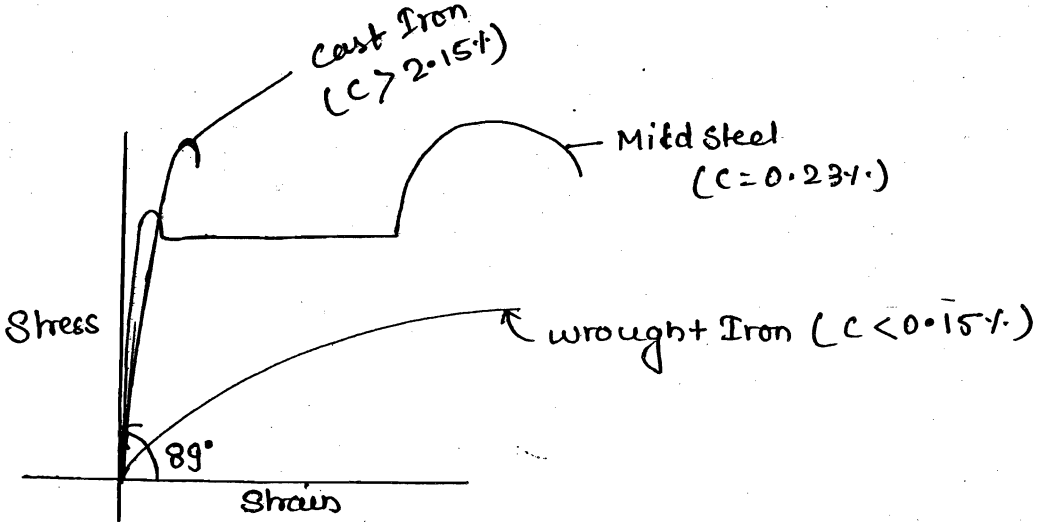
Steel Design.



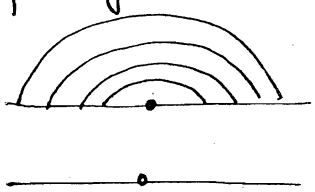
* Concrete was the first Material to be used as a construction material
* Concrete has good strength in compression as compared to tensile strength of the Concrete.
* Note: Concrete has fine cracks and voids.
* Carbon increases brittleness and Resisting capacity in the material. Mild steel has carbon contained less than cast iron and greater than wrought iron. Hence mild steel shows properties of both the material. i.e high Resisting capacity from cast iron and ductility from wrought iron.

* Wrought Iron → Large deformation.
* Cast Iron → Sudden failure.

* Corrosion is the only problem with the mild steel.
* volume of Fe_2O_3 is much higher as compared to volume of FeO but this does not happen in the case of stainless steel which contains chrominum
* Aluminium can be used for the construction purpose but it is uneconomical for the same Resisting capacity.

$$FeO \xrightarrow{O_2 + H_2O} Fe_2O_3$$

$$CrO \xrightarrow{O_2 + H_2O} Cr_2O_3.$$



$E_{AL} \approx \frac{E_S}{3}$ $\quad E_S = 2 \times 10^5 N/mm^2$ $\quad E_{AL} = 0.69 \times 10^5 N/mm^2$.

- Factor of Safety is combinedly defined for the variation of dead load, live load and Material properties.

Note
* yield stress is the stress at which there is definite deformation in the material (Servicibility) (Deformation Criteria).

In Mild Steel three theories are Generated:-

i) Yield Stress | elastic | Working stress method (WSM)

⇒ WSM provide highly safe design but design are uneconomical

ii) Ultimate load Method / Plastic load method

⇒ This method provide highly economical design but does not satisfy servicibility criteria. (deformations).

Margin of Safety will be less in plastic load method as compared to elastic load method.

Limit State Method (LSM)

* LSM Rectifies WSM by introducing partial safety factor for loads (γ_f).
LSM is based on probablistic approach.

* Endurance Limit is defined for ~~fatigue~~ fatigue phenomena (cyclic loading) - Residual Stress

* Endurance Limit for mild steel is 186 N/mm².

Permissible Stresses in WSM.

$$\text{Permissible stress} = \frac{f_y}{FOS}$$

$f_y = 250 N/mm^2$

E.L = 186 N/mm²

0.75 fy → Permissible Bearing Stress = 185 N/mm² (→ column / Base Plate.)

0.66 fy → Permissible Bending Stress = 165 N/mm²

0.6 fy → Permissible Tensile/ Compressive Stress = 150 N/mm²

0.45 fy → Permissible Max^m shear stress = 110 N/mm²

0.4 fy → Permissible Avg shear stress = 100 N/mm².