RC Beam Design

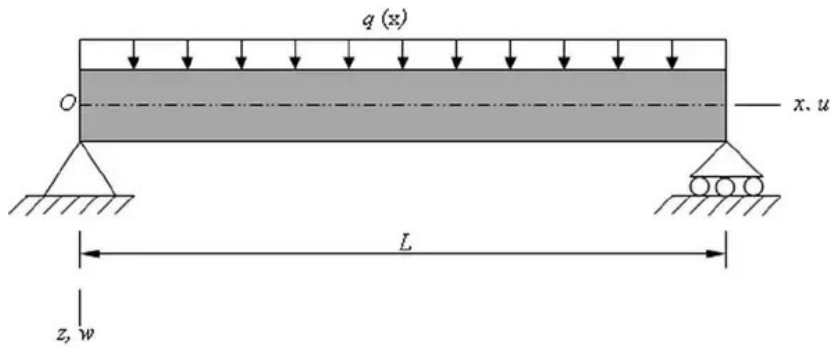
Design load and Moment

Moment design for simply Supported beam

Loading

Safety Factor	
Live Load	**1.5**
Dead Load	**1.35**

q= Live load + Dead load



Design Moment

$$M_{design} = \frac{ql^2}{8}$$

q- Design load

l- Length of the beam

Section Design for Moment

The web calculator will calculate the design moment and provide the required amount of steel section. The bending moment capacity of a beam is a result of the compression and tension couple force at a distance of lever arm z.

Singly reinforced concrete design

1. K and K'

K = M/ (bd^2f_{ck})

K'= 0.6 δ - 0.18$δ^2$ - 0.21 (δ=1.0 means no redistribution and δ = 0.8 means 20% moment redistribution)

Check if K ≤ K' (No compression steel needed)

K ≥ K' (Compression steel needed double reinforced)

2. Lever arm

$$Z = \frac{d}{2}[\,1 + \sqrt{1 - 3.53\,K}] \leq 0.95d^*$$

3. Steel area A_s

$$A_s = \frac{M}{f_{yd}Z}$$

4. Reinforcement requirement

- Minimum reinforcement requirements

$$A_{s,min} \geq \frac{0.26 f_{ctm} b_t d}{f_{yk}} \geq 0.0013 b_t d$$

- Maximum reinforcement requirement ; $A_{s,max} \leq \ 0.04 A_c$

Check min spacing between bars $> \emptyset_{bar} > 20 > A_{gg} + 5$

Doubly reinforced concrete design

1. K ≥ K' (Compression steel needed double reinforced)

2. . Lever arm

$$Z = \frac{d}{2}[1 + \sqrt{1 - 3.53\,K'}] \leq 0.95d^*$$

3. Excess moment

$$M' = bd^2 f_{ck}\,(K - K')$$

4. Compression steel required from

$$A_{s2} = \frac{M'}{f_{yd}(d - d_2)}$$

5. Tension steel required

$$A_s = \frac{K' f_{ck} b d^2}{f_{yd}\, z} + A_{s2}$$

6. Reinforcement requirement

Maximum reinforcement provided; $A_{s,max} \leq 0.04 A_c$

Check min spacing between bars $> \emptyset_{bar} > 20 > A_{gg} + 5$