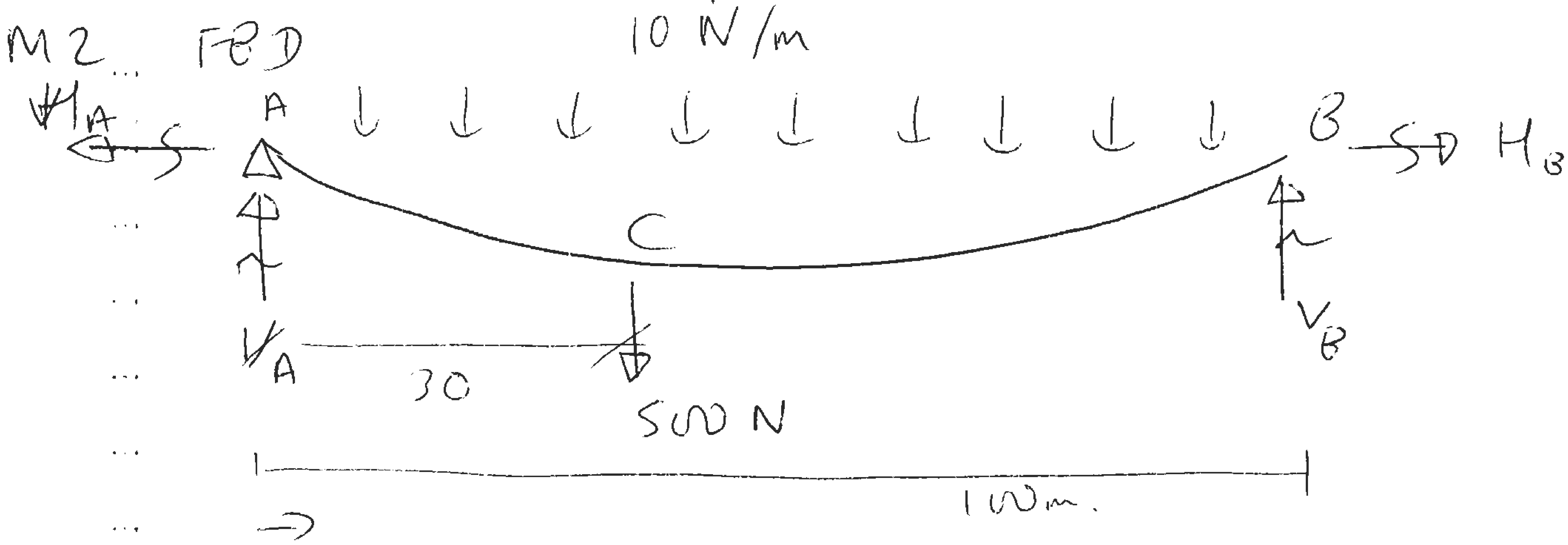
Assume weight of cable is constant per horizontal length.

