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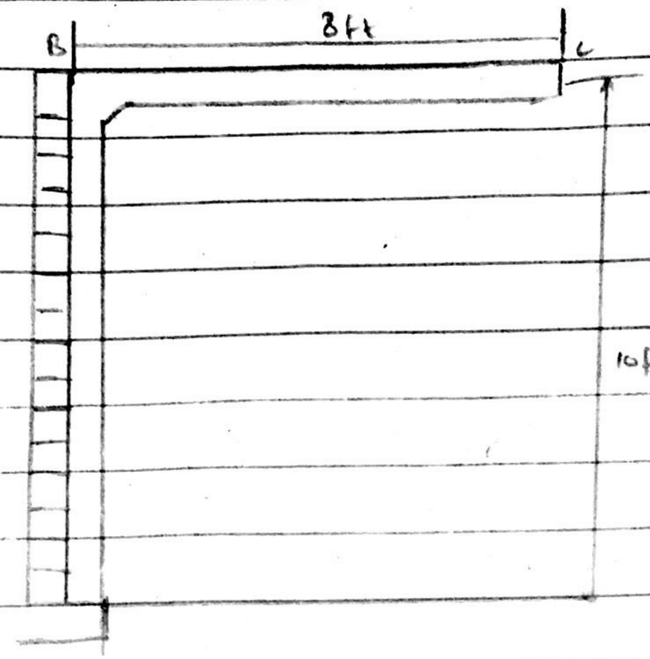
ID : 7957

Sec : B

Subject : Structure Analysis

Submitted to: Engg Amjad Aslam.

QNO: 1



Sol:-

Find reaction

$\circlearrowright + \sum M_A = 0$

$-4(10)(5) + C_y(8) = 0$

$C_y = 25 \text{ kip}$

$\sum F_y = 0 \uparrow^+$

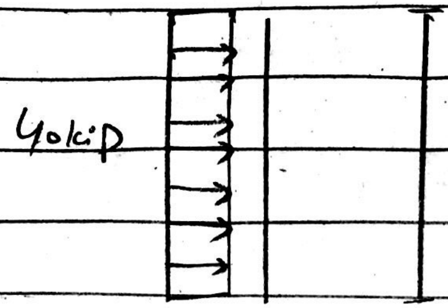
$25 + A_y = 0$

$A_y = -25 \text{ kips}$

$\sum F_x = 0 \rightarrow +$

$40 - A_x = 0 \Rightarrow A_x = 40k$

Taking Section.

