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ARCH 324 - Structures 2, Winter 2009

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15-1

A.2) find $M_u$

$f'_c = 3000 \text{ PSI}$

$k_i = 0.85$

$f_y = 60 \text{ KSI}$

$A_s = 3 \times \# 8$

![Diagram]

1) $A_s = \# \text{ bars (area of 1 bar)}$

$A_s = 3 \times (0.79) = 2.37 \text{ in}^2$

^from table p341

2) find limit of $a$ (depth of the stress block)

$$a = k_i \left[ \frac{87}{87 + f_y} \right] d (0.75)$$

based on strength of concrete

using $a = \frac{A_s f_y}{0.85 f_c b}$

$$a = \frac{0.85 f'_c}{0.85 f_c b}$$

3) $c = T$

$0.85f'_c ab = A_s f_y$

$$a = \frac{A_s f_y}{0.85 f'_c b}$$

$a = \frac{2.37 (60)}{0.85 (3)(12)} = 4.65 < \text{ limit so steel is yielding before compressive failure in concrete}$
4) find moment capacity

\[ M = A_s f_y y d = 0.85 f'_c a b j d \]

for a rectangular section \( y d = d - a/2 \)

\[ M = M_n = A_s f_y \left( d - \frac{a}{2} \right) = 2.37 \times (60) \left( 18 - \frac{4.65}{2} \right) \]

\[ M_n = 2228.99 \, k' = 185.75 \, k' \]

5) \( M_u = 0.9 \, M_n \)

\[ M_u = 0.9 \times (185.75) = 167.18 \, k' \]