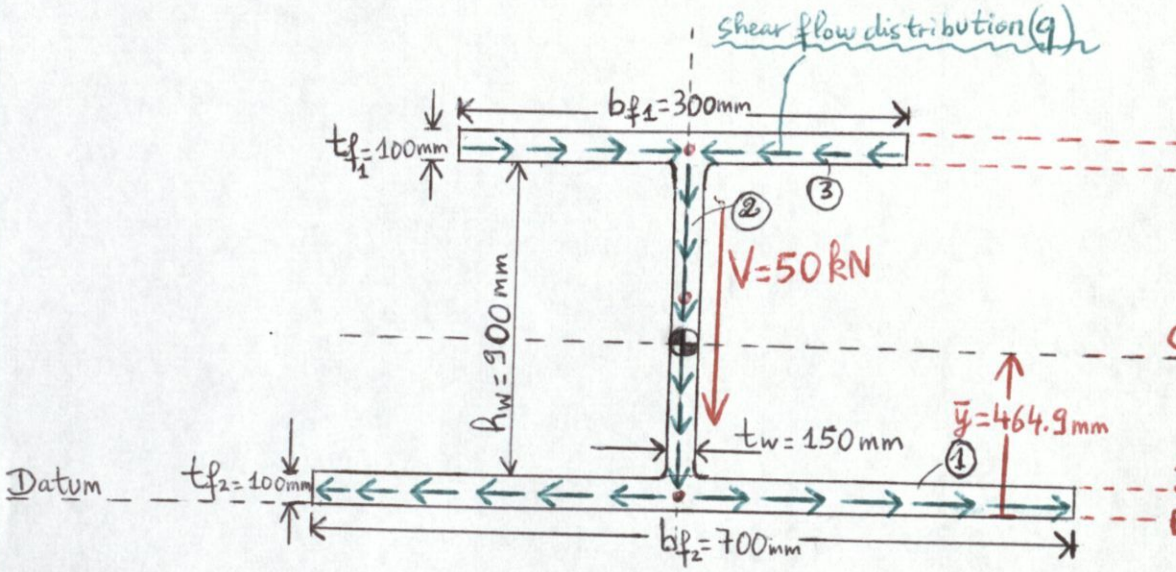
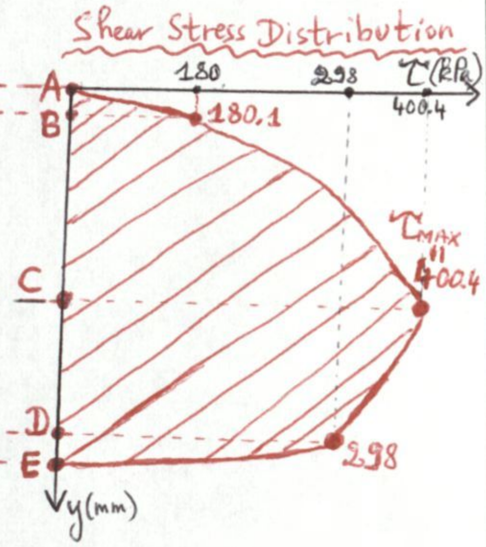
DTY Tutoring, inc.
Email: dtytutoring@gmail.com
Website:www.dtytutoring.com

Date: 7th March 2019





At A & E (top & bottom surface), $\tau_A = \tau_E = 0$

Section	b(mm)	h(mm)	$\tilde{y}$(mm)	A(mm²) = bh	$\tilde{y}A$(mm³)	d(mm) = $\lvert\bar{y}-\tilde{y}\rvert$
①	700	100	$\frac{100}{2} = 50$	70,000	3,500,000	414.893617
②	150	900	$100+\frac{900}{2} = 550$	135,000	74,250,000	85.106383
③	300	100	$100+900+\frac{100}{2} = 1,050$	30,000	31,500,000	585.106383
				ΣA = 235,000	Σ$\tilde{y}$A = 109,250,000	

$$\bar{y} = \frac{\Sigma \tilde{y}A}{\Sigma A} = \frac{109,250,000\,mm^3}{235,000\,mm^2} = 464.893617\,mm$$

$$I_{①} = \frac{bh^3}{12} + Ad^2 = \frac{(700)(100)^3}{12} + (70,000)(414.893617)^2 = 1.210790327 \times 10^{10}\,mm^4$$

$$I_{②} = \frac{bh^3}{12} + Ad^2 = \frac{(150)(900)^3}{12} + (135,000)(85.106383)^2 = 1.009031802 \times 10^{10}\,mm^4$$

