

## 14.533 ADVANCED FOUNDATION ENGINEERING

### HOMEWORK #4

#### Settlement and Consolidation of Shallow Foundations

1. Calculate the settlement of the 2.5m square footing shown below using:
  - a) AASHTO method
  - b) Schmertmann methods (1970 & 1978)
  - c) D'Appolonia method
  - d) Hough's method (FHWA modified curves)

Using the results of your analyses and the bias of the methods – evaluate the “accurate” settlement under the given loads. Tabulate your results as method, calculated settlement, bias and “corrected” settlement. Note the bias is related to the load and you have a settlement for a given load so you need to go both ways: (a) what is the actual load that will create the settlement you calculated and (b) what actually will be the settlement for the applied load (you may need to iterate in order to have the approximated “correct” settlement).

The density of the silty sand is  $18\text{kN/m}^3$

Depth below G.L. (m)	Range of SPT N-values (uncorrected for overburden)		$N_{avg.}$
0.75	6	4	5
1.50	7	7	7
2.25	5	4	4
3.00	11	13	12
3.75	13	11	12
4.50	18	17	17
5.25	20	25	22
6.00	22	30	26
6.75	25	22	23
7.50	30	28	29

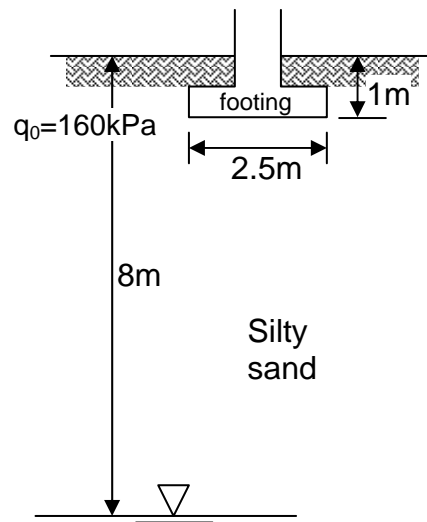
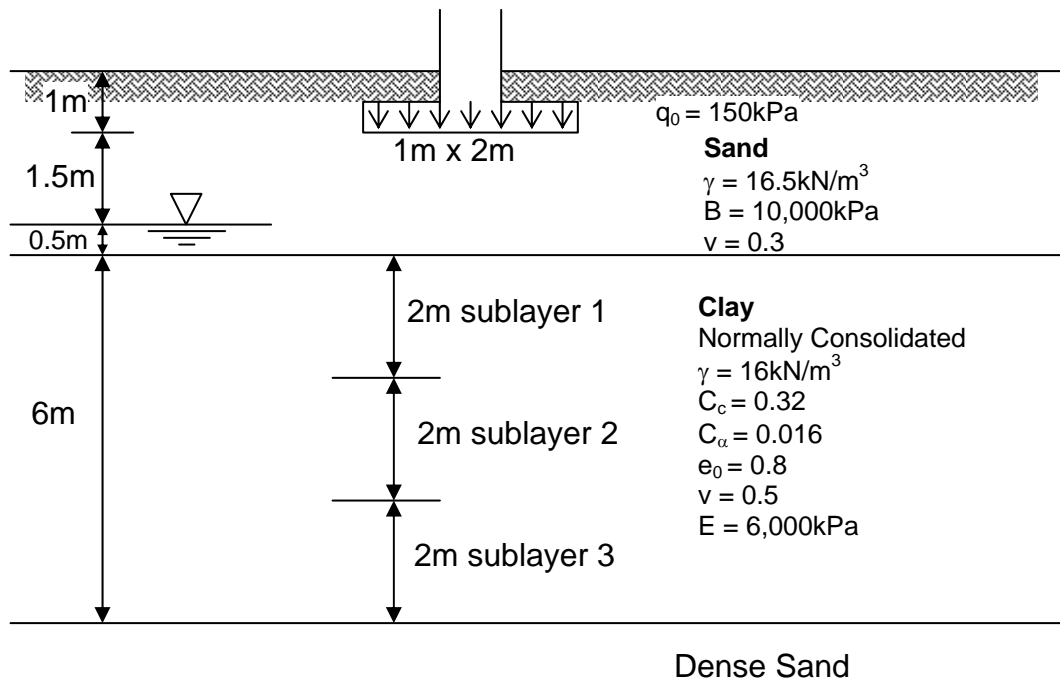


Figure 1.

2.

- Determine the **Immediate** and **Primary** consolidation settlement in the clay below the center of the shown footing. (1<sup>st</sup> calculate vertical stress below the loaded footing using Newmark solution  $\Delta q = q_0 I_\sigma$  Bowles Eq.5-8a and Table 5-1)
- Determine the time for 90% degree of consolidation for the clay (coefficient of consolidation  $C_v = 1.25 \text{ m}^2/\text{year}$ ).
- Using the hand calculation finite differences numerical procedure; find the pore pressure distribution at time  $t_{50}$ . Start with the varied initial pore pressure based on the load distribution under the foundation and progress with time to  $t_{50}$ . Draw the obtained pore pressure distribution at time of loading and at time  $t_{50}$ .
- Determine the Secondary Consolidation  $S_\alpha$  of the layer, assuming the service life of the structure is 50 years.



- Use the computer program "GEOPRO" to solve the problems 1 and 2 above. Compare your hand calculation to the computer output.