

LILLY MILL SDI CANTILEVER ANCHORED SHORING - PRELIMINARY DESIGN

Given:

Unit weight residual soils, $\gamma_r := 115 \text{pcf}$ Saturated unit weight, $\gamma_{\text{sat}} := 52.6 \text{pcf}$ Internal friction angle, $\varphi_f := 32 \text{deg}$ Surcharge load, $q := 250 \text{psf}$ Braced height of excavation, $H := 621 \text{ft} - 599 \text{ft} = 22 \text{ft}$

Required:

1. Calculate Rankine Active & Passive Pressure Coefficients:

$$\text{Active pressure coefficient, } K_a := \frac{1 - \sin(\varphi_f)}{1 + \sin(\varphi_f)} = 0.31$$

$$\text{Passive pressure coefficient, } K_p := \frac{1 + \sin(\varphi_f)}{1 - \sin(\varphi_f)} = 3.25 \qquad K'_p := \frac{K_p}{1.5} = 2.17$$

2. Calculate the pressures:

$$p_1 := K_a \cdot q = 77 \cdot \text{psf}$$

$$p_2 := K_a \cdot \gamma_r \cdot H = 777 \cdot \text{psf}$$

$$p_3 = K_a \cdot \gamma_{\text{sat}} \cdot D \text{ float, 2} \rightarrow p_3 = 16.0 \cdot D \cdot \text{pcf}$$

$$p_4 = K'_p \cdot \gamma_{\text{sat}} \cdot D \text{ float, 2} \rightarrow p_4 = 114.0 \cdot D \cdot \text{pcf}$$

3. Calculate the forces:

$$F_1 := p_1 \cdot H = 1690 \text{ ft psf}$$

$$F_2 := \frac{1}{2} \cdot p_2 \cdot H = 8551 \text{ ft psf}$$

$$F_3 = (p_1 + p_2) \cdot D \text{ float, 2} \rightarrow F_3 = D \cdot (5.4 \cdot \text{psi} + 0.53 \cdot \text{psi})$$

$$F_4 = \frac{1}{2} \cdot p_3 \cdot D \text{ float, 2} \rightarrow F_4 = \frac{D \cdot p_3}{2}$$

$$F_5 = \frac{1}{2} \cdot p_4 \cdot D \text{ float, 2} \rightarrow F_5 = \frac{D \cdot p_4}{2}$$

4. Determine depth of embedment, D. Compute $\Sigma M@0$ and solve for D:

$$\frac{1}{3} \cdot D \cdot F_4 + \frac{1}{2} D \cdot F_3 + \left(D + \frac{1}{3} \cdot H\right) \cdot F_2 + \left(D + \frac{1}{2} H\right) \cdot F_1 - \frac{1}{3} D \cdot F_5 \left| \begin{array}{l} \text{solve, D} \\ \text{float, 2} \\ \text{simplify} \end{array} \right. \rightarrow \frac{1.6e7 \cdot \text{ft} \cdot \text{lb}}{2.0e6 \cdot \text{lb} + 3.0 \cdot F_3 \cdot \text{s}^2 + 2.0 \cdot F_4 \cdot \text{s}^2 + -2.0 \cdot F_5 \cdot \text{s}}$$