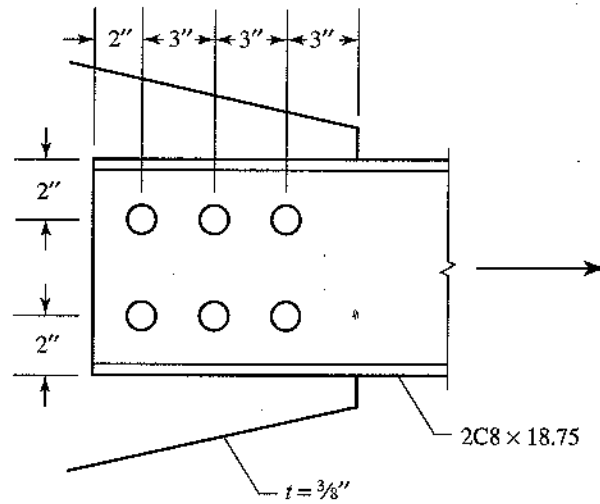


CE470 – Laboratory

Due Thursday 9/19 at 5:30pm

- 3.5-6** A double-channel shape, $2C8 \times 18.75$, is used as a tension member. The channels are bolted to a $\frac{3}{8}$ -inch gusset plate with $\frac{7}{8}$ -inch diameter bolts. The tension member is A572 Grade 50 steel and the gusset plate is A36. If LRFD is used, how much factored tensile load can be applied? Consider *all* limit states.

**FIGURE P3.5-6**

GIVEN: 2C 8x18.75 $\rightarrow$ A572 GRADE 50
 3/8" GUSSET PLATE $\rightarrow$ A36
 7/8" DIA BOLTS

COMPUTE DESIGN TENSILE LOAD (LRFD)

A572 GR50 $\rightarrow F_y = 50 \text{ KSI}$ $F_u = 65 \text{ KSI}$
 A36 $\rightarrow F_y = 36 \text{ KSI}$ $F_u = 58 \text{ KSI}$

$$d_{\text{hole}} = 7/8" + 1/8" = 1"$$

$$A_g = 11.0 \text{ in}^2, t_w = 0.487 \text{ in}, d = 8"$$

$$A_n = A_g - 4(d_{\text{hole}})t_w = 11.0 \text{ in}^2 - 4(1")(0.487 \text{ in}) = 9.052 \text{ in}^2$$

$$u = 1 - \frac{\bar{x}}{L} = 1 - \frac{(0.565 \text{ in})}{(3" + 3")} = 0.906$$

$$A_e = u A_n = (0.906)(9.052 \text{ in}^2) = 8.20 \text{ in}^2$$

LRFD

$$\text{YIELD} \rightarrow \phi P_n = (0.9) A_g F_y = (0.9)(11.0 \text{ in}^2)(50 \text{ KSI}) = \underline{495 \text{ K}}$$

$$\text{NSF} \rightarrow \phi P_n = (0.75) A_e F_u = (0.75)(8.20 \text{ in}^2)(65 \text{ KSI}) = \underline{400 \text{ K}}$$

BLOCK SHEAR MEMBER

$$A_{gv} = 4 t_w (8") = 4(0.487")(8) = 15.584 \text{ in}^2$$

$$A_{nv} = 4 t_w (8" - 2.5 d_{\text{hole}}) = 4(0.487")(8" - 2.5(1")) = 10.714 \text{ in}^2$$

$$A_{nt} = 2 t_w (d - 2" - 2" - d_{\text{hole}}) = 2(0.487")(8" - 2" - 2" - 1") = 2.922 \text{ in}^2$$

$$\phi P_n = (0.75) [0.6 F_u A_{nv} + F_u A_{nt}] = \underline{456 \text{ K}} < 0.75 [0.6 F_y A_{gv} + F_u A_{nt}] = \underline{493 \text{ K}} \quad \checkmark \text{ OK}$$

BLOCK SHEAR GUSSET PLATE

$$t = 0.375"$$

$$A_{gv} = 2 t (9") = 2(0.375")(9") = 6.75 \text{ in}^2$$

$$A_{nv} = 2 t [9" - 2.5 d_{\text{hole}}] = 2(0.375")[9" - 2.5(1")] = 4.875 \text{ in}^2$$

$$A_{nt} = t (4" - d_{\text{hole}}) = (0.375")(4" - 1") = 1.125"$$

$$\phi P_n = 0.75 [0.6 F_u A_{nv} + F_u A_{nt}] = 176 \text{ K} < 0.75 [0.6 F_y A_{gv} + F_u A_{nt}] = \underline{158 \text{ K}}$$

$\phi P_n = 158 \text{ K}$ GOVERNED BY BLOCK SHEAR IN THE GUSSET PL