CIVE 353 - Geotechnical Engineering I
ASSIGNMENT 7

University of Waterloo
Department of Civil Engineering

Posted Date: Monday March 13, 2006
Due Date: Monday March 20, 2006 @ 4:30pm in soil lab

1. A 3 metres square footing transmits a uniform pressure of 300 kPa to the subsoil. Site conditions below the footing consist of dense sand. The groundwater table was observed at 2m below the base of the footing.

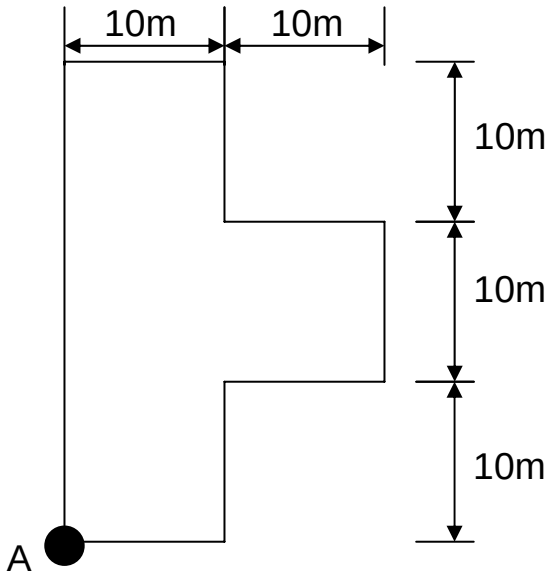
   a) Using Equation 9.12 on page 266 of Das, plot the intensity of the vertical applied stress at the centre and corner of the footing for the following depths below the footing: 0.25, 0.5, 1, 2, 3, 4, 6, 8 and 10 m.
   b) Repeat (a) using the Fadum chart.
   c) Repeat (a) using an approximate method (2 vertical : 1 horizontal Boston Rule).

   Note: The applied stress (q) may be converted to an equivalent point load (Q), acting at the centre of the footing, using:

   $$P = B^2 q$$

   Your centre and corner plots should be setup with:
   X-axis = vertical stress intensity/footing pressure (σ_Z/q)
   Y-axis = depth/footing width (Z/B).

2. The flexible foundation shown below transmits a foundation stress of 250 kPa to the soil. Using Fadum and Newmark charts determine the increase in vertical stress at point A 10 m below the foundation.



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1. A 20m by 20 m flexible foundation is to be founded in a normally consolidated clay deposit shown in Figure 1. The foundation stress applied to the soil is 1200 kPa on the left half and 600 kPa on the right half. A sewer pipe runs through the clay at a depth of 10m under the centre of the foundation. Determine the magnitude of differential settlement between points A and B on this pipe.

