DESIGN OF STEEL STRUTURE
INTRODUCTION

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1. What are steel structures

- In steel structures, structural steel is the main load carrying material to transfer the load within them and to transfer load to the ground
- Ex: - I-Beam, Tee section, [- Channel section, Steel plate etc..,
- Steel concrete composite structures are also used in high-rise buildings but we are only going to study about steel structures in this paper

2.Common Steel structures

1. Roof truss in factories, cinema halls, railways etc.,
2. Crane girders, columns, beams
3. Plate girders, bridges
4. Transmission towers, water tank, chimney etc.,

Old Arch Bridge

Framed Building

Industrial Building

Truss Bridge

Suspension Bridge

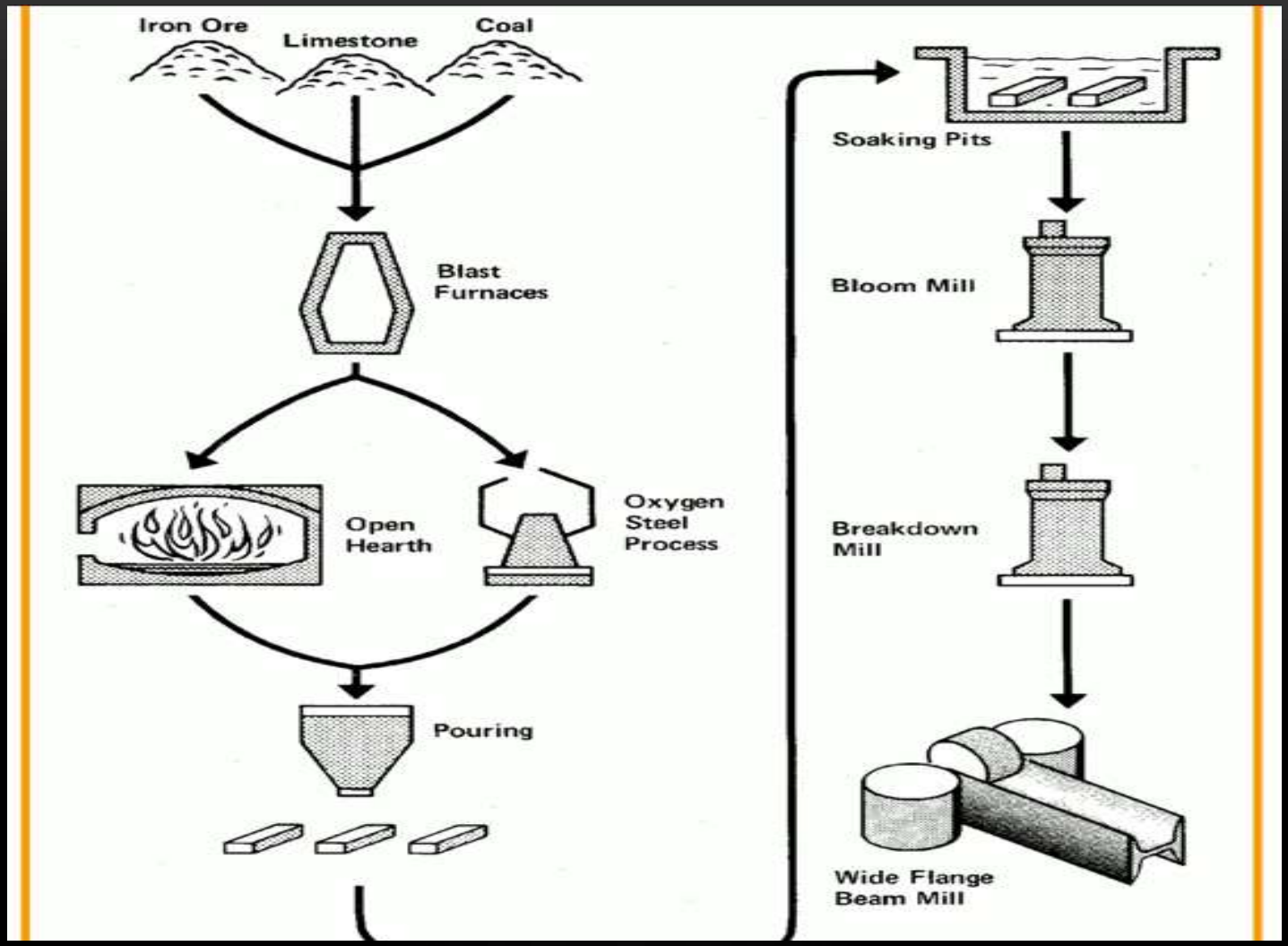
Cable Stayed Bridge

3. Steel

Steel making

- First iron is extracted from iron ores like haematite, limestone, magnetite in furnace
- Oxygen is passed through molten iron to remove carbon and impurities to make steel.
- Magnese is added to strengthen the steel
- Adding chrome, nickel, phosphorous can impart special properties in steel

- Semi finished products from the machine is hot rolled to different sections like bars, plates, angles, sections etc..,
- Adding carbon increases the tensile strength and hardness but lowers ductility and toughness
