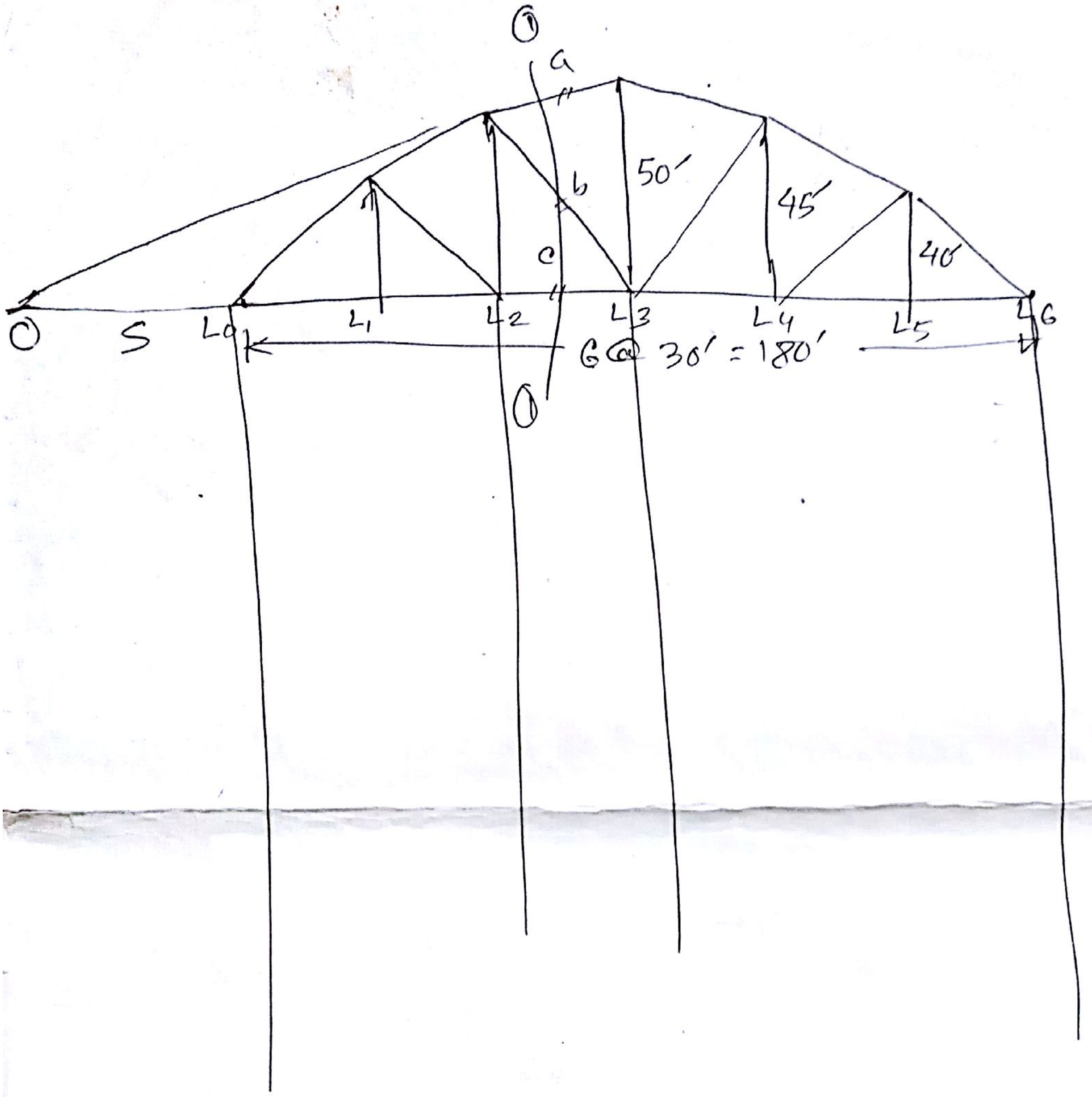
P: -Draw the ILD for a, b, c of the following structure.