$$I_{③} = \frac{bh^3}{12} + Ad^2 = \frac{(300)(100)^3}{12} + (30,000)(585.106383)^2 = 1.029548438 \times 10^{10}\,mm^4$$

$$I_{Tot} = I_{①} + I_{②} + I_{③} = (1.210790327 + 1.009031802 + 1.029548438) \times 10^{10}\,mm^4$$

$$= 3.249370567 \times 10^{10}\,mm^4 \left(\frac{1 \times 10^{-12}\,m^4}{1\,mm^4}\right) = 0.03249370567\,m^4$$

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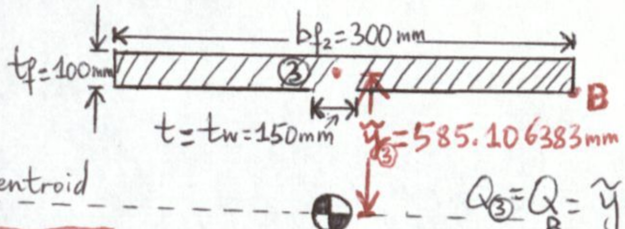
Shear Stress at point B, τ_B

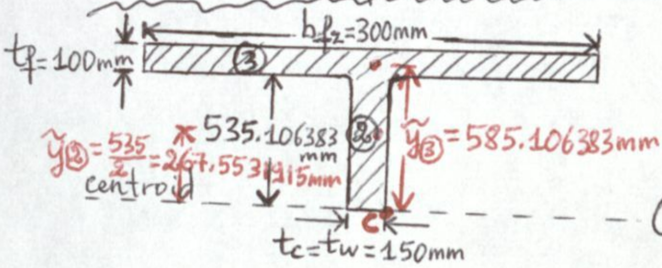


$V_{MAX} = 50kN$
$I = 0.03249370567 m^4$
$t_B = 0.150m$

$$Q_{③} = Q_B = \tilde{y}A = (0.585106383m)(0.1m)(0.3m) = 0.01755319149 m^3$$

$$\tau_B = \frac{V_{MAX} Q_B}{I t_B} = \frac{(50kN)(0.01755319149m^3)}{(0.03249370567m^4)(0.150m)} = 180.0676072 kPa = 180.1 kPa$$

Shear Stress at point C, $\tau_C = \tau_{MAX}$



$V_{MAX} = 50kN$
$I = 0.03249370567 m^4$
$t_c = 0.150m$

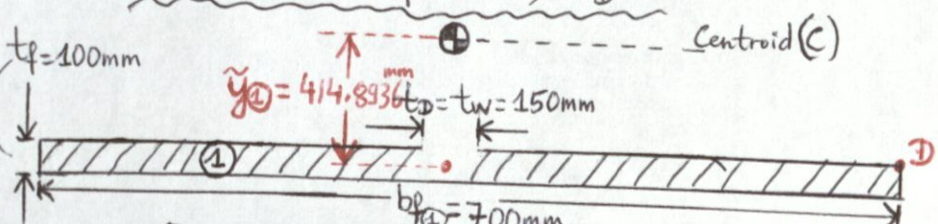
$$Q_{②} = \tilde{y}_{②} A_{②} = (0.2675531915m)(0.150m)(0.535106383m) = 0.02147541308 m^3$$

$$Q_{③} = \tilde{y}_{③} A_{③} = 0.01755319149 m^3 \text{ (from } Q_B \uparrow)$$

$$Q_c = Q_{②} + Q_{③} = (0.02147541308m^3) + (0.01755319149m^3) = 0.03902860457 m^3$$

$$\tau_{MAX} = \tau_c = \frac{V_{MAX} Q_c}{I t_c} = \frac{(50kN)(0.03902860457m^3)}{(0.03249370567m^4)(0.150m)} = 400.3709207 kPa = 400.4 kPa$$

Shear Stress at point D, τ_D



$V_{MAX} = 50kN$
$I = 0.03249370567 m^4$
$t_D = 0.150m$

$$Q_D = \tilde{y}_{①} A_{①} = (0.414893617m)(0.7m)(0.1m) = 0.02904255319 m^3$$

$$\tau_D = \frac{V_{MAX} Q_D}{I t_D} = \frac{(50kN)(0.02904255319m^3)}{(0.03249370567m^4)(0.150m)} = 297.930041 kPa = 298 kPa$$