Team Names: _____ **Date:** _____

Foundations Math Worksheet Answers

1. Compare the *actual* bearing pressure that the shallow foundation produces and the *allowable* bearing pressure of the soil. Does the foundation fail? Why is σzD equal to 0? Show all your work and calculations.

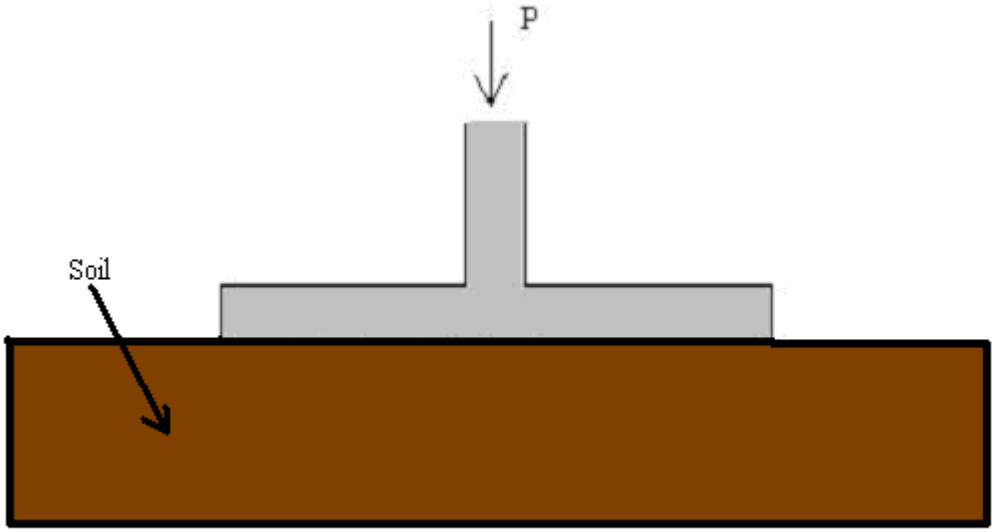
Actual bearing pressure is q = force ÷ area

The force, P, on the foundation is 100,000 lbs

The area of the bottom of the foundation is square with 10-foot sides

Allowable bearing pressure of the soil is $q_{ult} = 6.28 \times s_u + \sigma_{zD}$

From soil investigations, $s_u = 500$ lbs/ft^2 and σ_{zD} is 0.



Answer

q = 100,000 lbs ÷ (10 feet x 10 feet) = 1000 lbs/ft^2

q_{ult} = 6.28 x 500 lbs/ft^2 + 0 = 3140 lbs/ft^2

The foundation does not fail because q < q_{ult}

σ_{zD} is 0 because the foundation is on top of the soil and not embedded into the soil

2. Compare the *actual* bearing pressure that the shallow foundation produces and the *allowable* bearing pressure of the soil. Does the foundation fail? Show all your work and calculations.

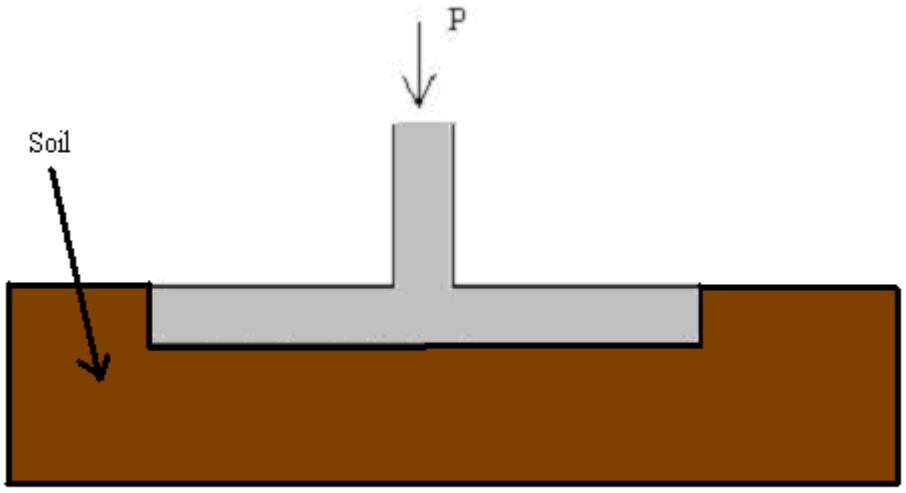
Actual bearing pressure is q = force ÷ area

