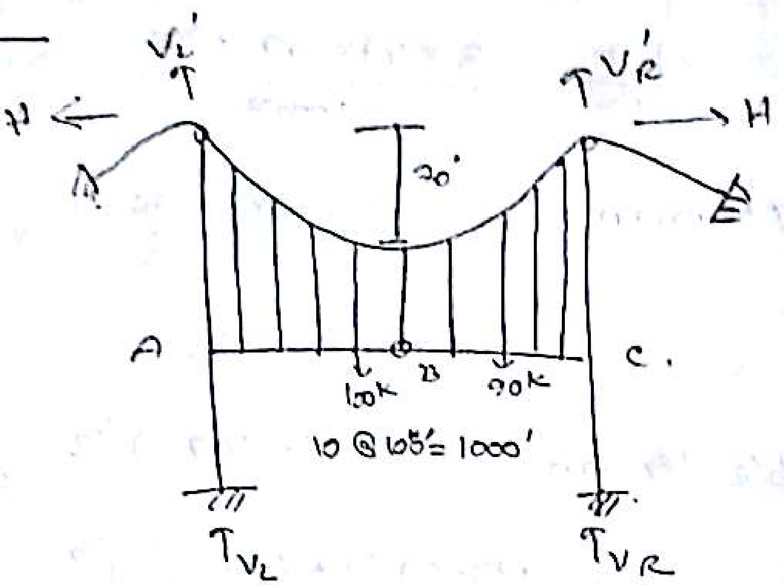
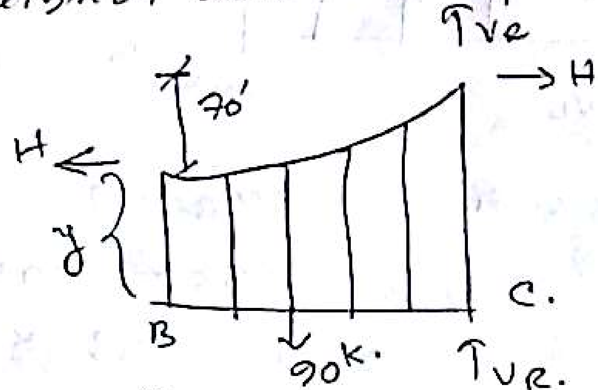
Cable

Assignment



(i) max cable tension?
(ii) hanger force?
(iii) SFD
(iv) BMD
(v) Unstretched length of cable.



→ whole structure

$\Sigma M_A = 0$

$100 \times 400 + 90 \times 700$
$-(V_R + V_R') \times 1000 = 0$
$\Rightarrow V_R + V_R' = 103^k$.

$\Sigma M_B = 0$

$-Hy + H(y+70) - (V_R + V_R') \times 500 + 90 \times 200 = 0$
$\Rightarrow H = 478.57^k$.

$$H = \frac{wL^2}{8h}.$$

$$\Rightarrow w = \frac{8hH}{L^2} = \frac{8 \times 478.57 \times 70'}{1000^2} = 0.268 \text{ k/ft.}$$

Hanger tension $= w \times$ hanger spacing

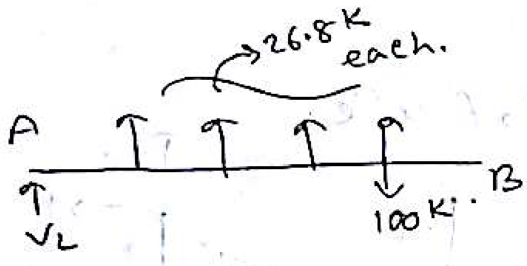
$= 0.268 \times 100$

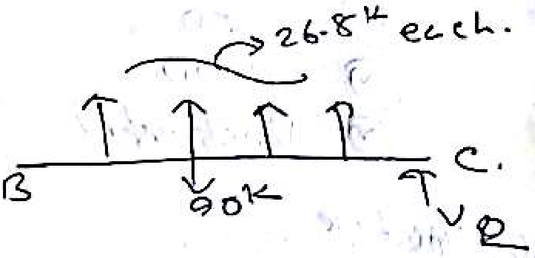
$= 26.8\text{k}.$

max cable tension $= H(1+16\theta^2)^{1/2}$ $\quad \theta = \frac{h}{L} = \frac{70}{1000}$

