Appendix D Example 20 – Individual Falsework Pads – Asymmetrical Loading

Refer to *Falsework Manual,* Section 8-2.06B, *Analysis of Asymmetrical Pads*. This example demonstrates how to analyze individual asymmetrical falsework pads.

Given Information

Timber pads:
Three 6x16 Rough Douglas Fir-Larch #2 (G=0.50)

Corbel:
12x12 Rough Douglas Fir-Larch #1 (G=0.50)

Post:
12x12 Douglas Fir-Larch #1 (G=0.50)

Allowable soil pressure = 3500 psf

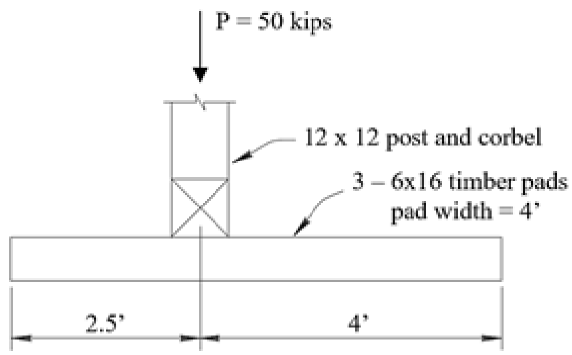


Figure D-20-1. Asymmetrical Individual Pad with Single Corbel

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 $F_b' = F_b (C_D)(C_M)(C_t)(C_L)(C_F)(C_i)(C_{fu})(C_r) = 1094$ psi

2. Calculate adjusted effective length

$$L_e = L_{SYM} = \frac{1}{12}\left(\frac{8F_b'S}{1000P} + t\right) = \frac{1}{12}\left(\frac{8(1094)(288)}{1000(50)} + 12\right) = 5.20 \text{ ft}$$

$$S = \frac{bh^2}{6} = \frac{3(16)(6)^2}{6} = 288 \text{ in}^3$$

3. Find limiting length on short side

Compare $\frac{1}{2}$ of effective length and actual length

$\frac{1}{2}$ (5.20) = 2.60 > 2.50; Pad length (L_1) = 2.50 ft

4. Calculate limiting length on long side

Compare $\frac{1}{2}$ of effective length and actual length

$\frac{1}{2}$ (5.20) = 2.60 < 4.0;   Pad length (L_2) = 2.60 ft

5. Calculate soil pressure

Bearing length = $L_1 + L_2$ = 2.50 + 2.60 = 5.10 ft

$$\text{Soil pressure} = \frac{P}{A} = \frac{50000}{4(5.10)} = 2451 \text{ psf}$$

2451 psf ≤ 3500 psf allowable **OK**

6. Calculate horizontal shear on the long side

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

Adjustment factors from NDS table 4.3.1:

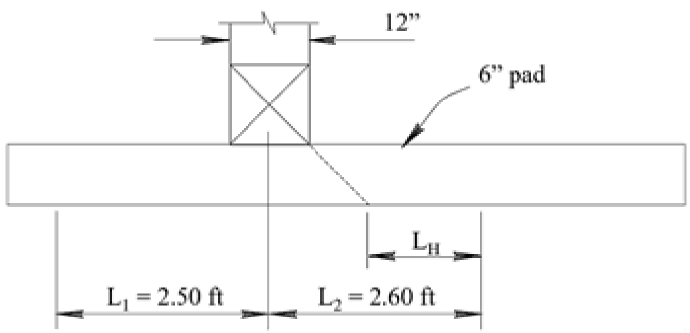
C_D = 1.25 Duration Factor

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



$$L_H = 2.60 - \frac{12/12}{2} - \frac{6}{12} = 1.50 \text{ ft}$$

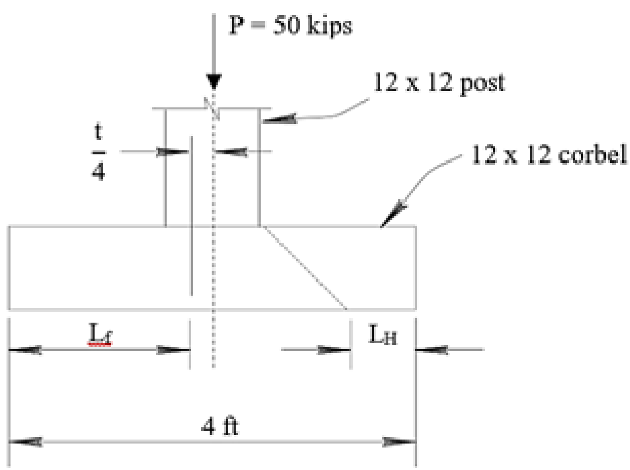
$$V = (2451)(1.60)(4.0) = 15686 \text{ lb}$$

$$f_v = \frac{3V}{2A} = \frac{3(15686)}{2(6)(16)(3)} = 82 \text{ psi}$$

82 psi < 213 allowable **OK**

Figure D-20-2. Asymmetrical Pad Shear Dimensions

Check Corbel



$$W = \frac{50000}{4} = 12500 \text{ plf}$$

$$S = \frac{bh^2}{6} = \frac{12(12)^2}{6} = 288 \text{ in}^3$$

$$L_f = \frac{4.0}{2} - \frac{12/12}{4} = 1.75 \text{ ft}$$

$$L_H = \frac{4.0}{2} - \frac{12/12}{2} - \frac{12}{12} = 0.5 \text{ ft}$$

Figure D-20-3. Timber Corbel Flexure and Shear Dimensions

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

$$f_c = \frac{P}{A} = \frac{50000}{12 \text{ x } 12} = 347 \text{ psi}$$

347 psi < 625 allowable **OK**

2. Calculate stress due to horizontal shear

V = (12500)(0.5) = 6250 lbs

$$f_v = \frac{3V}{2A} = \frac{3(6250)}{2(12)(12)} = 65 \text{ psi}$$

65 psi < 213 allowable **OK**

3. Calculate bending stress

$$M = \frac{WL^2}{2} = \frac{(12500)(1.75)^2}{2} \text{ 19141 ft-lbs}$$

$$f_b = \frac{M}{S} = \frac{(19141)(12)}{288} = 798 \text{ psi}$$

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

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

798 psi < 1688 psi allowable **OK**