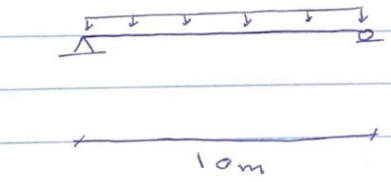
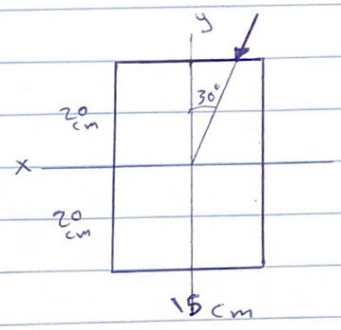
- HW #2 - ENCE 436

- Mohanad Moayad Shannak - 1181401



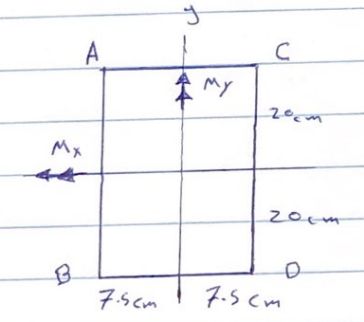


$M_{max} = \frac{wL^2}{8} = 62.5 \text{ t.m}$

(about axis perpendicular to load plane.)

$M_y = M_{max} \sin 30 = 31.25 \text{ t.m} = 3125 \text{ t.cm}$

$M_x = M_{max} \cos 30 = 54.13 \text{ t.m} = 5413 \text{ t.cm.}$



$$\sigma_A = + \frac{M_y X}{I_y} - \frac{M_x y}{I_x} = \frac{(3125)(7.5)}{1.125(10^4)} - \frac{(5413)(20)}{8(10^4)}$$

$\sigma_A = 0.73 \text{ t/cm}^2$ (tension)

Max stress:

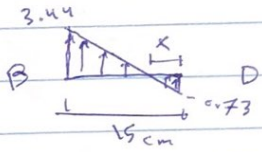
$\sigma_B = 3.44 \text{ t/cm}^2$ (tension)

$\sigma_C = -3.44 \text{ t/cm}^2$ (compression)

$\sigma_D = -0.73 \text{ t/cm}^2$ (compression).

$I_x = \frac{1}{12} BH^3 = 8 * 10^4 \text{ cm}^4$

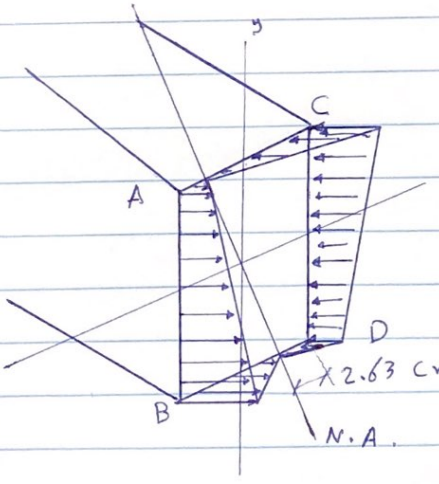
$I_y = \frac{1}{12} BH^3 = 1.125 * 10^4 \text{ cm}^4$



$\Rightarrow \frac{3.44}{15-X} = \frac{0.73}{X} \Rightarrow X = 2.63 \text{ cm.}$

or $Y = \left(\frac{I_x}{I_y} \tan 30^\circ\right) X$

$Y = 4.1056 X$ ⇐ Neutral axis equation.



axial force = 370 t.

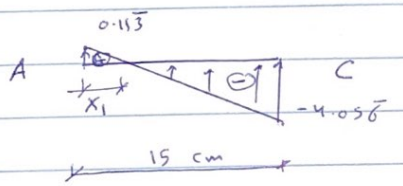
$$\sigma_A = \frac{M_y\, x}{I_y} - \frac{M_x\, y}{I_x} - \frac{P}{A}$$