$= 478.57\left(1 + 16 \cdot \frac{70^2}{1000^2}\right)^{1/2}$

$= 496.98\text{k} \approx 497\text{k}.$





AB section. $\quad \Sigma M_B = 0 \circlearrowright$

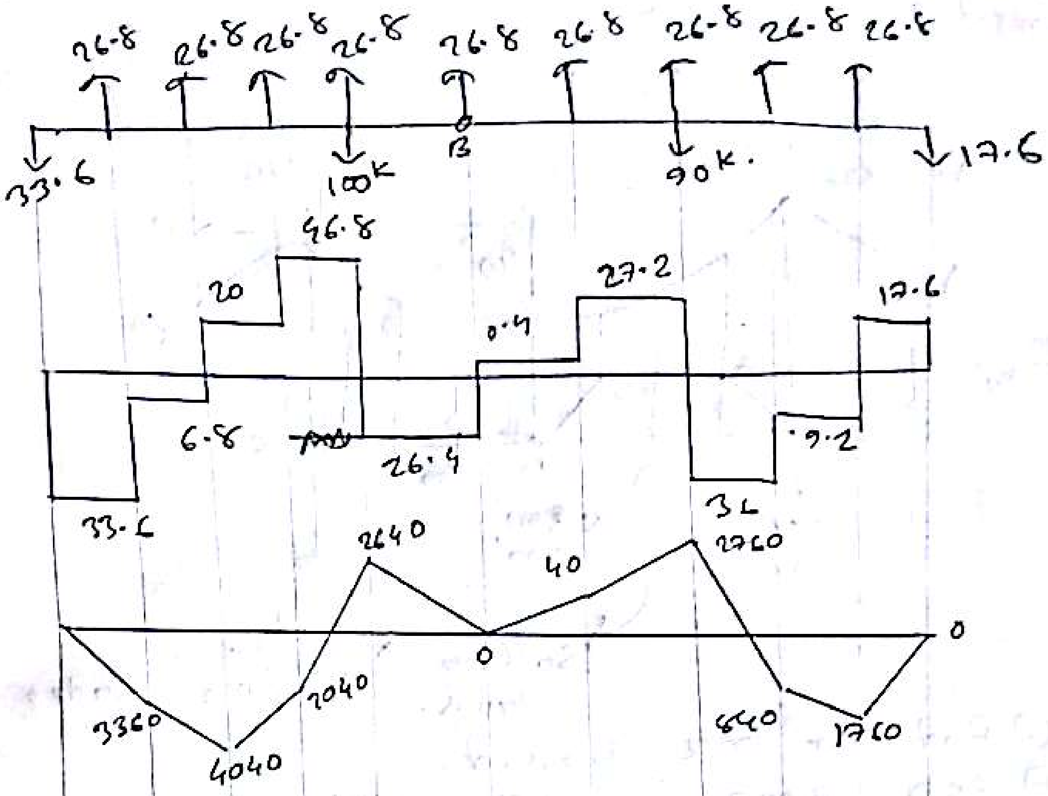
$V_L \times 500 + 26.8 \times (400+300+200+100) - 100 \times 100 = 0.$

$\Rightarrow V_L = 33.6\text{k} \, (\downarrow)$

BC section. $\quad \Sigma M_B = 0 \circlearrowright$

$-V_R \times 500 - 26.8 \times (400+300+200+100) + 90 \times 200 = 0$

$\Rightarrow V_R = 17.6\text{k} \, (\downarrow)$



Cable length. $S = \frac{L}{2}(16\theta^2+1)^{1/2} + \frac{L}{8\theta}\ln\{4\theta+(1+16\theta^2)^{1/2}\}$.

$= 1012.92$ ft.

