Nail vs. Screw

Tuesday, October 13, 2026 9:25 PM

Wood specific gravity: $G = 0.55$
Total shear load: $V = 200\,lbf$
Total withdrawal load: $F = 100\,lbf$

Shear analysis

Force per fastener:

$$V_f = \frac{V}{n} = \frac{200}{2} = 100\,lbf$$

(n: 2 fasteners)

Cross-sectional area:

Nail: 16d common nail

$$A_n = \frac{\pi (0.162)^2}{4} = 0.02061\,in^2$$

Screw: #10 wood screw

$$A_s = \frac{\pi (0.130)^2}{4} = 0.01327\,in^2$$

Shear stress:

Nail:

$$\tau_n = \frac{100}{0.02061} = \boxed{4852\,psi}$$

Screw:

$$\tau_s = \frac{100}{0.01327} = \boxed{7534\,psi}$$

55.3% higher shear stress in the screw.

Withdrawal Analysis

Withdrawal resistance: Using simplified NDS reference withdrawal equations. 2 inch embedded length.

Nail:

$$W_n = 1380\,G^{5/2}D = 1380(0.55)^{5/2}(0.162)$$

$$W_n = 50.3\,lbf/in$$

$$F_n = nW_nL = 2(50.3)(2)$$

$$F_n = 201.2\,lbf$$

Screw:

$$W_s = 2850\,G^2D = 2850(0.55)^2(0.190)$$

$$W_s = 163.8\,lbf/in$$

$$F_s = nW_sL = 2(163.8)(2)$$

$$F_s = 655.2\,lbf$$

Withdrawal to load Ratio: $R = \frac{F_{reference}}{F_{applied}}$

Nail:

$$R_n = \frac{201.2}{100} = \boxed{2.01}$$

Screw:

$$R_s = \frac{655.2}{100} = \boxed{6.55}$$

3.26 times higher reference withdrawal resistance.