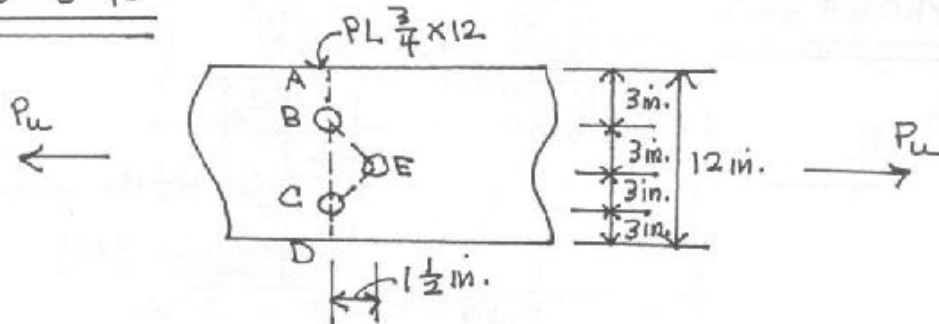


**ENCE 355 – Introduction to Structural Design**  
**SOLUTIONS to Homework Set No. 10**  
**Fall 2002**

PROB #3-10



Net widths

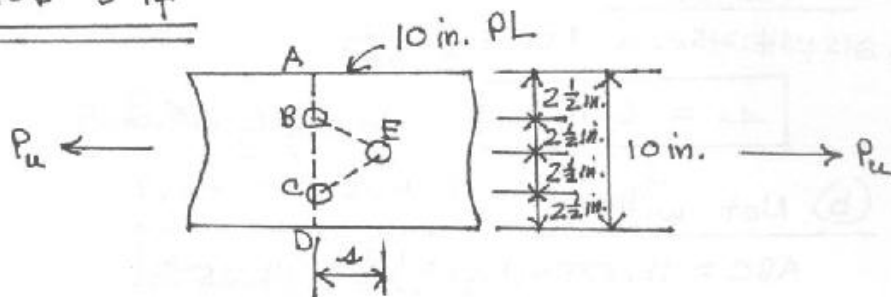
$$ABCD = 12.00 - (2) \left( \frac{3}{4} + \frac{1}{8} \right) = 10.25 \text{ in.}$$

$$ABECD = 12.00 - (3) \left( \frac{3}{4} + \frac{1}{8} \right) + (2) \frac{(1.5)^2}{(4)(3)} = 9.75 \text{ in.} \leftarrow$$

Net area

$$A_{net} = (9.75) \left( \frac{3}{4} \right) = \boxed{7.31 \text{ in.}^2} \quad \checkmark \text{ gcm}$$

PROB #3-14



Net widths

$$ABCD = 10.00 - (2.5) \left( \frac{7}{8} + \frac{1}{8} \right) = 7.50 \text{ in.}$$

$$ABECD = 10.00 - (3) \left( \frac{7}{8} + \frac{1}{8} \right) + (2) \frac{4^2}{(4)(2.5)} = 7.00 + \dots$$

Equating

$$7.50 = 7.00 + \frac{4^2}{5}$$

$$\boxed{4 = 1.58 \text{ in.}} \quad \checkmark \text{ gcm}$$

PROB #3-20

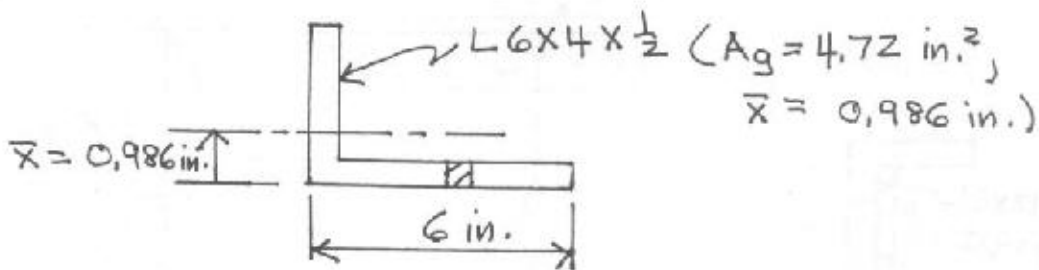
$$A_{net} = 4.72 - (1) \left( \frac{7}{8} + \frac{1}{8} \right) \left( \frac{1}{2} \right) = 4.22 \text{ in.}^2$$

$u$  from Table 3-2 in text = 0.85

$$A_e = u A_{net} = (0.85)(4.22) = \boxed{3.59 \text{ in.}^2}$$

✓ JCMC

PROB #3-24



$$A_{net} = 4.72 - (1) \left( \frac{7}{8} + \frac{1}{8} \right) \left( \frac{1}{2} \right) = 4.22 \text{ in.}^2$$