Cable streech. $\Delta s = \frac{HL}{AE}\left(1+\frac{16}{3}\theta^2\right)$

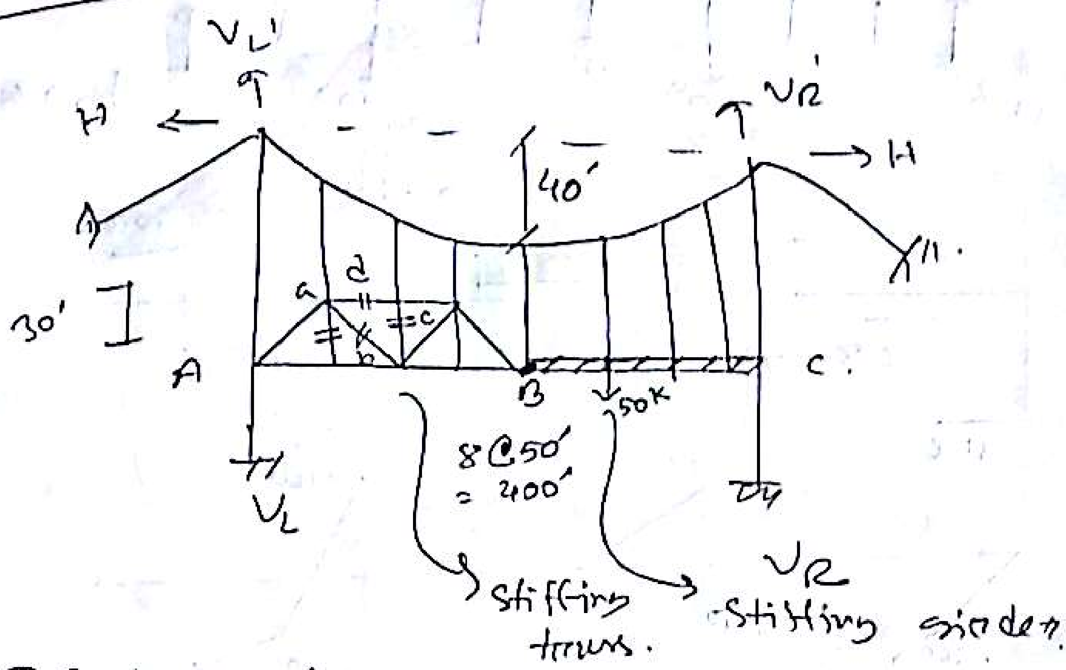
$= \frac{478.57\times 1000}{50\times 27\times 10^6}\left[1+\frac{16}{3}\left(\frac{70}{1000}\right)^2\right]$

$= 0.004$ ft

Unstreesed length $= S - \Delta S$

$= 1012.916$ ft.

Assignment · 2



(i) find bar force a, b, c, d.

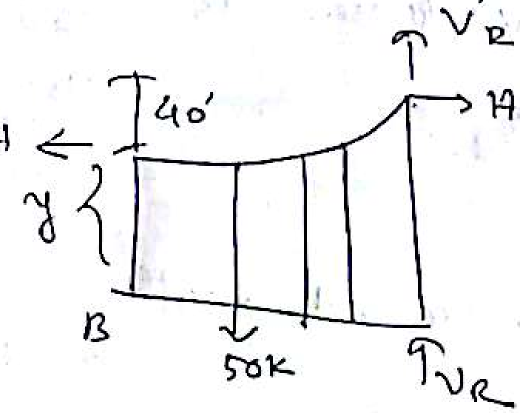
(ii) SFD BMD for Stiffing girder.

(iii) Cable tension ?

$\Sigma M_A = 0$ ↺

$\Rightarrow 50 \times 250 - (V_R + V_R') \times 400 = 0 \Rightarrow V_R + V_R' = 31.25^k.$

$\Sigma M_B = 0$ ↺



$\Rightarrow -Hy + 50 \times 50 - (V_R + V_R') \times 200$

$+ H(y + 40) = 0.$

$\Rightarrow H = 93.75^k.$

$H = \frac{wL^2}{8h} \Rightarrow w = \frac{8hH}{L^2}$

$= \frac{8 \times 40 \times 93.75}{400^2} = 0.1875\ ^k/ft.$

Tension in each hanger = w x Spacing.

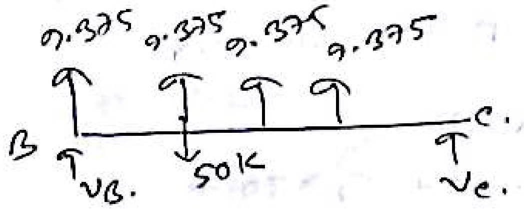
$= 0.1875 \times 50$

$= 9.375^k$.

$T_{max} = H(1+16\theta^2)^{1/2}$ $\qquad \theta = \frac{h}{L} = \frac{.400}{7100}$

$= 93.75(1+16\times0.4^2)^{1/2}$

$= 01^k$.



