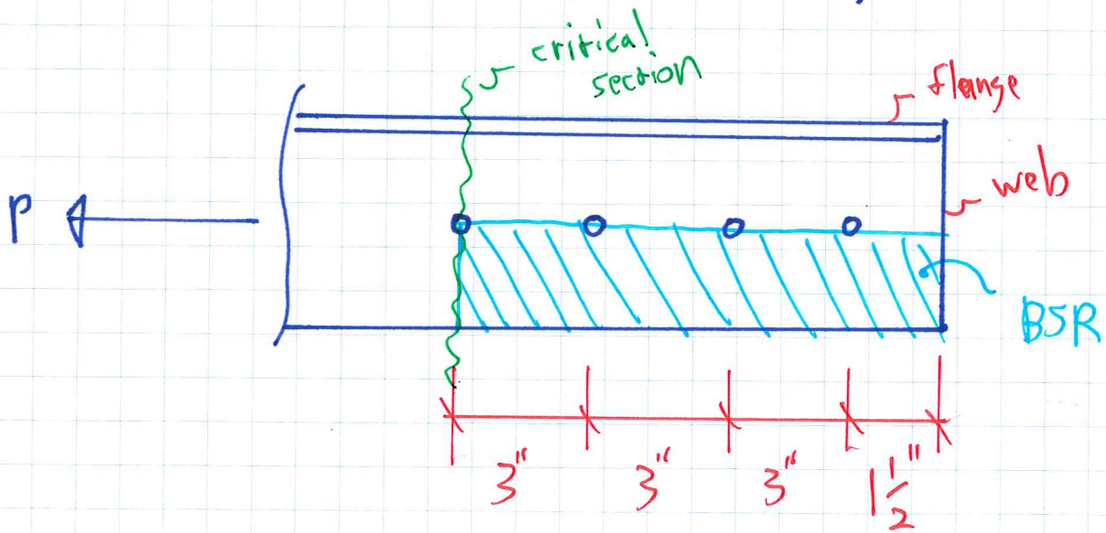
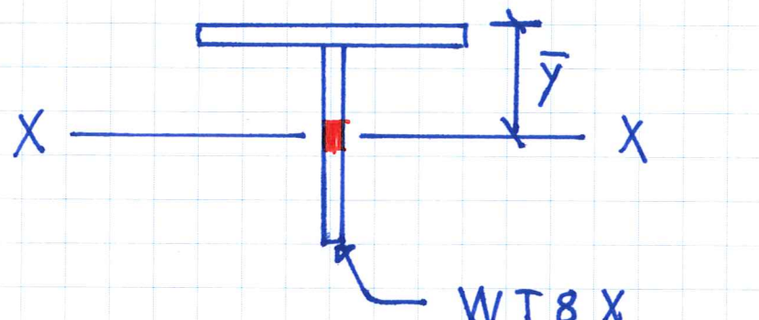
## EXAMPLE

**GIVEN:** A WT Section, A36 Steel, is to carry service tension loads: $P_L = 24^k$, $L_L = 80^k$




Member is 12 ft Long

**REQD** Select the lightest WT8 to carry the load

Use $\frac{3}{4}$" ø bolts

**SOLN:** By inspection: $P_u = 1.2D + 1.6L = 1.2(24) + 1.6(80) = 156.8^k$

$$(A_g)_{reqd} = \frac{P_u}{\phi F_y} = \frac{156.8^k}{0.9(36^{ksi})} = 4.84\ in^2$$

A36: $F_y = 36^{ksi}$, $F_u = 58^{ksi}$

try WT8X18: $A_g = 5.29\ in^2 \geq (A_g)_{reqd} = 4.84\ in^2$ ∴ GSY is ok

$t_w = 0.295\ in$

$\bar{y} = 1.88\ in$

$r_{min} = 1.52\ in$

NSR: $\phi P_n = \phi A_e F_u$

$A_n = A_g - \Sigma A_{holes} = 5.29\ in^2 - (1\ hole)\left(\frac{3}{4}" + \frac{1}{8}"\right)(0.295") = 5.032\ in^2$

$A_e = U A_n = 0.7(5.032\ in^2) = 3.522\ in^2$

↑ Discrete Value, Table D3.1, Case #7

$\phi P_n = 0.75(3.522\ in^2)(58^{ksi}) = 153.2^k \not\geq 156.8^k$

try WT 8 X 20:

