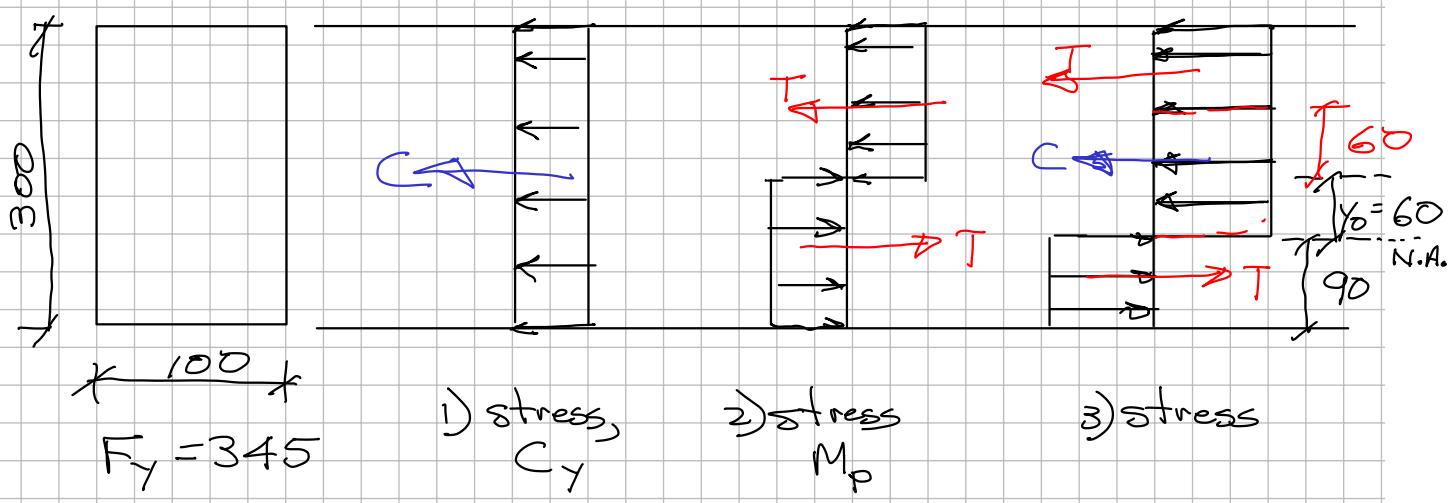
CIVE 3205

Example BC05b

Calculate points on Interaction Curve

Rectangular X-section



$F_y = 345$

1) stress, C_y 2) stress M_p 3) stress

1) stress distribution 1)

$$C = C_y = 100\,mm \times 300\,mm \times 345\,\frac{N}{mm^2} \times 10^{-3}\,\frac{kN}{N}$$

$$C_y = 10350\ kN$$

$$T = 0$$

$$M = 0$$

2) stress distribution 2)

$$C = 0$$

$$T = 100\,mm \times 150\,mm \times 345\,\frac{N}{mm^2} \times 10^{-3}\,\frac{kN}{mm}$$

$$T = 5175\ kN$$

$$M = M_p = T\left(\frac{d}{2}\right)$$

$$= 5175\ kN \times \frac{300\,mm}{2} \times 10^{-3}\,\frac{m}{mm}$$

$$M_p = 776.25\ kN\text{-}m$$

3) stress distribution 2)

for $y_o = 60$

$$C = 2 \times 60 \times 100 \ mm^2 \times 345 \frac{N}{mm^2} \times 10^{-3} \frac{kN}{N}$$

$$C = 4140 \ kN$$

$$T = (150-60) mm \times 100 mm \times 345 \frac{N}{mm^2} \times 10^{-3} \frac{kN}{N}$$