$\Sigma M_c = 0.2$

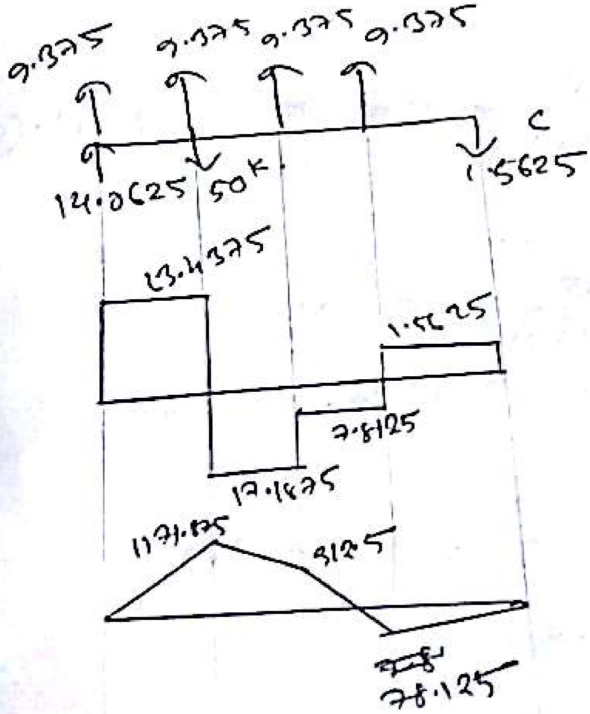
$9.375 \times (200+150+100+50) - 50\times150 + V_B \times 200 = 0$

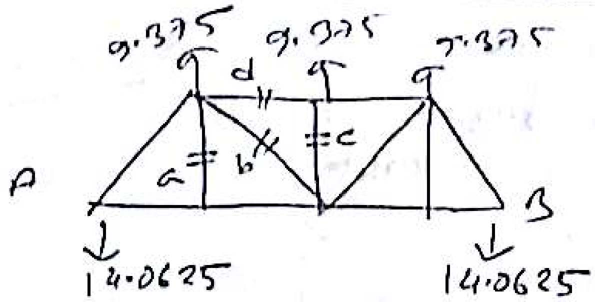
$\Rightarrow V_B = 14.0625(\uparrow)$

$\Sigma M_B = 0$.

$\Rightarrow -V_c \times 200 - 9.375(150+100+50) + 50\times50 = 0$

$\Rightarrow V_c = 1.5625(\downarrow)$

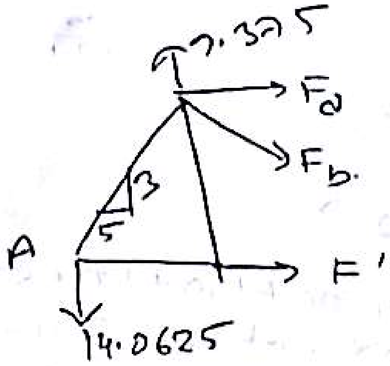




$\Sigma M_B = 0 \circlearrowright$

$\Rightarrow v_A \times 200 + 9.375 \times (150 + 100 + 50) = 0$

$\Rightarrow v_A = 14.0625 (\downarrow)$



$\Sigma F_y = 0$

$\Rightarrow 9.375 - 14.0625 - \frac{F_b \times 3}{\sqrt{3^2+5^2}} = 0$

$\Rightarrow F_b = -9.011 \ (C)$

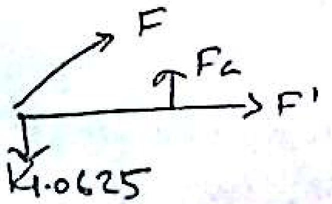
$\Sigma M_A = 0 \circlearrowright$.

$-9.375 \times 50 + F_d \times 30 + \frac{F_b \times 30 \times 5}{\sqrt{3^2+5^2}} + \frac{F_b \times 50 \times 3}{\sqrt{3^2+5^2}} = 0$

$\Rightarrow F_d = 31.25^K (T)$

$\Sigma F_x = 0$

$\Rightarrow F_d + F' + \frac{F_b \times 5}{\sqrt{3^2+5^2}} = 0 \Rightarrow F' = -23.44K (C)$



$\Sigma F_x = 0$

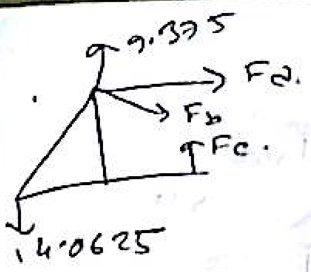
$\Rightarrow \frac{F \times 5}{\sqrt{3^2+5^2}} + F' = 0$

$\Rightarrow F = 27.34K$.

$\Sigma F_y = 0$

$\Rightarrow \frac{F \times 3}{\sqrt{3^2+5^2}} + F_c = 14.0625$

$\Rightarrow F_c = 0K$.



