

199

Mansoura University

Foundation Engineering

Faculty of Engineering

Open book exam

Civil Engineering Department

4th Civil Year -2012- Tues., June,19th

Time : 4 hours-Max. Grade 110 points

Final Exam- Any missing data can be assumed reasonably

Part 1- Pile foundation (55 points)

Question No. 1 -(12 points)

A-Suggest (without calculations) a suitable pile type for the following projects and explain why you select these types of piles:

1. An office building tower in New Damietta city (sandy soil).
2. A bridge over Nile River (clayey soil).
3. A cargo quay at Safaga port

B-Define in short with sketches if needed the following expressions:

Pile spacing, Pile cap, Battered piles, and Critical depth for pile foundation in sand.

C-Answer the following questions:

- 1-Explain when and why the group efficiency value is less than one, higher than one and also equal to one?
- 2-Explain the final and initial layout?

Question No. 2 -(30 points)

An office building is to be supported on a series of 500 mm diameter, 18.0 m long R.C pile that will be built using CFA (continuous flight auger) method. The soil profile at this site is as shown in table.

Soil classification	Depth (m)	γ (t/m ³)	Φ	Cu(kPa)
Clay	0 - 4	1.6	0	20
Silt	4 -10	2.0	20	40
Dense Sand	10 -50	1.8	35	0

The ground water table is at a depth of 50 m.

- a. Determine the safe axial compression bearing capacity for **single pile** (based on shear strength parameters only) using a factor of safety of 3? **(5 points)**
Determine the safe axial tension bearing capacity for **single pile** using a factor of safety of 2.5? **(5 points)**
- b. Calculate the allowable horizontal load for **single pile**? **(5 points)**
- c. Also calculate the settlement of single pile? **(5 points)**
- d. How could the bearing capacity of the pile group be estimated, if the foundation load is 4500 kN? **(5 points)**
- e. What is the group efficiency? **(5 points)**

Question No. 3 -(13 points)

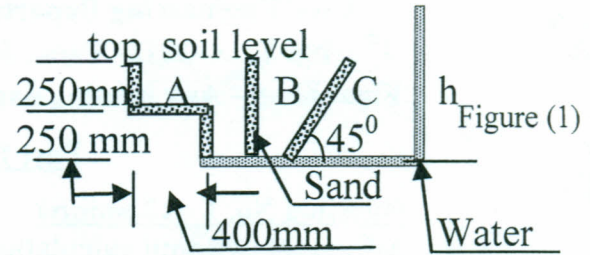
A R. C. column 50x120 cm in cross section carries a vertical load of 440 tons at ground level and moment 50 m.t , the column is to be founded on a group of piles. These piles are supposed to carry 50 tons with a diameter of 50 cm. The piles were in a deep layer of medium cohesive soils. Determine the **number** of piles, the **force** in each pile, and **design** the R.C pile cap use proper sketches showing concrete dimensions and arrangement of reinforcement.

See next page

Part 2- Soil Hydraulic (55 points)

Question No. 1 -(15 points)

A water tank is connected to the three tubes A, B, & C shown in Figure 1. The tubes are full of sand with $\phi=30^\circ$, $\gamma=1.8 \text{ t/m}^3$. Calculate the value of h which causes sand boiling in each of the three cases. All tubes have 10mm diameter?



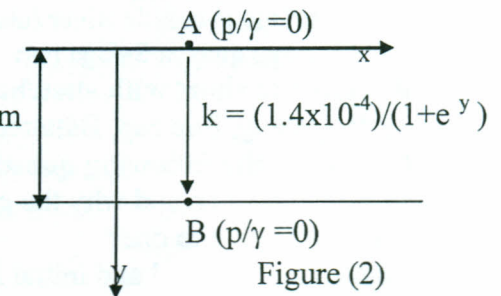
Question No. 2 -(10 points)

Water percolates vertically downwards in a soil with hydraulic conductivity that varies according to the relation:

$$k = (1.4 \times 10^{-4}) / (1 + e^y) \text{ m/s}$$

The pore water pressure at points A and B of (Fig. 2) is atmospheric. Draw along the line AB the 5 m distribution of the following variables:

- The velocity
- The total head
- The pore pressure head



Question No. 3 -(30 points)

A cantilever sheet pile of length 12.00m penetrates a layer of sandy soil as shown in Figure (3). The water levels at both sides of the sheet pile, the location of the impermeable layer and soil properties are shown in the same figure. It is required to:

- Calculate the earth pressure forces on the sheet pile
- Calculate the water pressure forces on the sheet pile
- Study the stability of the sheet pile

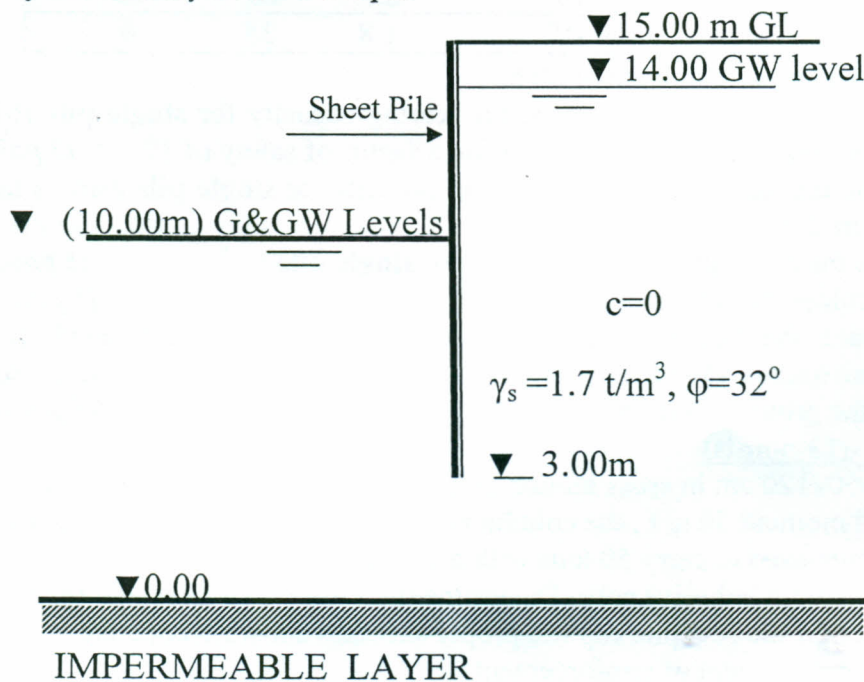


Figure (3)

*With our best wishes
(Examiners)
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19/6/2011*