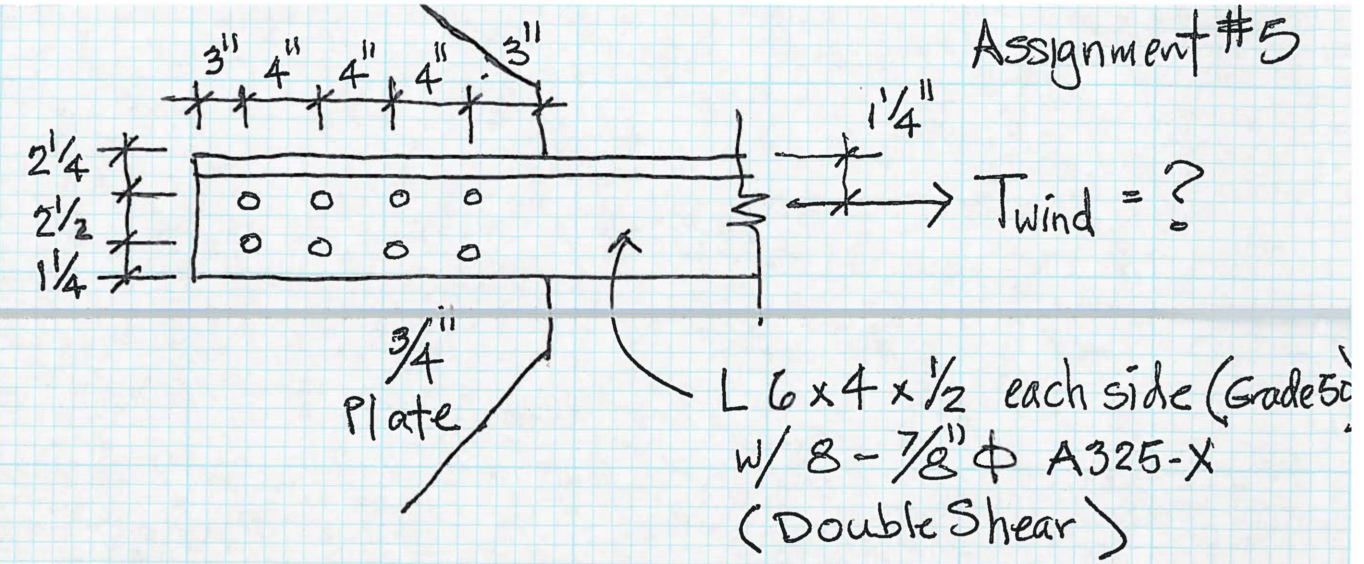
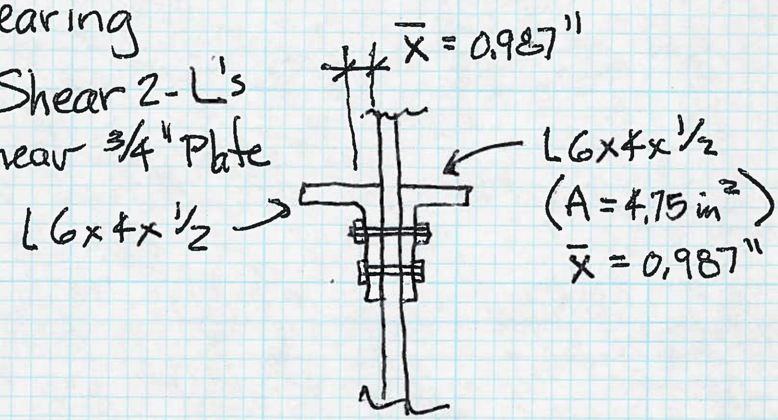
Assignment #5



A. <u>Find T_{wind}</u> (Note $T_u = 1.3\,T_{wind}$)

1. General Yeilding of Members
2. Fracture of Net Section
3. Bolt Shear
4. Bolt Bearing
5. Block Shear 2-L's
6. Block Shear 3/4" Plate



