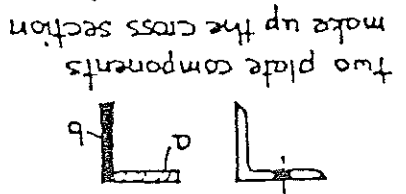
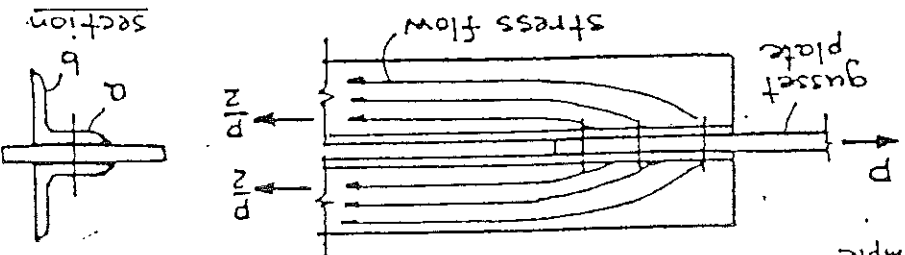


# EFFECTIVE NET AREA, $A_e$ - LRFD, Section B3

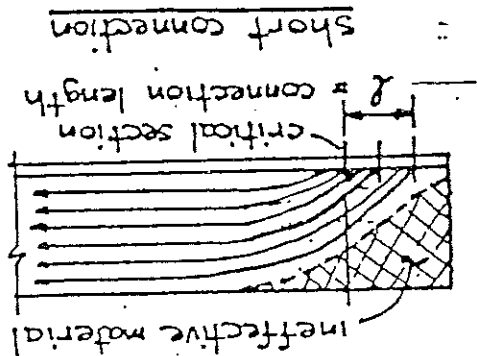
The stress distribution is uniform at sections away from the connectors ( $A_g$ ), but at the connection  $A_n$  will not be fully effective unless all the plate components of the cross section are connected. For example



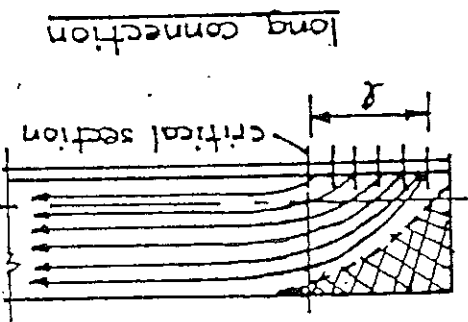
make up the cross section



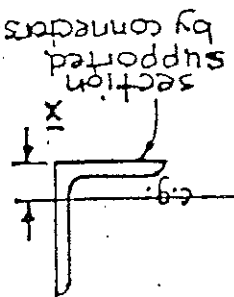
Stress must flow out of the plate components 'b' and into 'a' in order to reach the connectors to the single gusset plate. Plate sections do not remain plane near the connectors - called shear lag.



short connection



long connection



The long connection has more effective material at the critical section. The same concept is applicable to welded construction.

