

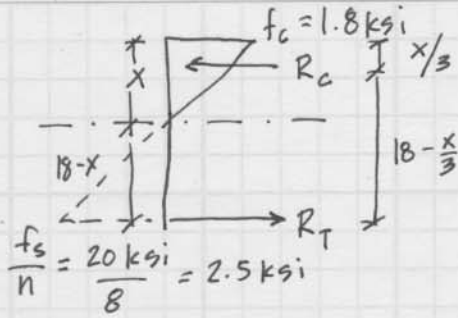
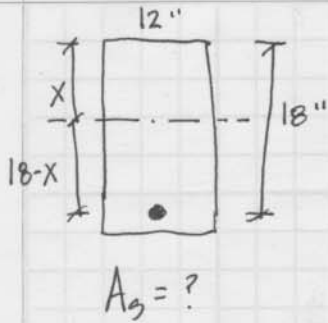
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13-2 (F) (A)



steel:  
 $F' = 20 \text{ ksi}$   
 $E_s = 29000 \text{ ksi}$   
 concrete:  
 $F' = 1.8 \text{ ksi}$   
 $E_c = 3625 \text{ ksi}$   
 $n = 8$  (Data Sheet D-23)

By Similar Triangles From stress Diagram:

$$\frac{1.8 \text{ ksi}}{x} = \frac{2.5 \text{ ksi}}{18-x} \quad 2.5x = 1.8(18-x)$$

$$\boxed{x = 7.5''}$$

$$R_c = \frac{f_c B x}{2} = \frac{(1.8 \text{ ksi})(12'')(7.5'')}{2} = 81 \text{ k}$$

$$R_c = R_T = A_s f_s$$

$$A_s f_s = 81 \text{ k} = A_s (2.5 \text{ ksi})$$

$$A_s = 32.4 \text{ in}^2$$

Now Reduce by  $\alpha = 8$

$$A_s = \frac{32.4 \text{ in}^2}{8} = 4.05 \text{ in}^2$$

$$A_s f_s = 81 \text{ k}$$

$$A_s = \frac{81 \text{ k}}{f_s} = \frac{81 \text{ k}}{20 \text{ ksi}} = 4.05 \text{ in}^2$$

$$M = R_c (18 - x/3) = R_T (18 - x/3) = \frac{81 \text{ k} (18'' - 7.5''/3)}{12''} = 104.6 \text{ k-ft}$$