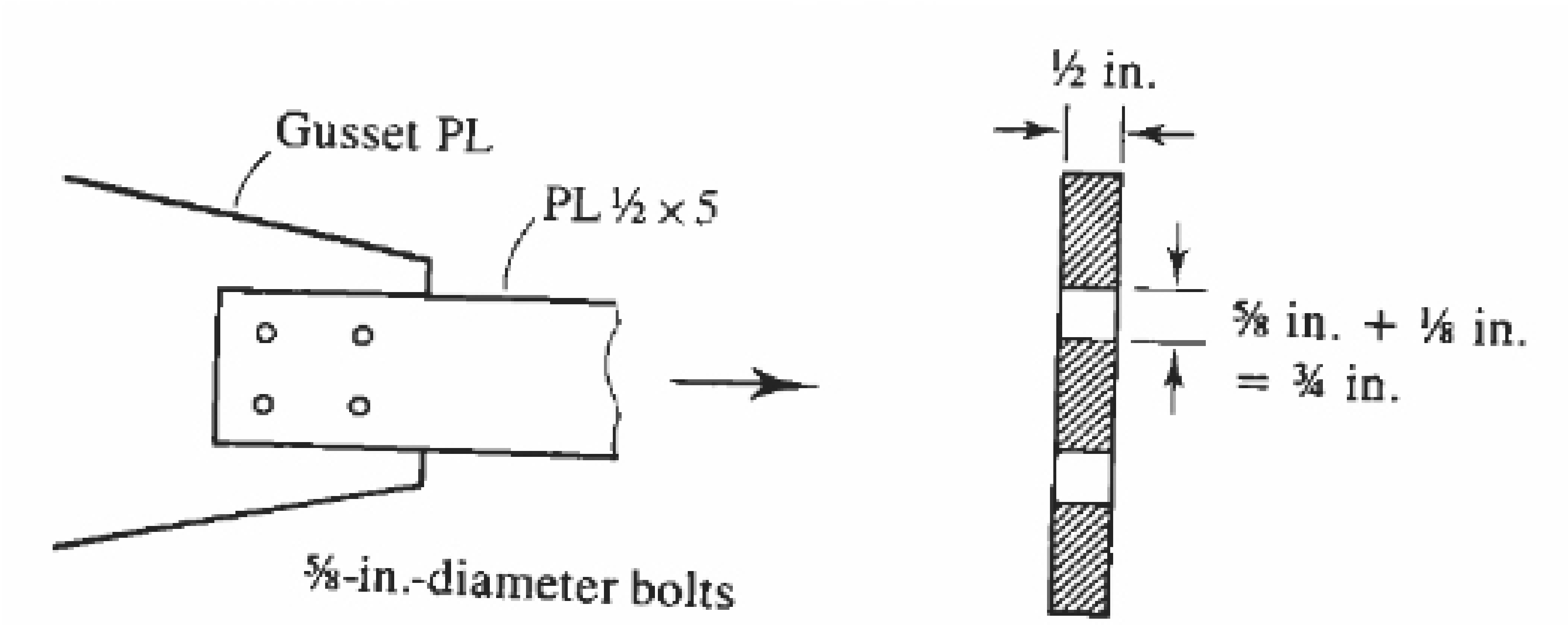
Example 1 (LRFD Steel Design, Third Edition by William T. Segui, page 37-38.)



A ½ × 5 plate of A36 steel is used as a tension member. It is connected to a gusset plate with four ⅝-inch-diameter bolts, as shown in Figure 3.3. Assume that the effective net area A_e equals the actual net area A_n and compute the design strength.

For yielding of the gross section,

$$A_g = 5\left(\frac{1}{2}\right) = 2.5 \text{ in.}^2$$

The *nominal* strength is

$$P_n = F_y A_g = 36(2.5) = 90 \text{ kips}$$

and the *design* strength is

$$\phi_t P_n = 0.90(90) = 81 \text{ kips}$$

For fracture of the net section,

$$A_n = A_g - A_{\text{holes}}$$

$$= 2.5 - \left(\frac{1}{2}\right)\left(\frac{3}{4}\right) \times 2 \text{ holes}$$

$$= 2.5 - 0.75 = 1.75 \text{ in.}^2$$

$A_e = A_n = 1.75 \text{ in.}^2$ (This is true for this example, but A_e does not always equal A_n)

The *nominal* strength is

$$P_n = F_u A_e = 58(1.75) = 101.5 \text{ kips}$$

and the *design* strength is

$$\phi_t P_n = 0.75(101.5) = 76.1 \text{ kips}$$

The smaller value controls.

