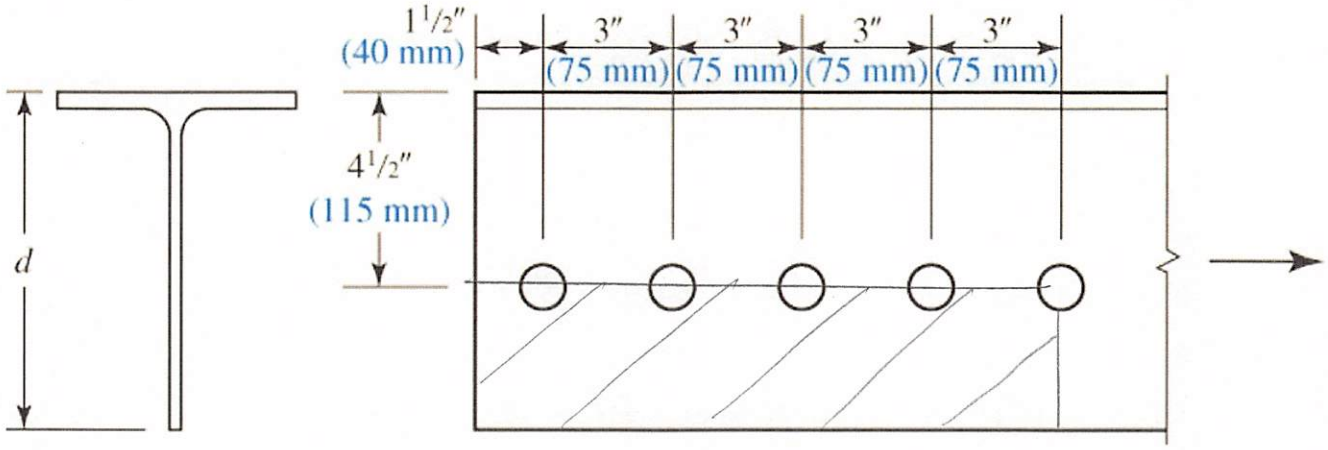
3.5-5 A WT 8 × 13 (WT 205 × 19.4) of A992 ($F_y = 50$ ksi (345 MPa); $F_u = 65$ ksi (450 MPa)) steel is used as a tension member. The connection is with $^7/_8$-in. diameter (M22) bolts as shown in Figure P3.5-5. Use the LRFD approach.



$d_{HOLE} = \frac{7}{8}'' + \frac{1}{8}'' = 1''$

FROM TABLE 1-8 (1-64)

$A_g = 3.84\,in^2$ $t_s = 0.25\,in$

$\bar{x} = 2.09\,in$ $d = 7.85\,in$

CASE 2

$$U = 1 - \frac{\bar{x}}{\ell} = 1 - \frac{2.09\,in}{12\,in} = 0.8258$$

CASE 7

$U = 0.7$

GROSS SECTION

$$0.9 F_y A_g = 0.9(50ksi)(3.84in^2) = \underline{172.80k}$$

RUPTURE $A_n = A_g - A_{HOLE} = 3.84in^2 - 1in(0.25in) = 3.59in^2$

$$0.75 F_u A_e = 0.75(65ksi)(0.8258)(3.59in^2)$$

$$= \underline{144.53k} \quad \overset{OR}{(0.7)} \rightarrow \underline{\underline{122.51k}}$$

3.5-5

BLOCK SHEAR

$A_{gv} = (0.25in)(13.5in) = 3.375 in^2$

$A_{nv} = 3.375in^2 - 4.5(1in)(0.25in) = 2.25 in^2$

$A_{nt} = (7.05in - 4.5in)(0.25in) - \frac{1}{2}(1in)(0.25in) = 0.7125 in^2$

$R_n = 0.6F_u A_{nv} + U_{bs}F_u A_{nt}$ $\quad U_{bs} = 1$

$= 0.6(65ksi)(2.25 in^2) + (1)(65ksi)(0.7125in^2)$

$= \underline{134.06^k}$

UPPER LIMIT $0.6F_y A_{gv} + U_{bs}F_u A_{nt}$

$= 0.6(50ksi)(3.375in^2) + (1)(65ksi)(0.7125in^2)$

$= \underline{147.56^k}$ *

LRFD $\phi R_n = 0.75(134.06^k) = \underline{100.56^k}$