FAQs

1. An RC beam 300mm wide and 700mm deep overall, is reinforced with 3 Nos. of 20mm dia bars. The centres of bars are 50mm from the underside of the beam. The maximum stresses are not to exceed 7 N/mm^2 for concrete and 190 N/mm^2 for steel. Find the moment of resistance and the safely distributed load, the beam can carry. The span is 6m.

Solution:

Given

b = 300mm
D = 700mm
Effective cover = 50mm
d = 700 – 50 = 650mm
A_{st} = 942mm^2
σ_{cbc} = 7 N/mm^2
σ_{st} = 190 N/mm^2
M_r = ?

To find x_c

$$\sigma_{cbc} / \sigma_{st}/m = x_c / d\text{-}x_c$$

x_c = 214.08mm

To find x

$$bx.x/2 = mA_{st}(d\text{-}x)$$

x = 195.115mm

here $x < x_c$; it is under reinforced section

To find M_r

$$M_r = T \text{ X } z = A_{st}\sigma_{st}\,(d\text{-}x/3)$$

M_r = 104.7 kNm

$M_r = M = wl^2/8 = 104.7$ kNm

w = 23.27 kN/m

self wt. of beam = 0.3 x 0.7 x 25 = 5.25 kN/m

Net wt. on beam = 23.27 – 5.25 = 18.02 kN/m

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2. An RC beam 250 x 500mm overall in section, is reinforced with four 22mm dia bars at the bottom with a cover of 40mm from the centre of reinforcement. The effective span is 5m. Find the concentrated load the beam can support at the support at the centre. Take σ_{cbc}=5 N/mm^2 σ_{st}=190 N/mm^2.

Solution:

Given

b = 250mm

D = 500mm

Effective cover = 40mm

d = 500 – 40 = 460mm

A_{st} = 1520mm^2

σ_{cbc} = 5 N/mm^2

σ_{st} = 190 N/mm^2

M_r = ?

To find x_c

$$\sigma_{cbc} / \sigma_{st}/m = x_c / d\text{-}x_c$$

x_c = 156.44mm

To find x

$$bx.x/2 = mA_{st}(d\text{-}x)$$

x = 230mm

here $x > x_c$; it is over reinforced section

To find M_r

$$M_r = C \times z = bx\, \sigma_{cbc}/2\, (d\text{-}x/3)$$

M_r = 58.05 kNm

Self wt. of beam w_s = 0.25 x 0.5 x 25 = 3.125 kN/m

$M_s = w_s l^2/8 = 9.765$ kNm

Net Moment M = 58.05 – 9.765 = 48.285 kNm

M = 48.285 = wl/4

Net load on beam w = 38.628 kN.

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3. The cross section of a rectangular beam has to resist a bending moment of 75 kNm. If the beam is 250mm wide and the permissible stresses in concrete and steel are 5 N/mm^2 and 190 N/mm^2 respectively, find the effective depth and tensile reinforcement required.

Solution:

Given

M_r = 75 kNm

b = 250mm

σ_{cbc} = 5 N/mm^2

σ_{st} = 190 N/mm^2

d = ?

A_{st} = ?

Assuming a balanced section

To find x_c

$$\sigma_{cbc} / \sigma_{st}/m = x_c / d\text{-}x_c$$

x_c = 0.329d

z = (d-x/3) = 0.89d

To find d

$$M_r = C \times z = bx\, \sigma_{cbc}/2\, (d\text{-}x/3)$$

M_r = $183.86d^2$ = 75 kNm

d = 639.22mm = 640mm

To find A_{st}

$$M_r = T \times z = A_{st}\sigma_{st}\, (d\text{-}x/3)$$

A_{st} = 693 mm^2