

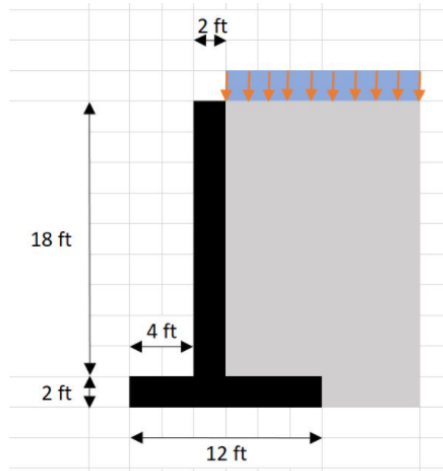
Find solutions for your homework

Search

home / study / engineering / civil engineering / civil engineering questions and answers / the backfill behind the concrete retaining wall weighs 11...

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.



- Determine the total active force acting on the wall per unit width. (lb - round to the nearest whole number)
- Find the factor of safety against overturning. (use 2 decimal places)
- Compute the rest earth pressure on the retaining wall per unit width. (lb - round to the nearest whole number)

Show transcribed image text

Expert Answer



Anonymous answered this
176 answers

Was this answer helpful?



Post a question

Answers from our experts for your tough homework questions

Enter question

Continue to post

18 questions remaining



Snap a photo from your phone to post a question

We'll send you a one-time download link

888-888-8888

Text me

By providing your phone number, you agree to receive a one-time automated text message with a link to get the app. Standard messaging rates may apply.

My Textbook Solutions



Discrete...

6th Edition

[View all solutions](#)



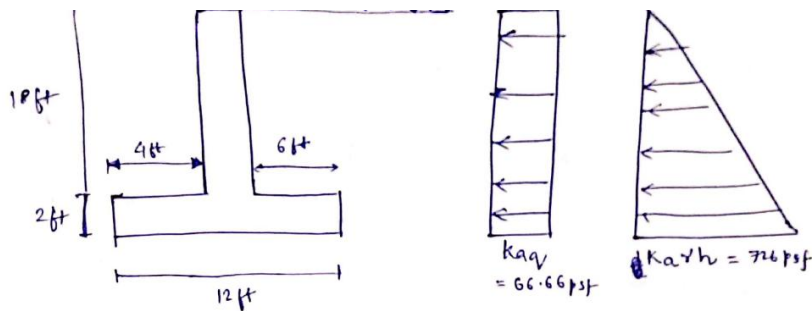
Chemistry

1st Edition



Accounting Information...

9th Edition



∴ Act Given:

$$\text{Surcharge } q = 200 \text{ psf}$$

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

and angle of internal friction (ϕ) = 30°

and weight of backfill soil = 110 pcf

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

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

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

and this will vary uniformly over the length.

⇒ Active earth pressure due to soil backfill = $\frac{1}{2} K_a \gamma h$

$$\text{at top of wall, } p_2 = \frac{1}{2} K_a \gamma h = \frac{1}{2} \times 0.33 \times 110 \times 0 = 0$$

$$\text{at bottom of the wall, } p_2 = \frac{1}{2} K_a \gamma h = \frac{1}{2} \times 0.33 \times 110 \times 20 = 363 \text{ psf} \\ = 726 \text{ psf}$$

∴ Total active pressure acting on the wall = $P =$

$$\Rightarrow P = p_1 h + \frac{1}{2} \times (p_2 + p_1) \times h = (66.66 \times 20) + \left(\frac{0 + 726}{2}\right) \times 20 \\ \therefore P = 8593.2 \text{ p/f} = 8593.2 \text{ lb/f}$$

CS Scanned with CamScanner

Total active pressure acts at a distance $\frac{h}{3}$ from bottom.

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

Now Restoring force, = weight of the retaining wall

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

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

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

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

∴ Factor of safety against overturning, F_s

Restoring moment



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

$$F_2 = 110 \times 6 \times 18 = 11880 \text{ p/ft}$$

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

Restoring force, F_3 = Due to surcharge force = $200 \times 6 = 1200 \text{ p/ft}$

acting at 9 ft from toe of the retaining wall.

$$\begin{aligned} \therefore \text{Restoring moment} &= F_1 \times x_1 + F_2 \times x_2 + F_3 \times x_3 \\ &= 9000 \times 5.4 + 11880 \times 9 + 1200 \times 9 \\ &= 48600 + 106920 + 10800 \\ &= 166320 \text{ p/ft-ft.} \end{aligned}$$

CS Scanned with CamScanner

$$\begin{aligned} \text{New overturning moment} &= \text{active earth force} \times \bar{h} \\ &= 8593.2 \times \frac{20}{3} = 57288 \text{ p/ft-ft} \end{aligned}$$

\therefore Factor of safety against overturning, FOS_{OT}

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

$$FOS_{OT} = 2.9$$

\Rightarrow Rest earth pressure on the retaining wall $\Rightarrow P_R$

$$\begin{aligned} \text{Coefficient of rest earth pressure, } K_0 &= 1 - \sin \phi = 1 - \sin 30^\circ \\ &= 0.5 \end{aligned}$$

$$\text{Rest earth pressure due to surcharge} = K_0 q = 0.5 \times 200 = 100 \text{ psf}$$

Rest earth pressure due to backfill,

$$\text{at top, } P_{R1} = K_0 \gamma h = 0.5 \times 110 \times 0 = 0$$

$$\text{at bottom, } P_{R2} = K_0 \gamma h = 0.5 \times 110 \times 20 = 1100 \text{ psf}$$

\therefore Total rest earth pressure / unit width on wall, P_R

$$\begin{aligned} P_R &= K_0 q h + \left(\frac{1}{2} K_0 \gamma h \right) h \\ &= 100 \times 20 + \left(\frac{1}{2} \times 0.5 \times 110 \times 20 \right) 20 \\ &= 13000 \text{ p/ft} \\ P_R &= 13000 \text{ lb/ft.} \end{aligned}$$

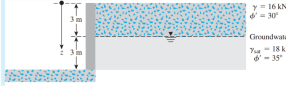
CS Scanned with CamScanner

Comment >

Up next for you in Civil Engineering

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

For the retaining wall shown in the following figure determine the force per unit length of Rankine's active state. Also find the location of the resultant forces. (after Das, 2009) A



[See answer](#)

For the retaining wall shown in figure below, determine

[See answer](#)

[See more questions for subjects you study](#)

Questions viewed by other students

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](#)

[Show more](#) ▼

COMPANY ▼

LEGAL & POLICIES ▼

CHEGG PRODUCTS AND SERVICES ▼

CHEGG NETWORK ▼

CUSTOMER SERVICE ▼



© 2003-2021 Chegg Inc. All rights reserved.