Grade 50 Steel

$F_y = 50$ ksi

$F_u = 65$ ksi

Assignment #5 A

A. (1) $\phi_t T_n = \phi_t F_y A_g$

$= 0.9(50)(4.75 \times 2) = \underline{427.5^k}$

(2) $A_n = 2\left(4.75 - 2(0.5'')\left(\tfrac{7}{8}+\tfrac{1}{8}\right)\right) = 7.5\ in^2$

$U = 1 - \frac{\bar{x}}{L} = 1 - \frac{0.987''}{12''} = 0.92 > \underline{\underline{0.9}}$

$A_e = UA_n = 0.9 \times 7.5 = 6.75\ in^2$

$\phi_t T_n = \phi_t F_u A_e = 0.75(65)(6.75) = \underline{329.1^k}$

(3) $\phi R_n = 54.1^k$ A325-X Double Shear

$\phi_t T_n = 54.1 \times 8 \text{ bolts} = \underline{432.8^k}$

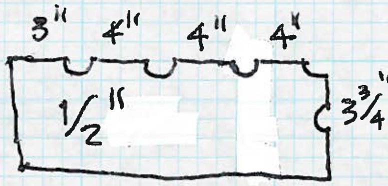
(4) Check 3/4" plate $\quad 3/4'' < 2 \times 0.5''$

$L_e > 2d \qquad L_e = 3'' - \left(\frac{7}{8}+\frac{1}{8}\right)\frac{1}{2} = 2\tfrac{1}{2}'' > 2 \times \tfrac{7}{8}''\phi$

$\phi R_n = 0.75\left(2.4 \times \tfrac{7}{8}'' \times \tfrac{3}{4}'' \times 65\ ksi\right)$

$= 76.8^k/\text{bolt} > \phi R_n$ Bolt shear

(5)



$A_{gv} = \tfrac{1}{2} \times 15'' = 7.5$

$A_{nv} = \tfrac{1}{2}\left(15 - 3\tfrac{1}{2} \times 1''\right) = 5.75$

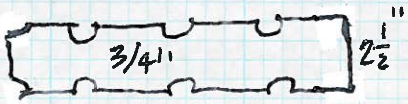
$A_{gt} = \tfrac{1}{2}\left(3\tfrac{3}{4}\right) = 1.875$

$A_{nt} = \tfrac{1}{2}\left(3\tfrac{3}{4} - 1\tfrac{1}{2} \times 1''\right) = 1.125$

$\phi R_n = \phi[0.6 F_y A_{gv} + F_u A_{nt}] = 0.75[0.6 \times 50 \times 7.5 + 65 \times 1.125] = 223.6^k$

$\phi R_n = \phi[0.6 F_u A_{nv} + F_y A_{gt}] = 0.75[0.6 \times 65 \times 5.75 + 50 \times 1.875] = 238.5^k$

$\phi T_n = 2 \times 223.6^k = \underline{447.2^k}$ (two L's)