$$= 3105 \ kN$$

$$M = T\left(d - \frac{90}{2} \times 2\right)$$

$$= 3105 kN \times (300_{mm} - 90_{mm}) \times 10^{-3} \frac{m}{mm}$$

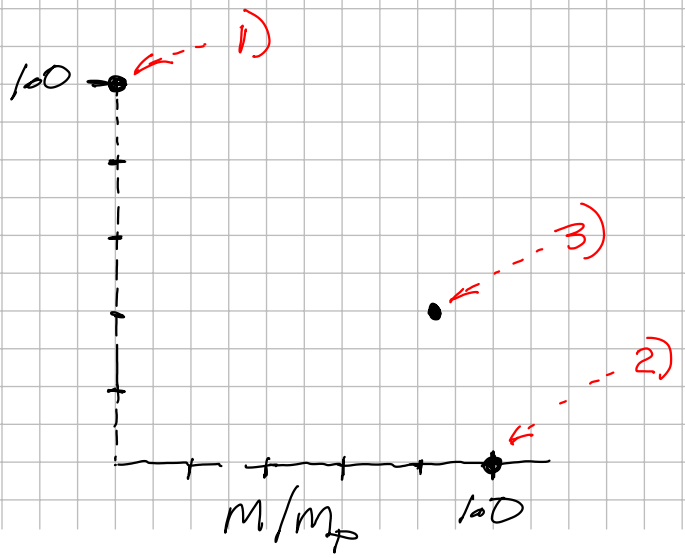
$$M = 652.05 \ kN\text{-}m$$

1) $y_o = 150$ $\quad C = C_y$ $\quad c/c_y = 1$ $\quad M = 0$ $\quad M/M_p = 0$

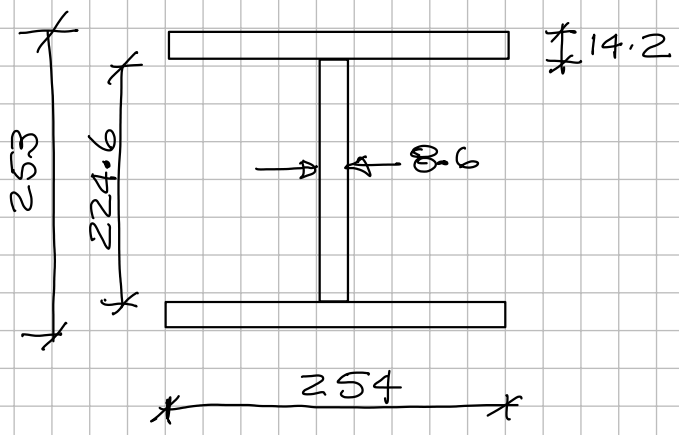
2) $y_o = 0$ $\quad C = 0$ $\quad c/c_y = 0$ $\quad M = M_p$ $\quad M/M_p = 1$

3) $y_o = 60_{mm}$ $\quad C = 4140 kN$ $\quad c/c_y = \frac{4140}{10350} = 0.4$ $\quad M = 652.05$ $\quad M/M_p = \frac{652.05}{776.25} = 0.84$

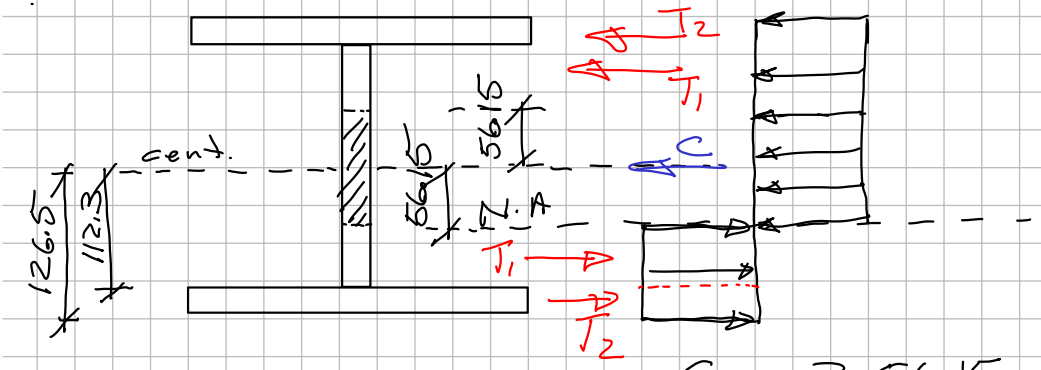
3 pts on I.C.



2) I-Shape (W250x73)



1) N.A. in web, $y_0 = 56.15$ mm



$$C = 2 \times 56.15 \times 8.6 \times 345 \times 10^{-3}$$

$$C = 333.19 \text{ kN}$$

T_1 = tension in web

$$= (112.3 - 56.15) \times 8.6 \times 345 \times 10^{-3}$$

$$= 166.597 \text{ kN}$$

T_2 = tension in flange

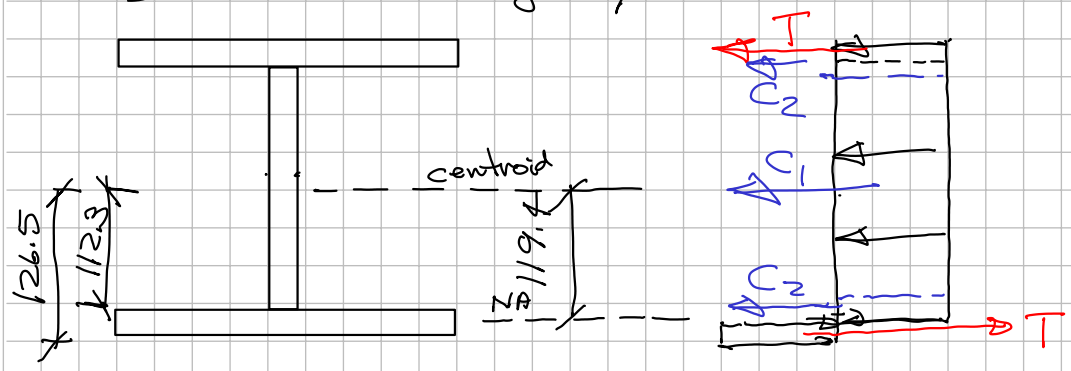
$$= 254 \times 14.2 \times 345 \times 10^{-3}$$

$$= 1244.346 \text{ kN}$$

$$M = T_1 \left(56.15 + \frac{112.3 - 56.15}{2}\right) \times 2 + T_2 \left(253 - 2 \times \frac{14.2}{2}\right) \times 10^{-3}$$

$$M = 325.21 \text{ kN-m}$$

2) N.A in flange $y_o = 119.4$ mm



C_1 = compression in web

$= 224.6 \times 8.6 \times 345 \times 10^{-3}$

$= 666.388$ kN

C_2 = compression in part of one flange

$= 254(119.4 - 112.3) \times 345 \times 10^{-3}$

$= 622.173$ kN

$C = C_1 + 2C_2$

$= 666.388 + 2 \times 622.173$

$C = 1910.7$ kN

T = tension in part of flange

$t' = 126.5 - 119.4 = 7.1$ mm

$T = 7.1 \times 254 \times 345 \times 10^{-3}$

$= 622.173$ kN

$M = T\left(d - 2\frac{t'}{2}\right)$

$= 622.173 \times (253 - 7.1) \times 10^{-3}$

$M = 152.99$ kN-m