CAIRO UNIVERSITY
FACULTY OF ENGINEERING
Soil Mechanics and Foundations Engineering Division

FOUNDATIONS

EXERCISE (2)

4th Year Civil — 2016-2017

BEARING CAPACITY

1) a- State the factors affecting the bearing capacity of shallow foundations resting on clays and sands.

b- A footing of area 2 × 3 m was founded at a depth 2 m below G.S. on a silty clay layer ($c = 0.5$ kg/cm^2, $\phi = 20°$ and $\gamma_{sat} = 1.8$ t/m^3). If the factor of safety against bearing capacity failure is 3, find the ultimate and allowable load that can be supported by the footing if:

i) Water level is 2.0 m above G.S.,

ii) Water level is at F.L., and

iii) Water level is at a great depth.

iv) Comment on the results.

2) a- Discuss how the bearing capacity of footing is affected if placed on top of sloping ground.

b- A column carries 200 tons which is to rest on a square footing on dry sand with $\phi = 34°$ and $\gamma = 1.7$ t/m^3. The factor of safety is to be 3.

i) Find the size of the footing if it rests at the ground surface.

ii) Find the size of the footing if it rests at a depth of 2 m below ground surface.

iii) Find the size of square footing required for cases (i), (ii) if the water table rises to G.S. increasing the soil unit weight to 2 t/m^3.

iv) Comment on the results.

3) a- Sketch the shear failure surface below a strip footing due to a general symmetric bearing capacity failure, indicating the active, transition and passive zones.

b- In Figure (1), calculate the minimum width of the isolated footing required to ensure that the settlement due to clay compressibility does not exceed 2.5 cm.

c- Calculate the factor of safety against bearing capacity failure associated with the footing dimensions determined in (b).

d- Calculate the soil modulus of subgrade reaction considering the applied load given in (b).

4) a- What are the effects of the following factors on the bearing capacity of shallow foundations:

1. Foundation shape.
2. Eccentric loading.

b- A rectangular footing measures 1.50 m by 0.75 m is subjected to an eccentric load as shown in Figure (2). Determine the allowable gross bearing capacity and the allowable load applied eccentrically on the footing, given that $\gamma = 1.8$ t/m^3, $c = 0$ and $\phi = 30^o$.

5) A raft (15m x 20 m) with a basement is to be designed to support a residential building, with a foundation level 5.0 m below ground surface. The supporting soil is deep clay of $\gamma_{sat} = 1.75$ t/m^3, $c = 4$ t/m^2, and $\phi = 0°$. Estimate the allowable bearing capacity in the following cases:-

1. The water table is 5.0 m deep, i.e. @ F.L.
2. The water table is 1.0 m deep below G.S.

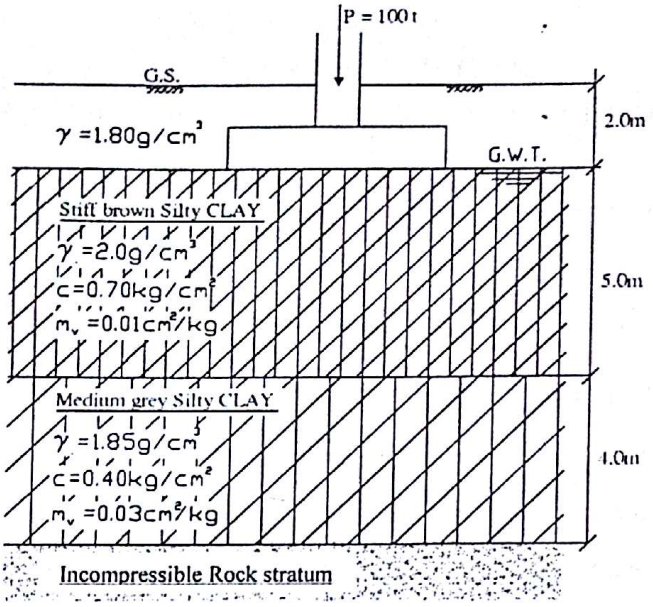
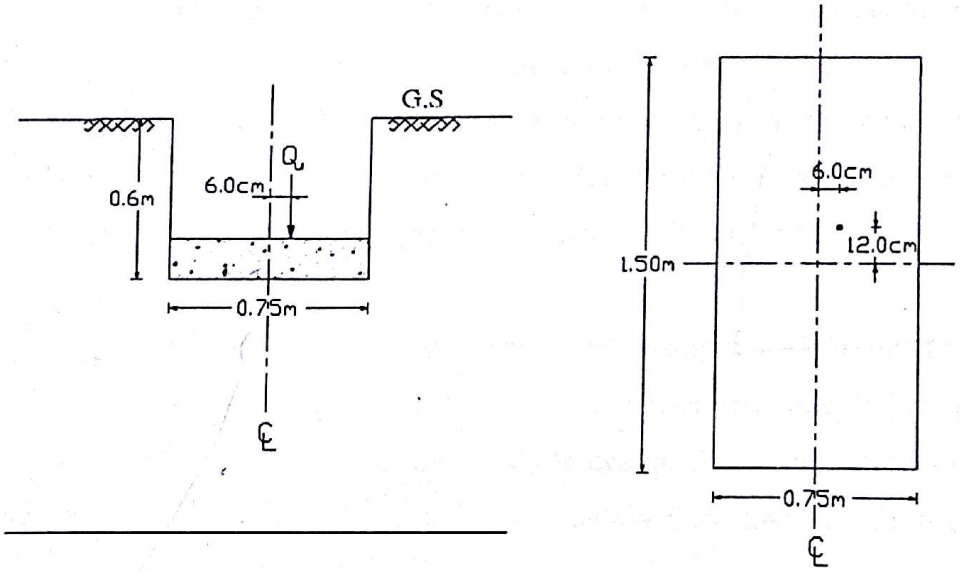


Figure (1)



Section View

Plan View

Figure (2)