LRFD  
B3

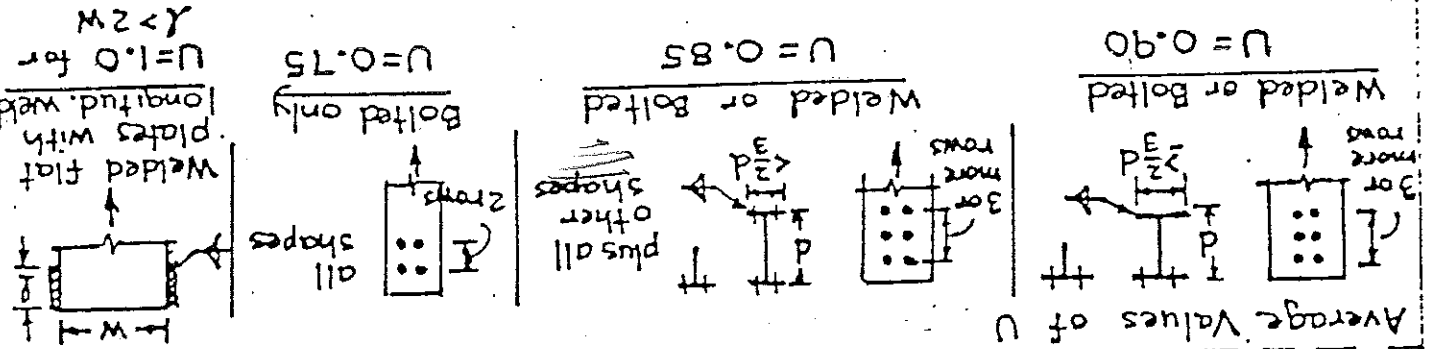
$$A_e = U A_n \text{ or } U A_g$$

$\downarrow$  welded  
 $\downarrow$  bolted

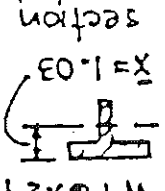
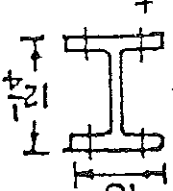
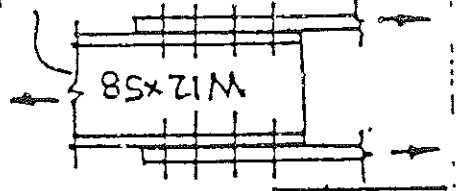
$$\text{reduction coefficient} = 1 - \frac{\lambda}{\lambda_c} \text{ or } [\text{average values}]$$

If all the plate elements are connected,  $U = 1.0$  - except for a flat welded plate.

Average Values of U



Example



Commentary:  $U = 1 - 1.03/q = 0.886$  or Average

In this expression,  $\bar{x}$  is the distance from the centroid of the connected area to the shear plane of the connection, and  $L$  is the length of the connection. In the event a member has two symmetrically located planes of connection,  $\bar{x}$  is measured from the centroid of the nearest one-half of the area. Figure 3.6 illustrates  $\bar{x}$  for various cross-sectional configurations.

(AISC Equation B3-2)

$$U = 1 - \left( \frac{\bar{x}}{L} \right) \leq 0.9$$

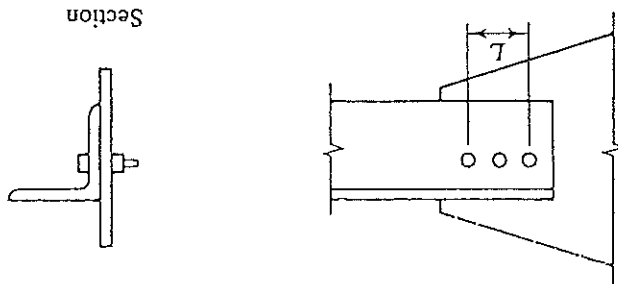
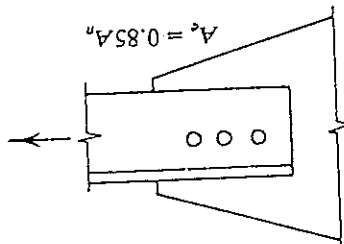
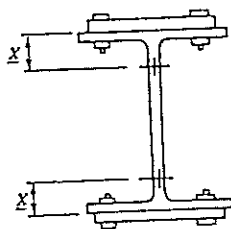
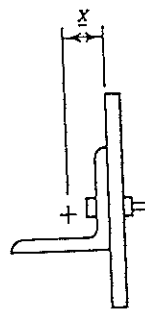
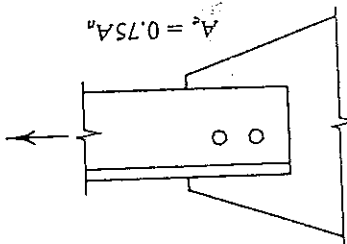


FIGURE 3.6



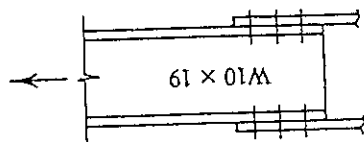
(Single or double angle)

$$A_e = 0.85A_n$$



(Single or double angle)

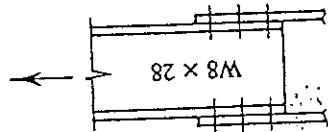
$$A_e = 0.75A_n$$



(b)

$$\frac{d}{b_f} = 0.393 < \frac{1}{2}$$

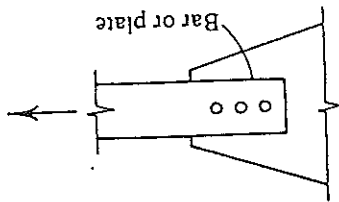
$$A_e = 0.85A_n$$



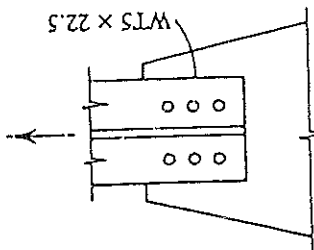
(a)

