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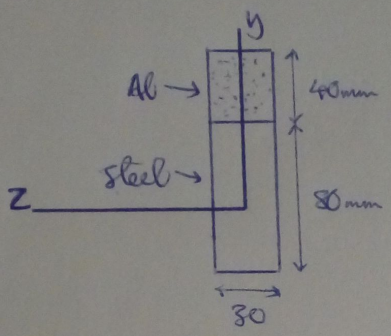
* COMP Nº: 201824953 3
* COURSE: 3211 (Mechanics of Materials)
* ASSIGNMENT COVERAGE: BENDING MOMENTS IN COMPOSITE BEAMS

ASSIGNMENT

A composite beam is made of Aluminium and Steel. Take E for steel and aluminium 200GPa and 75GPa respectively:
Under the action of a bending moment that produces a maximum stress of 50MPa in the aluminium, what is the maximum stress in the steel?

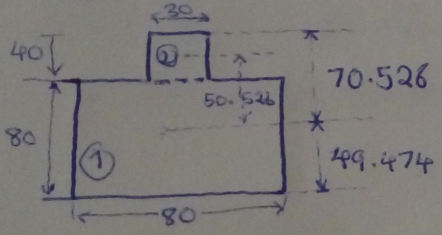


* $\sigma = \frac{Mc}{I}$

* $n = \frac{E_1}{E_2}$, where $E_1 > E_2$

Solutions

* If we modify this beam to be completely made of aluminium, new dimensions are;



	y	A	yA
1	40	6400	256000
2	100	1200	120000

$\bar{y} = \frac{\Sigma yA}{\Sigma A} = \frac{376000}{7600}$

$\therefore \bar{y} = 49.474$

* Since we don't have M & I, we'll use the ratio of σ_{steel} & σ_{Al} to find the maximum stress in Aluminium.

- $\sigma_s = \frac{Mc_1 n}{I}$ where $c_1 = 49.474$ & $\sigma_{Al} = \frac{Mc_2}{I}$, $c_2 = 70.526$

$$\Rightarrow \frac{\sigma_s}{\sigma_A} = \frac{\left(\frac{Mc_1 n}{I}\right)}{\left(\frac{Mc_2}{I}\right)} = \frac{c_1 n}{c_2} = \frac{49.474\left(\frac{8}{3}\right)}{70.526}$$

$\therefore \frac{\sigma_s}{\sigma_A} = 1.8707$ ⇒ This means that $\sigma_s : \sigma_A = 1.8707 : 1$ in terms of max stress.

σ_s		σ_A
1.807	:	1
x	:	50MPa

$\therefore \sigma_s = 50(1.807)$

$= 93.5 MPa$

* Max stress of in Aluminium is smaller by a factor of $\frac{1}{1.807}$