Scanned by CamScanner

When unit load at L_0,

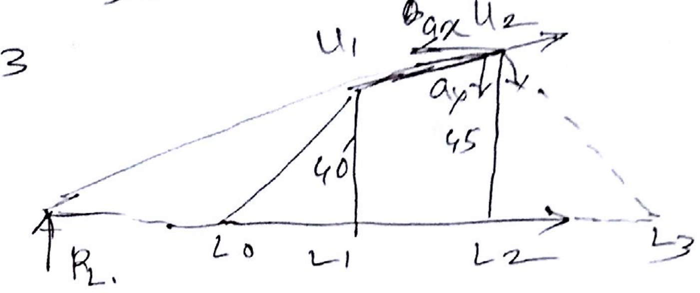
$R_L = 1$, $R_R = 0$, $a = b = c = 0$

When unit load at L_2,

$R_L = \frac{4}{6} = \frac{2}{3} = 0'67$

$R_R = 0'33$

$\Sigma M_{u_2} = 0$,



$c \times 45 = '67 \times 60$

$c = 0'89$.

Similar triangle

$$\frac{\overset{10}{\cancel{50}}}{90+s} = \frac{\overset{9}{\cancel{45}}}{60+s}$$

$810 + 9s = 10s + 600$

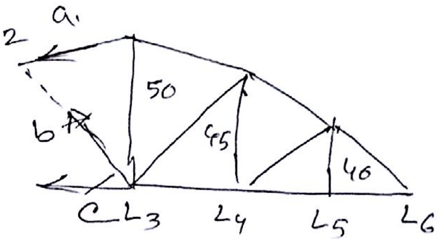
$s = 210$

Right portion for calculation 4312(3.

$\Sigma M_{u_2} = 0$

$c \times 45 = 0'33 \times 120$

$c = 0'88$.

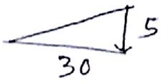


$\Sigma M_{L_3} = 0$

$a_x \times 50 + '33 \times 90 = 0$

$50 \times 0'986 \times a + 0'33 \times 90 = 0$

$a = -0'60$



$a^2 = a_x^2 + 5^2$

$a_x = '986a$.