$\sigma_A = 0.11\bar{3}$ t/cm²

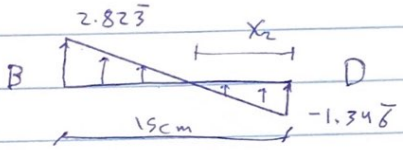
$\sigma_B = 2.82\bar{3}$ t/cm²

$\sigma_C = -4.05\bar{8}$ t/cm²

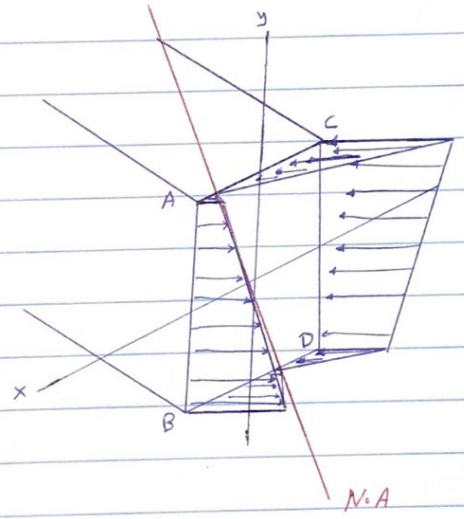
$\sigma_D = -1.34\bar{6}$ t/cm²



$X_1 = 0.41$ cm.



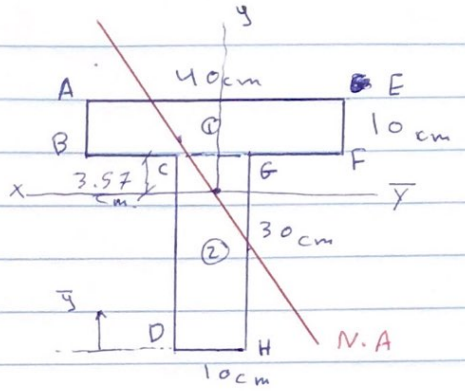
$X_2 = 4.84$ cm



12

$M_y = 3125 \quad t.cm$

$M_x = 5413 \quad t.cm$



Max. stress in tension.

$$\sigma_D = +\frac{M_y X}{I_y} + \frac{M_x y}{I_x}$$

$$\sigma_D = \frac{(3125)(5)}{5.583(10^4)} + \frac{(5413)(26.43)}{9.44(10^4)}$$

$\sigma_D = 1.795 \ t/cm^2$

Max. stress in Compresion.

$$\sigma_E = \frac{-M_y X}{I_y} - \frac{M_x y}{I_x}$$

$$\sigma_E = \frac{(-3125)(20)}{5.583(10^4)} - \frac{(5413)(13.57)}{9.44(10^4)}$$

$\sigma_E = -1.898 \ t/cm^2$

	$A_{(cm^2)}$	$\bar{y}$	$A\bar{y}$
①	400	35	14000
②	300	15	4500
	$\Sigma A = 700$		$\Sigma A\bar{y} = 18500$

$\bar{Y} = 26.43 \ cm$

$\bar{I}_y = \Sigma(\bar{I}_s + Ad^2) = 5.583 \times 10^4 \ cm^4$

	$I_{x(cm^4)}$	$d_{(cm)}$	$Ad^2 \ (cm^4)$
①	3333.33	8.57	68571.43
②	22500	11.43	39193.5

$\bar{I}_x = \Sigma(I_x + Ad^2) = 9.44 \times 10^4 \ cm^4$

N.A :

$$Y = \left(\frac{I_x}{I_y} \tan 30^\circ\right) X$$

$Y = 0.976 \ X$

add. axial force = 370 ton.

$$\sigma_A = \frac{M_y X}{I_y} + \frac{M_x y}{I_x} - \frac{P}{A} = -0.187 \ t/cm^2$$