The force, P, on the foundation is 200,000 lbs

The area of the bottom of the foundation is square with 7-foot sides

Allowable bearing pressure of the soil is $q_{ult} = 6.28 \times s_u + \sigma_{zD}$

From soil investigations, $s_u = 500$ lbs/ft^2 and σ_{zD} is 110 lbs/ft^2



Answer

q = 200,000 lbs ÷ (7 feet x 7 feet) = 4082 lbs/ft^2

q_{ult} = 6.28 x 500 lbs/ft^2 + 110 = 3250 lbs/ft^2

The foundation fails because q > q_{ult}

3. Compare the *actual* load given for the deep foundation and the *allowable* ultimate load calculated. Does the foundation fail? Show all your work and calculations.

The **actual load**, P, on the foundation is 100,000 lbs

The **allowable load** $P_a = q_t' \times A_t + f_s \times A_s$.

The area of the bottom of the foundation is circular with a 1-foot radius

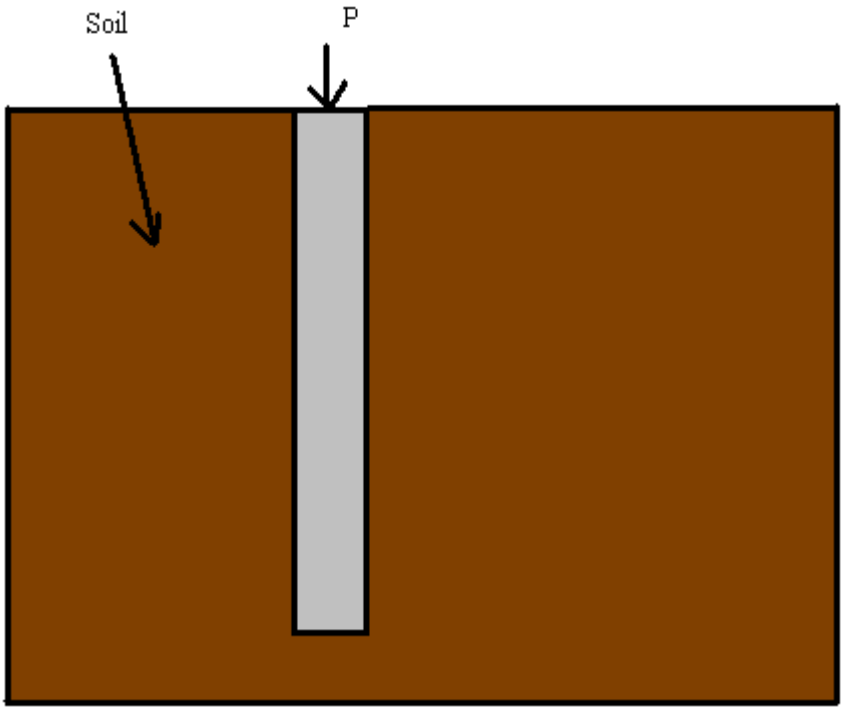
Area of a circle = π x radius x radius

The area of the side of the foundation is the surface area of the foundation in contact with the soil. The area is the foundation circumference of the multiplied by the foundation length.

Circumference = 2 x π x radius $\pi = 3.14$

Length of the foundation = 40 feet

From soil investigations, $q_t' = 3000$ lbs/ft^2 and $f_s = 600$ lbs/ft^2



Answer

$P_a = q_t' \times A_t + f_s \times A_s = 3000$ lbs/ft^2 * (3.14 x 1ft x 1 ft) + 600 lbs/ft^2 * (2 x 3.14 x 1 ft x 40 ft)

$P_a = 160{,}140$ lbs

The foundation does not fail because $P < P_a$.