STATICS

Internal Forces

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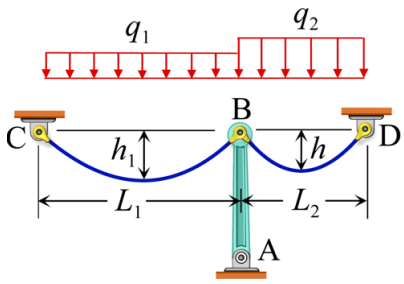
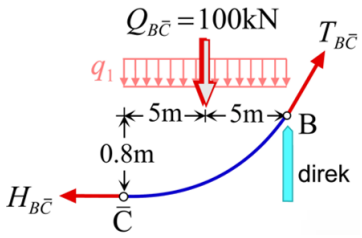
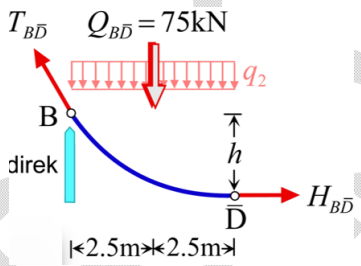
Question : The post AB is hinged at both ends and expected to be in a vertical position. Determine the sag h of the cable BD. The uniformly distributed loads are $q_1 = 10\text{kN/m}$ and $q_2 = 15\text{kN/m}$. The dimensions are $h_1 = 0.8\text{m}$, $L_1 = 20\text{m}$ and $L_2 = 10\text{m}$.



Solution :

The net horizontal force acting on the post at point B should be equal to zero $H_{BC} = H_{BD}$.





$$Q_{BC} = \left(\tfrac{1}{2} \times 20\text{m}\right)\left(10\text{kN/m}\right) = 100\text{kN}$$

$$Q_{BD} = \left(\tfrac{1}{2} \times 10\text{m}\right)\left(15\text{kN/m}\right) = 75\text{kN}$$

Segment BC: $\sum M_B = 0; \quad H_{BC} = \dfrac{100 \times 5}{0.8} = 625\text{kN}$

Segment BD: $\sum M_B = 0; \quad H_{BD} = \dfrac{75 \times 2.5}{h} = \dfrac{187.5}{h}$

The sag at point D is obtained using the above equations as $h = \dfrac{187.5}{625} = 0.3\text{m}$.