$$u = 1 - \frac{\bar{x}}{L} = 1 - \frac{0.986}{8} = 0.877$$

< 0.9 OK

$$A_e = u A_{net} = (0.877)(4.22) = \boxed{3.70 \text{ in.}^2}$$

✓ JCMC

PROB # 3-27

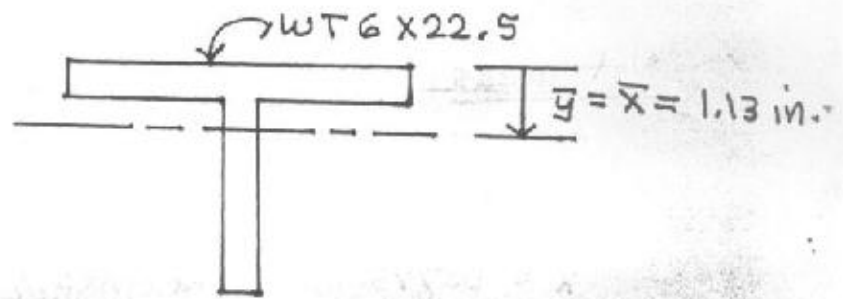
using a W12x45 ( $A_g = 13.10 \text{ in.}^2$ ,  $t_f = 0.575 \text{ in.}$ )

Gross section yield

$$\phi_t P_m = \phi_t F_y A_g = (0.9)(50)(13.10 \text{ in.}^2) = 589.5 \text{ k}$$

Net section fracture

$$A_{net} = 13.10 - (4)\left(\frac{3}{4} + \frac{1}{8}\right)(0.575) = 11.09 \text{ in.}^2$$



$$u = 1 - \frac{\bar{x}}{L} = 1 - \frac{1.13}{6} = 0.812 < 0.9 \quad \underline{\text{OK}}$$

$$A_e = u A_{net} = (0.812)(11.09) = 9.01 \text{ in.}^2$$

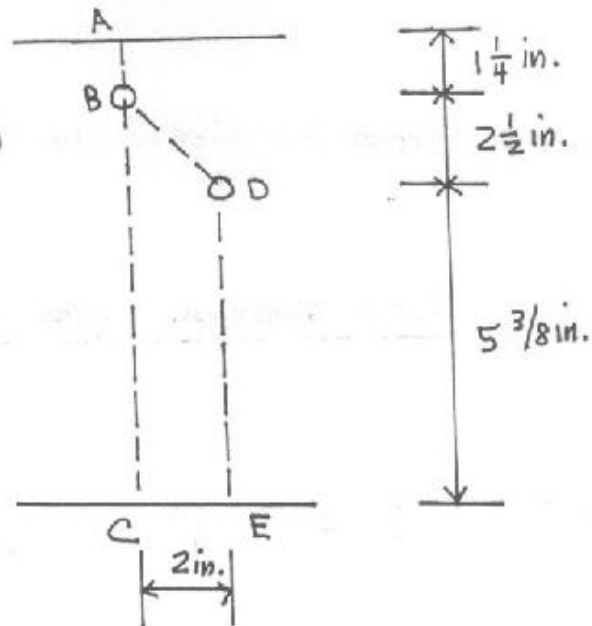
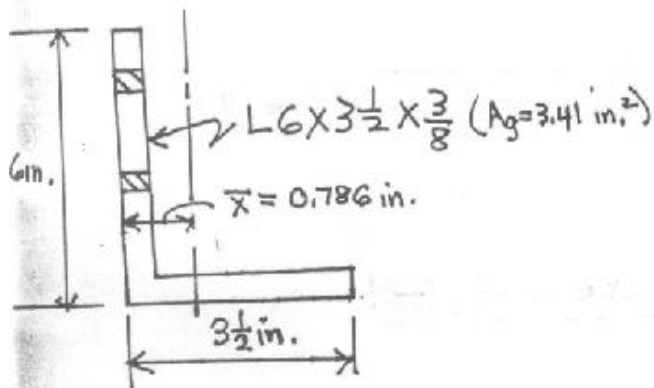
$$\phi_t P_m = \phi_t F_u A_e$$

$$= (0.75)(65)(9.01)$$

$$= \boxed{439.2 \text{ k}} \leftarrow$$

✓ gcm

PROB # 3-30



Using  $L 6 \times 3\frac{1}{2} \times \frac{3}{8}$  ( $A_g = 3.41 \text{ in.}^2$ ,  $\bar{y} = 0.786 \text{ in.}$ )

Gross section yield

$$\phi_t P_m = \phi_t F_y A_g = (0.9)(36)(3.41) = 110.5 \text{ k} \leftarrow$$

Net area

$$ABC = 3.41 - (1)\left(\frac{3}{4} + \frac{1}{8}\right)\left(\frac{3}{8}\right) = 3.08 \text{ in.}^2$$

$$ABDE = 3.41 - (2)\left(\frac{3}{4} + \frac{1}{8}\right)\left(\frac{3}{8}\right) + \frac{(2)^2}{(4)(2.5)}\left(\frac{3}{8}\right) = 2.90 \text{ in.}^2 \leftarrow$$

Net section fracture

$$u = 1 - \frac{\bar{x}}{L} = \frac{0.786}{8} = 0.902 < 0.9 \therefore \underline{\underline{\text{Use } 0.9}}$$

$$A_e = u A_{net} = (0.9)(2.90) = 2.61 \text{ in.}^2$$

$$\phi_t P_m = \phi_t F_u A_e = (0.75)(58)(2.61) = 113.5 \text{ k}$$

$\phi_t P_m = 110.5 \text{ k}$

 $\checkmark \text{ } \phi_t P_m \leq$