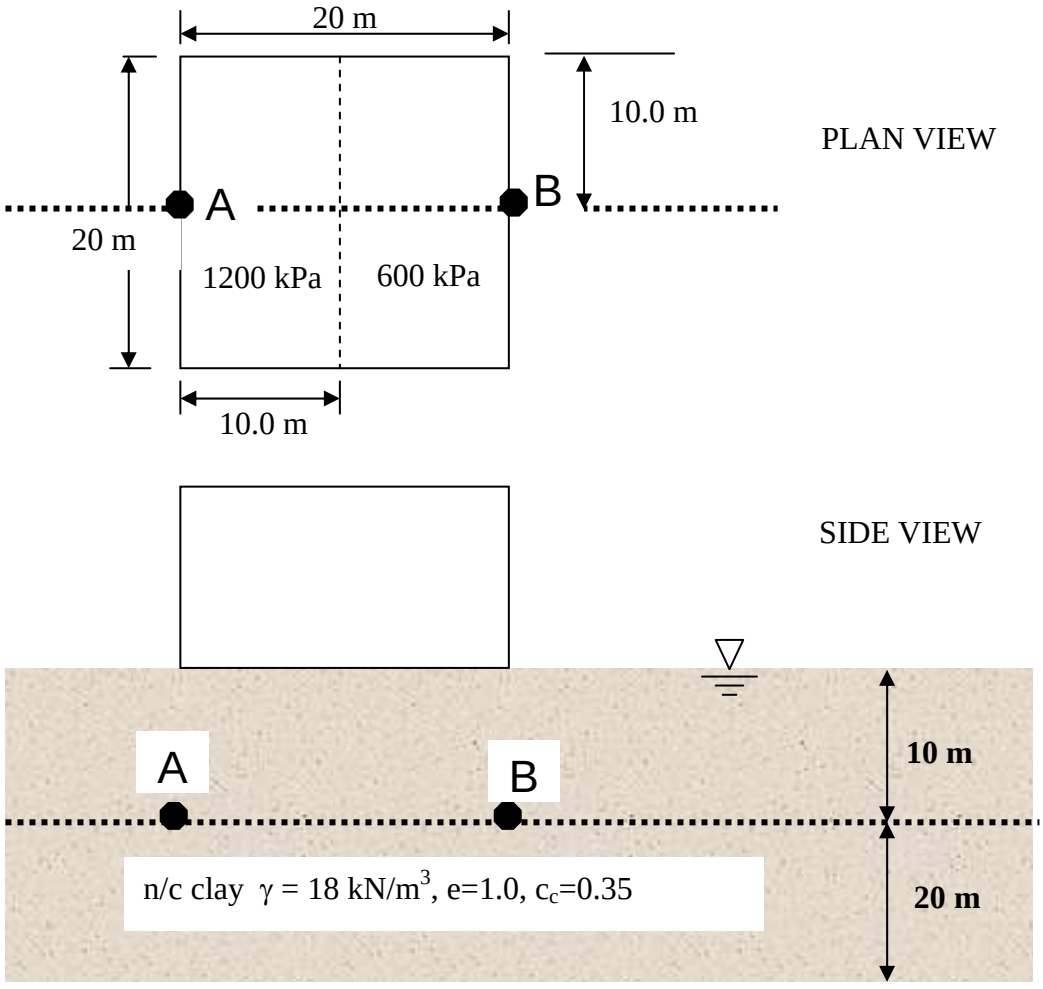

Figure 1

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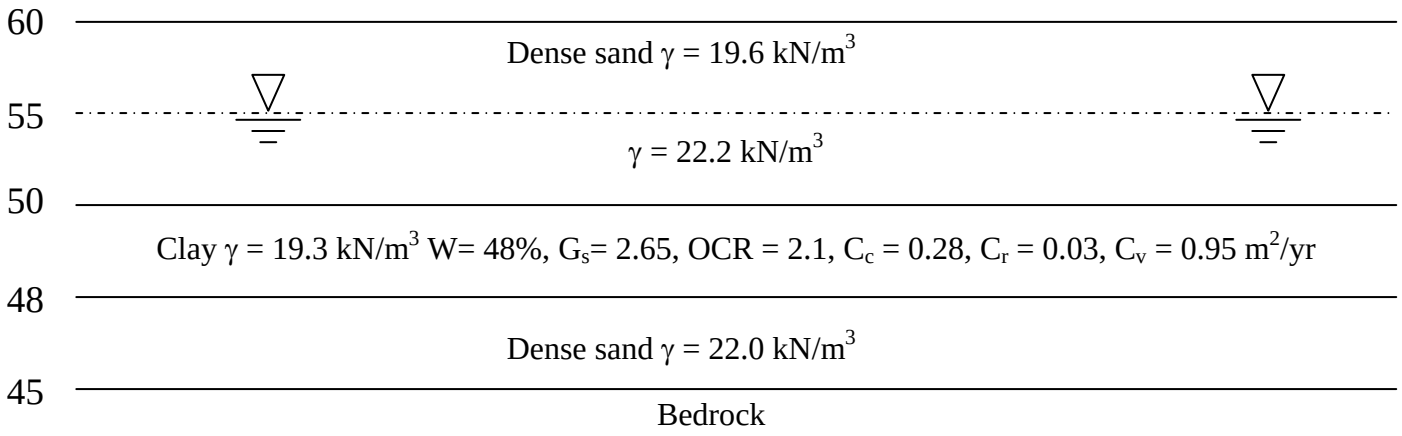
2. A municipal solid waste facility is to be constructed on a site with the soil stratigraphy shown below. It is estimated that 30m of garbage will cover the site over a wide area. The compacted garage has a density of 1830 g/cm^3.
    a. Estimate the magnitude of the ground surface settlement due to the placement of the garbage.
    b. How long will it take for consolidation to occur?
    c. Develop a consolidation vs time curve for the solid waste.



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3. Due to groundwater pumping the water level has been lowered from elevation 55 to 50m. Estimate the magnitude of the ground surface settlement due to lowering the water table. Assume no settlement of the sand layers. How long will it take for 50 and 90 percent of the consolidation to occur?