$\Sigma F_y = 0.$

$$\Rightarrow F_c - \frac{F_b \times 3}{\sqrt{3^2+5^2}} + 9.375 + 14.0625 = 0.$$

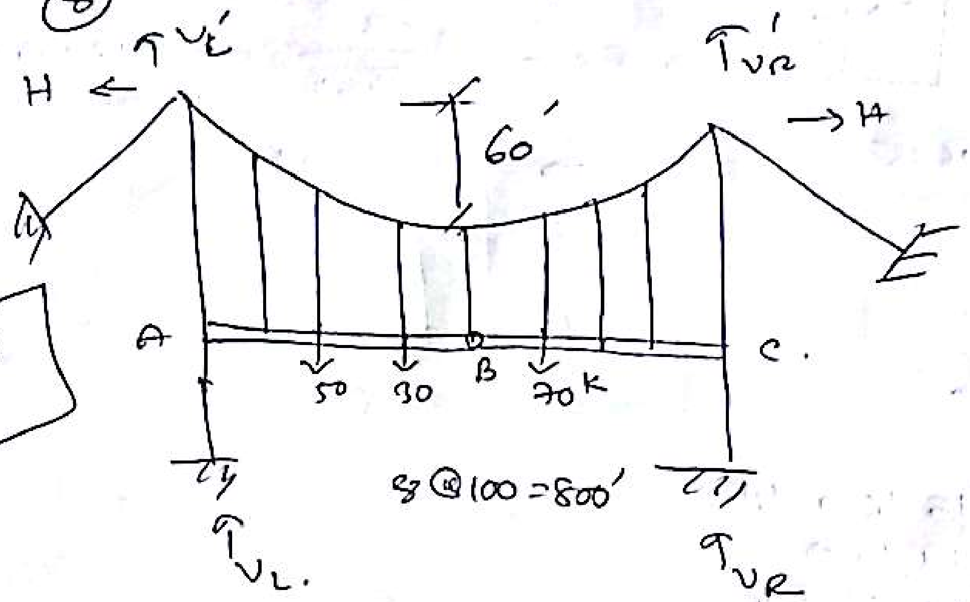
$$\Rightarrow F_c = 0\ K.$$

Q. solve

15-16 → NA.
14-15 → 8
13-14 → 4
12-13 → 9
11-12 → 3
10-11 → 13
9-10 → 13.
8-9 → 10.

201415

(8)

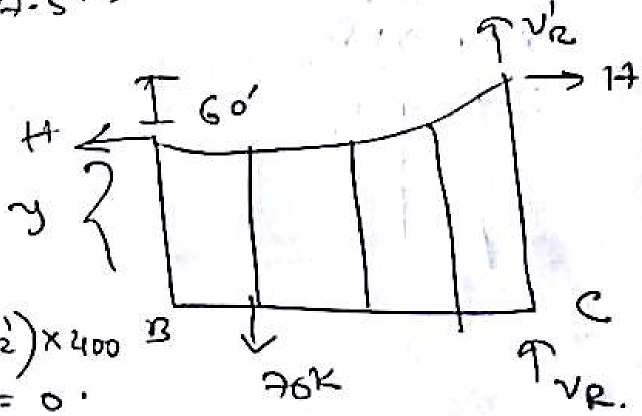


SFD BMD
Tmax.

$\Sigma M_A = 0$ ↻

$\Rightarrow \quad 50 \times 200 + 30 \times 300 + 70 \times 500 - (V_R + V_R') \times 800 = 0.$

$\Rightarrow \quad V_R + V_R' = 67.5^k$



$\Sigma M_B = 0$ ↻

$-Hy + H(y+60)$
$+ 70 \times 100 - (V_R + V_R') \times 400 = 0.$

$\Rightarrow \quad H = 433.33^k.$

$\theta = h/L = \frac{60}{800}$

$T_{max} = H(1+16\theta^2)^{1/2} = 433.33\left(1 + 16 \times \frac{60^2}{800^2}\right)^{1/2}$

