Geotechnical Design
CEG 4801
Homework # 8

Solve the Following Problems

Problem 1

Refer to Figure 11.3 for a square rigid foundation measuring 3 m × 3 m in plan supported by a layer of sand. Given that $D_f = 1.5$ m, $E_s = 16{,}000$ kN/m^2, $\mu_s = 0.3$; $H = 20$ m, and $\Delta\sigma = 100$ kN/m^2, calculate the elastic settlement.

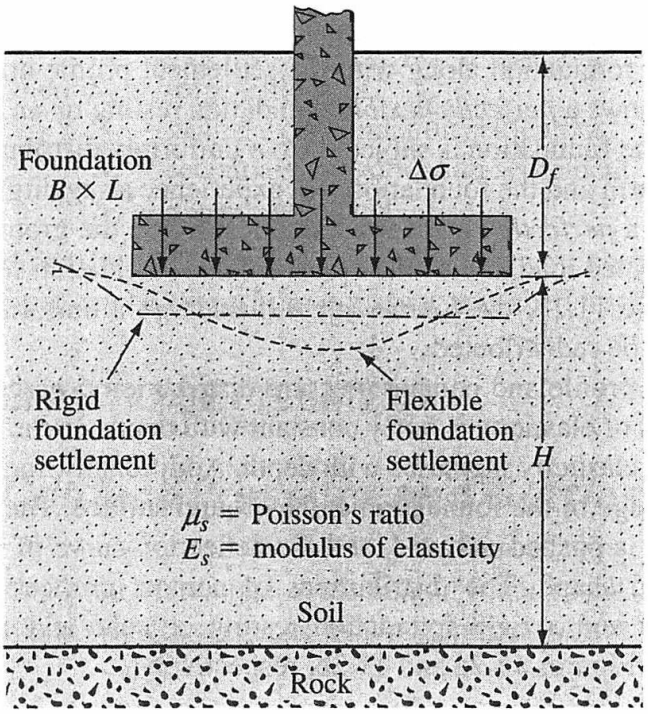

Figure 11.3 Elastic settlement of flexible and rigid foundations

Problem 2

The following are the results of a consolidation test.

e	Pressure, σ' (ton/ft^2)
1.1	0.25
1.085	0.50
1.055	1.00
1.01	2.00
0.94	4.00
0.79	8.00
0.63	16.00

a. Plot the e-log σ' curve
b. Using Casagrande's method, determine the preconsolidation pressure
c. Calculate the compression index, C_c, from the laboratory e-log σ' curve

Problem 3

Figure 11.40 shows a soil profile. The uniformly distributed load on the ground surface is $\Delta\sigma$. Given: $\Delta\sigma = 1000$ lb/ft^2, $H_1 = 8$ ft, $H_2 = 15$ ft, and $H_3 = 17$ ft. Also,

- Sand: $\gamma_{dry} = 110$ lb/ft^3, $\gamma_{sat} = 115$ lb/ft^3
- Clay: $\gamma_{sat} = 120$ lb/ft^3, $LL = 50$, $e = 0.9$

Estimate the primary consolidation settlement if

a. The clay is normally consolidated
b. The preconsolidation pressure is 2600 lb/ft^2 ($C_s \approx \frac{1}{6} C_c$)

