$$130(10^6) = \frac{M(0.0625)}{5.9489(10^{-6})}$$

$M = 12374\ N\cdot m$

ii) Assume failure of Wood.

$$(\sigma_{allow})_w = n\frac{Mc}{I}$$

$$20(10^6) = 0.065\frac{M(0.0625)}{5.9489(10^6)}$$

$M = 29063\ N\cdot m$

so $M = 12374\ N\cdot m$

i) Assume failure of steel

$$(\sigma_{max})_{st} = (\sigma_{allow})_{st} = \frac{Mc}{I}$$

$$180(10^6) = \frac{M(0.08355)}{51.621(10^{-6})}$$

$M = 124130\ N\cdot m$

ii) Assume failure of brass

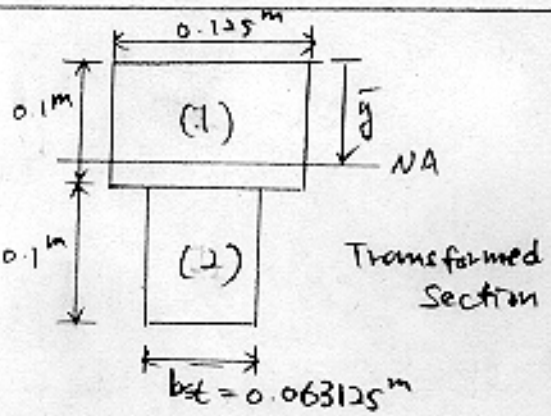
$$(\sigma_{allow})_{br} = n\frac{Mc}{I}$$

$$60(10^6) = 0.505\frac{M(0.2-0.08355)}{51.621(10^{-6})}$$

$M = 58792\ N\cdot m$

so, $M = 58792\ N\cdot m$ controls

6-127



$$n = \frac{E_{br}}{E_{st}} = \frac{101(10^9)}{200(10^9)} = 0.505$$

$$b_{st} = n\,b_{br} = 0.505(0.125) = 0.063125$$

$$\bar{y} = \frac{\Sigma \bar{y}A}{\Sigma A} = \frac{0.05(0.125)(0.1)+0.15(0.1)(0.063125)}{0.125(0.1)+0.1(0.063125)}$$

$$= 0.08355\ (m)$$

$$I = I_1 + I_2$$

$$= \frac{1}{12}(0.125)(0.1^3) + 0.125(0.1)(0.08355-0.05)^2$$

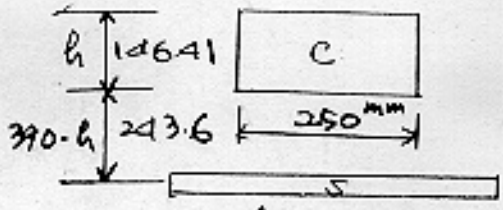
$$+ \frac{1}{12}(0.063125)(0.1^3)$$

$$+ 0.063125(0.1)(0.15-0.08355)^2$$

$$= 51.621(10^{-6})\ m^3$$

4-166 supplemental problem (1)

$$n = \frac{E_s}{E_c} = \frac{200}{15} = 13.333$$



$nA_s = 13.333(825)$

$$M_{max} = \frac{wL^2}{8} = \frac{12(4^2)}{8} = 24\ kN\cdot m$$

$$250h\left(\frac{h}{2}\right) = 13.333(825)(390-h)$$

$$125h^2 + 11000h - 4.290(10^6) = 0$$

$h = 146.41\ (mm)$

$$I = \frac{1}{3}(250)(146.41)^3 + 13.333(825)(243.6)^2$$

$$= 914.3(10^6)\ mm^4$$