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**Question: A frictionless retaining wall is shown in figure below. Determin...**

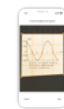
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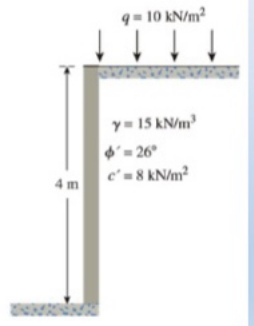
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A frictionless retaining wall is shown in figure below. Determine:

- a) The active force  $P_a$  after the tensile crack occurs
- b) The passive force  $P_p$



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**Expert Answer**



DANISH answered this  
622 answers

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**Handwritten Solution:**

**(a) The active earth pressure after the tensile crack**

The Active Earth Pressure in  $c-\phi$  soil with surcharge  $q$  at depth  $z$

$$P_a = K_a \gamma z - 2c \sqrt{K_a} + K_a q$$

Active Earth Pressure Coefficient

$$K_a = \frac{1 - \sin \phi'}{1 + \sin \phi'} = \frac{1 - \sin 26^\circ}{1 + \sin 26^\circ}$$

$$K_a = 0.39$$

At  $z=0$

$$P_a = 0 - 2 \times 8 \times \sqrt{0.39} + 0.39 \times 10$$

$$P_a = -6.09 \text{ kN/m}^2$$

At  $z=4\text{m}$

$$P_a = 0.39 \times 15 \times 4 - 2 \times 8 \times \sqrt{0.39} + 10 \times 0.39$$

$$= 23.4 - 9.89 + 3.9$$

$$P_a = 17.31 \text{ kN/m}^2$$

Depth of Tension crack  $Z_0 = \frac{2c}{\gamma \sqrt{K_a}} = \frac{2 \times 8}{15 \times \sqrt{0.39}}$

$$Z_0 = 1.71 \text{ m}$$

**(b) The Passive Pressure**

The Passive Pressure at a depth  $z$  in  $c-\phi$  soil is given by

$$P_p = K_p \gamma z + 2c \sqrt{K_p} + K_p q$$

Passive Earth Pressure Coefficient

$$K_p = \frac{1 + \sin \phi'}{1 - \sin \phi'} = 2.56$$

At  $z=0$

$$P_p = 0 + 2 \times 8 \times \sqrt{2.56} + 2.56 \times 10$$

$$P_p = 35.84 \text{ kN/m}^2$$

At  $z=4\text{m}$

$$P_p = 2.56 \times 15 \times 4 + 2 \times 8 \times \sqrt{2.56} + 2.56 \times 10$$

$$P_p = 189.44 \text{ kN/m}^2$$

Total Pressure =  $10.24 \times 4 + 25.6 \times 4 + 3 \times 153.6 \times 4$

$$= 450.56 \text{ kN/m length of wall}$$

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