$\Sigma F_x = 0$

$-a_x - b_x - c = 0$

$-'986 \times '60 - 0'556 - 0'88 = 0$

$b = -0'52$

$a = 30'41$

$\frac{a_x}{a} = \frac{30}{30'41}$

$\boxed{a_x = '986a}$

when unit load at L_3

$R_R = 0'5$

$\Sigma M_{U_2} = 0$

$c \times 45 + 1 \times 30 = \cdot 5 \times 120$

$c = 0'67,$

$\Sigma M_{L_3} = 0, \quad 50 \times 0'986a + 0'50 \times 90 = 0$

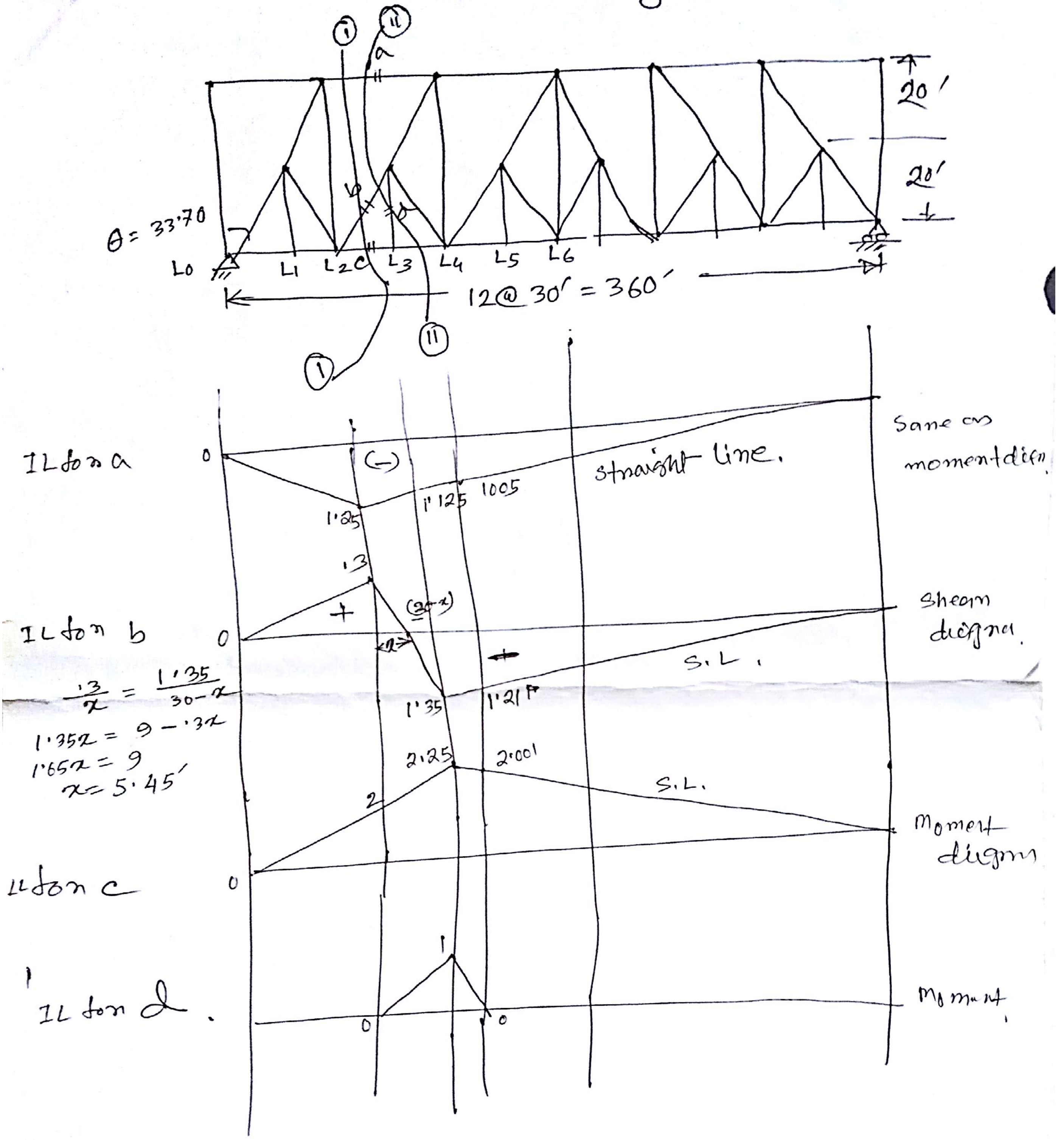
$a = 0'91$

$\Sigma F_x = 0.$

$-0'986 \times (-0'91) - 0'555b - 0'67 = 0$

$b = 0'41,$

Draw ILD for member a, b, c, d also calculate minimum stress due to H20 loading of the same structures.



$$\frac{.3}{x} = \frac{1.35}{30-x}$$

$1.35x = 9 - .3x$

$1.65x = 9$

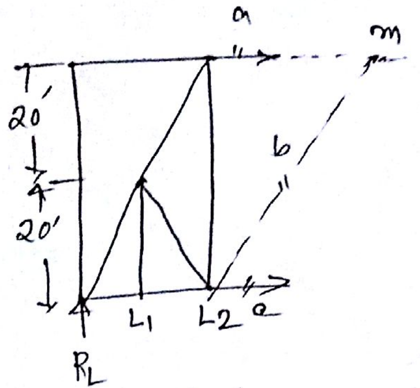
$x = 5.45'$

Calculation :

When unit load at L_0

$R = 1$, $R_R = 0$

$a = 0$, $b = 0$, $c = 0$, $d = 0$



S-1

When unit load at L_2

$R_L = \frac{10}{12} = \frac{5}{6} = 0'83$

$R_R = \frac{1}{6}$

S-1 , $\Sigma M_{L_2} = 0$

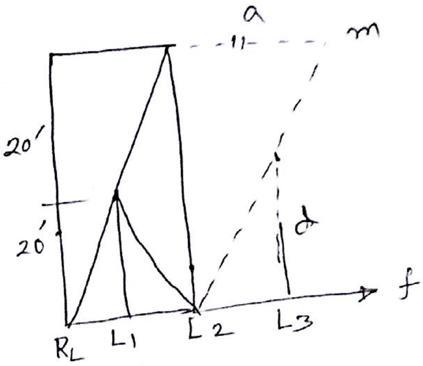
$a \times 40 + \frac{5}{6} \times 60 = 0$

