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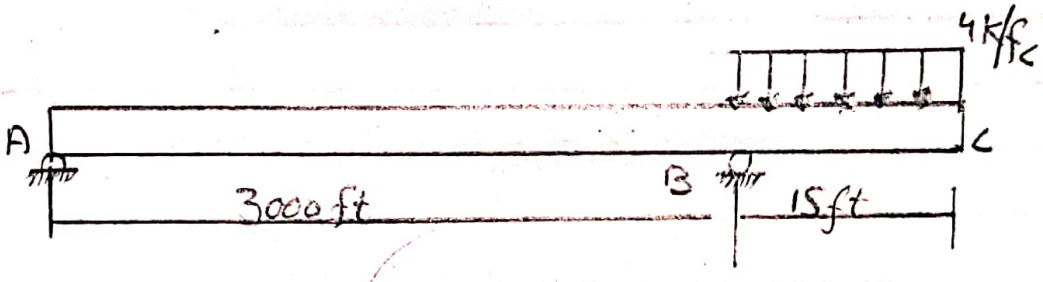
Subject # Structure Analysis

Assignment # 03

Q#1

Determine the Slope and displacement at C EI Constant. Use moment Area Theorem.



Slope $(\theta_C) = ?$

Displacement $= \Delta C = ?$

Draw M/EI Diagram.

$\curvearrowright + \sum M_A = 0.$

$$-V_B \times 30 + (4 \times 15) \times 37.5 = 0$$

$$V_B = 75 \text{ k}$$

$$+\circlearrowright \quad \Sigma M_B = 0$$

$$V_A \times 30 + (4 \times 15) \times 7.5 = 0$$

$$V_A = -15 \text{ K}.$$

$$\rightarrow \quad \Delta_C = -\frac{194062.5}{2} - \left(\frac{67503}{EI}\right)\frac{3}{2}$$

$$\Delta_C = \frac{295312.5}{EI} = \text{K-ft}^3$$

Slope at "B"

$$\theta_B = \frac{\Delta_C}{15} = \left(\frac{795312.5}{EI}\right)/15$$

$$\theta_B = \frac{19687.5}{EI} \text{ k.ft}^2.$$

For displacement

$$t_{C/A} = \Delta_C + \Delta'$$

By proportionality.

$$\frac{\Delta'}{45} = \frac{t_{B/A}}{30}$$

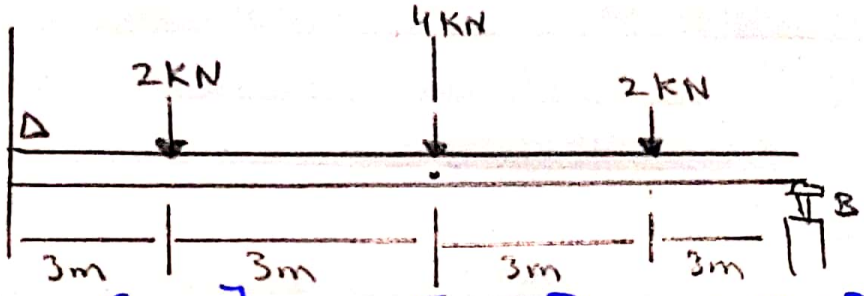
$$\Delta' = \frac{3}{2} t_{B/A}$$

→ eq ①.

$$\Delta_C = t_{C/A} - \frac{3}{2} t_{B/A}.$$

Question: no 2:

Determine Slope at A and displacement at C of the beam in the figure. $E = 200\ GPa, I = 6(10^6)\ mm^4$.



$$\theta_{B/C} = \frac{1}{2}\left[\frac{Pa}{EI}\right]a + \left[\frac{Pa}{EI}\right]a + \frac{1}{2}\left(\frac{Pa}{EI}\right)a.$$

$$\theta_{B/C} = \frac{7Pa^2}{4EI} = \frac{7(4)(3)^2}{4\times 1200} \quad \therefore EI = 1200.$$

$$\theta_{B/C} = 0.052 \text{ radian.}$$

$$t_{B/C} = \left[\frac{1}{2}\left(\frac{Pa}{EI}\right)a\right]\left(\frac{2}{3}a\right) + \left(\frac{Pa}{EI}a\right)\left(a+\frac{1}{2}a\right)$$

$$\theta_{B/C} = 0.052 \text{ radian.}$$

$$t_{B/C} = \left[\frac{1}{2}\left(\frac{Pa}{EI}\right)a\right]\left(\frac{2}{3}a\right) + \left[\frac{Pa}{EI}a\right]\left(a+\frac{1}{2}a\right) + \left[\frac{1}{2}\left(\frac{Pa}{EI}\right)a\right]\left(a+\frac{2}{3}a\right).$$

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$$t_{B/C} = \frac{9Pa^3}{4EI}$$

$$= \frac{9 \times 4 (3)^3}{4 \times 1200} \quad \therefore EI = 1200$$

$$= \frac{36 \times 27}{4800} = \frac{972}{4800}.$$

$$= 0.202 \text{ m}.$$

Then;

$$\theta_B = \theta_{B/C} = \frac{7Pa^2}{4EI} \text{ ⟲} \quad \text{Ans.}$$

$$A_C = t_{B/C} = \frac{9Pa^3}{4EI} \downarrow \quad \text{Ans.}$$

$$\Delta C = t_{A/C} = 0.202 \text{ m}$$

$$\Delta C = 202 \text{ mm}.$$

(b)