Appendix D Example 19 – Individual Falsework Pads – Symmetrical Loading

Refer to *Falsework Manual,* Section 8-2.06A, *Analysis of Symmetrical Pads*. This example demonstrates how to analyze individual symmetrical falsework pads.

Given Information

Timber pads:
Three 6 x 12 Rough Douglas Fir-Larch #2 (G=0.50)

Corbel:
8 x 8 Rough Douglas Fir-Larch #1 (G=0.50)

Post:
8x8 Douglas Fir-Larch #1 (G=0.50)

Allowable soil pressure = 2500 psf

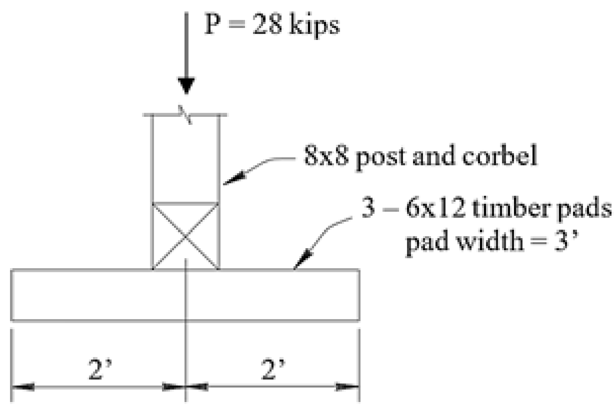

Figure D-19-1. Symmetrical Individual Pad with Single Corbel

Check Pad

1. Calculate allowable bending stress

Reference design value in bending F_b = 875 psi (NDS supplement table 4D)

Adjustment factors from NDS table 4.3.1:

C_D = 1.25	Duration Factor
C_M = 1.0	Wet Service Factor NDS table 4D (Assume < 19% moisture content)
C_t = 1.0	Temperature Factor NDS table 2.3.3 (Temp up to 100ºF)
C_L = 1.0	Beam Stability Factor NDS 4.4.1
C_F = 1.0	Size Factor NDS Table 4D
C_{fu} = 1.0	Flat Use Factor NDS table 4D
C_i = 1.0	Incising Factor NDS 4.3.8

C_r = 1.0 Repetitive Member Factor NDS 4.3.9

Adjusted design value Fb' = Fb $(C_D)(C_M)(C_L)(C_t)(C_F)(C_i)(C_{fu})(C_r)$ = 1094 psi

2. Calculate effective length

$$L_{SYM} = \frac{1}{12}\left(\frac{8F_b'S}{1000P} + t\right) = \frac{1}{12}\left(\frac{8(1094)(216)}{1000(28)} + 8\right) = 6.29 \text{ ft}$$

$$S = \frac{bh^2}{6} = \frac{3(12)(6)^2}{6} = 216 \text{ in}^3$$

3. Find the limiting length

Compare adj. effective length and actual length 6.29 > 4.0; <u>use actual length</u>

4. Calculate soil pressure

$$\text{Soil pressure} = \frac{P}{A} = \frac{28000}{3.0(4.0)} = 2333 \text{ psf}$$

2333 psf < 2500 psf allowable **<u>OK</u>**

5. Calculate horizontal shear stress

Reference design value in shear F_v = 170 psi (NDS supplement table 4D)

Adjustment factors from NDS table 4.3.1:

C_D = 1.25 Duration Factor
C_M = 1.0 Wet Service Factor NDS table 4D (Assume < 19% moisture content)
C_t = 1.0 Temperature Factor NDS table 2.3.3 (Temp up to 100ºF)
C_i = 1.0 Incising Factor NDS table 4.3.8

