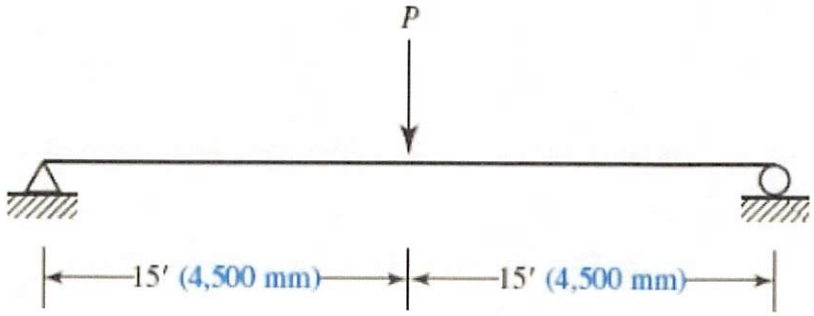
5.5-1 The beam shown in Figure P5.5-1 is a W10 × 77(**W250 × 115**) and has continuous lateral support. The load P is a service live load. If $F_y = 50$ ksi(**345 MPa**) what is the maximum permissible value of P ?



FROM TABLE 1-1 (1-28) $\frac{b_f}{2t_f} = 5.86$ $\frac{h}{t_w} = 14.8$ $Z_x = 97.6\ in^3$

FLANGE $\lambda_p = 0.38\sqrt{E/F_y} = 9.15$

$\lambda_r = 1.0\sqrt{E/F_y} = 24.08$

$\lambda < \lambda_p$ COMPACT

WEB $\lambda = \frac{h}{t_w} = 14.8$ $\lambda_p = 3.76\sqrt{E/F_y} = 90.55$

$\lambda_r = 5.70\sqrt{E/F_y} = 137.27$

$\lambda < \lambda_p$ COMPACT

$* \quad M_n = M_p = F_y Z_x = 50ksi(97.6\ in^3) = 4,880.0\ k\cdot in$

$= 406.67\ k\,ft$

$M_u = \phi_B M_n = 0.9(406.67\ k\,ft) = 366\ k\,ft$

3.5-1 | L D

$$M_n = 1.6\left(\frac{PL}{4}\right) + \left(\frac{wL^2}{8}\right)1.2 = 1.6\left(\frac{P(30\,ft)}{4}\right) + 1.2\left(\frac{0.077\,k/ft(30\,ft)^2}{8}\right)$$

$$= (12P + 10.395)\,kft = \phi_B M_n = 366\,kft$$

$$\underline{P = 29.63\,k}$$

b) ASD

$$M_a = \frac{M_n}{\Omega_b} = \frac{406.67\,kft}{1.67} = 243.52\,kft$$

$$M_a = \frac{0.077\,k/ft(30\,ft)^2}{8} + \frac{P(30\,ft)}{4} = M_a$$

$$8.6625\,kft^2 + 7.5P = 243.52\,kft$$

$$\underline{P = 31.31\,k}$$