$a = -1'25$

$\Sigma M_m = 0$

$1 \times 60 + c \times 40 = \frac{5}{6} \times 120$

$c = 1$



S-2

$\Sigma F_y = 0$

$0'83 + b \sin 33'70 - 1 = 0$

$b = 0'30$

S-2

$\Sigma M_{L_2} = 0$

$0'833 \times 60 - 1'25 \times 40 = d \times 30$

$d = '0007 \approx 0$

When unit load at L_3

$R_L = \frac{9}{12} = \frac{3}{4} = 0'75$

$R_R = 0'25$

S-1 $\Sigma M_{L_2} = 0$

$a \times 40 + 0'75 \times 60 = 0$, $a = -1'125$

$\Sigma M_m = 0$, $c = 2'25$

$c \times 40 = '75 \times 120$,

$\Sigma F_y = 0$, $0'75 + b \sin 33'70 = 0$

$b = -1'35$

S-2, $\Sigma M_{L_2} = 0$

$0'75 \times 60 + 1 \times 30 - 1'125 \times 40 = d \times 30$

$d = 1$

When Load at L_4

$R_L = \frac{8}{12} = \frac{2}{3} = 0'67$

$R_R = 0'33$

S-1 , $\Sigma M_{L2} = 0$

$a \times 40 + 0'67 \times 60 = 0$

$a = -1'005$

$\Sigma M_m = 0$,

$c \times 40 = 0'67 \times 120$

$a = 2'01$

$\Sigma F_y = 0$

$0'67 + b \sin 33'70 = 0$

$b = -1'21$

S-2 , $\Sigma M_{L2} = 0$

$0'67 \times 60 - 1'005 \times 40 = d \times 30$

$d = 0$

Maximum stress at member a $= \left[\frac{1}{2} \times 360 \times 1'25\right] '640 + 1'25 \times 18000$

$= 288 + 22'5 = 310'5$ kips ,

Maximum stress at member b ;

Negative stress $= \left[\frac{1}{2} \times 270 \times 1'35 + \frac{1}{2} \times 24'54 \times 1'35\right]$

$(182'25) \quad + 16'56$

$\times '64 + 1'35 \times 26 = 162'34$ Ki

positive stress $= \left[\frac{1}{2} \times 60 \times '3 + \frac{1}{2} \times \times 5'45 \times '3\right] \times '64 + '3 \times 26$

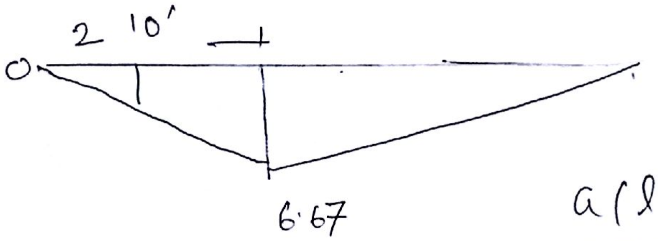
$= [9 + '8175] \times '64 + '3 \times 26 = 14'08$ Kips

maximum stress for c $= \left[\frac{1}{2} \times 360 \times 2'25\right] \times '64 + 18 \times 2'25$

$= 259'2 + 40'5 = 299.7$

Maximun stress for d $= \left[\frac{1}{2} \times 60 \times 1\right] \times '64 + 1 \times 18$

$= 37'2$.



$$\frac{a(l-a)}{l}\ 10$$

$$\frac{6.67}{\cancel{2}10} = \frac{x}{2}$$

$$= \frac{2(30-\cancel{2})}{30}$$

$$x = 1.334$$

$$= 1.334$$

$$\frac{6.67}{10} = \frac{x}{5}$$

$$\frac{\overset{x}{a}(l-a)}{\underset{x}{}\ l}\quad 10-a$$

$$x = 3.335$$

$$= \frac{\overset{x}{5}(30-\cancel{5})}{30}$$

$$= 3.33$$