$$\frac{d}{b_f} = 0.811 > \frac{1}{2}$$

$$A_e = 0.90A_n$$



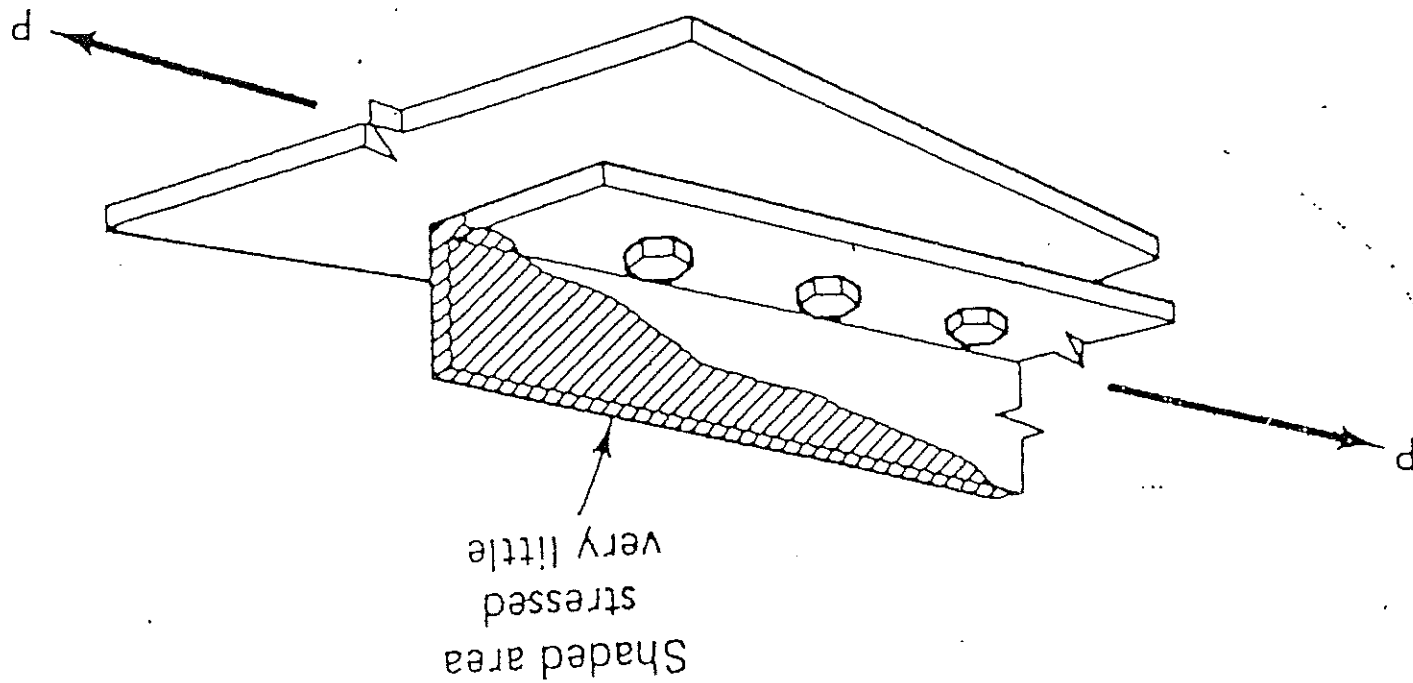
$$A_e = A_n$$



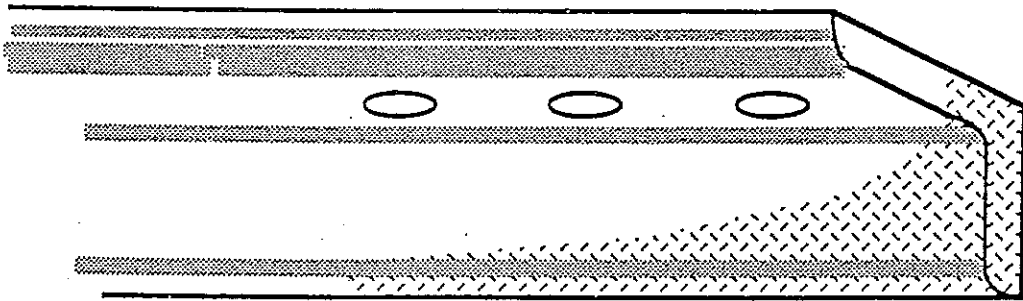
(d)

$$\frac{d}{b_f} = 0.794 > \frac{1}{2} \text{ (for parent W-shape)}$$





Angle Connected by Only One Leg



Angle with Staggered Pattern

