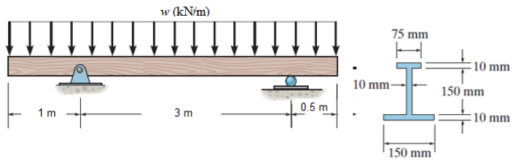
Question: The beam with cross-section shown carries a uniformly distrib…

The beam with cross-section shown carries a uniformly distributed load of intensity w over its entire length. Determine w if $f_{bt} \leq 40$ MPa and $f_{bc} \leq 80$ MPa. (



Hello guys, can you show complete solution for this problem. Thank you

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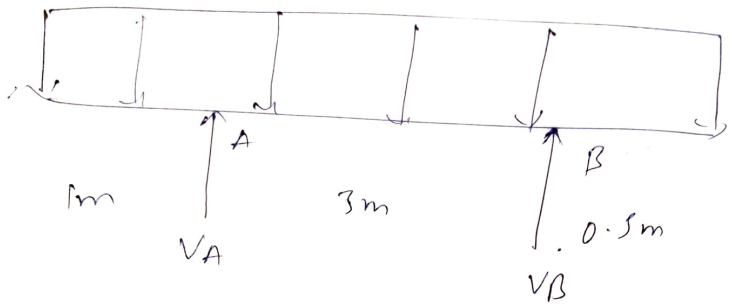
Expert Answer

Anonymous answered this
564 answers

Was this answer helpful? 1 0

Below is the complete solution. Taking clockwise moment as positive and anti-clockwise moment as negative.



$$\Sigma M_A = 0$$

$$-V_B \times 3 + w \times 3.5 \times \frac{3.5}{2} - w \times 1 \times \frac{1}{2} = 0$$

$$-3V_B + 6.125w - 0.5w = 0$$

$$V_B = \frac{5.625w}{3}$$

$$V_B = 1.875w$$

$$\Sigma f_y = 0$$

$$V_A + V_B = w \times (4.5)$$

$$V_A = 2.625w$$

BM maximum can occur at

A or B or Between A & B

$$(BM)_A = -w \times 1 \times \frac{1}{2} = -\frac{w}{2}$$

(BM) Between A & B where shear force is zero

Location of zero shear force

$$V_A - w \times (1+x) = 0$$

$x = 1.625$

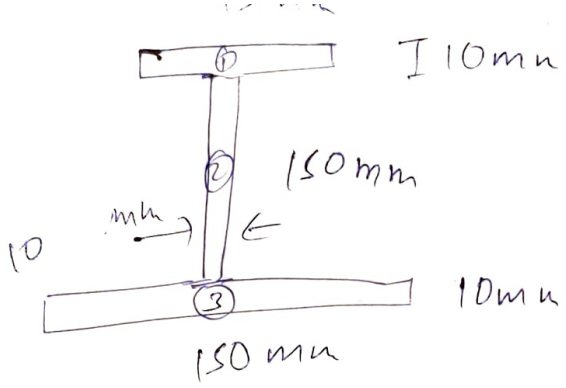
$(BM)_{x=1.625} = V_A \times 1.625 - w \times \frac{(1+1.625)(1+1.625)}{2}$

$= 2.625w \times 1.625 - \frac{2.625 \times 2.625\, w}{2}$

$(BM)_{x=1.625} = 0.82w$

(Max) bending moment = $0.82w$

It is positive so sagging moment will occur & bottom tension & Top compression.



$$A_1 = 75 \times 10 = 750\ mm^2$$

$$Y_1 = 10 + 150 + \frac{10}{2} = 165mm.$$

$$A_2 = 150 \times 10 = 1500\ mm^2$$

$$Y_2 = 10 + \frac{150}{2} = 85mm.$$

$$A_3 = 150 \times 10 = 1500\ mm^2$$

$$Y_3 = \frac{10}{2} = 5$$

$$\bar{Y} = \frac{A_1Y_1 + A_2Y_2 + A_3Y_3}{A_1 + A_2 + A_3}$$

$$= \frac{750 \times 165 + 1500 \times 85 + 1500 \times 5}{750 + 1500 + 1500}$$

$$\boxed{\bar{Y} = 69mm}$$

$$= \frac{75\times10^3}{12} + 750(69-165)^2 + \frac{10\times150^3}{12} + 1500(69-85)^2$$

$$+ \frac{150\times10^3}{12} + 1500(69-5)^2$$

$$= 6918250 + 31965000 + 6156500$$

$$= 16271250\ mm^2$$

$$\sigma_T = \frac{M\bar{y}}{I} = \frac{(0.82w)\times 69}{16271250}$$

$\sigma_T = 40$ mpa

$$40 = \frac{0.82w\times69}{16271250}$$

$$\boxed{w = 11.50\ kN}$$

$$\sigma_C = \frac{M(170-69)}{16271250}$$

$\sigma_C = 80$ mpa

$$80 = \frac{(0.82w)(101)}{16271250} \Rightarrow \boxed{w = 15.72\ kN}$$

$$\boxed{w = 11.50\ kN}$$

$$w(kN/m) = \frac{11.50}{4.5} = 2.56\ kN/m$$

Comment

Two vertical, parallel, clean, glass plates are spaced a distance of 2.3 mm apart. If the plates are placed in water how high will the water

See answer

A fluid having a density of 1400 kg/m3 stands in a thin tube of 6mm diameter at a height of 27mm. What is the true static height? Use

See answer

See more questions for subjects you study