$= 452.40^k.$

$$H = \frac{wL^2}{8h}$$

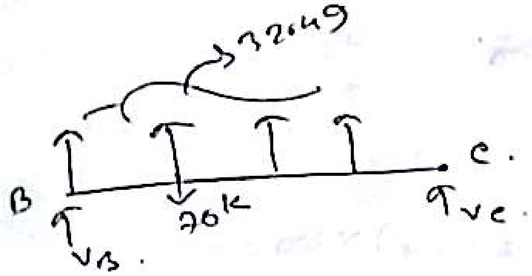
$$\Rightarrow w = \frac{8hH}{L^2} = \frac{8 \times 60 \times 433.33}{800^2}$$

$$= 0.3249 \text{ k/ft}$$

Tension in hanger $= w \times$ Spacing

$= 0.3249 \times 100$

$= 32.49 \text{ k}$

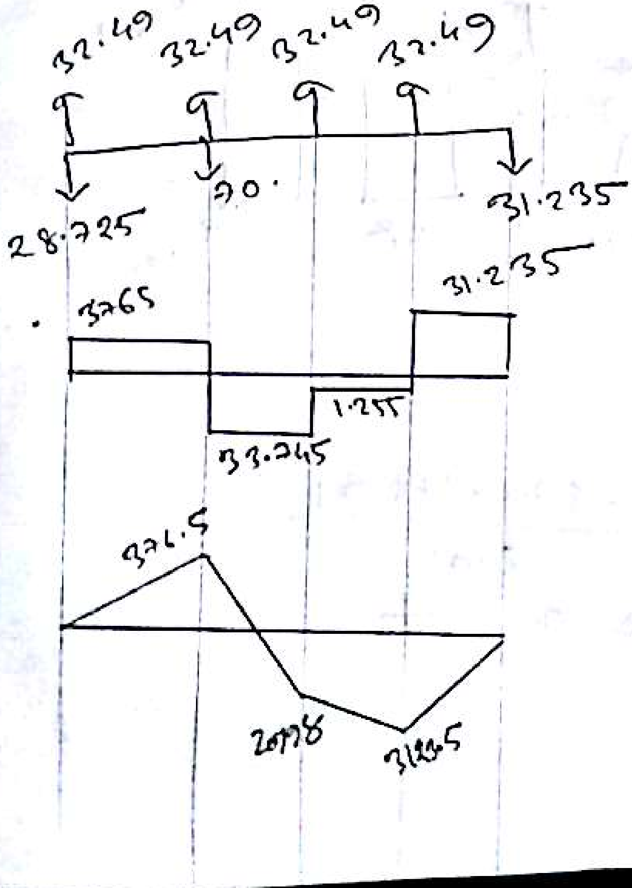


$\Sigma M_C = 0$

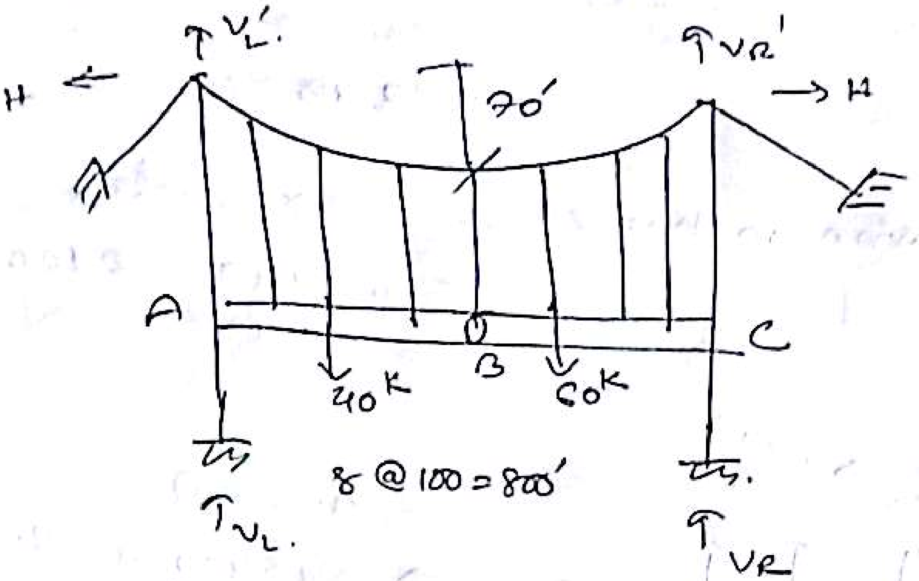
$\Rightarrow V_B \times 400 + 32.49 \times (400 + 300 + 200 + 100) - 70 \times 300 = 0$

$\Rightarrow V_B = -28.725$ (↓)

$V_C = -31.235$ (↓)