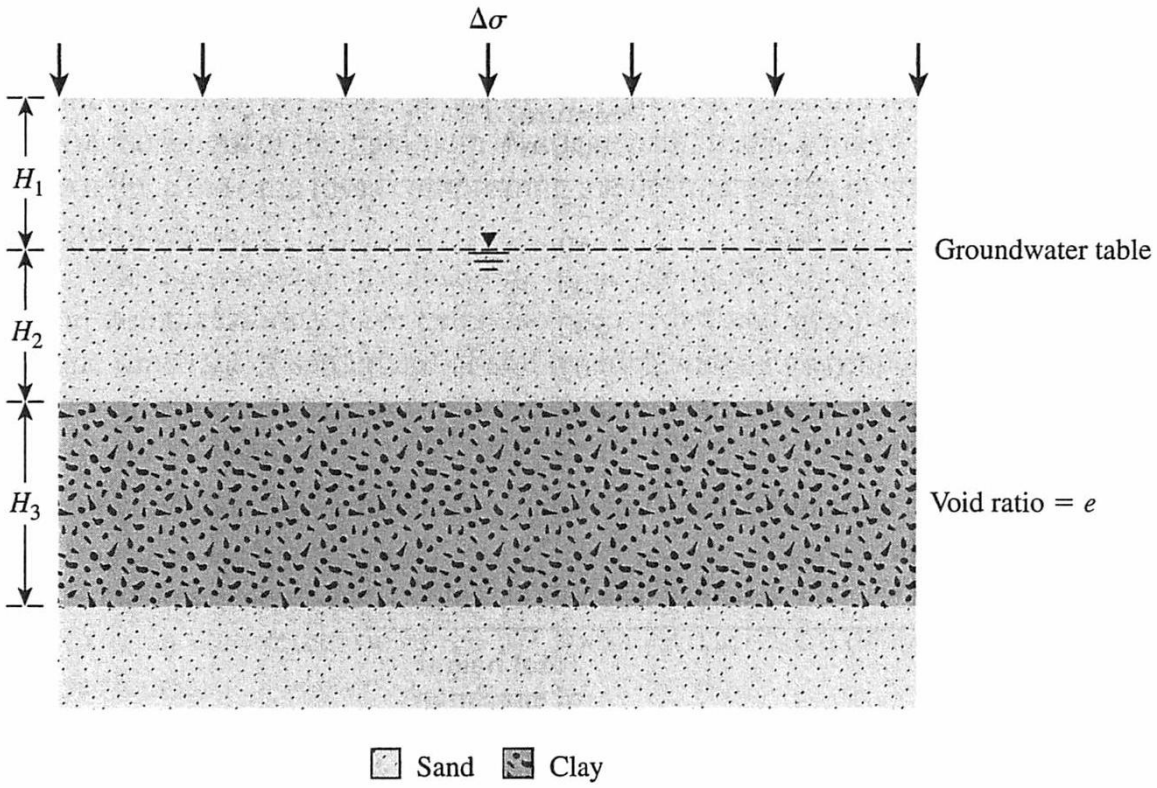

Figure 11.40

Problem 4

Refer to Figure 11.41. Given that $B = 1$ m, $L = 3$ m, and $Q = 110$ kN, calculate the primary consolidation settlement of the foundation.

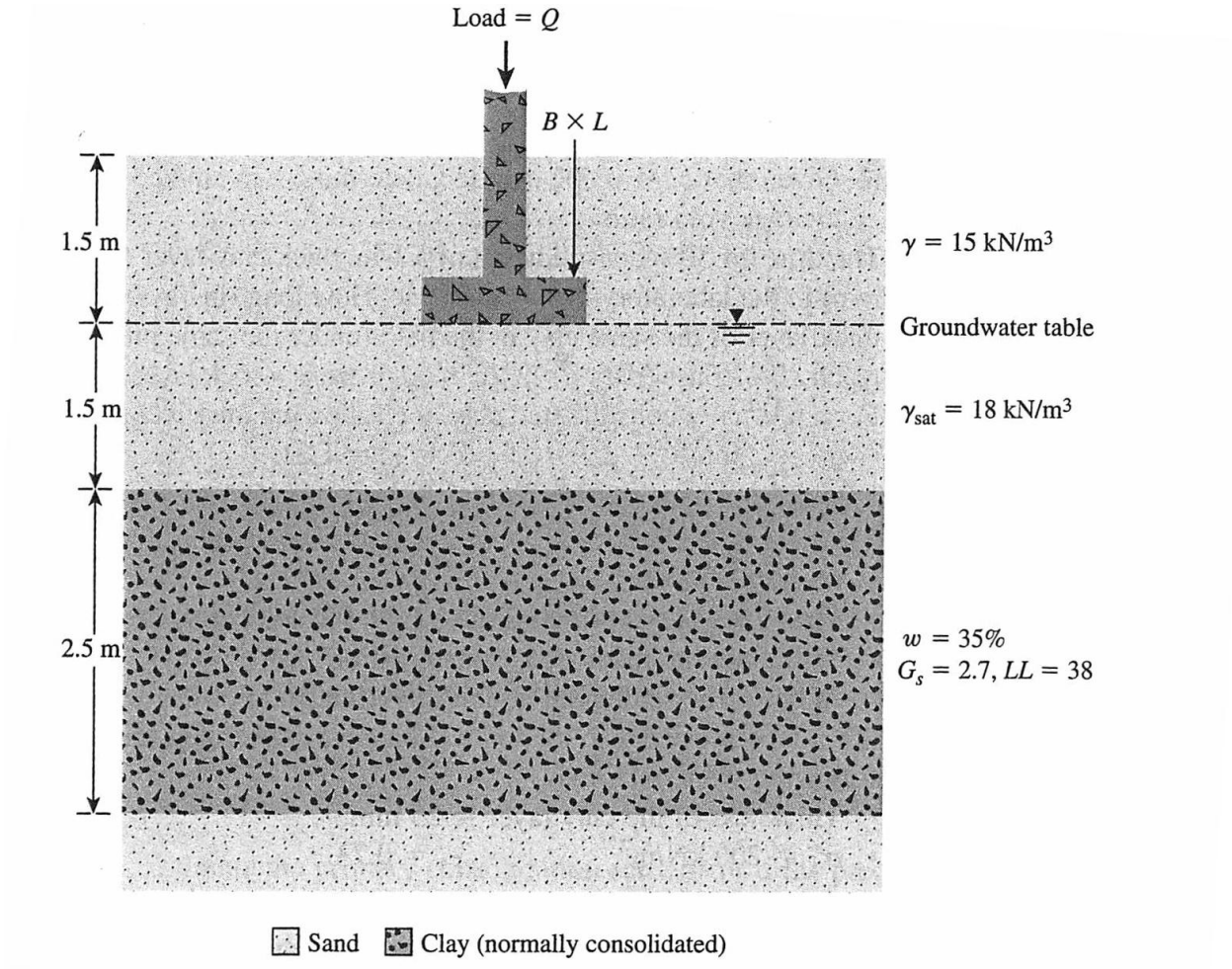

Figure 11.41

Problem 5

The time for 50% consolidation of a 25-mm thick clay layer (drained at top and bottom) in the laboratory is 225 sec. How long (in days) will it take for a 2-m thick layer of the same clay in the field (under the same pressure increment) to reach 50% consolidation? There is a rock layer at the bottom of the clay in the field.

Problem 6

A flexible shallow foundation 1 m * 2 m supported by a clay layer is shown in the figure below. Calculate the elastic settlement at the center and the corner of the foundation.