

Retaining Wall Loading:

Soil Info:

$$\beta = 39\text{deg} \quad \phi = 39\text{deg} \quad \delta = 26\text{deg} \quad \gamma = 120\text{pcf} \quad W_1 = 0\text{psf} \quad \alpha = 90\text{deg}$$

$$H = 10\text{ft}$$

Calculate Rankine Active Earth Pressure Coefficient:

$$K_{a_R} = \frac{\cos(\beta) - \sqrt{\cos(\beta)^2 - \cos(\phi)^2}}{\cos(\beta) + \sqrt{\cos(\beta)^2 - \cos(\phi)^2}} \cdot \cos(\beta) = 0.777$$

$$K_{a_C} = \frac{\sin(\alpha + \phi)^2}{\left(1 + \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \beta)}{\sin(\alpha - \delta) \cdot \sin(\alpha - \beta)}}\right)^2 \cdot \sin(\alpha)^2 \cdot \sin(\alpha - \delta)} = 0.672$$

Calculate Horizontal component: $K_0 = 0.5$

$$K_{ah} = \cos(\beta) \cdot \max(K_{a_R}, K_{a_C}, K_0) = 0.604$$

Calculate Equivalent Fluid Pressure (EFP):

$$P_a = K_{ah} \cdot \gamma = 72.475\text{pcf}$$

Calculate Passive Pressure Coefficient:

Flat in front of footing: $\beta = 0\text{deg}$

$$K_{p_R} = \frac{\cos(\beta) + \sqrt{\cos(\beta)^2 - \cos(\phi)^2}}{\cos(\beta) - \sqrt{\cos(\beta)^2 - \cos(\phi)^2}} \cdot \cos(\beta) = 4.395 \quad K_{ph} = \cos(\beta) \cdot K_{p_R} = 4.395$$

Calculate Passive Earth Pressure:

$$P_p = K_{ph} \cdot \gamma = 527.459\text{pcf}$$

Wall Loading Functions at any point on wall:

Pressure at any point on wall:

$$P(h) = K_{ah} \cdot \gamma \cdot h + W_1 \cdot K_{ah}$$

Shear at any point in cantilevered wall:

$$V(h) = \int_{0ft}^h K_{ah} \cdot \gamma \cdot h + W_1 \cdot K_{ah} dh$$

Moment at any point in cantilevered wall:

$$M(h) = \int_{0ft}^h \int_{0ft}^h K_{ah} \cdot \gamma \cdot h + W_1 \cdot K_{ah} dh dh$$

$$M(H) \cdot 1ft = 12.079 \cdot kip \cdot ft$$

Pressure to apply at Top of Wall:

$$P(0ft) = 0 \cdot psf$$

Pressure to apply at Bottom of Wall:

$$P(H) = 724.747 \cdot psf$$

Pressure on heel of the footing:

$$W_1 + \gamma \cdot H = 1200 \cdot psf$$