

Analysis for existing wood joists under shoring loads

Structural analysis for the wood joists on building second floor assuming additional load from shore post supporting floors above.

Acting loads and conditions:

DL := 25 psf	LL := 50 psf	Floor dead load and live load
L := 9 ft	B := 13 ft	Joists Length and spacing
w := (DL + LL) • B = 975 plf	w _L := LL • B = 650 plf	Total and live lineal loads
$M := \frac{w \cdot L^2}{8} = 9871.88 \text{ ft} \cdot \text{lbf}$	$V := \frac{w \cdot L}{2} = 4387.5 \text{ lbf}$	Moment and shear due to gravity load

Considering 3.5" x 9.5" SP. No.2 Wood Joists (Based on NDS -S Tables 1A, 1B and 4B)

d := 9.5 in	b := 3.5 in	Stud height and width
F _b := 2400 psi	F _v := 300 psi	Bending and shear allowable stress
F _{cp} := 565 psi	E := 1700000 psi	Compression perp. to grain stress and elasticity modulus
E' _{min} := 510000 psi	A := b • d = 33.25 in ²	Minimum Modulus of elasticity
$I_x := \frac{b \cdot d^3}{12} = 250.1 \text{ in}^4$	$S_x := \frac{2 I_x}{d} = 52.6 \text{ in}^3$	Moment of Inertia and section modulus about x

Adjustment factors

$C_M := 1$	$C_t := 1$	Wet service factor and temperature factor	
$C_F := 1$	$C_D := 1$	Size factor and load duration factor	
$C_r := 1$	$C_{fu} := 1$	$C_i := 1$	Repetitive member factor, flat use factor and incising factor

Bending strength for gravity loads

$$I_e := 1 \text{ in} \quad R_B := \sqrt{\frac{I_e \cdot d}{b^2}} = 0.881$$

Effective length and slenderness ratio

$$\text{if } (R_B < 50, \text{"OK"}, \text{"Not OK"}) = \text{"OK"}$$

$$F_{\#b} := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_F \cdot C_i \cdot C_r = 2400 \text{ psi}$$

Reference bending design value

$$F_{bE} := \frac{1.2 E'_{\min}}{R_B^2} = 789157.9 \text{ psi}$$

Slenderness bending design value

$$C_L := \frac{1 + \frac{F_{bE}}{F_{\#b}}}{1.9} - \sqrt{\left(\frac{1 + \frac{F_{bE}}{F_{\#b}}}{1.9} \right)^2 - \frac{F_{bE}}{F_{\#b}}} = 1$$