M2 FBD



$\sum \vec{F}_x = 0 \qquad -H_A + H_B = 0 \qquad H_A = H_B$

$\sum F_y \uparrow = 0 \qquad V_A + V_B - 100 \times 10 - 500 = 0$

$\qquad\qquad\qquad\qquad\qquad\qquad - 1500$

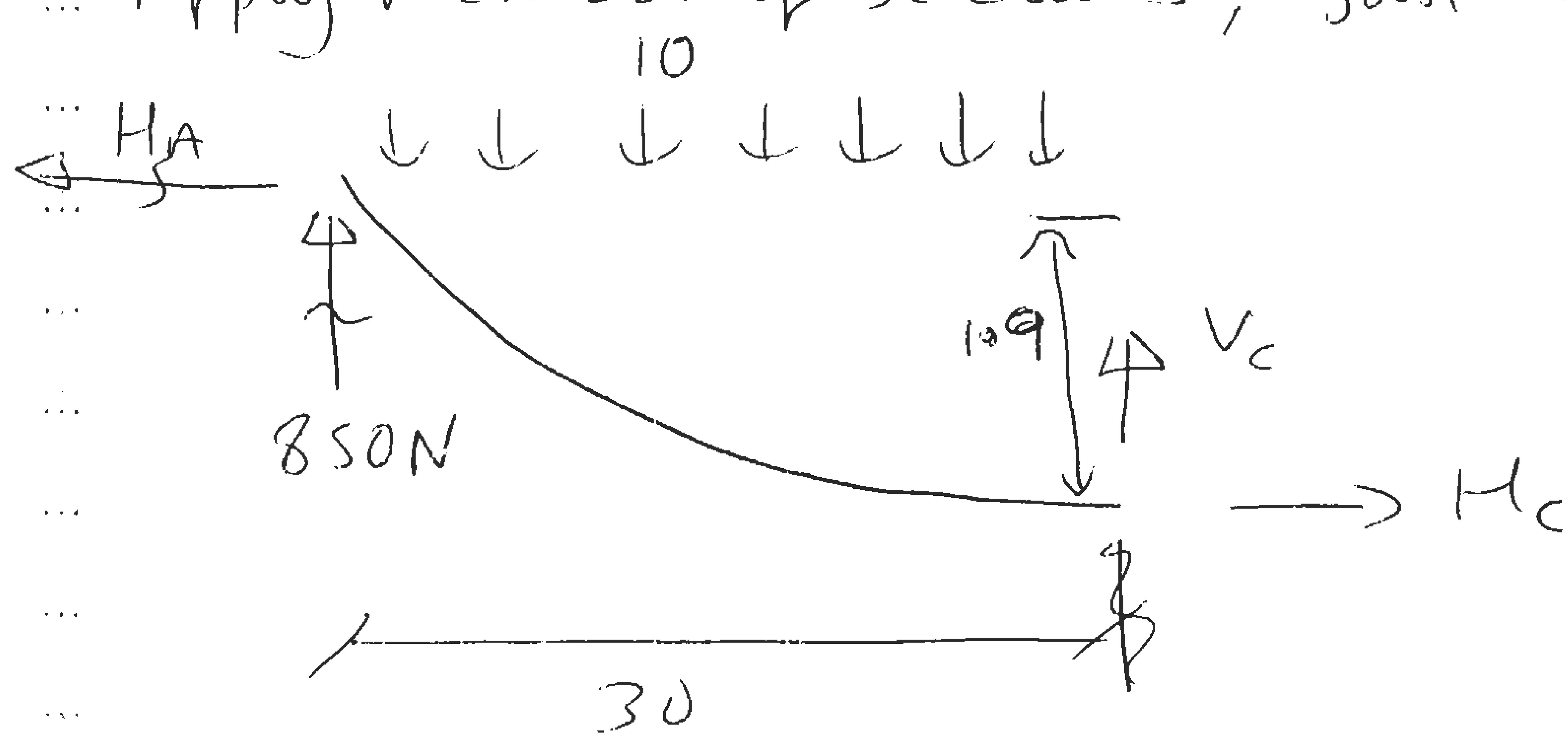
$\circlearrowleft \sum M_A = 0 \qquad V_B\, 100 - 500 \times 30 - 1000 \times 50 = 0$

$V_B = \cancel{600}\ 650\ N$

$V_A = 1500 - 650 = 850\ N$

~~Ap~~ Structure is apparently statically indeterminate

Apply method of sections, just to left of C



$\sum \vec{F_x} = 0: \ -H_A + H_c = 0$ (tension in cable constant)