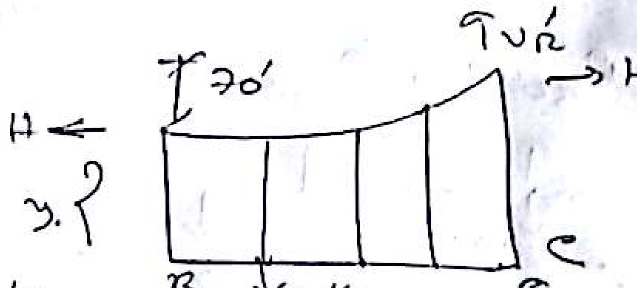
13-14 SFD BMD



$\Sigma M_A = 0 .$

$\Rightarrow 40 \times 200 + 60 \times 500 - (V_R + V_R') \times 800 = 0 .$

$\Rightarrow V_R + V_R' = 47.5^k$



$\Sigma M_B = 0 .$

$\Rightarrow -Hy + H(y+70)$

$+ 60 \times 100 - (V_R + V_R') \times 400 = 0 .$

$\Rightarrow H = 185.71$

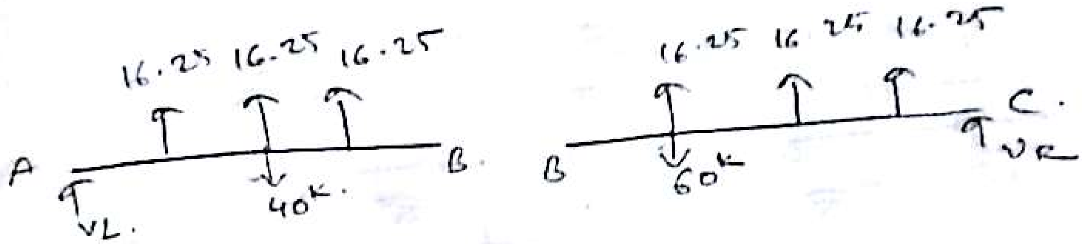
$H = \dfrac{wL^2}{8h}$

$\Rightarrow w = \dfrac{8hH}{L^2} = \dfrac{8 \times 70 \times 185.71}{800^2}$

$= 0.1625 \text{ K/ft}$

Hanger force = $w \times$ spacing

$= 0.1625 \times 100 = 16.25^{k}$



AB section

$\Sigma M_B = 0$

$\Rightarrow V_L \times 400 + 16.25 \times (300+200+100) - 40 \times 200 = 0$

$\Rightarrow V_L = -4.375$ (↓)

