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Section : B

Subject : Structural Analysis

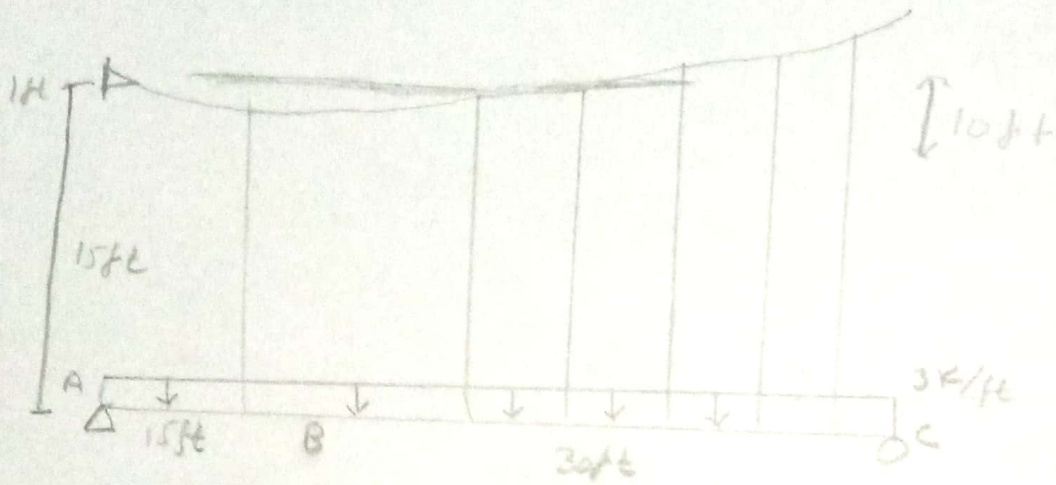
Department : BS civil

Assignment No : 04

Submitted To : Eng. Amjed Islam

①

Cable & Arches



Member BC:-

$$\begin{aligned} \sum F_x = 0 & \quad B_x = 0 \\ \leftarrow \quad \rightarrow \end{aligned}$$

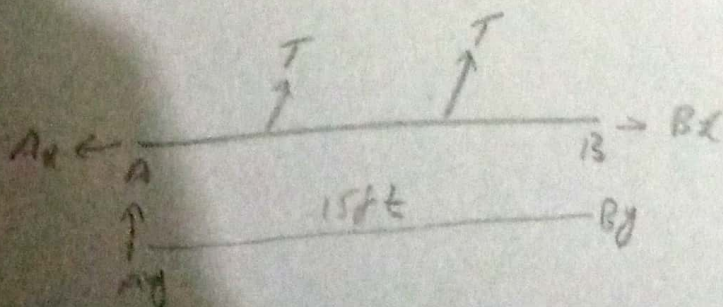
Member AB:-

$$\begin{aligned} \sum F_x = 0 & \quad A_x = 0 \\ \leftarrow \quad \rightarrow \end{aligned}$$

FBD 1 (Member AB)

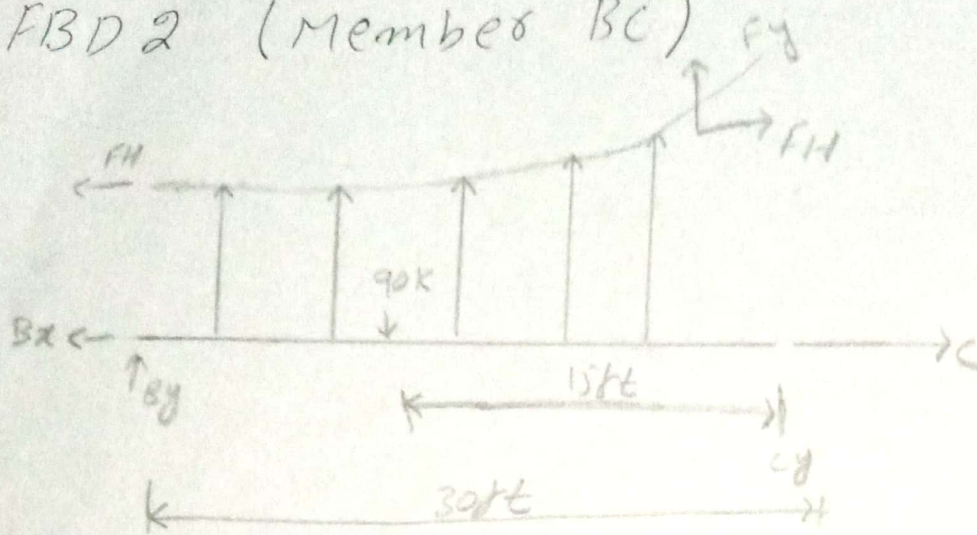
$$\sum M_A = 0$$

$$F_H \times 1 - B_y \times 15 - 45 \times (7.5) = 0 \Rightarrow \textcircled{0}$$



(2)

FBD 2 (Member BC)



$$\sum + M_C = 0$$

$$-B_y \times 30 - F_H \times 10 + 90 \times 15 = 0$$

$$1350 - 10F_H - 30B_y = 0 \rightarrow \textcircled{i}$$

Now multiplying eq (i) by (2) & then subtract from eq (ii)

$$\textcircled{i} \quad 1350 - 10F_H - 30B_y = 0$$

$$\mp 675 \mp 2F_H \mp 30B_y = 0$$

$$2025 - 12F_H = 0$$

$$F_H = 168.75 \text{ k} \quad \& \quad B_y = -11.25 \text{ k}$$

$F_H = F_{\min} = 168.75 \text{ k}$ Because we determine the force at 0° slope therefore $F_H = F_{\min}$

(3)

Max Force occurs at Point E,
where slope is max.

