

มหาวิทยาลัยสงขลานครินทร์
คณะวิศวกรรมศาสตร์

การสอบปลายภาค ประจำภาคการศึกษาที่ 1

ปีการศึกษา 2547

สอบวันที่ 2 ตุลาคม 2547

เวลา 13:30-16:30 น

วิชา 223-491 Waste Geotechnics

ห้องสอบ ห้องหัวหุ่น

ข้อสอบ มี 4 ข้อ คะแนนเต็ม = 100 คะแนน

ออกข้อสอบโดย ดร. ธนิต เถลิงยานนท์

Problem 1: Laboratory Hydraulic Conductivity (15 points)

A falling head-raising tail hydraulic conductivity test was conducted to verify a clayey soil to be used in landfill liner construction. The soil specimen had a diameter of 10 cm and height of 12 cm. The test was performed using flexible wall permeameter with a cell pressure of 320 kPa, an applied influent pressure of 300 kPa, and an applied effluent pressure of 280 kPa. The top of the influent burette (reading = "0 cm") was 25 cm higher than the bottom of the effluent burette (reading = "25 cm"). Both influent and effluent burette had cross-sectional area of 5.0 cm^2 . Test results are tabulated in Table 1.

Table 1. Laboratory Hydraulic Conductivity Results

Time	Inflow Burette, (cm)	Outflow Burette, (cm)	Comment
27/8 10:07	15.0	15.0	Steady
30/8 10:07	20.0	10.0	State

Determine: (1) the average back pressure, (2) the effective stress at the influent and effluent ends of the specimen, (3) the average effective stress, (4) back pressure saturation and explain how it was performed on this specimen, and (5) the hydraulic conductivity.

Problem 2: Two-Stage Borehole Test (30 points)

A two-stage borehole test was conducted to measure a field hydraulic conductivity of a clay liner. The casing had an inside diameter of 10 cm and the standpipe had an inside diameter of 1.0 cm. The zero reading on the standpipe was located at the bottom of the borehole. The borehole

extension was 18 cm long. Data collected from stage 1 and stage 2, at steady state, are shown in Table 2. Determine the vertical and horizontal hydraulic conductivities of the clay liner.

Table 2. Two-Stage Borehole Test Results

Stage 1			Stage 2		
Date	Time	Reading (cm)	Date	Time	Reading (cm)
2/10	9:11	78.3	15/10	11:35	83.9
2/10	16:00	74.5	15/10	14:32	79.8

Problem 3: Veneer Analysis (35 points)

A liner system consists of (from top to bottom): sand (LCS), geotextile, geonet, geomembrane, and compacted clay liner. The tensile strength values of the geotextile, geonet, geomembrane are 75, 50, and 50 kN/m, respectively. The interface and internal friction angles are as follows: sand-GT = 23°, GT-GN = 29°, GN-GM = 12°, GM-CCL = 25°, and sand (internal) = 30°. The slope is 18° and the length of the slope is 60 m. The unit weight of sand is 16 kN/m³. Determine the tension in each goesynthetic layer. Do these materials have adequate tensile capacity? Can these layers be adequately anchored with an anchor trench (0.6 m wide and 1.0 m deep) and a run-out length of 1.0 m. The trench is backfilled with sand.

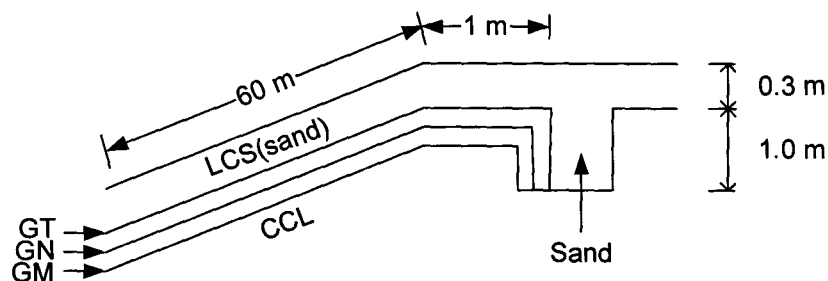


Fig. 1. Cross section of the landfill liner

Problem 4: Leachate Collection System Design (20 points)

A landfill being designed is 120 m long and 120 m wide. A pipe system in a leachate collection system has $L_p = 60$ m, $L = 20$ m, $q_i = 1000$ mm/yr, $K = 1 \times 10^{-2}$ cm/s, $\beta = 2^\circ$, and $S = 1:200$. Determine T_{max} . Is this T_{max} acceptable? Also design the sizes of lateral pipe and header pipe. Make sure that the pipes deform within an acceptable range.