Beam Stability factor

$$F'_b := F_{\#b} \cdot C_L \cdot C_{fu} = 2399.6 \text{ psi}$$

Adjusted bending stress

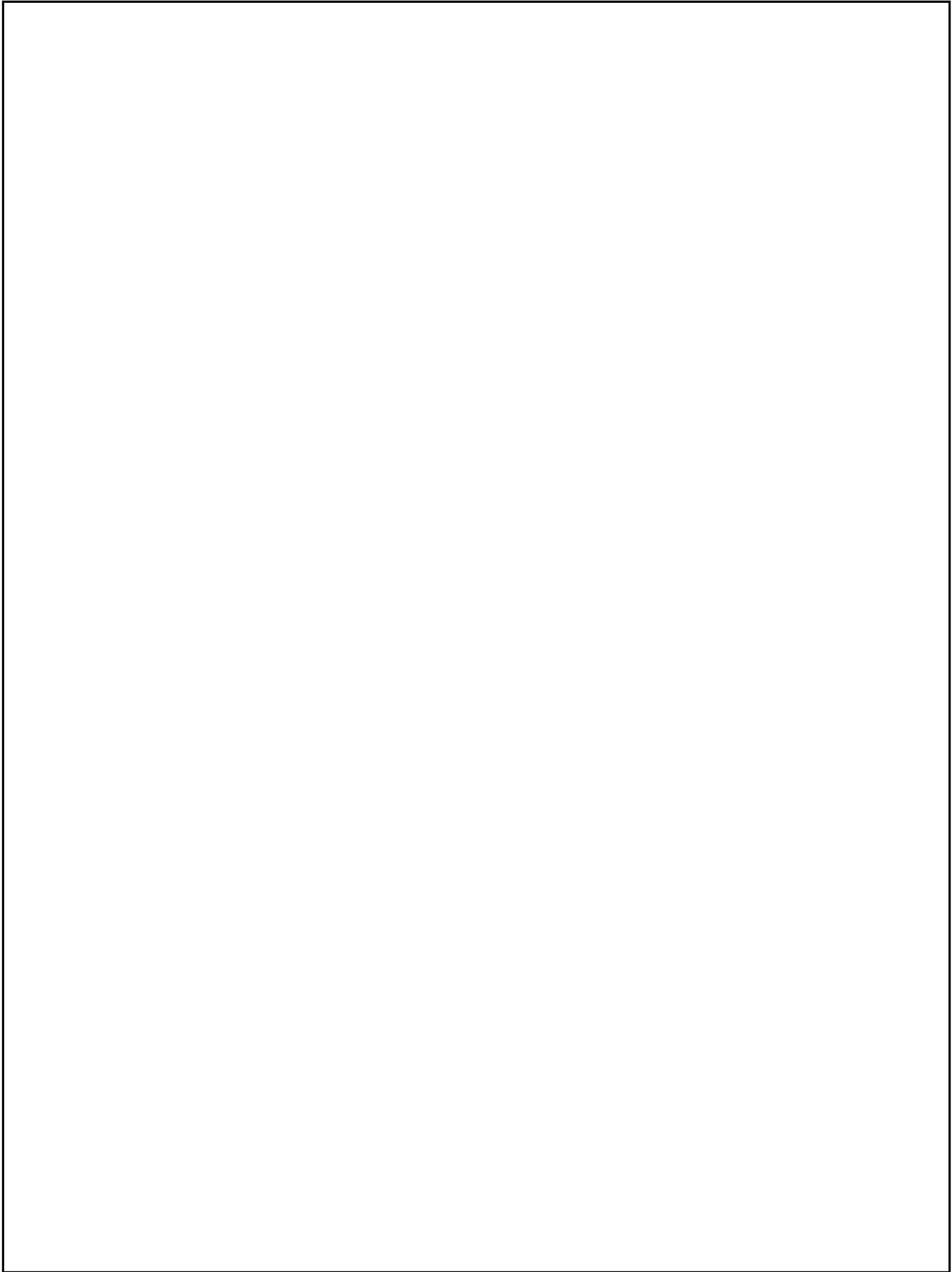
$$f_b := \frac{M}{S_x} = 2250.2 \text{ psi}$$

Acting bending stress

$$\text{if } (F'_b > f_b, \text{"OK"}, \text{"NOT OK"}) = \text{"OK"}$$

$$\frac{f_b}{F'_b} = 0.938$$

$$M_a := S_x \cdot F'_b = 10527.6 \text{ lbf} \cdot \text{ft}$$



Shear strength

$$C_{vr} := 1$$

Shear reduction factor

$$F'_v := F_v \cdot C_D \cdot C_M \cdot C_t \cdot C_{vr} = 300 \text{ psi}$$

$$f_v := \frac{3 V}{2 A} = 197.932 \text{ psi}$$

Acting bending stress

$$\text{if } (F'_v > f_v, \text{"OK"}, \text{"NOT OK"}) = \text{"OK"}$$

$$\frac{f_v}{F'_v} = 0.66$$

Bearing Capacity

$$l_b := 2.5 \text{ in}$$

Bearing length considering support on wood beam.

$$C_b := \frac{\frac{l_b}{\text{in}} + 0.375}{\frac{l_b}{\text{in}}} = 1.15$$

Bearing area factor

$$F'_{cp} := F_{cp} \cdot C_M \cdot C_t \cdot C_i \cdot C_b = 649.75 \text{ psi}$$

$$A_b := l_b \cdot b = 8.75 \text{ in}^2 \quad f_{cp} := \frac{0.5 w \cdot L}{A_b} = 501.429 \text{ psi}$$

Bearing area and acting bearing stress

$$\text{if } (F'_{cp} > f_{cp}, \text{"OK"}, \text{"NOT OK"}) = \text{"OK"}$$

$$\frac{f_{cp}}{F'_{cp}} = 0.772$$

Serviceability (Deflection Analysis)

$$\Delta_{total} := \frac{5 w \cdot L^4}{384 E \cdot I_x} = 0.339 \text{ in}$$

$$\Delta_{live} := \frac{5 w_L \cdot L^4}{384 E \cdot I_x} = 0.226 \text{ in}$$

Total and live acting deflection

$$\Delta_{allow, total} := \frac{L}{240} = 0.45 \text{ in}$$

$$\Delta_{allow, live} := \frac{L}{360} = 0.3 \text{ in}$$

Allowable total and live deflection

$$\text{if } (\Delta_{total} < \Delta_{allow, total}, \text{"OK"}, \text{"Not OK"}) = \text{"OK"}$$

$$\text{if } (\Delta_{live} < \Delta_{allow, live}, \text{"OK"}, \text{"Not OK"}) = \text{"OK"}$$