

Staggered Fasteners

Cochrane (1922) proposed that when deducting the area corresponding to a staggered hole, use a reduced diameter given by Eq. (1).

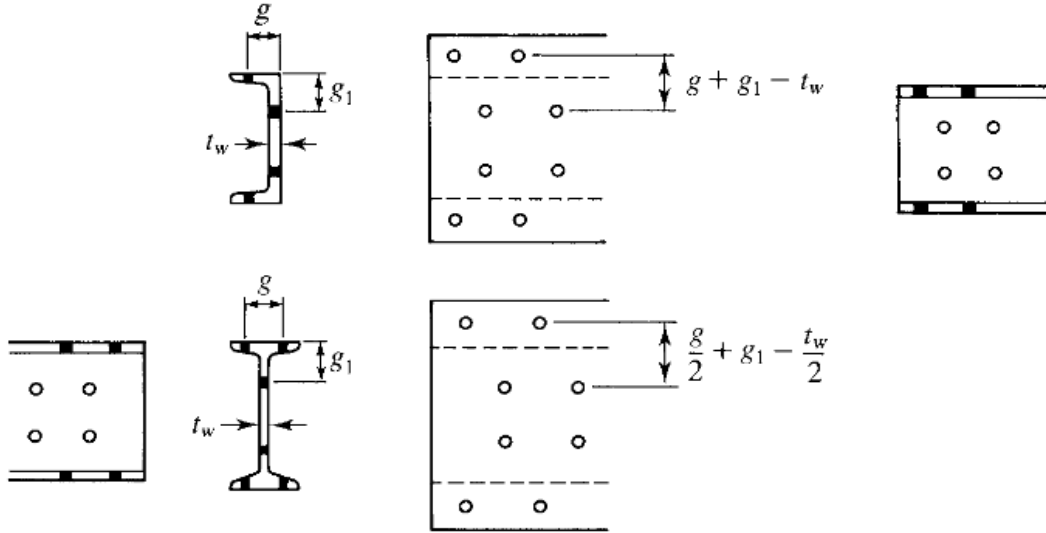
$$d' = d - \frac{s^2}{4g} \quad (1)$$

where d is the hole diameter, s is the stagger (pitch) of the bolts (spacing in the load direction) and g is the gage (transverse spacing). If the net area is treated as the product of a thickness times a net width and the diameter from Eq. (1), the net width in a failure line consisting the both staggered and unstaggered holes is given by Eq. (2).

$$w_n = w_g - \sum d' \quad (2)$$

$$w_g - \sum d - \frac{s^2}{4g}$$

A method for unfolding U- and I-shaped cross-sections with staggered holes is illustrated in the following figure (Segui 2011).



Cochrane, V. H. (1922). Rules for rivet hole deductions in tension members. Engineering News-Record, 89(16), 847-848.

Segui, W. T. (2012). Steel design. Cengage Learning.