- In building we use structural steel which has low carbon of upto 0.1% to have ductility and yield.


Iron Ore
Limestone
Coal
Blast Furnaces
Open Hearth
Oxygen Steel Process
Pouring
Soaking Pits
Bloom Mill
Breakdown Mill
Wide Flange Beam Mill

4.Properties of steel

- Physical properties (IS800:2.2.4)
  1. r = 7850 kg/m3 = 78.5kN/m3
  2. E = 2x105 N/mm2
  3. Poison ratio μ = 0.3

Ductility

- Ability of material to change its shape without fracture

  Mild steel – high ductility

  High carbon steel – low ductility

Toughness & brittle fracture

- Ability of material to resist (absorb) impact load like earthquake load, machine load etc..,
- Requires both strength and ductility
- At low temp. steel fails on impact loading due to reduction in ductility and toughness called brittle fracture

Temp

At high temp strength reduces

Corrosion

Steel corrodes in moist air, sea water and acid. Adopt Painting, metallic coating, plastic coating, using corrosion resistant steel to resist corrosion

Hardness

- Resistance of the material to intentions and scratching
- Brinell harness, rockwell hardness number are used to measure hardness

Fatigue

- Damage of material to cyclic loading
- Occurs due to moving loads, vibration in bridge

Residual stress

- Latent stress present in the steel sections due to uneven heating and cooling during steel making

