FOUNDATION ENGINEERING 53:139
Midterm Exam
(1.5 Hours)

Spring 1996   Instructor: C.C. Swan

Question #1: (20 points)

List four standard methods of slope stability analysis. Discuss the assumptions, limitations, and range of validity for each method. Outline the analysis procedure for one of the methods.

Question #2: (20 points)

Assume that a major aircraft manufacturer is considering building a $ 1 billion production facility on what is currently rural farmland between Iowa City and Cedar Rapids. The proposed location is relatively virgin in that no major construction has yet been performed in the area. Working for a local geotechnical firm, you have volunteered to lead the charge in developing a subsurface exploration plan. Briefly, what methods or resources might you exploit to perform a subsurface exploration? What information might you request from the facility's designers? What soil information would you propose to obtain in your study and what specific methods might you use to get each specific piece of information? Also, how much might you budget for the exploration?

Question #3: (20 points)

A purely empirical method of estimating ultimate bearing stresses under foundations is the field plate load test. A building contractor who wants to estimate the ultimate bearing stress under 5m square footings uses a field load test on a 1ft square plate to directly measure q_{ult} under the 1ft square plate. The contractor believes that $q_{ult,B=5m} = q_{ult,B=1ft}$. The subsurface soil conditions are as shown below:
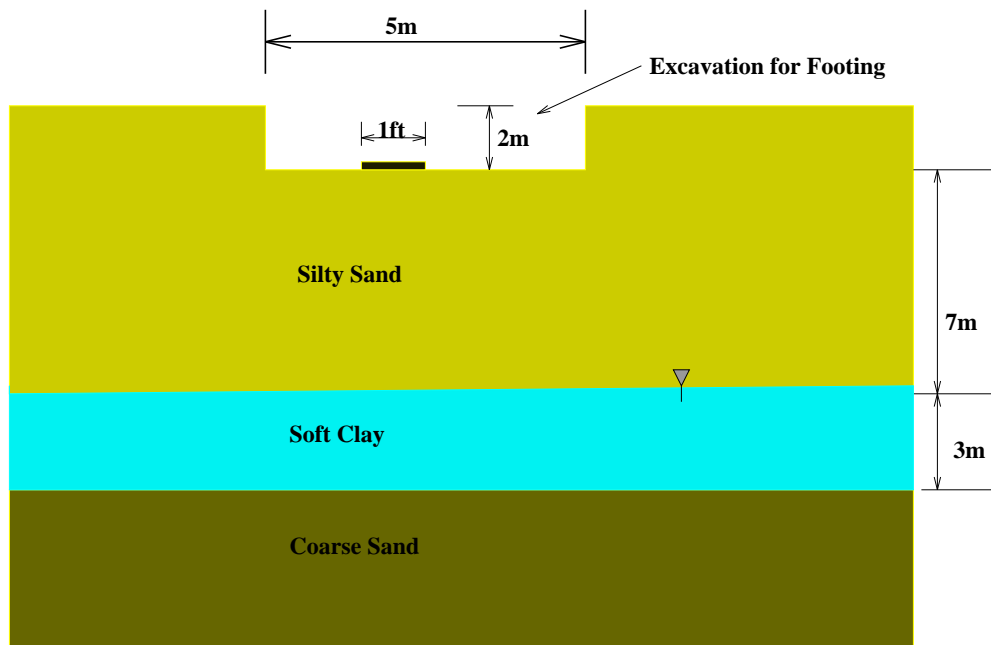

Figure 1.

Assess and discuss the validity of the contractor's thinking. If the contractor is mistaken, state what factors he/she has neglected.

Question #4: (20 points)

Discuss "compensation" of mat foundations. Why is it used? What is the depth of a fully compensated foundation?

Question #5: (20 points)

In Terzaghi's theory for general shear failure under shallow strip foundations the ultimate bearing stress was found to be:

$$q_u = cN_c + qN_q + \frac{1}{2}\gamma B N_\gamma$$

This suggests that three separate mechanisms exist in the soil to resist general shear failures. Briefly explain how each of the three mechanisms work, according to Terzaghi's theory, using sketches and physical arguments.