Design strength = 76.1 kips.

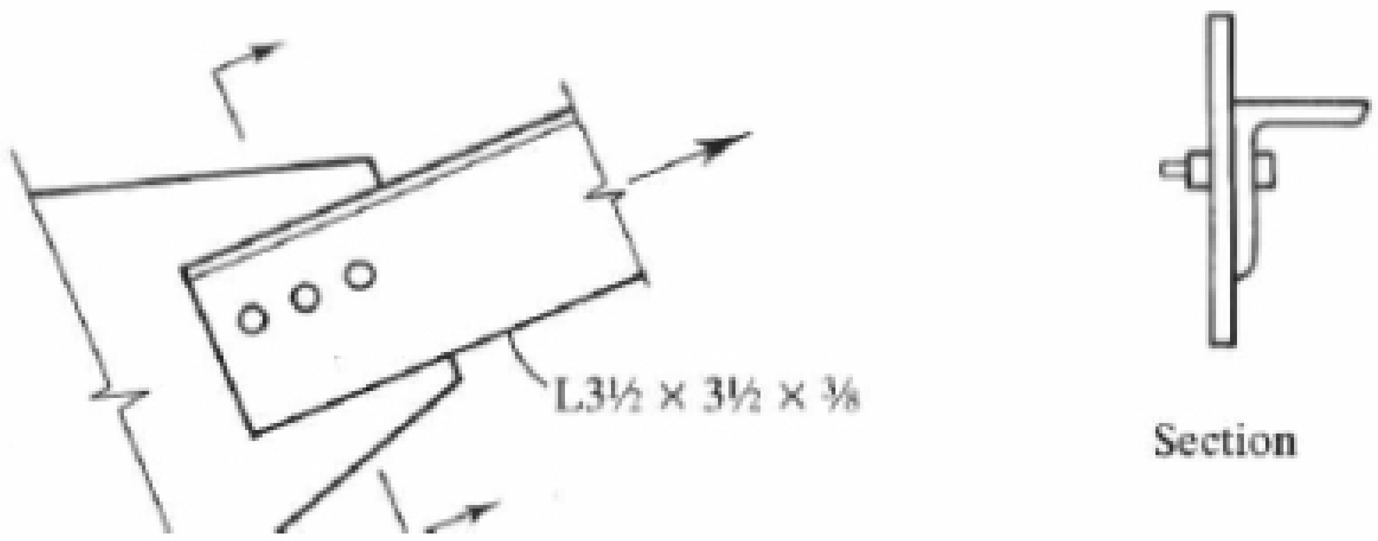
Example 2 (LRFD Steel Design, Third Edition by William T. Segui, page 38-39.)

A single-angle tension member, an L3½ × 3½ × ⅜, is connected to a gusset plate with ⅞-inch-diameter bolts, as shown in Figure 3.4. A36 steel is used. The service loads are 35 kips dead load and 15 kips live load. Investigate this member for compliance with the AISC Specification. Assume that the effective net area is 85% of the computed net area (we cover computation of effective net area in Section 3.3).

When only dead load and live load are present, the only load combinations with a chance of controlling are combinations 1 and 2.

Combination 1: $1.4D = 1.4(35) = 49$ kips

Combination 2: $1.2D + 1.6L = 1.2(35) + 1.6(15) = 66$ kips



The second combination controls; $P_u = 66$ kips.

The design strengths are

Gross section: $A_g = 2.50$ in.^{2} (from Part 1 of the *Manual*)

$\phi_t P_n = \phi_t F_y A_g = 0.90(36)(2.50) = 81$ kips

Net section: $A_n = 2.50 - \left(\frac{3}{8}\right)\left(\frac{7}{8} + \frac{1}{8}\right) = 2.125 \text{ in.}^2$

$A_e = 0.85A_n = 0.85(2.125) = 1.806$ in.^{2} (in *this* example)

$\phi_t P_n = \phi_t F_u A_e = 0.75(58)(1.806) = 78.6$ kips (controls)

Since $P_u < \phi_t P_n$ (66 kips < 78.6 kips), the member is satisfactory.