ARCH 324 - Structures 2, Winter 2009

von Buelow, Peter

http://hdl.handle.net/2027.42/64938
1. Determine Neutral Axis of the Effective Section:

\[ A_e \bar{x}_e = A_t \bar{x}_t \]

\[ (18" \times 3") (x + 1.5") + (8" \times x) (x / 2) = 24 \text{ in}^2 (15 - x) \]

\[ 54x + 81 + 4x^2 = 360 - 24x \]

\[ 4x^2 + 78x - 279 = 0 \]

Solve using quadratic formula:

\[ x = \frac{-78 \pm \sqrt{78^2 - (4)(4)(-279)}}{2(4)} \]

\[ x = 3.088" \]

2. Transformed Moment of Inertia:

\[ b d^3 / 12 = \frac{18}{12} (3)^3 = 40.5 \text{ in}^4 \]

\[ A y^2 = (18)(5)(3.088 + 1.5)^2 = 1136.7 \text{ in}^4 \]

\[ A y^2 = \frac{24 \text{ in}^2}{11.912 \text{ in}^2} = 3405 \text{ in}^4 \]

\[ I_{TR} = 4661.2 \text{ in}^4 \]

3. Resisting Capacity of Concrete & Steel:

Concrete \( f' = 1.8 \text{ ksi} \)

\[ M = \frac{F' I_{TR}}{C} \]

Steel \( f' = 20 \text{ ksi} \)

Steel governs.

4. Actual Stress in concrete:

\[ f = \frac{M_c}{I_{TR}} = \frac{(978 '' k)(6.088'')}{4661 \text{ in}^4} = 1.28 \text{ ksi} \]