



$$H := 8 \text{ ft} + 10 \text{ in}$$

Depth of Excavation

$$L := 4 \text{ ft} + 6 \text{ in} + \frac{13}{16} \text{ in}$$

Length of Culvert

$$L_1 := 10 \text{ ft}$$

Distance From Edge to Point Load

$$m := \frac{L_1}{H} = 1.132$$

Ratio of Distance From Edge to Point Load to Height of Excavation

$$Q_p := 67500 \text{ lbf}$$

Largest Load from Outrigger - See Compucrane printout

$$n := 0.01 \dots 1$$

Point of Interest Factor

$$\sigma_h(n) := \text{if } m \leq 0.4$$

$$\left\| \begin{array}{l} 0.28 \cdot \frac{Q_p}{H^2} \cdot \frac{n}{(0.16 + n^2)^3} \\ \text{else} \\ 1.77 \cdot \frac{Q_p}{H^2} \cdot \frac{m^2 \cdot n^2}{(m^2 + n^2)^3} \end{array} \right\|$$

CALTRANS EQ 4-70

CALTRANS EQ 4-71

$$d := \frac{L}{2}$$

Distance Between Load Applied at Center and Culvert Section End

$$\theta_{max} := \text{atan} \left(\frac{d}{L_1} \right) = 12.865 \text{ deg}$$

Maximum Angle of Interest - To Culvert Section End

$$\theta := 0 \text{ deg} \dots .45 \cdot \text{deg} \dots \theta_{max}$$

Angle to Point of Interest

$$\sigma'_h(n, \theta) := \sigma_h(n) \cdot \cos(1.1 \cdot \theta)^2$$

CALTRANS EQ 4-72

$$\int_0^{1\theta_{max}} \int_0 \sigma'_h dn d\theta = ?$$