ARCH 324 - Structures 2, Winter 2009

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15-1

\( A_{s,2} \) find \( M_u \)

\[ f'_{c} = 3000 \text{ PSI} \]
\[ k_1 = 0.85 \]
\[ f_y = 60 \text{ KSI} \]
\[ A_s = 3 \times \# 8 \]

1) \( A_s = \# \text{bars (area of 16 bars)} \)
\[ A_s = 3 \times (0.79) = 2.37 \text{ in}^2 \]
\[ \text{from table p341} \]

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

\[ a = k_1 \left[ \frac{87}{87+f_y} \right] d (0.75) \]

based on strength of concrete

\[ a = 0.85 \left[ \frac{87}{87+60} \right] 18 \times (0.75) \]
\[ a = 6.79'' \]

using \( a = \frac{A_s f_y}{0.85 f'_{c} b} \)

\[ c = \frac{0.85 f'_{c}}{0.85 f'_{c} b} \]
\[ 0.85 f'_{c} ab = A_s f_y \]

\[ a = \frac{A_s f_y}{0.85 f'_{c} b} \]
\[ a = \frac{2.37}{0.85 (3)(12)} = 4.65 < \text{limit so steel is yielding before compressive failure in concrete} \]
4) find moment capacity
\[ M = A_s f_y d = 0.85 f_c a b j d \]
for a rectangular section \( j_d = d - a/2 \)

\[ M = M_n = A_s f_y (d - \frac{a}{2}) = 2.37 \times (60) \times (18 - \frac{4.65}{2}) \]
\[ M_n = 2228.99 \text{ kN} = 185.75 \text{k} \]

5) \( M_u = 0.9 M_n \)
\[ M_u = 0.9 \times (185.75) = 167.18 \text{ kN} \]