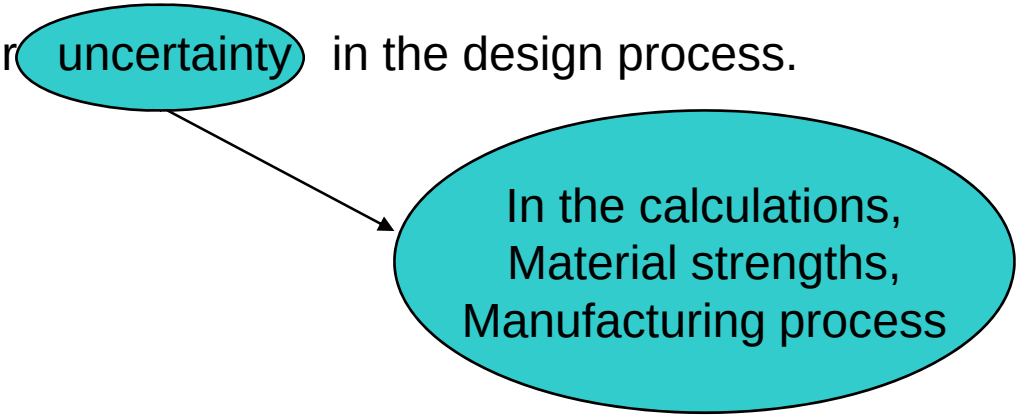
Factor of Safety (Safety Factor)

Eg: If a component needs to withstand a load of 100 N and a FoS of 3 is selected then it is designed with strength to support 300 N.

Is used to provide a **design margin** over the **theoretical design capacity** to allow for uncertainty in the design process.



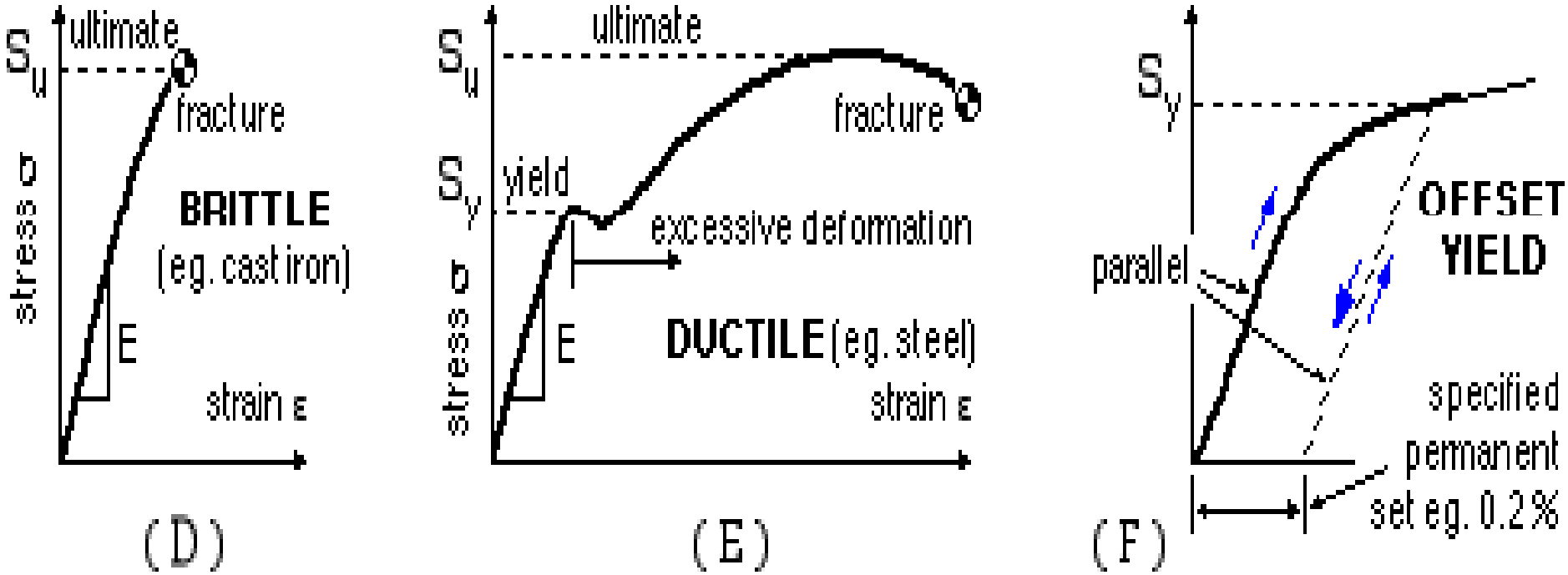
$$\text{FoS} = \frac{\text{Strength of the component (Max load)}}{\text{Load on the component (Actual load)}}$$

Factor of Safety (Safety Factor)

FoS (*Based on yeild strength*)	Application
1.25 – 1.5	Material properties known in detail Operating conditions known in detail Load and the resulting stresses and strains are known to a high degree of accuracy Low weight is important
2 – 3	For less tried materials or Brittle materials under average conditions of environment, load and stress
3 – 4	For untried materials under average conditions of environment, load and stress Better known materials under uncertain environment or uncertain stresses

Above FoS should consider fatigue strength, Impact shock forces, Vibration, Brittle materials

Factor of Safety (Safety Factor)



$$\text{FoS} = \frac{\text{Strength of the component } (S_u, S_y)}{\text{Stress in the component due to the actual load}}$$

Factor of Safety (Safety Factor)

- How critical that component is
- The cost factor (cost of material, manufacture)
- Whether failure could cause serious injury or death (a steam boiler or pressure vessel would use 8 – 10 FoS)
- Unknown stresses in the manufacturing process (casting would use 10 – 14 FoS)
- Environmental conditions (used in harsh environment or not)
- Knowledge of the environment
- Knowledge of the properties of the material used
- Knowledge of the loads (tension, compressive, shear, bending, cyclic loads, impact loads etc)
- Weight factor (aerospace 1.5 – 3 to reduce weight but strict quality control)
- Quality control, maintenance