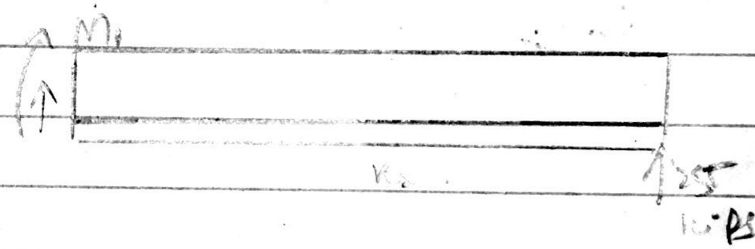


Real moment

$$\circlearrowright + \Sigma M_1 = 0$$

$$-40(x_1) + 4x_1\left(\frac{x_1}{2}\right) + Cx_1 = 0$$

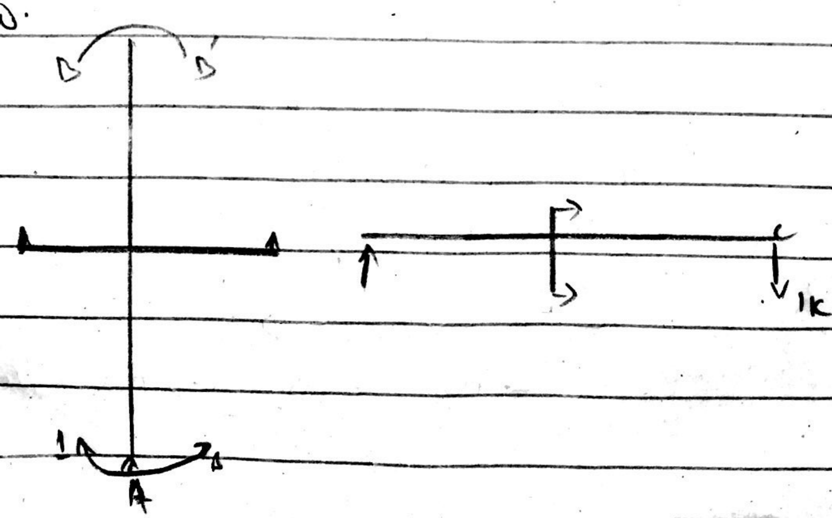
$$M_1 = 40x_1 - 2x_1$$



$$-25(x_2) + M_2 = 0$$

$$M_2 = 25x_2 \text{ kips.}$$

Now.



Mem	BA	CB
origin	B	C
limit	0-10	~~0-8~~
m	$2x^2$	0
M	8	x

By vertual work Method

$$1 \cdot \Delta_1 = \int_0^{10} \frac{2x_2 (8)\, dx}{EI} + \int_0^{8} \frac{(0)(x_2)}{EI}$$

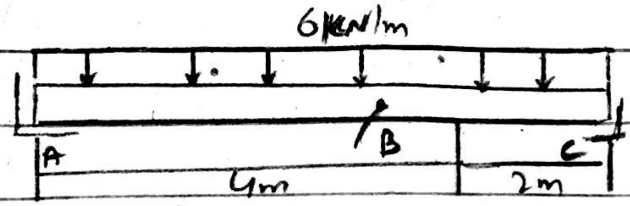
$$= \frac{16x^3}{3} \Big|_0^{10} + 0$$

$$= \frac{16 \times 1000}{3} \Big/ EI$$

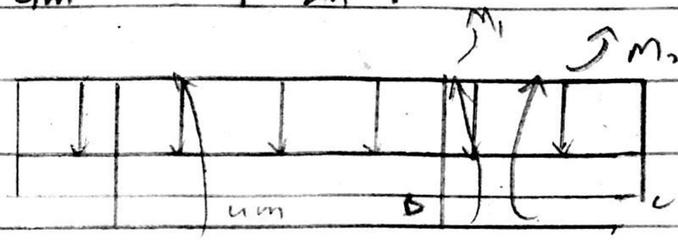
$$= \frac{6333.33}{Ei} = \frac{5333.33}{29 \times 10^3 \times 608}$$

$$\boxed{1 \cdot \Delta_1 = 3.06 \times 10^{-4} \text{ in.}}$$

Q No: 2



Sol:



$R_1 + R_2 = 0 \quad --- \quad (1)$

$\Sigma M_A = 0 \quad \circlearrowleft +$

$1 + R_2(6) = 0$

$- 0.16667$ put in eq (1)