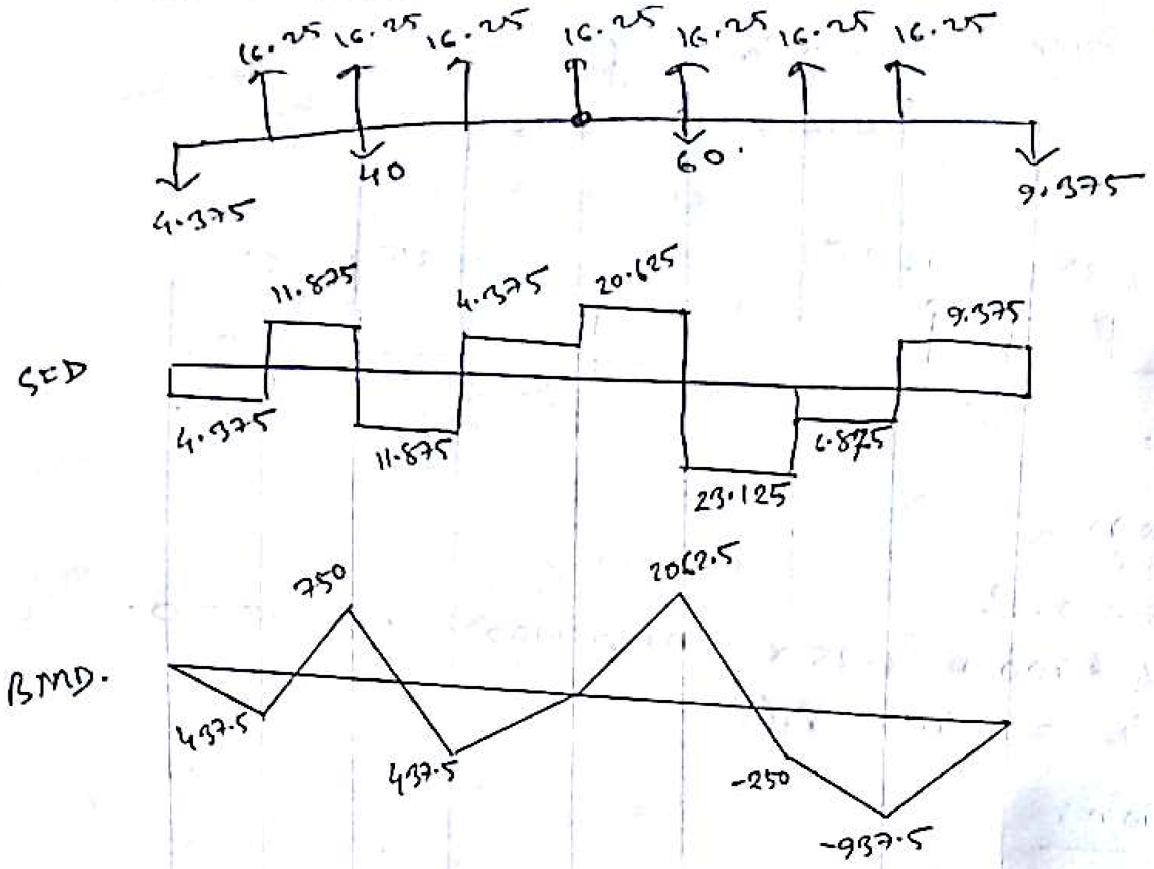
BC section

$\Sigma M_B = 0$

$-16.25 \times (100+200+300) - V_R \times 400 + 60 \times 100 = 0$

$\Rightarrow$

$\Rightarrow V_R = 9.375$ (↓)



12-13 ⑨ SFD BMD
↳ Same type

11-12 ③ Same type.

10-11 ⑬

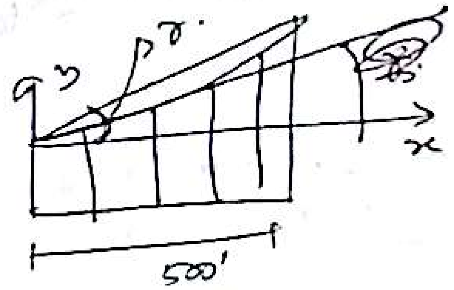
10-11

(13) Span = 500 ft.

$\frac{h}{L} = \theta = \frac{1}{40}$.

$\tan\gamma = 0.7$

$w = 1^{K}/ft$.



(i) slop at 400'
(ii) Tmax.
(iii) length

(i). ~~max~~ slop.
we know,
$$y = \frac{4hx}{L^2}(x-L) + x\tan\gamma.$$

$$\Rightarrow \frac{dy}{dx} = \frac{8hx}{L^2} - \frac{4h}{L} + \tan\gamma.$$

$$= \frac{8\theta x}{L} - 4\theta + \tan\gamma.$$

$$= \frac{8\times 400}{40\times 500} - 4\times\frac{1}{40} + 0.7$$

$\boxed{x = 400'}$

$$= 0.76$$

(ii) $T_{max} = H\cdot\frac{ds}{dx}.$

$$= H\sqrt{1+\left(\frac{dy}{dx}\right)^2} = \frac{wL^2}{8h}\sqrt{1+\left(\frac{dy}{dx}\right)^2}$$

$$= \frac{wL}{8\cdot h/L}\sqrt{1+\left(\frac{dy}{dx}\right)^2} = \frac{1\times 500}{8\times\frac{1}{40}}\times\sqrt{1+0.8^2}$$

$$= 3201.56^{K}.$$

(iii) Length of loaded cable.

$$S = \frac{L \sec\gamma}{2}\left(1+\frac{16\partial^2}{\sec^4\gamma}\right)^{1/2} + \frac{L\sec^3\gamma}{8\partial} \ln \left[\frac{4\partial}{\sec\gamma} + \left(1+\frac{16\partial^2}{\sec^4\gamma}\right)^{1/2}\right]$$

$\boxed{\begin{array}{l}\tan\gamma = 0.7 \\ \sec\gamma = 1.22\end{array}}$

$$= \frac{500\times 1.22}{2}\left(1+\frac{16\times 1^2}{40^2\times 1.22^4}\right)^{1/2} + \frac{500\times 1.22^3}{8\times\frac{1}{40}} \ln\left[\frac{4\times 1}{40\times 1.22^2} + \left(1+\frac{16\times 1^2}{40^2\times 1.22^4}\right)^{1/2}\right]$$

$$= 305.68 + 304.77 = 610.45 \approx 611'$$

9-10 Same type.

8-9 Same type.