

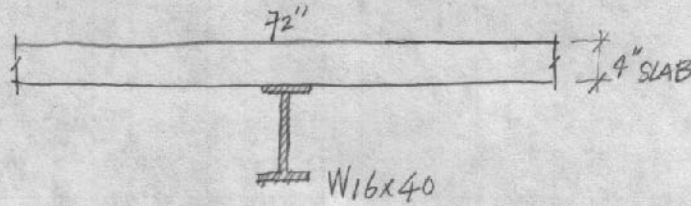
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14-2 (I)



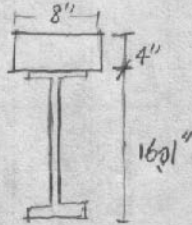
ALLOW f (steel) = 24 ksi
ALLOW f (conc.) = 1,350 psi

$$\eta = \frac{E_c}{E_s} = \frac{1}{9}$$

$$S = 64.7 \text{ in}^3, I_x = 518 \text{ in}^4$$

$$A = 11.8 \text{ in}^2$$

• TRANSFORMED SECTION



• Determine the Neutral Axis

use top of concrete as base line

$$\bar{X} = \frac{\sum A_i X_i}{\sum A} = \frac{(4 \times 8) \times 2 + 11.8 \times 12.05}{(4 \times 8) + 11.8} = 4.695$$

• Determine I_{tr}

	I	$A y^2$	I_y
I_{tr}	$\frac{8 \times 4^3}{12} = 42.67$	$32 \times 2.695^2 = 232.42$	275.09
	518	$11.8 \times 7.31^2 = 630.55$	1148.55
			<u>1423.64 in⁴</u>

(1) Resisting Moment Capacity

Steel: $M = f_b \cdot \frac{I_{tr}}{C_s} = 24 \text{ ksi} \times \frac{1423.64 \text{ in}^4}{15.315 \text{ in}} = 2230.97 \text{ k-in} = 185.91 \text{ k-ft}$

Concrete: $M = f_c \cdot \frac{I_{tr}}{C_c \times \eta} = 1.35 \text{ ksi} \times \frac{1423.64}{4.695 \times \frac{1}{9}} = 3684.18 \text{ k-in} = 307.01 \text{ k-ft}$

∴ steel governs.

$$M = 185.91 \text{ k-ft}$$

(2) Safe uniform load on a simple span of 24 FT.

$$M = \frac{\bar{W}l}{8}$$

$$\therefore \bar{W} = \frac{8M}{l} = \frac{8 \times 185.91 \text{ K-FT}}{24 \text{ FT}} = \boxed{61.97 \text{ K}}$$

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

$$M_{\max} = \frac{\bar{W}l}{8} = \frac{61.97 \times 24}{8} = 185.91 \text{ K-FT}$$

$$S \geq \frac{M_{\max}}{f_b_{\text{steel}}} = \frac{185.91 \times 12 \text{ in/FT}}{24 \text{ ksi}} = 92.955 \text{ in}^3$$

FROM DATA SHEET D-36. Choose $\boxed{W21 \times 50}$ ✓