$\sigma_B = 0.386 \ t/cm^2$

$\sigma_C = -0.453 \ t/cm^2$

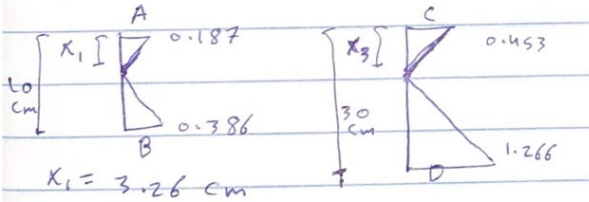
$\boxed{\sigma_D = 1.266 \ t/cm^2}$

$\sigma_H = 0.707 \ t/cm^2$

$\boxed{\sigma_E = -2.427 \ t/cm^2}$

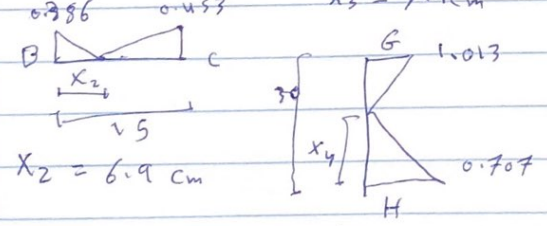
$\sigma_F = -1.853 \ t/cm^2$

$\sigma_G = -1.013 \ t/cm^2$



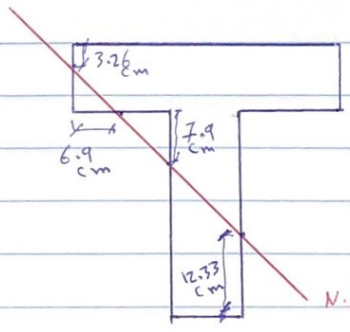
$X_1 = 3.26 \ cm$

$X_3 = 7.9 \ cm$



$X_2 = 6.9 \ cm$

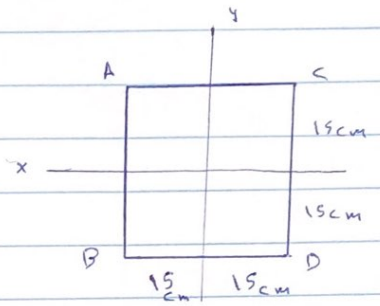
$X_4 = 12.33 \ cm$



3

$M_y = 3125 \ t.cm$

$M_x = 5413 \ t.cm$



$$\sigma_A = \frac{M_y X}{I_y} - \frac{M_x y}{I_x} = \frac{(3125)(15)-(5413)(15)}{I}$$

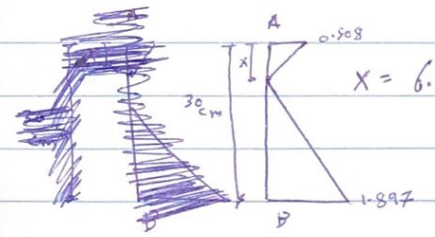
$\sigma_A = -0.508 \ t/cm^2$

max. $\begin{cases} \sigma_B = 1.897 \ t/cm^2 \\ \sigma_C = -1.897 \ t/cm^2 \end{cases}$

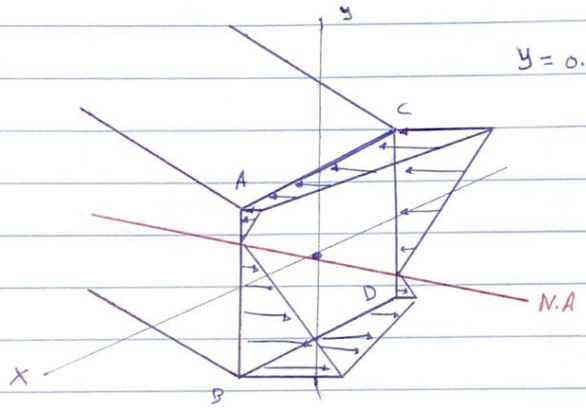
$\sigma_D = 0.508 \ t/cm^2$

$I_x = I_y = 6.75 \times 10^4 \ cm^4$

$y = 0.577 \ X$



$X = 6.34 cm$

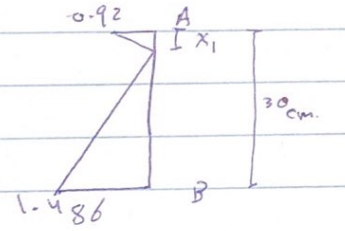


add. axial force = 370 ton

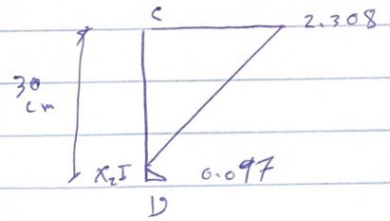
$$\sigma_A = \frac{M_y x - M_x y}{I} - P/A$$

$\sigma_A = -0.92 \ t/cm^2$, $\sigma_B = 1.486 \ t/cm^2$

$\sigma_C = -2.308 \ t/cm^2$, $\sigma_D = 0.097 \ t/cm^2$



$X_1 = 11.47 \ cm.$



$X_2 = 1.21 \ cm.$