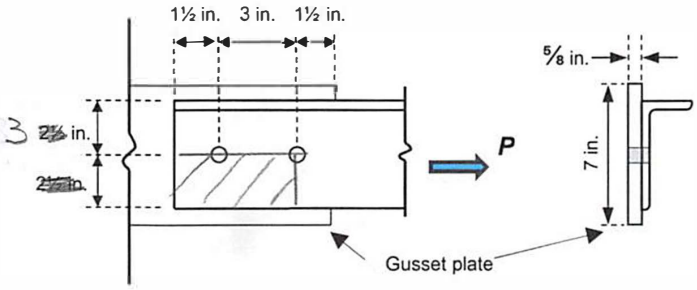
**CIVL 3131 Quiz #2 S26** **Name:** _____

Compute the design strength of an **L5 × 3 × ¼** tension member connected to a gusset plate by two ⅞-in.-diameter bolts in the standard holes. **A572 Grade 50** steel ($F_y$ = 50 *ksi*, $F_u$ = 65 *ksi*) is used. Assume $U$ = 0.60




FROM TABLE 1-5
$A = 1.94\ in^2$

$d_{HOLE} = 7/8\ in + 1/8\ in = 1\ in$

YIELD - GROSS AREA

$$\phi P_n = \phi F_y A_g = 0.9(50ksi)\,1.94in^2 = \underline{87.3^K}$$

RUPTURE - NET AREA

$$\phi P_n = \phi F_u A_n U \qquad A_n = A_g - 1\,HOLE = 1.94in^2 - (1in)\,1/4\,in = 1.69\,in^2$$

$$= 0.75(65ksi)\,0.6\,(1.69in^2)$$

$$= \underline{49.43^K}$$

BLOCK SHEAR

$$A_{gv} = (3in + 1\tfrac{1}{2}in)\,1/4\,in = 1.125\,in^2$$

$$A_{nv} = A_{gv} - 1\tfrac{1}{2}\,HOLES = 1.125in^2 - 1\tfrac{1}{2}(1in)\,1/4\,in = 0.75\,in^2$$

$$A_{nt} = 2in\,(1/4in) - 1/2\,(1in)\,1/4in = 0.375\,in^2$$

$$P_n = MIN\left[0.6F_u A_{nv},\ 0.6F_y A_{gv}\right] + F_u A_{nt}$$

$$= MIN\left[0.6(65ksi)\,0.75in^2,\ 0.6(50ksi)\,1.125in^2\right] + 65ksi\,(0.375in^2)$$

$$= MIN\left[29.25^K, 33.75^K\right] + 24.38^K = 53.63^K$$

$$\phi P_n = 0.75(53.63^K) = \underline{40.22^K}$$ * BLOCK SHEAR CONTROLS