$R_1 + (-0.1667) = 0$

$R_1 = 0.1667\ kN$

$\Rightarrow \quad R_1 + R_2 = 1$

$\circlearrowleft + \ \Sigma M_A = 0$

$-(1)(4) + R_2(6) = 0$

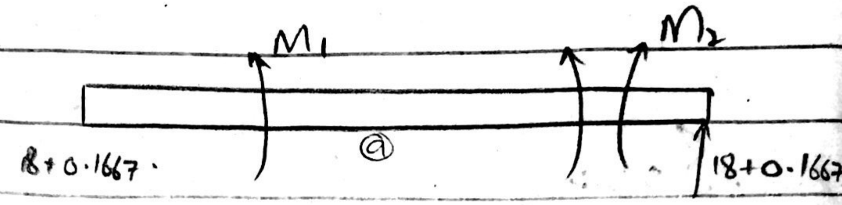
$R_1 = 0.667\ kN$

$R_2 = 1 - 0.6667\ kN$

$R_2 = 0.333kN$

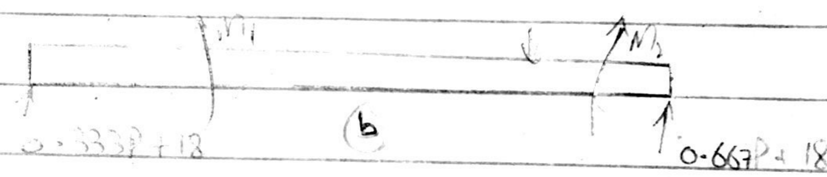
$\Rightarrow M_1 = (18 + 0.1667M')x_1 - 2x_1^2$

$M_2 = (18 - 0.1667M')x_2 - 2x_2^2$



$M_1 = (0.333P + 18)x_1 - 2x_1^2$

$M_2 = (0.667P + 18)(x_2 - 2x_1^2$



The displacement function shown in the figure @ above

$$\frac{\partial M_1}{\partial M'_1} = 0.1667x_1 \quad \& \quad \frac{\partial M_2}{\partial M'} = 0.1667x_2$$

Set $M' = 0$ then

$$M_1 = (18 + 0.1667(0))\, x_1 - 2x_1^2$$

$$M_1 = (18x_1 - 2x_1^2)$$

$$M_2 = (18x_2 - 2x_2^2)$$

$$\phi B = \int_0^2 M\left(\frac{\partial M}{\partial M_1}\right)\frac{dx}{Ei} = \int_0^4 \frac{(18x_1 - 2x_1^2)(0.1667x_1)}{Ei}$$

$$+ \int_0^2 \frac{(18x_2 - 2x_2^2)(0.16667x_2)\,dx_2}{Ei}$$

$$\phi B = \frac{42.65}{Ei} + \frac{6.66}{Ei}$$

$$\phi B = \frac{49.31}{Ei}$$

$$\phi B = \frac{49.31}{(200\times10^6\ kPa)(0.00006)}$$

⇒ For the displacement function are shown in figure "b"

$$\frac{\partial M_1}{\partial M_P} = 0.333x_1 \quad \& \quad \frac{\partial M_2}{\partial P} = 0.6667x_2$$

also set $P = 0$

Then $M_1 = (18x_1 - 2x_1)$ kN.m

$M_2 = (18x_2 - 2x_2^2)$ kN.m

Thus

$$\Delta B = \int_{0}^{L} M \left(\frac{\partial M}{\partial P}\right) \frac{dx}{Ei}$$

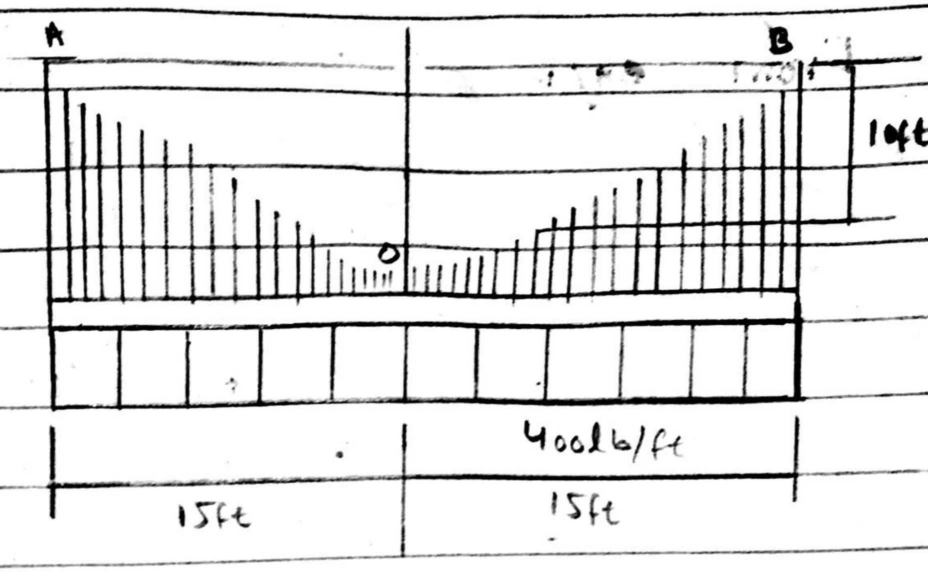
$$\Delta B = \int_{0}^{4} \frac{(30 \times x_1 - 2x_1^2)(0.333\, x_1)\, dx}{Ei}$$