GSY: $\phi P_n = 191^k > P_u = 156.8^k$ ✓

NSR: $\phi P_n = 171^k > P_u = 156.8^k$ ✓

BSR: $\phi P_n = 128.4^k > P_u = 156.8^k$ X

$$(t_w)_{new} \approx (t_w)_{old}\left(\frac{P_u}{P_{BSR}}\right) \approx (0.305")\left(\frac{156.8^k}{128.4^k}\right) \approx 0.372\ in$$

$(0.305")$ ↑ WT8 X20

try WT8x 25:

$A_g = 7.37\ in^2$

$d = 8.13\ in$

$t_w = 0.380\ in$

$r_{min} = 1.59\ in$

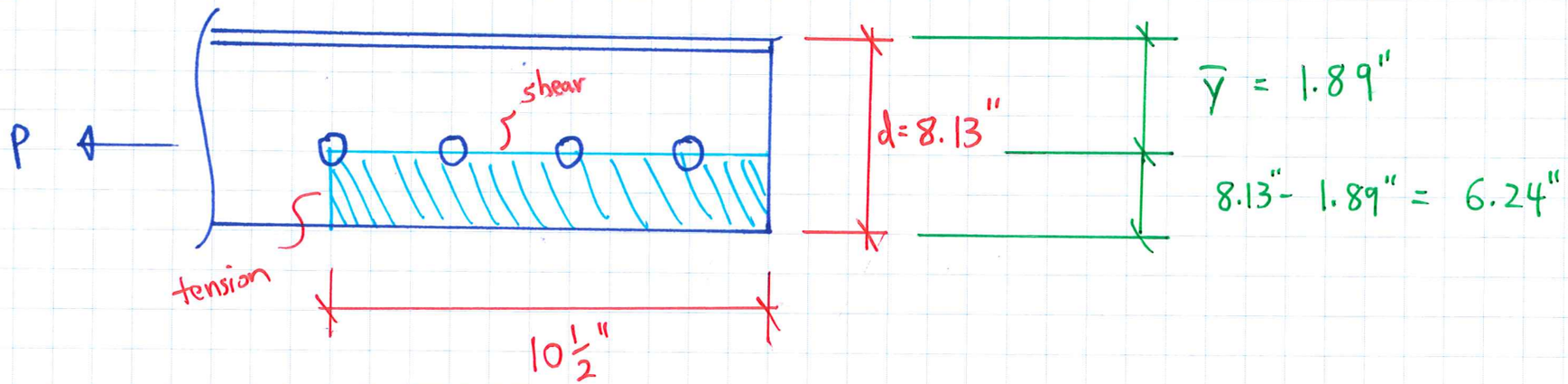
GSY: $\phi P_n = 0.9(36^{ksi})(7.37\ in^2) = \underline{283.8}^{k} \geq P_u$ ✓

NSR: $\phi P_n = 0.75 A_e f_u$

$A_e = U A_n = 0.7\left(7.37\ in^2 - \left(\frac{3}{4}" + \frac{1}{8}"\right)(0.38")\right) = 4.926\ in^2$

$\phi P_n = 0.75(4.926\ in^2)(58^{ksi}) = \underline{214.3}^{k} \geq P_u$ ✓

**BSR:**




$$A_{nt} = (0.38")\left(6.24" - (0.5\ hole)\left(\tfrac{3}{4}" + \tfrac{1}{8}"\right)\right) = 2.205\ in^2$$

$$A_{gv} = (10.5")(0.38") = 3.99\ in^2$$

$$A_{nv} = A_{gv} - \Sigma A_{holes} = 3.99 - (3.5\ holes)\left(\tfrac{3}{4}" + \tfrac{1}{8}"\right)(0.38") = 2.826\ in^2$$

$$\phi P_n = \phi[0.6 F_u A_{nt} + U_{bs} F_u A_{nt}] \leq \phi[0.6 F_y A_{gv} + U_{bs} F_u A_{nt}]$$

$$\phi P_n = \underline{160.6}\ ^k \geq P_u = 156.8^k \quad \underline{\surd}$$

Check Slenderness:

$$\frac{L}{r_{min}} = \frac{(12\,ft)(12)}{(1.59\,in)} = 90.6 < 300 \quad \checkmark$$

conversion ft-to-inch