

### 3.2.5.3 Combined shear and tension failure

*Bolt Subjected to Combined Shear and Tension* – A bolt required to resist both design shear force ( $V_{sd}$ ) and design tensile force ( $T_{nd}$ ) at the same time shall satisfy

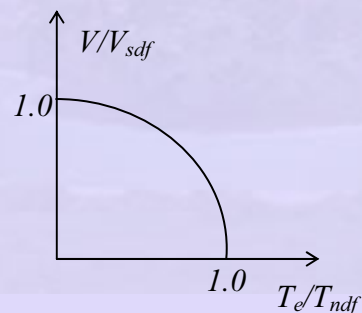
$$\left(\frac{V}{V_{sd}}\right)^2 + \left(\frac{T_e}{T_{nd}}\right)^2 \leq 1.0 \quad (3.13)$$

Where,  $V$  = applied shear;  $V_{sd}$  = design shear capacity;  $T_e$  = externally applied tension and  $T_{nd}$  = design tension capacity. This gives a circular interaction curve as shown in Fig. 3.11.

Bolts in a connection for which slip in the serviceability limit state shall be limited, which are subjected to a tension force,  $T$ , and shear force,  $V$ , shall satisfy (Cl.10.4.6)

$$\left(\frac{V}{V_{sdf}}\right)^2 + \left(\frac{T_e}{T_{ndf}}\right)^2 \leq 1.0 \quad (3.14)$$

Where,  $V$  = applied shear at service load;  $V_{sdf}$  = design shear strength;  $T_e$  = externally applied tension at service load;  $T_{ndf}$  = design tension strength.



**Fig. 3.11 Shear and Tension Interaction Curve**