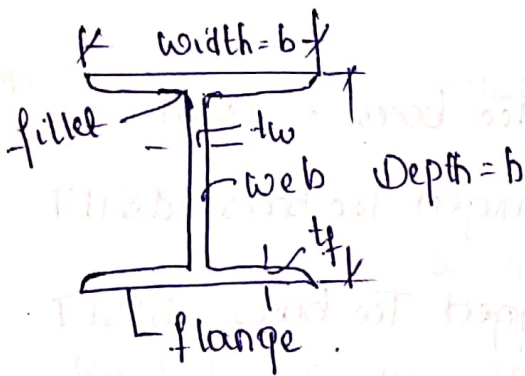
Rolled steel Sections -

Various types of Rolled steel Sections manufactured are listed below.

1) Rolled steel I-sections [Beam sections]

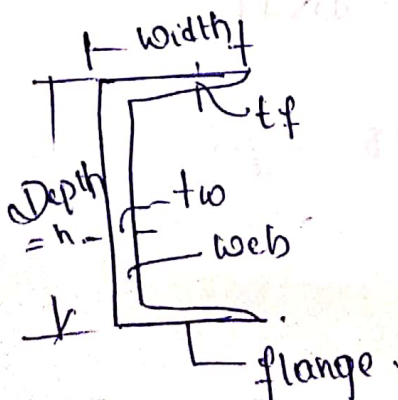
The following five series of rolled steel I-sections are manufactured in India.

- a) Indian standard Junior Beams - ISJB
- b) Indian standard Light Beams - ISLB
- c) Indian standard Medium Beams - ISMB
- d) Indian standard Wide-flange Beams - ISWB
- e) Indian standard Heavy Beams - ISHB.



Ex - ISWB 600 @ 1.423 kN/m
 ISHB 450 @ 0.855 kN/m.

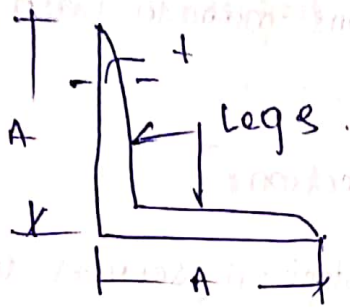
2) Rolled steel Channel Sections



- a) Indian standard Junior Channel - ISJC
- b) I.S. Light Channel - ISLC
- c) I.S. Medium weight Channel - ISMC
- d) I.S. Special Channel - ISSC

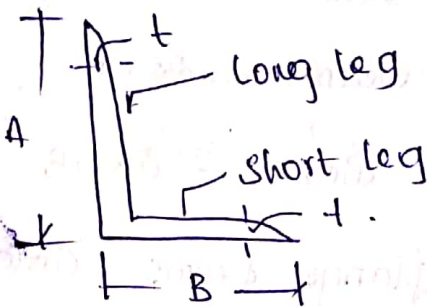
3. Rolled steel Angle Sections -

1) Indian standard Equal Angle - IS A.



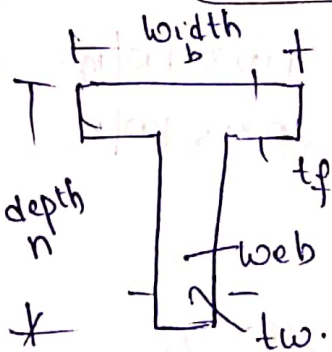
IS A 150 x 150 x 12 mm

2) Indian standard Unequal Angle - IS A.



IS A 150 x 115 x 10 mm.

4. Rolled steel Tee Sections -



a) I.S Normal Tee bases - IS NT

b) I.S Heavy flanged Tee bases - IS HT

c) I.S Special legged Tee bases - IS LT

d) I.S Light Tee bases - IS LT

e) I.S Junior Tee bases - IS JT

Ex - IS NT 60 @ 3.0/m.

5. Rolled steel Bars -

a) Indian Standard Round bars - ISRO

b) IS Square bars - ISRQ

ex - ISRO - 16, ISRQ 20

6) Rolled steel Tubes.

These sections are designated by their nominal bore sizes.

In each size there are three classes, namely Light, Medium & Heavy. The difference is due to difference in their thickness. Hence their cross sectional properties are also different.

ex - 40 mm tube \rightarrow 3 types of their sect properties
L, M, H [Light, Medium, Heavy]

7) Rolled steel plates -

Thickness \rightarrow 5, 6, 8, 10, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36,
40, 45, 50, 56, 63, 71, 80 mm.

widths \rightarrow 160, 180, 200, 220, 250, 280, 320, 355, 400,
500, 560, 630, 710, 800, 900, 1000, 1100, 1250,
1400, 1600, 1800, 2000, 2200, 2500 mm.

Eg - ISPL - 2000 x 1000 x 6mm

8) Rolled steel strips.

⑧ strips. Rolled steel strip is designated as RSST followed by width & thickness.

Width - 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 355, 400, 450, 500, 560, 630, 710, 800, 900, 1000 mm

Thickness - 0.8, 0.9, 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.5, 4.0, 4.5 mm

Eg - RSST 250 x 2.5 mm.

9) Rolled steel flats -

flats differ from strips in the sense that the thickness of flats is 5mm onward & their width is limited.

Width - 12, 16, 20, 25, 32, 40, 50, 63, 80, 100, 125, 160, 200, 250 mm

Thickness - 5, 5.5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 18, 20, 22, 25 mm.

Eg - 80 RSF 10 mm.
↳ wide thickness.