Pin-connected members should be designed for the following limit states (see Figure 3.38).

1. **Tension** on the net effective area (Figure 3.38a):

   $\phi_t = 0.75,\ \Omega_t = 2.00, \qquad P_n = F_u(2tb_e)$ (AISC Equation D5-1)

2. **Shear** on the effective area (Figure 3.38b):

   $\phi_{sf} = 0.75,\ \Omega_{sf} = 2.00, \qquad P_n = 0.6F_uA_{sf}$ (AISC Equation D5-2)

3. **Bearing.** This requirement is given in Chapter J ("Connections, Joints, and Fasteners"), Section J7 (Figure 3.38c):

   $\phi = 0.75,\ \Omega = 2.00, \qquad P_n = 1.8F_yA_{pb}$ (AISC Equation J7-1)

4. **Tension** on the gross section:

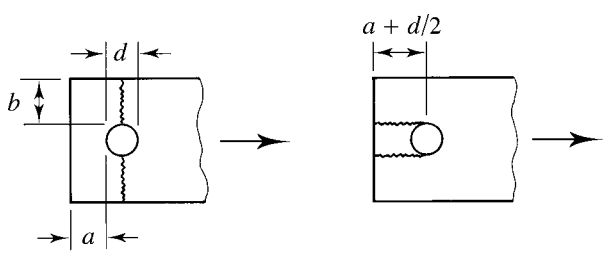
   $\phi_t = 0.90,\ \Omega_t = 1.67, \qquad P_n = F_yA_g$ (AISC Equation D2-1)

where

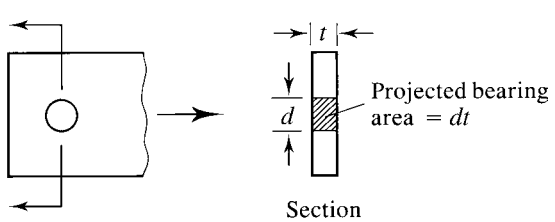
t = thickness of connected part
b_e = $2t + 0.63 \le b$
b = distance from edge of pin hole to edge of member, perpendicular to direction of force
A_{sf} = $2t(a + d/2)$
a = distance from edge of pin hole to edge of member, parallel to direction of force
d = pin diameter
A_{pb} = projected bearing area = dt

Additional requirements for the relative proportions of the pin and the member are covered in AISC D5.2

FIGURE 3.38



(a) Fracture of net section **(b) Longitudinal shear**



(c) Bearing

Problems

Tensile Strength

3.2-1 A PL ⅜ × 7 tension member is connected with three 1-inch-diameter bolts, as shown in Figure P3.2-1. The steel is A36. Assume that $A_e = A_n$ and compute the following.

a. The design strength for LRFD.

b. The allowable strength for ASD.

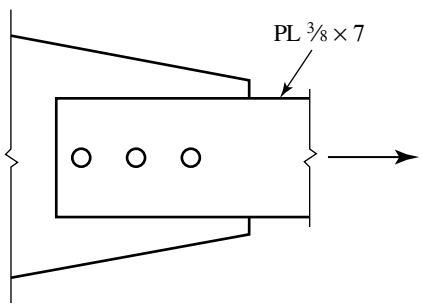


FIGURE P3.2-1

3.2-2 A PL ½ × 8 tension member is connected with six 1-inch-diameter bolts, as shown in Figure P3.2-2. The steel is ASTM A242. Assume that $A_e = A_n$ and compute the following.

a. The design strength for LRFD.

b. The allowable strength for ASD.

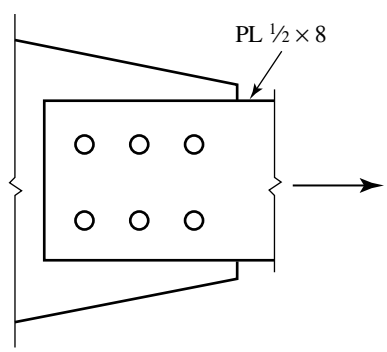


FIGURE P3.2-2

3.2-3 A C12 × 30 is connected with 1-in. diameter bolts in each flange, as shown in Figure P3.2-3. If $F_y = 50$ ksi, $F_u = 65$ ksi, and $A_e = 0.90A_n$, compute the following.

a. The design strength for LRFD.

b. The allowable strength for ASD.