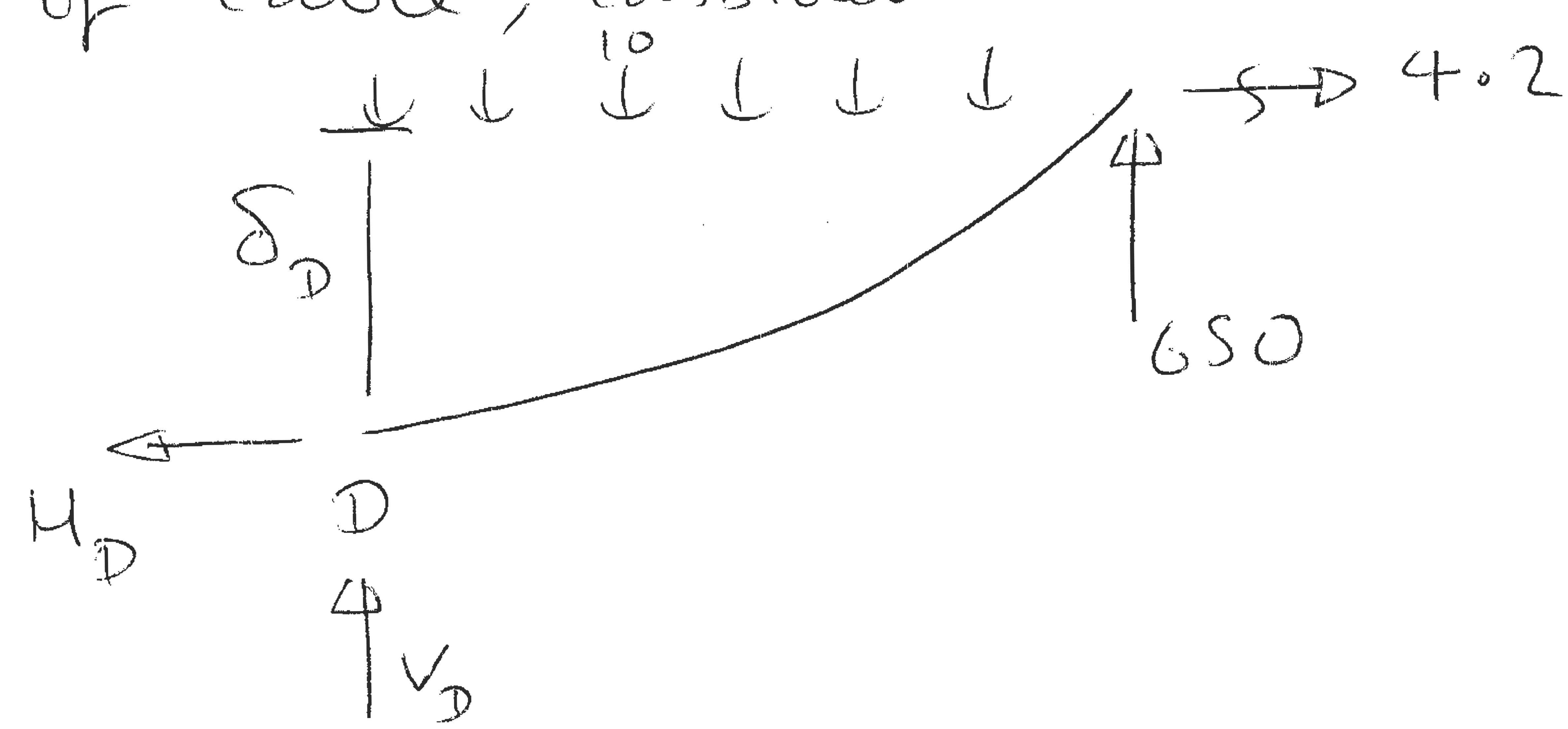
$\sum F_y \uparrow = 0 \quad 850 - 10 \times 30 + V_c = 0$

$V_c = -550 \text{ N}$

$\sum M_A = 0: -30 \times 10 \times 15 + V_c \cdot 30 + H_c \cdot 1.9 = 0$

$\dfrac{-4500 - 550 \times 30}{-1.9} = H_c = \cancel{11.05}\ 11.0 \text{ kN}$

At center of cable, consider RHS



$\cancel{\sum M_A} \sum F_y \uparrow = 0. \quad \cancel{V_D - 10 \times 50 + 650 = 0}$

$\cancel{V_D = -150 \text{ N}}$

$\cancel{\sum M_D = 0: \ 650 \times 50 - 4.2 \times 10^3 \cdot \delta_D = 0}$

$\cancel{\delta_D = \dfrac{650 \times 50}{4.2 \times 10^3}} =$

$$\sum \circlearrowright M_D = 0 : \quad 650 \times 50 - 10 \times 50 \times 25 - 11.05 \times 10^3 \delta_D = 0$$

$$\delta_D = \frac{650 \times 50 - 500 \times 25}{11.05 \times 10^3} = 1.8\text{ m} \Leftarrow$$

---

b) Consider only horizontal component of tension in cable (much larger than vertical)

$$H = 11\text{kN} \quad \therefore \quad \sigma = \frac{11 \times 10^3}{1000 \times 10^{-6}} = 11.0\text{MPa}$$

Young's modulus = 2 GPa

$$\therefore \quad \text{Strain} = \frac{11 \times 10^6}{2 \times 10^9} = 5.5 \times 10^{-3} = 5500 \mu\varepsilon \Leftarrow$$

$$\text{Change in length} = 5500 \times 10^{-6} \times 100 = 0.55\text{m}$$

$= 0.55$ m $\rightarrow$ this is on the same order as the dip of the cable so it is likely to result in an appreciable change in geometry which would need to be accounted for.

<u>Note</u> 2 GPa is a low modulus – equivalent to Nylon or polyester rope.