ARCH 324 - Structures 2, Winter 2009

von Buelow, Peter

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TRIANGULAR SECTION

1. Transform Section

2. Determine the Neutral Axis

3. Determine $I_{yr}$

4. Resisting Moment Capacity

**Steel:** $M = rac{f_{y}}{f_{y,c}} \cdot \frac{I_{yr}}{C_{x,n}} = 24,000 \times \frac{1423.64}{15.315} = 22,309.97 \text{ k-in} = \frac{223,099.7}{12} = 18,591.65 \text{ ft-lbs}$

**Concrete:** $M = \frac{f_{y}}{f_{y,c}} \cdot \frac{I_{yr}}{C_{x,n}} = 135,000 \times \frac{1423.64}{4.695} = 3684,18 \text{ k-in} = 307,01 \text{ ft-lbs}$

Steel governs $M = 185,91 \text{ k-ft}$
(2) Safe uniform load on a simple span of 24 ft.

\[ M = \frac{Wl}{8} \]
\[ W = \frac{8M}{l} = \frac{8 \times 185.91}{24} = 61.97 \text{k} \]

(3) Determine the most economical wide flange steel section needed for the same load, without composite action.

\[ M_{\text{max}} = \frac{Wl}{8} = \frac{61.97 \times 24}{8} = 185.91 \text{k-ft} \]

\[ S > \frac{M_{\text{max}}}{f_{\text{steel}}} = \frac{185.91 \times 12}{24^{\frac{9}{5}}} = 92.955 \text{ in}^3 \]

From DATA SHEET U-36, choose \( W21 \times 50 \)