$A_{gv} = 3/4 \times 15 \times 2 = 22.5$

$A_{nv} = 3/4\left(15 - 3\tfrac{1}{2} \times 1''\right)2 = 17.25$

$A_{gt} = 3/4 \times 2\tfrac{1}{2} = 1.875$

$A_{nt} = 3/4 \times \left(2\tfrac{1}{2} - 1 \times 1''\right) = 1.125$

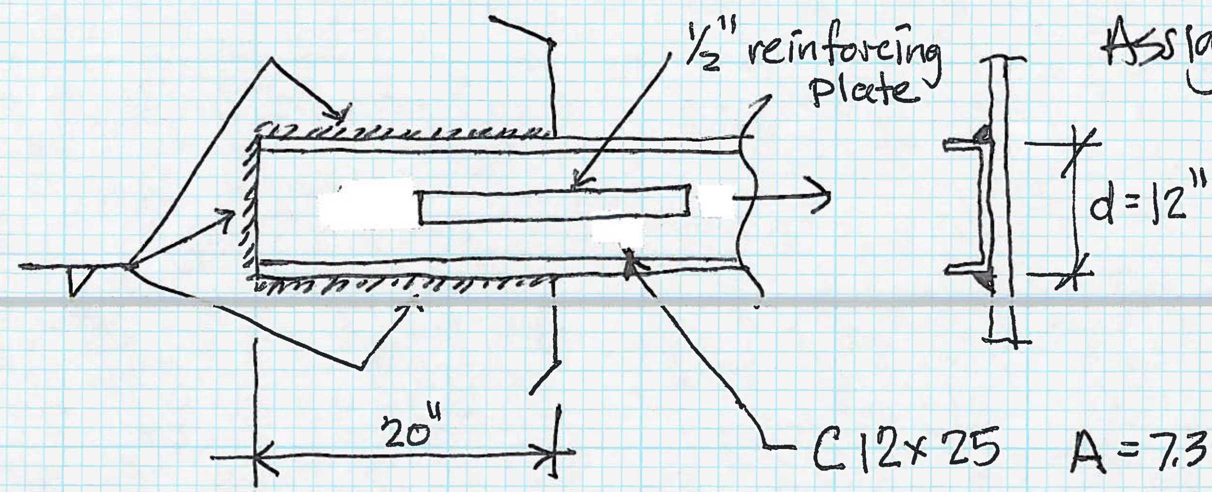
$\phi R_n = 0.75[0.6 \times 50 \times 22.5 + 65 \times 1.125] = 561.1^k$

$\phi R_n = 0.75[0.6 \times 65 \times 17.25 + 50 \times 1.875] = 574.3^k$

$\phi T_n = \underline{561.1^k}$ $\qquad$ (2) Controls $\phi T_n = 329.1$

$T_u = 329.1/1.3 = 253.1$

Assignment #5



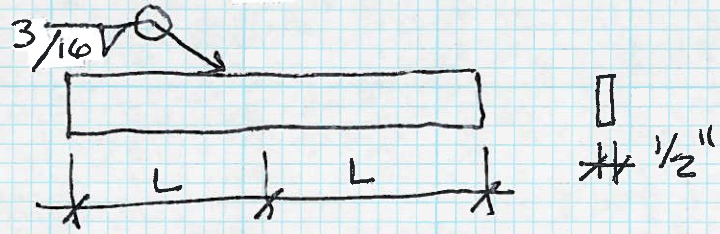
$A = 7.34\ \square''$

$t_f = 1/2''$

$\bar{x} = 0.674''$

B. Design Connection for Expected Yeild Strength of the Channel

1. $P_u = R_y F_y A_g$
2. Weld (Fillet) size W
3. Width of 1/2" reinforcing plate
4. Length of reinforcing plate L (Assume 3/16" Fillet weld on two sides)



Assignment 5B

(1) $P_u = R_y F_y A_g = 1.1 \times 50 \times 7.34 = \underline{\underline{404^k}}$

(2) Available weld length $L = 20'' + 12'' + 20'' = 52''$

$$w = \frac{P_u}{0.707 \times L \times \phi F_w} = \frac{404}{0.707 \times 52'' \times 31.5} = 0.35''$$

Max $w = \frac{1}{2}'' - \frac{1}{16} = \frac{7}{16}$ use $\underline{\underline{3/8''}}$

(3) $U = 1 - \frac{\bar{x}}{L} = 1 - \frac{0.674}{20} = 0.97$ $\underline{\text{use } 0.9}$

Check Rupture

$\phi P_n = 0.75(65\,\text{ksi})(7.34 \times 0.9) = 322^k$

Reinforce channel

$(A_n + A_{rn})U > A_g$

$$A_{rn} = \frac{A_g - U A_n}{U} = \frac{7.34 - 0.9 \times 7.34}{0.9} = 0.82^{\square''}$$

x $\quad x = \frac{0.82}{0.5} = 1.63'' \sim \underline{\underline{1\frac{3}{4}''}}$

~~x~~ $\frac{1}{2}''$

(4) $P_u = 1.1 \times 50 \times (\frac{1}{2} \times 1\frac{3}{4}) = 48.2^k$

$D = 3$ $\phi R_n = 4.18^k/''$

end

$L_{total} = 48.2/4.18 = 11.5'' = 1\frac{1}{2}'' + 5'' + 5''$

$L_{min} = \underline{\underline{5''}}$