Adjusted design value F_v' = F_v $(C_D)(C_M)(C_t)(C_i)$ = 213 psi

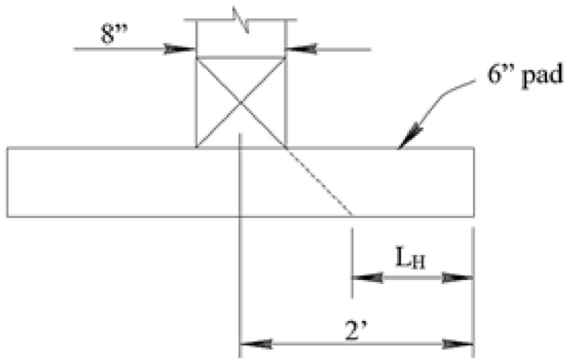

Figure D-19-2. Symmetrical Pad Shear Dimensions

$$L_H = \frac{4.0}{2} - \frac{8/12}{2} - \frac{6}{12} = 1.17 \text{ ft}$$

$$V = (2333)(1.17)(3.0) = 8189 \text{ lbs.}$$

$$f_v = \frac{3V}{2A} = \frac{3(8189)}{2(6)(12)(3)} = 57 \text{ psi}$$

57 psi < 213 psi allowable **OK**

Check corbel

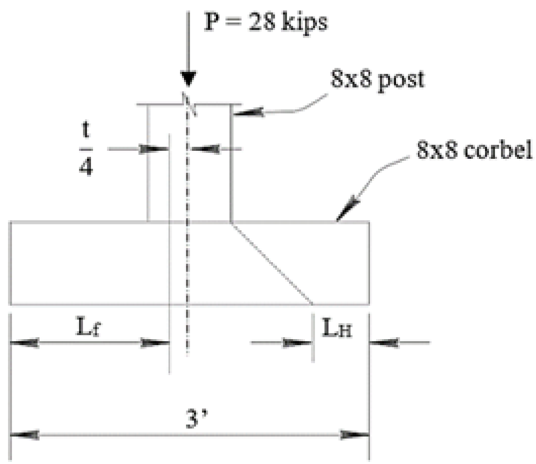

Figure D-19-3. Timber Corbel Flexure and Shear Dimensions

$$W = \frac{28000}{3} = 9333 \text{ plf}$$

$$S = \frac{bh^2}{6} = \frac{8(8)^2}{6} = 85.3 \text{ in}^3$$

$$L_H = \frac{3.0}{2} - \frac{8/12}{2} - \frac{8}{12} = 0.50 \text{ ft}$$

$$L_f = \frac{3.0}{2} - \frac{8/12}{4} = 1.33 \text{ ft}$$

1. Calculate compression perpendicular to grain

Reference design value in shear $F_{c\perp}$ = 625 psi (NDS supplement table 4D)

Adjustment factors from NDS table 4.3.1:

C_M = 1.0	Wet Service Factor NDS table 4D (Assume < 19% moisture content)
C_t = 1.0	Temperature Factor NDS table 2.3.3 (Temp up to 100ºF)
C_i = 1.0	Incising Factor NDS table 4.3.8
C_b = 1.0	Bearing Area Factor NDS 3.10.4

Adjusted design value $F_{c\perp}' = F_{c\perp}(C_M)(C_t)(C_i)(C_b) = 625$ psi

$$f_c = \frac{P}{A} = \frac{28000}{8(8)} = 438 \text{ psi}$$

438 psi < 625 psi allowable **OK**

2. Calculate horizontal shear stress

V = 0.5 (9333) = 4667 lbs

$$f_v = \frac{3V}{2A} = \frac{3(4667)}{2(64)} = 109 \text{ psi}$$

109 psi < 213 psi allowable **OK**

3. Calculate bending stress

$$M = \frac{WL^2}{2} = \frac{(9333)(1.33)^2}{2} = 8255 \text{ ft-lbs}$$

$$f_b = \frac{M}{S} = \frac{8255(12)}{85.3} = 1161 \text{ psi}$$

Reference design value in bending $F_b = 1350$ psi (NDS supplement table 4D)

Adjusted design value $F_b' = F_b(C_D)(C_M)(C_L)(C_t)(C_F)(C_i)(C_{fu})(C_r) = 1688$ psi (see “Pad Check” step 1 for adjustment factors)

1161 psi < F_b = 1688 psi allowable **OK**