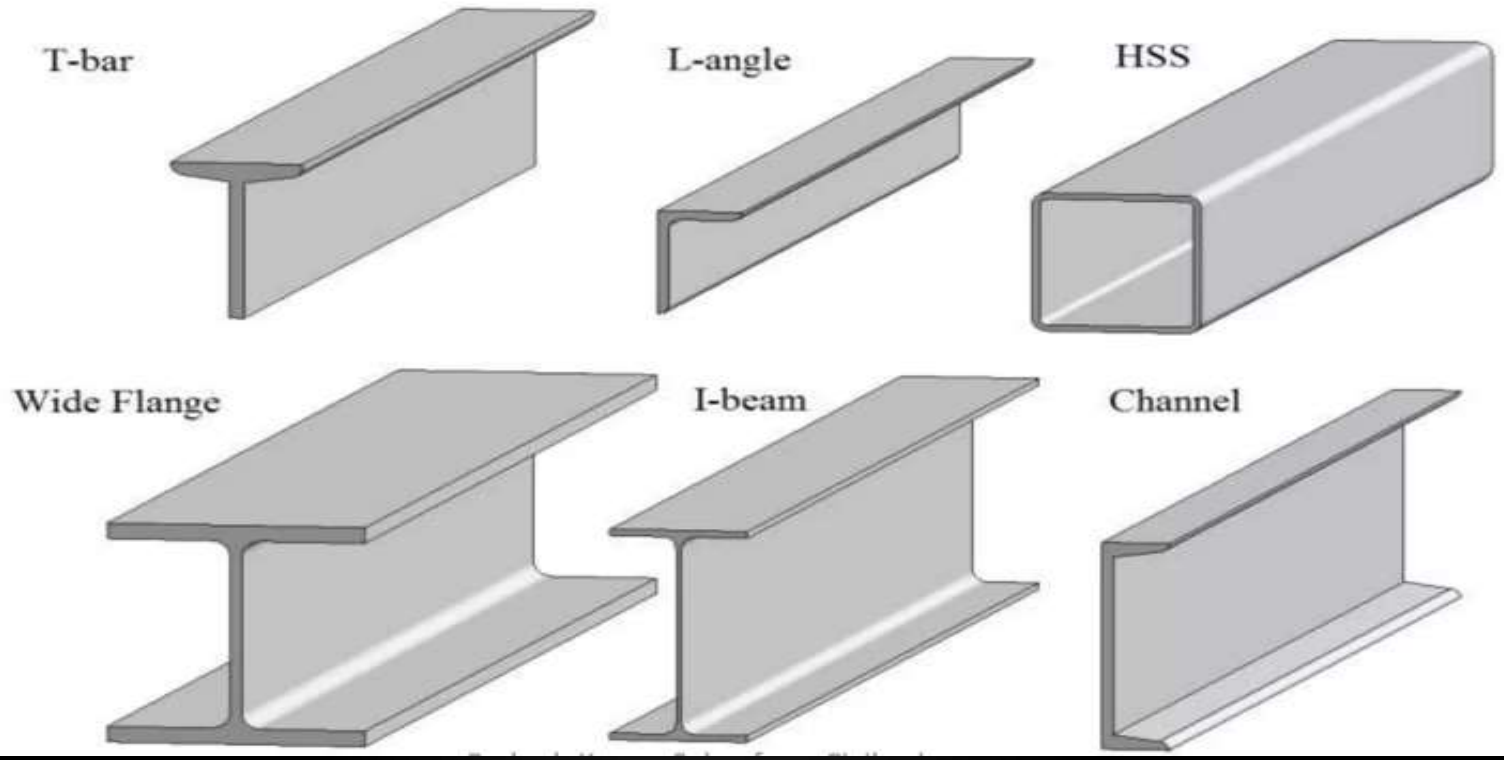
Stress concentration

- Under loading, stress is concentrated at places at abrubt change in geomentry like holes bolts

Steel sections

- Steel is rolled to a required shape during fabrication.
- Commonly available
  - I section – I
  - Tee section – T
  - Channel sections – [
  - Angle sections – l
  - Steel bars , tubes, plates, sheets, strips

Common Steel members



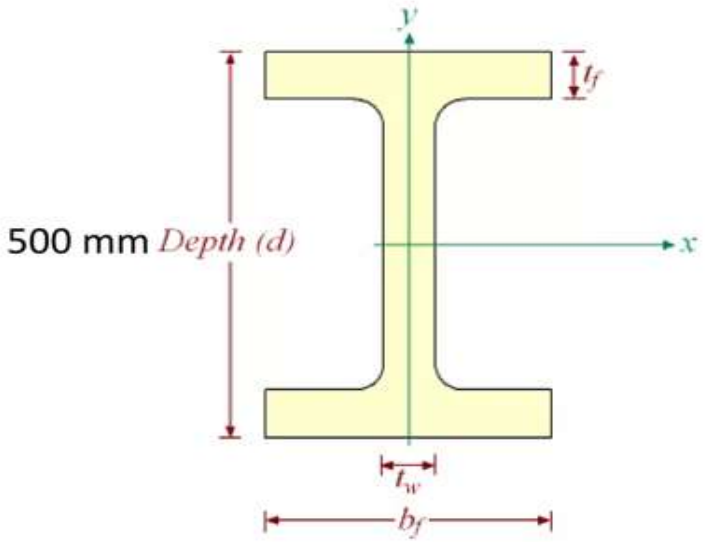
Rolled steel I - section

- ISJB – Indian standard junior beam
- ISLB – " Light beam
- ISMB - " Medium beam
- ISWB - " Wide flange beam
- ISHB - " Heavy beam

