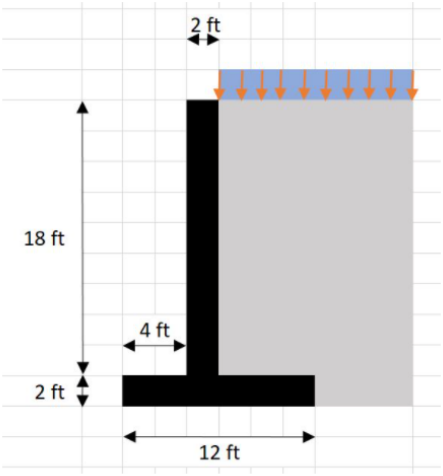
Question: The backfill behind the concrete retaining wall weighs 110 pcf...

The backfill behind the concrete retaining wall weighs 110 pcf and the angle of internal friction is 30 degrees. The live load surcharge on the surface of horizontal backfill is 200 psf.



a. Determine the total active force acting on the wall per unit width. (lb - round to the nearest whole number)

b. Find the factor of safety against overturning. (use 2 decimal places)

c. Compute the rest earth pressure on the retaining wall per unit width. (lb - round to the nearest whole number)

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Expert Answer

Anonymous answered this
176 answers

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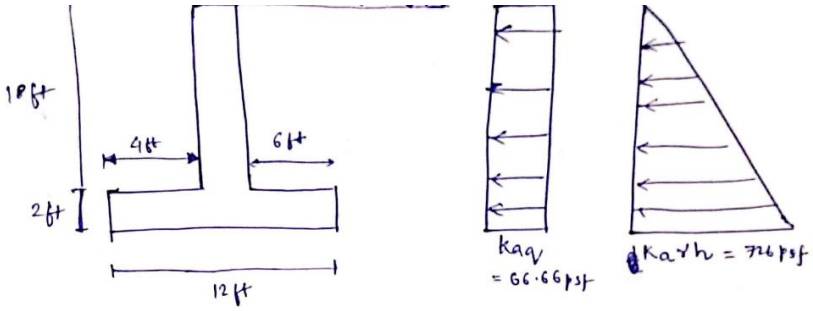

∴ Given

surcharge q = 200 psf

and weight of retaining wall = 150 pcf (assumed).

and angle of internal friction(ϕ) = 30°

and weight of backfill soil = 110 pcf

⇒ Active earth pressure coefficient, $K_a = \frac{1-\sin\phi}{1+\sin\phi} = \frac{1}{3} = 0.33$

∴ Active earth pressure due to surcharge will be = $K_a \cdot q$

⇒ $p_1 = K_a \cdot q = \frac{1}{3} \times 200 = 66.66$ psf

and this will varry uniformly over the length.

⇒ Active earth pressure due to soil backfill = $K_a \gamma h$

at top of wall, $p_{20} = K_a \gamma h = 0.33 \times 110 \times 0 = 0$

at bottom of the wall, $p_{21} = K_a \gamma h = 0.33 \times 110 \times 20 = 363$ psf

= 726 psf

∴ Total active pressure acting on the wall = P =

⇒ $P = p_1 h + \frac{1}{2} \times (p_{20} + p_{21}) \times h = (66.66 \times 20) + \left(\frac{0+726}{2}\right) \times 20$

∴ $P = 8593.2$ pff = 8593.2 lb/f

Total active pressure acts at a distance $h/3$ from bottom,

∴ $\bar{h} = \frac{h}{3} = \frac{20}{3}$ ft.

Now Restoring force, f_1 = weight of the retaining wall

$= \{(18 \times 2) + (12 \times 2)\} \times 150 = 9000$ p/f

weight acts downward through c.g. of retaining wall,

$\bar{x} = \frac{a_1 x_1 + a_2 x_2}{a_1 + a_2} = \frac{(18 \times 2) \times 5 + (12 \times 2) \times 6}{(18 \times 2) + (12 \times 2)}$

$\bar{x} = \frac{180 + 144}{60} = 5.4$ ft.

∴ Factor of safety against overturning, F_s

= Restoring moment

Restoring force, F_2 = weight of the backfill soil on the retaining wall

$F_2 = 110 \times 6 \times 18 = 11880$ p/f

acting at $(\frac{6}{2} + 2 + 4) = 9$ ft from toe of the retaining wall.

Restoring force, F_3 = Due to surcharge force = $200 \times 6 = 1200$ p/f

acting at 9 ft from toe of the retaining wall.

∴ Restoring moment = $f_1 \times x_1 + F_2 \times x_2 + F_3 \times x_3$

$= 9000 \times 5.4 + 11880 \times 9 + 1200 \times 9$

$= 48600 + 106920 + 10800$

$= 166320$ p/f-ft.

Now overturning moment = active earth force $\times \bar{h}$

$= 8593.2 \times \frac{20}{3} = 57288$ p/f-ft

∴ Factor of safety against overturning, FOS_{OT}

$FOS_{OT} = \frac{\text{Restoring moment}}{\text{overtaking moment}} = \frac{166320}{57288} = 2.9$

$\boxed{FOS_{OT} = 2.9}$

⇒ Rest earth pressure on the retaining wall ⇒ P_R

Coefficient of rest earth pressure, $K_o = 1 - \sin\phi = 1 - \sin 30^\circ$

$= 0.5$

Rest earth pressure due to surcharge = $K_o q = 0.5 \times 200 = 100$ psf

Rest earth pressure due to backfill,

at top, $P_{R_1} = K_o \gamma h = 0.5 \times 110 \times 0 = 0$

at bottom, $P_{R_2} = K_o \gamma h = 0.5 \times 110 \times 20 = 1100$ psf

∴ Total rest earth pressure/unit width on wall, P_R

$P_R = K_o q h + \left(\frac{1}{2} K_o \gamma h\right) h$

$= 100 \times 20 + \left(\frac{1}{2} \times 0.5 \times 110 \times 20\right) 20$

$= 13000$ p/ft

$P_R = 13000$ lb/ft.

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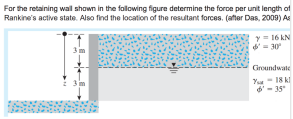
For the retaining wall shown in the following figure determine the force per



See answer

For the retaining wall shown in figure below, determine

See answer

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Q: Please assist to provide detail workings for easier understanding. Thank you.

A: See answer

Q: Q23: An ogee spillway has 12 m clear length, at the design flow; the depth of water over the spillway crest is 2.96 m, the spillway height is 9 m. 1. Find the design flow rate. 2. Find the flow rate corresponding to head of flow (including the head of approach velocity)=4 m. 3. Find the flow rate corresponding to head of flow (including the head of approach velocity) =1.5 m....

A: See answer

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