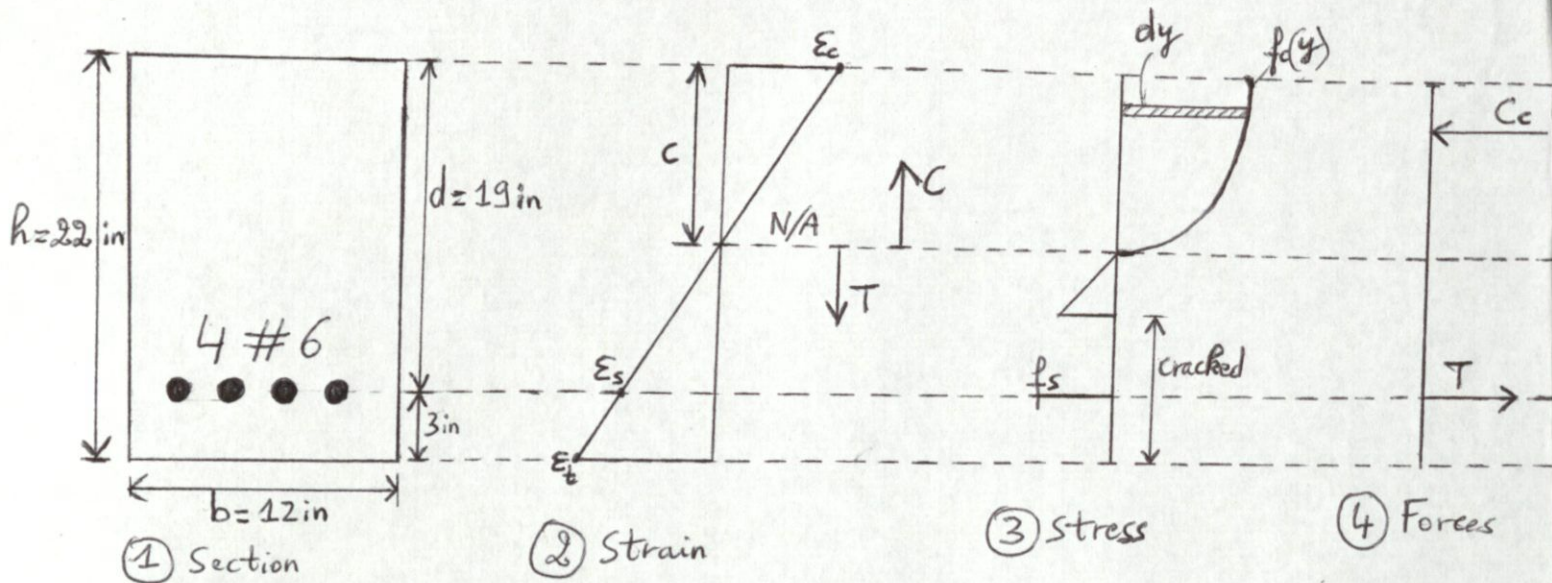


Date: 9th October 2018

Singly Reinforced Beam Example 2



#6 bars $\rightarrow A = 0.44 \text{ in}^2$
 $A_s = (4)(0.44 \text{ in}^2) = 1.76 \text{ in}^2$

$f'_c = 3,000 \text{ psi} \leq 4,000 \text{ psi} \Rightarrow \beta_1 = 0.85, f_y = 60,000 \text{ psi} = 60 \text{ ksi}$

$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(1.76 \text{ in}^2)(60 \text{ ksi})}{0.85(3 \text{ ksi})(12 \text{ in})} = 3.450980392 \text{ in}$

$M_N = A_s f_y \left[d - \frac{a}{2} \right] = (1.76 \text{ in}^2)(60 \text{ ksi}) \left[19 \text{ in} - \frac{3.45098}{2} \right] = 1,824.188235 \text{ kips-in}$

Strain Compatibility

$c = \frac{a}{\beta_1} = \frac{3.450980392 \text{ in}}{0.85} = 4.059976932 \text{ in}$

$\epsilon_t = \epsilon_s = \left(\frac{d-c}{c} \right) \epsilon_{cu} = \left(\frac{19 \text{ in} - 4.059976932 \text{ in}}{4.059976932 \text{ in}} \right) (0.0035) = 0.01287940341 > 0.005$
 $\phi = 0.9$ ← Tension controlled

$\phi M_N = (0.9)(1,824.188235 \text{ kips-in}) = 1,641.769412 \text{ kips-in} \approx 1,642 \text{ kips-in}$