DTY TUTORING, inc.

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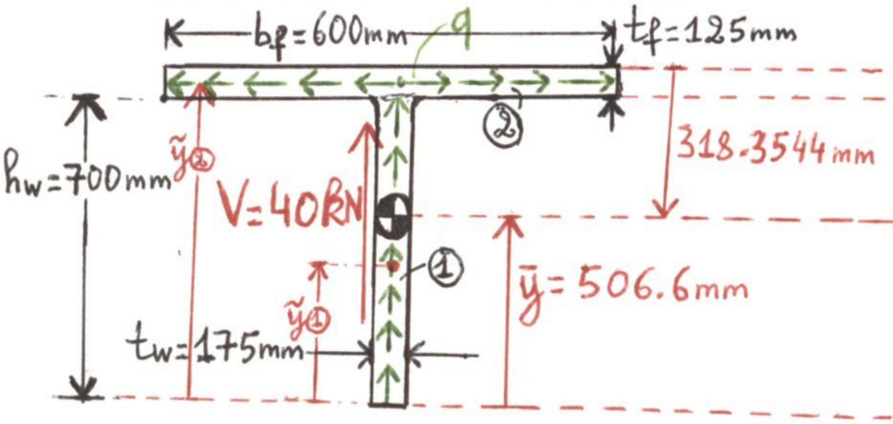
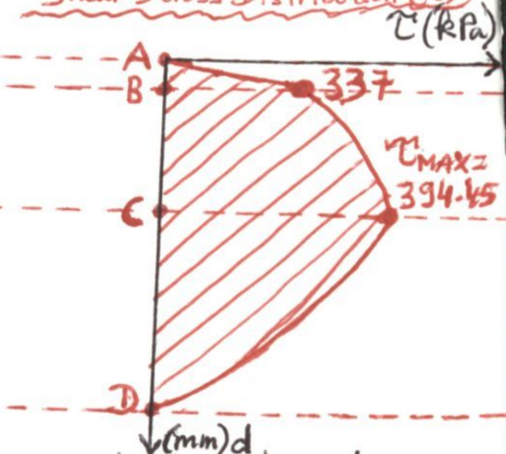
Date: 7th June 2019

Shear Flow Distribution (q)



Shear Stress Distribution (τ)



Section	b(mm)	h (mm)	$\tilde{y}$ (mm)	A (mm^2)	$\tilde{y}A$ (mm^3)	$d = \lvert\bar{y} - \tilde{y}\rvert$ (mm)
①	175	700	$\frac{700}{2} = 350$	(175)(700) = 122,500	(350)(122,500) = 42,875,000	(506.6)-(350) = 156.6456
②	600	125	$700 + \left(\frac{125}{2}\right) = 762.5$	(600)(125) = 75,000	(762.5)(75,000) = 57,187,500	$\lvert(506.6)-(762.5)\rvert$ = 255.8544
			+↓ΣA =	197,500		
				+↓Σ$\tilde{y}$A =	100,062,500	

$$\bar{y} = \frac{\Sigma \tilde{y} A}{\Sigma A} = \frac{100{,}062{,}500\ mm^3}{197{,}500\ mm^2} = 506.6456\ mm$$

$$I_{①} = \frac{bh^3}{12} + Ad_{①}^2 = \frac{(175)(700)^3}{12} + (122{,}500)(156.6456)^2 = 8{,}007{,}969{,}223\ mm^4$$

$$I_{②} = \frac{bh^3}{12} + Ad_{②}^2 = \frac{(600)(125)^3}{12} + (75{,}000)(255.8544)^2 = 5{,}007{,}266{,}800\ mm^4$$

$$I_{z(tot)} = I_{①} + I_{②} = (8{,}007{,}969{,}223) + (5{,}007{,}266{,}800) = 1.301523602 \times 10^{10}\ mm^4$$

$$= 1.301523602 \times 10^{10}\ mm^4 \left(\frac{1 \times 10^{-12}\ m^4}{1\ mm^4}\right)$$

$$= 0.01301523602\ m^4$$

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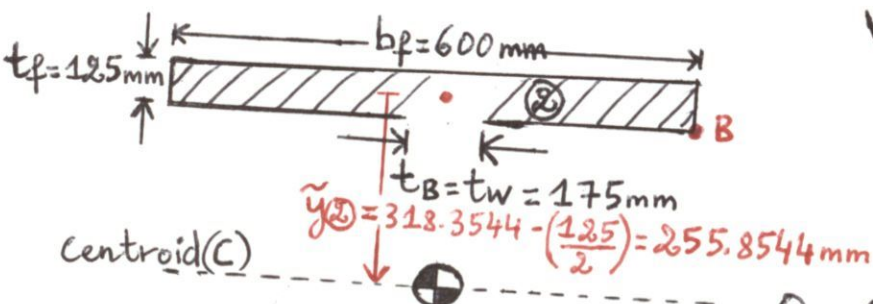
At A & D (top & bottom surfaces), $\tau_A = \tau_D = 0$

Shear stress at point B, τ_B



$V_{MAX} = 40 kN$

$I = 0.01301523602 \, m^4$

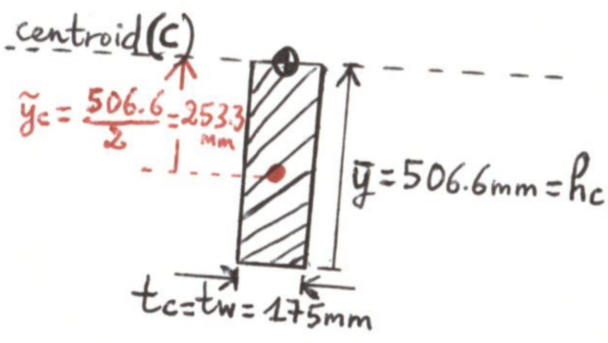
$t_B = 175 mm = 0.175 m$

$A_② = 75{,}000 \, mm^2 \left(\frac{1 \, m^2}{1 \times 10^6 \, mm^2}\right) = 0.075 \, m^2$

$Q_B = Q_② = \tilde{y}_② A_② = (0.2558544 m)(0.075 m^2) = 0.01918908 \, m^3$

$$\tau_B = \frac{V_{MAX} Q_B}{I \, t_B} = \frac{(40 kN)(0.01918908 \, m^3)}{(0.01301523602 \, m^4)(0.175 m)} = 336.995 \approx 337 \, kPa$$

Shear stress at point C (Centroid), τ_C



$V_{MAX} = 40 kN$

$I = 0.01301523602 \, m^4$

$t_c = 175 mm = 0.175 m$

$A_c = (h_c)(t_w) = (0.5066456 m)(0.175 m) = 0.08866298 \, m^2$

$Q_c = \tilde{y}_c A_c = (0.2533228 m)(0.08866298 \, m^2) = 0.02246035435 \, m^3$

$$\tau_c = \frac{(V_{MAX})(Q_c)}{(I)(t_c)} = \frac{(40 kN)(0.02246035435 \, m^3)}{(0.01301523602 \, m^4)(0.175 m)} = 394.45 \, kPa$$