FAQs

1. An RC beam 300mm x 500mm effective, is reinforced with 804mm^2 and 1520mm^2 of steel at the top and bottom respectively. Find the M_U the beam using M20 and Fe415 as materials. d' = 33mm.

   To find $x_{u,lim}$

   $$\mathbf{x_{u,lim} = 0.479d}$$

   $$\mathbf{x_{u,lim} = 239.50mm}$$

   To find strain at d^1 from top

   $$\text{Strain at } d^1 \text{ from top} = \mathbf{0.0035\ (x_{u,lim} - d^1) / x_{u,lim}}$$

   $$= \mathbf{0.00302}$$

   To find stress f_{sc} at d^1 from top

   $$\mathbf{f_{sc} = 354.08\ N/mm^2}$$

   To find stress f_{cc} at d^1 from top

   $$\mathbf{f_{cc} = 0.446\ f_{ck}}$$

   $$= \mathbf{8.92\ N/mm^2}$$

   To find M_u

   $$\mathbf{M_U = 0.36 f_{ck} x_{u,lim} b\ (d - 0.416 x_{u,lim}) + A_{sc}\ (f_{sc} - f_{cc})\ (d - d')}$$

   $$\mathbf{M_U = 181.14\ kNm.}$$

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2. An RC beam 200mm x 300mm effective, is constructed with M20 and Fe415 as materials. d' = 30mm. Find the steel required, of the factored moment on beam is 74kNm.

   To find $M_{u,lim}$

   $$\mathbf{M_{u,lim} = 0.138 f_{ck} b d^2}$$

   $$\mathbf{M_{u,lim} = 49.68\ kNm}$$

Here $M_u > M_{u,lim}$; hence it is doubly reinforced section.

To find A_{st1} required for a balanced section

$$\mathbf{A_{st1}} = \mathbf{0.36 f_{ck} b}\ x_{ulim} / \mathbf{0.87 f_y}$$

$$\mathbf{A_{st1} = 573.31\ mm^2}$$

To find M_{u1}

M_{u1} = $M_u - M_{ulim}$

= **24.32 kNm**

To find A_{st2}

M_{u1} = $\mathbf{0.87 f_y A_{st2} (d-d')}$

$\mathbf{A_{st2}}$ = **249.975 mm²**

To find total A_{st}

A_{st} = 822.61 mm²

To find strain at d^1 from top

Strain at d^1 from top = $\mathbf{0.0035 (x_{u,lim} - d^1) / x_{u,lim}}$

= **0.002769**

To find stress f_{sc} at d^1 from top

$\mathbf{f_{sc}}$ = **353 N/mm²**

To find stress f_{cc} at d^1 from top

$\mathbf{f_{cc}}$ = $\mathbf{0.446 f_{ck}}$

= **8.92 N/mm²**

To find $\mathbf{A_{sc}}$

M_{u1} = $\mathbf{A_{sc} (f_{sc} - f_{cc}) (d-d')}$

$\mathbf{A_{sc}}$ = **261.78 mm²**