Rationale Behind the Block Shear Interaction Eq. Shown in "Blue Book" p164.

The calculation shown is based on von Mises yield criterion (which can be found in many engineering texts), for the condition of plane stress where:

$$\sqrt{\sigma_x^2 - \sigma_x\sigma_y + \sigma_y^2 + 3\tau^2} \le \sigma_{yp}$$

If the normal stress in the y direction is assumed to be zero, we obtain:

$$\frac{\sigma_x^2}{\sigma_{yp}^2} + \frac{3\tau^2}{\sigma_{yp}^2} \le 1$$

Noting that the allowable shear stress is equal to $\sigma_{yp}/\sqrt{3}$ we get:

$$\frac{f_a^2}{F_a^2} + \frac{f_v^2}{F_v^2} \le 1$$

This is then converted from stresses into forces as:

$$\left(\frac{T}{\phi R_{bst}}\right)^2 + \left(\frac{V}{\phi R_{bsv}}\right)^2 \le 1$$

Which is the equation used in our design calculations.