FAQs

1. An RC beam 300 x 600mm effective dimensions is provided with tensile and compressive reinforcement of 1256 each. The compressive steel is placed 40mm from the top edge of the beam. If σ_{cbc}=7 N/mm^2 and σ_{st}=190 N/mm^2, find the moment of resistance of the beam.

   Solution:

   Given

   b = 300mm
   d = 600mm
   A_{st} = 1256mm^2
   A_{sc} = 1256mm^2
   d^1 = 40mm
   σ_{cbc} = 7 N/mm^2
   σ_{st} = 190 N/mm^2
   M_r = ?

   To find x_c

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

   x_c = 197.61mm

   To find x

   $$\boldsymbol{bx.x/2 + (1.5m\text{-}1)\, A_{sc}\, (x\text{-}d^1) = m\, A_{st}(d\text{-}x)}$$

   x = 164.778mm

   To find actual σ_{cbc}

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

   σ_{cbc} = 5.4 N/mm^2 < 7 N/mm^2

   To find actual $\sigma_{cbc}{}^1$

   $\boldsymbol{\sigma_{cbc}{}^1 = \sigma_{cbc}\, (x\text{-}d^1) / x}$

   = 4.08 N/mm^2

   To find M_r

   M_r = $\boldsymbol{bx\, \sigma_{cbc}/2\, (d\text{-}x/3) + (1.5m\text{-}1)\, A_{sc}\sigma_{cbc}{}^1(d\text{-}d^1)}$

   = 127.26 kNm

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2. An RC beam 250 x 550mm overall in section, is reinforced with four 25mm dia bars on tension side and three 22mm dia bars on compression side. The bars are at 50 and 40 mm centres from bottom and top edges of the beam respectively. Calculate the moment of resistance of the beam if σ_{cbc}=5 N/mm^2 σ_{st}=140 N/mm^2.

   Solution:

   Given

b = 250mm
D = 550mm
d = 500mm
A_{st} = 1963.50mm^2
A_{sc} = 1140.40mm^2
d^1 = 40mm
σ_{cbc} = 5 N/mm^2
σ_{st} = 140 N/mm^2
M_r = ?

To find x_c

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

x_c = 199.95mm

To find x

$$bx.x/2 + (1.5m-1) A_{sc} (x-d^1) = m A_{st}(d-x)$$

x = 206.41mm

σ_{cbc} is known.

To find $\sigma_{cbc}{}^1$

$$\sigma_{cbc}{}^1 = \sigma_{cbc} (x-d^1) / x$$

= 4.0 N/mm^2

To find M_r

$$M_r = bx \sigma_{cbc}/2 (d-x/3) + (1.5m-1) A_{sc}\sigma_{cbc}{}^1(d-d^1)$$

= 112.14 kNm