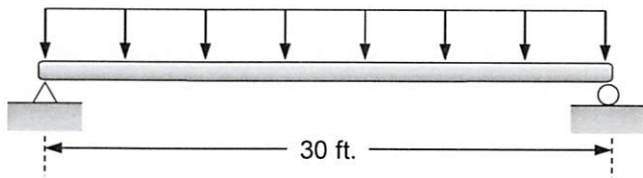


A W16 x 40 of A992 steel with $F_y = 50 \text{ ksi}$; $F_u = 65 \text{ ksi}$ is used for the simply supported beam shown. If lateral support is provided at the mid-point. Determine the design moment capacity of the beam.



$$L_b = 15 \text{ ft}$$

* FROM TABLE 3-1 $C_b = 1.30$

* FROM TABLE 3-2: $\left[\phi_b M_p = 274 \text{ kft} \Rightarrow M_p = 304.4 \text{ kft} \right.$
 $\left. L_p = 5.55 \text{ ft} \quad L_r = 15.9 \text{ ft} \right.$

$\therefore L_p < L_b < L_r \Rightarrow \text{USE EQ. F2-2}$

$$M_n = C_b \left[M_p - (M_p - 0.7 F_y S_x) \left[\frac{L_b - L_p}{L_r - L_p} \right] \right] \leq M_p$$

$$M_p = 304.4 \text{ kft} = 3,653 \text{ k}\cdot\text{m}$$

$$M_r = 0.7 F_y S_x = 0.7 (50 \text{ ksi}) 64.7 \text{ in}^3 = 2,264.5 \text{ k}\cdot\text{m}$$

$$M_n = 1.3 \left[3,653 - (3,653 - 2,264.5) \left[\frac{15 - 5.55}{15.9 - 5.55} \right] \right]$$

$$= 3,100.8 \text{ k}\cdot\text{m} = 258.4 \text{ k}\cdot\text{ft} < M_p$$

$$\therefore \phi M_n = 0.90 (258.4 \text{ k}\cdot\text{ft}) = \underline{\underline{232.6 \text{ kft}}}$$