Now,

$$w_0 = \frac{2FHh}{L^2}$$

$$w_0 = \frac{2 \times 108.75 \times 10}{30^2}$$

$$w_0 = 3.075 \text{ k/ft}$$

As we know that

$$F_{\max} = w_0 L \sqrt{1 + \left(\frac{L}{2h}\right)^2}$$

$$F_{\max} = 3.075 \times 30 \times \sqrt{1 + \left(\frac{3}{2 \times 10}\right)^2}$$

$$F_{\max} = 202.81 \text{ N}$$

Load on each hanger
in member BC.

(4)

Each hanger carries 5ft of w_0

$$T = 3.75 \times 5 = 18.75 \text{ K}$$

w_0 for member AB

$$w_0 = \frac{2FHh}{L^2}$$

$$w_0 = \frac{2 \times 168.75 \times 1}{15^2}$$

$$w_0 = 1.05 \text{ K/ft}$$

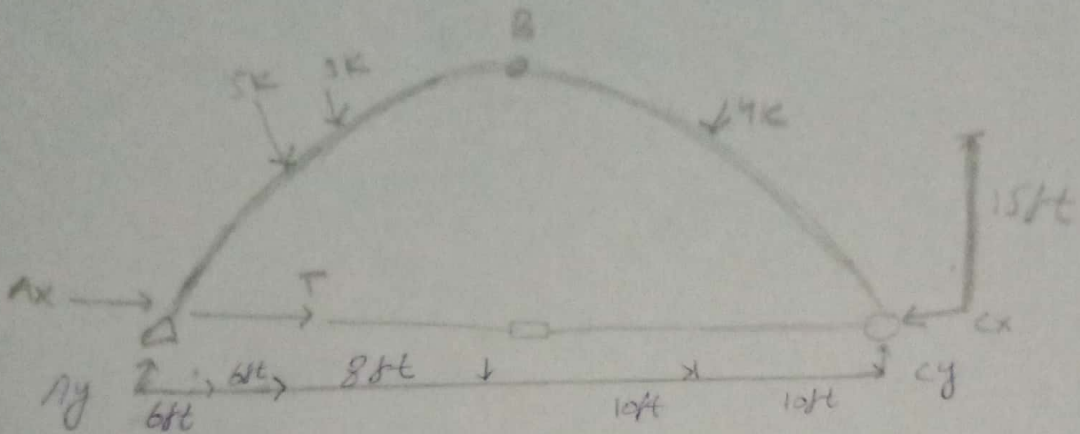
Here in member AB
each hanger carry 7.5ft
of w_0 .

$$T = 1.05 \times 7.5$$

$$T = 11.25 \text{ K}$$

(5)

Pb 2:



Required :-

$$A_x = ?$$

$$A_y = ?$$

$$C_y = ?$$

$$T = ?$$

Sol:-

Entire Arch

$$\rightarrow \sum F_x = 0$$

$$A_x = 0$$

$$\sum M_A$$

$$C_y \times 40 - 4 \times 30 - 3 \times 12 - 5 \times 6 = 0$$

$$40 C_y = 186$$

$$C_y = 4.65 \text{ k}$$

⑥

$$\sum M_C = 0$$

$$-A_y \times 40 + 5 \times 34 + 3 \times 28 + 4 \times 10 = 0$$

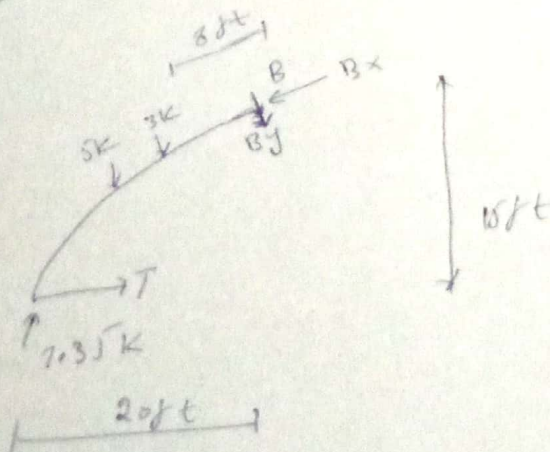
$$A_y = 7.35 \text{ k}$$

$$\sum F_y = 0$$

$$7.35 + 4.65 = 5 + 3 + 4$$

$$12 = 12 \text{ (OK)}$$

Member AB



$$\sum M_B = 0$$

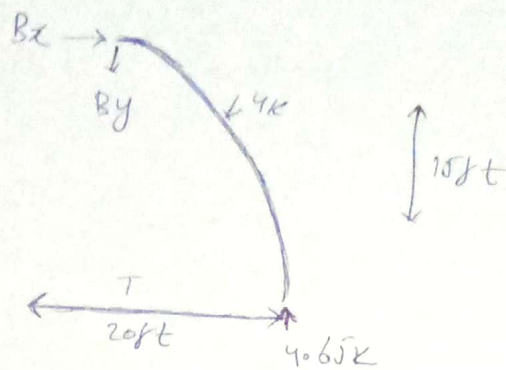
$$-7.35 \times 20 + T \times 15 + 5 \times 14 + 3 \times 8 = 0$$

$$15T = 53$$

$$T = 3.53 \text{ k}$$

⑦

Members CB:-



$$\sum M_B = 0$$

$$-T \times 15 + 4.65 \times 20 - 4 \times 10 = 0$$

$$15T = 53$$

$$T = 3.53 \text{ k}$$

Hence

