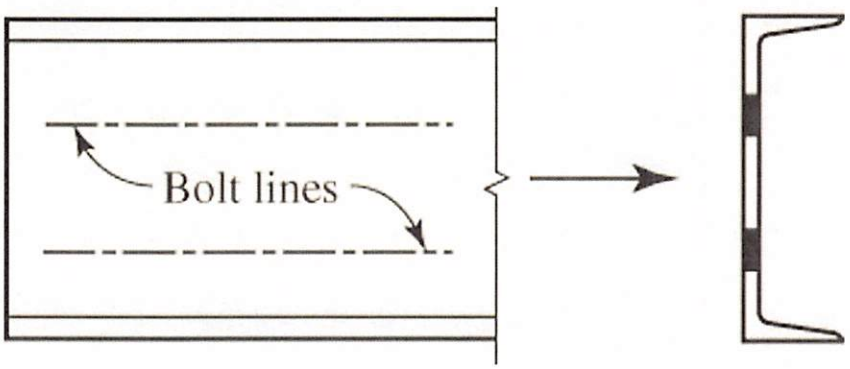
3.6-5 Use load and resistance factor design and select an American Standard Channel shape to resist a *factored* tensile load of 180 kips (800 kN) . The length is 15 ft (4,500 mm) , and there will be two lines of $^7/_8$-in. diameter (M22) bolts in the web, as shown in Figure P3.6-5. Estimate the shear lag factor U to be 0.85 . (In a practical design, once the member and bolt layout are selected, the value of U could be computed and the member design could be revised if necessary.) Use A36 ($F_y = 36$ ksi (250 MPa); $F_u = 58$ ksi (400 MPa)) steel.



$d_{Hole} = 7/8\,in + 1/8\,in = 1\,in$

$L = 15ft(12in/ft) = 180in.$

$U = 0.85$

LRFD

$$REQ.\ A_g = \frac{P_U}{0.9F_y} = \frac{180k}{0.9(36ksi)} = 5.556in^2$$

$$REQ\ A_e = \frac{P_U}{0.75F_U} = \frac{180k}{0.75(58ksi)} = 4.138\,IN^2$$

$$REQ\ r_{min} = \frac{L}{300} = \frac{180IN}{300} = 0.600in$$

$$REQ\ A_n = \frac{A_e}{U} = \frac{4.138\,IN^2}{0.85} = 4.868in^2$$

TRY C9 x 20 $A_g = 5.87\,in^2$ $t_w = 0.448\,in$ 2/2

$r = 0.640\,in$

- $A_g > REQ\,A_g$ ✓
- $A_e = U A_n = (0.85)(5.87\,in^2 - 2(1\,in)(0.448\,in))$

  $= 4.228\,in^2 > 4.138\,in^2$ ✓
- $r_{min} = 0.640\,in > REQ\,r_{min}$ ✓

USE C9 x 20