$$\Delta B = \frac{218.5}{Ei} \Rightarrow \frac{218.5}{(200 \times 10^6)(0.00006)}$$

$$= 0.018 \text{ m}$$

$$\Delta B = 18 \text{ mm} \downarrow$$

Q No: 3.



Solution:-

From Eq:-

$$y = \frac{h}{l^2} x^2 = \frac{10}{(15)^2} x^2$$

$$y = 0.0444 x^2$$

From eq:-

$$T_o = F_H = \frac{w_o L^2}{2h} = \frac{400(15)^2}{2(10)}$$

$T_o = 4500 lb$ ÷ing by 1000

$T_o = 4.5k$

From eq:-

$$T_B = T_{max} = \sqrt{F_H^2 + (w_o L)^2}$$

$$= \sqrt{(4500)^2 + (400)^2(15)^2}$$

$$= \sqrt{\cancel{2}0250\cancel{0}00 + 9\cancel{0}000}$$

$$= \sqrt{20250000 + (400 \times 15)^2}$$

$= 7500 lb$ ÷ing by 1000

$T_B = T_{max} = 7.5k$

Also from Eq 5.11

$$T_B = T_{max} = w_o L \sqrt{1 + \left(\frac{L}{2h}\right)^2}$$

$$= 400(15)\sqrt{1 + \left(\frac{15}{20}\right)^2}$$

$$= 6000\sqrt{1 + \frac{225}{400}}$$

10

$$\div 6000(1.25)$$

$= \quad 7500lb \div ing \text{ by } 1000$

$T_B = T_{max} = 7.5 \text{ kg. Ans.}$

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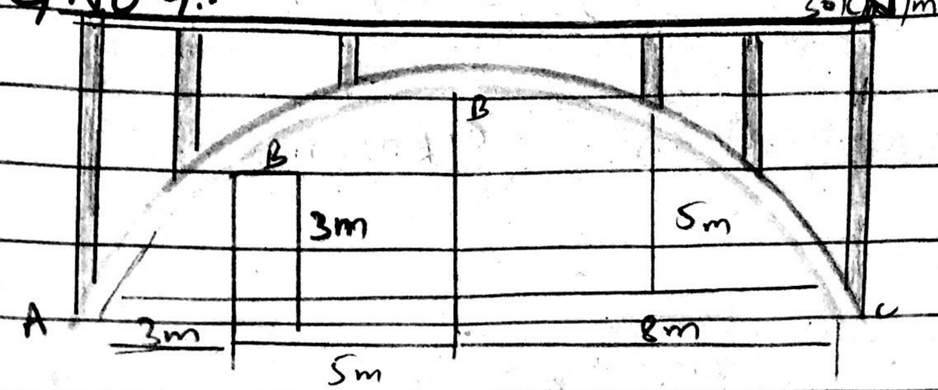
Q No 4:-



Sol:-

Member AB.

$\circlearrowright + \sum M_A = 0$

$B_x(5) + B_y(8) - 240(4) = 0$

Member BC:-

$\circlearrowright + \sum M_C = 0$

$-B_x(5) + B_y(8) + 240(4) = 0$

$\Rightarrow \quad B_x = 192\,kN \qquad B_y = 0.$

Segment BD:-

$\circlearrowright + \sum M_D = 0$

$$= 192(2) - 150(2.5) - M_D = 0$$

$$M_D = 9\,kN \cdot m$$