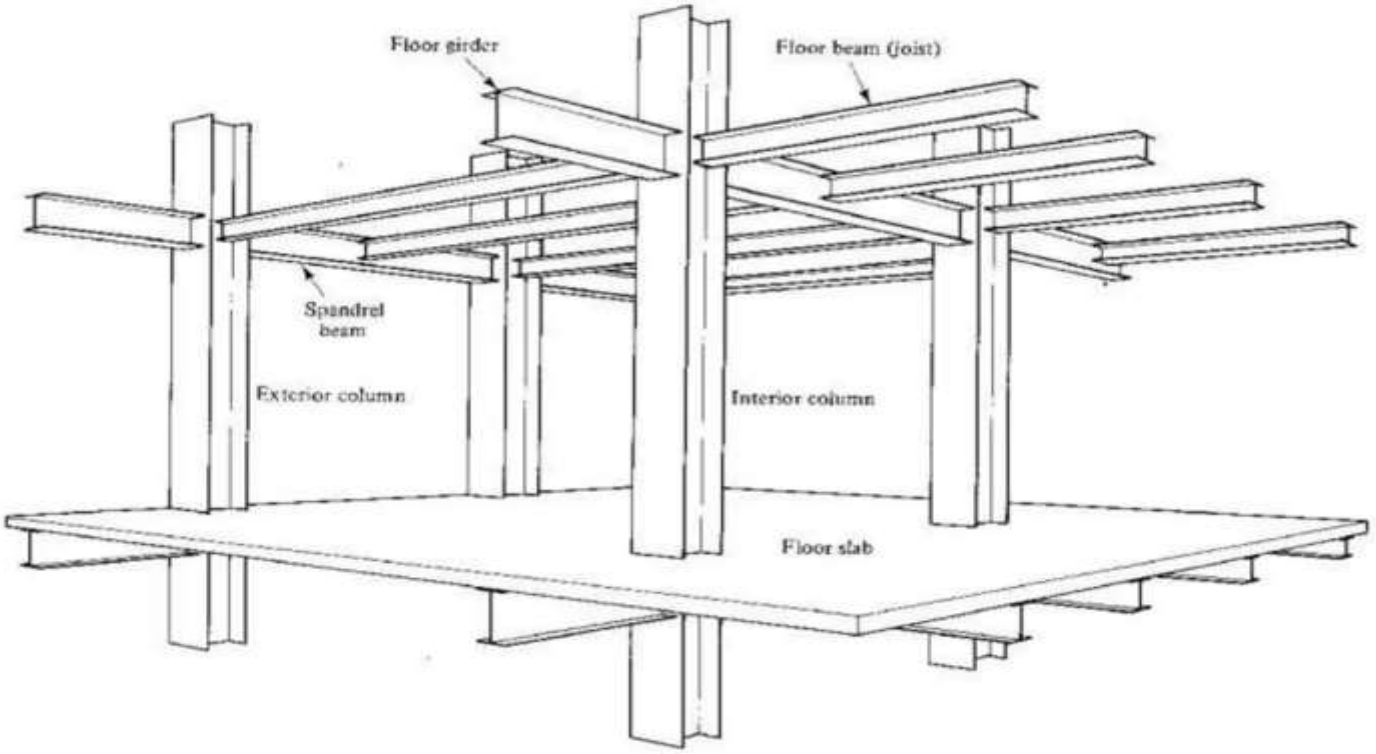
Rolled steel I - section

- Example = ISMB 500 & 0.852 kN/m

Depth **Weight per Unit length**



Beam – Column construction



2. Adv. & Disadv.

Advantages

- High comp. & tensile strength per unit weight hence low construction weight, saves space
- Good aesthetic view
- Good quality and durability
- Very high speed of construction
- Reusability and scrap value – env. Friendly
- Better solution to cover large span and tall structures

Disadvantages

- Highcost – Initial
- Corrosion
- Low fire resistance

Rolled steel Channel - section

- ISLC, ISMC, ISLC, ISSC(Indian standard special section)
- Example ISMC 300 & 0.351 kN/m