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

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:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_D$</td>
<td>1.25</td>
<td>Duration Factor</td>
</tr>
<tr>
<td>$C_M$</td>
<td>1.0</td>
<td>Wet Service Factor NDS table 4D (Assume &lt; 19% moisture content)</td>
</tr>
<tr>
<td>$C_t$</td>
<td>1.0</td>
<td>Temperature Factor NDS table 2.3.3 (Temp up to 100°F)</td>
</tr>
<tr>
<td>$C_L$</td>
<td>1.0</td>
<td>Beam Stability Factor NDS 4.4.1</td>
</tr>
<tr>
<td>$C_F$</td>
<td>1.0</td>
<td>Size Factor NDS Table 4D</td>
</tr>
<tr>
<td>$C_{fu}$</td>
<td>1.0</td>
<td>Flat Use Factor NDS table 4D</td>
</tr>
<tr>
<td>$C_i$</td>
<td>1.0</td>
<td>Incising Factor NDS 4.3.8</td>
</tr>
</tbody>
</table>

Figure D-19-1. Symmetrical Individual Pad with Single Corbel
\[ C_r = 1.0 \quad \text{Repetitive Member Factor NDS 4.3.9} \]

Adjusted design value \( F_{b'} = F_b \left( C_D \right) \left( C_M \right) \left( C_L \right) \left( C_r \right) \left( C_t \right) \left( C_i \right) \left( C_{fu} \right) \left( C_r \right) = 1094 \text{ 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; **use actual length**

4. **Calculate soil pressure**

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

2333 psf < 2500 psf allowable \hspace{1cm} **OK**

5. **Calculate horizontal shear stress**

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

Adjustment factors from NDS table 4.3.1:

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

Adjusted design value \( F_{v'} = F_v \left( C_D \right) \left( C_M \right) \left( C_t \right) \left( C_i \right) = 213 \text{ psi} \)
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

Check corbel

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

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

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

$$L_f = \frac{3.0}{2} - \frac{8/12}{4} = 1.33 \text{ ft}$$
Adjusted design value $F_{c\perp}' = F_{c\perp}(C_M)(C_i)(C_b) = 625 \text{ psi}$

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

438 psi < 625 psi allowable \hspace{1cm} \textbf{OK}

2. Calculate horizontal shear stress

$$V = 0.5 \times 9333 = 4667 \text{ lbs}$$

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

109 psi < 213 psi allowable \hspace{1cm} \textbf{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 $F_b = 1350 \text{ psi}$ (NDS supplement table 4D)

Adjusted design value $F_{b}' = F_b (C_D)(C_M)(C_i)(C_F)(C_t)(C_{tu})(C_r) = 1688 \text{ psi}$

(see “Pad Check” step 1 for adjustment factors)

$$1161 \text{ psi} < F_b = 1688 \text{ psi allowable} \hspace{1cm} \textbf{OK}$$