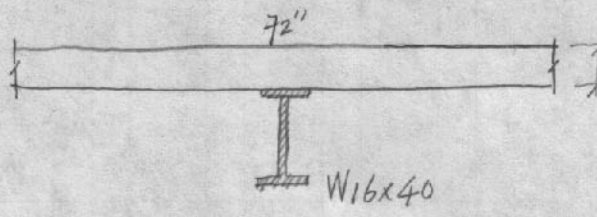
open.michigan

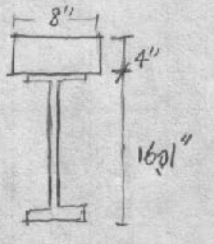
14-2 (I)



$S = 64.7\ in^3$, $I_x = 518\ in^4$
$A = 11.8\ in^2$

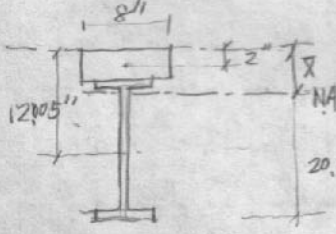
ALLOW f_s (steel) = 24 KSI
ALLOW f_c (conc.) = 1,350 psi
$n = \frac{E_c}{E_s} = \frac{1}{9}$

- TRANSFORMED SECTION



- Determine the Neutral Axis

use top of concrete as base line



$$\bar{x} = \frac{\Sigma A_i x_i}{\Sigma A} = \frac{(4\times8)\times 2" + 11.8 \times 12.005"}{(4\times8) + 11.8} = 4.695"$$

- Determine I_{tr}

		I	Ay^2	I_g
I_{tr}		$\frac{8\times4^3}{12} = 42.67$	$32 \times 2.695^2 = 232.42$	275.09
		518.	$11.8 \times 7.31^2 = 630.55$	1148.55
				$1423.64\ in^4$

(1) Resisting Moment Capacity

Steel: $M = f_{b(s)} \cdot \frac{I_{tr}}{c_s} = 24^{KSI} \times \frac{1423.64^{in^4}}{15.315_{in}} = 2230.97^{K\text{-}in} = \underline{185.91^{K\text{-}ft}}$ ✓

Concrete: $M = f_{b(c)} \cdot \frac{I_{tr}}{c_c \times n} = 1.35^{KSI} \times \frac{1423.64}{4.695 \times \frac{1}{9}} = 3684.18^{K\text{-}in} = 307.01^{K\text{-}ft}$

∴ steel governs.

$$\boxed{M = 185.91^{K\text{-}ft}}$$

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

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

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

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

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

$$S \geq \frac{M_{max}}{f_{b_{steel}}} = \frac{185.91^{K\text{-}FT} \times 12^{IN/FT}}{24^{KSI}} = 92.955\ in^3$$

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