

มหาวิทยาลัยสงขลานครินทร์  
คณะวิศวกรรมศาสตร์

การสอบปลายภาค ประจำปีการศึกษาที่ 2  
สอบวันที่ 21 กุมภาพันธ์ 2551  
วิชา 220-527 Geosynthetic Engineering

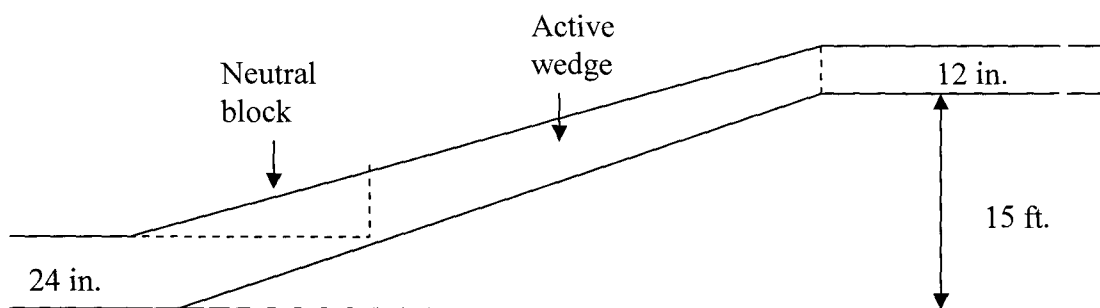
ปีการศึกษา 2550  
เวลา 13.30-16.30 น.  
ห้องสอบ R300

ข้อกำหนด:

1. ข้อสอบ มี 5 ข้อ คะแนนเต็ม 50 คะแนน ให้ทำทุกข้อ
2. ให้นำสมุด Lecture, Sheet และ หนังสือ เข้าห้องสอบได้
3. ให้นำเครื่องคิดเลขทุกชนิดเข้าห้องสอบได้

ออกข้อสอบโดย  
ดร. พิพัฒน์ ทองฉิม  
14 กุมภาพันธ์ 2551

1. Determine the factor of safety against sliding of tapered soil cover on HDPE geomembrane covering a 3.0 (H) to 1 (V) slope 15 ft. deep. The taper is uniform going from 24 in. on the bottom to 12 in. on the top and the soil is a well-graded sand. The well graded sand weighs  $110 \text{ lb./ft}^3$  and it makes an angle  $\delta = 18 \text{ deg.}$  with HDPE membrane while it has an angle  $\phi = 35 \text{ deg.}$  itself. (10 points)



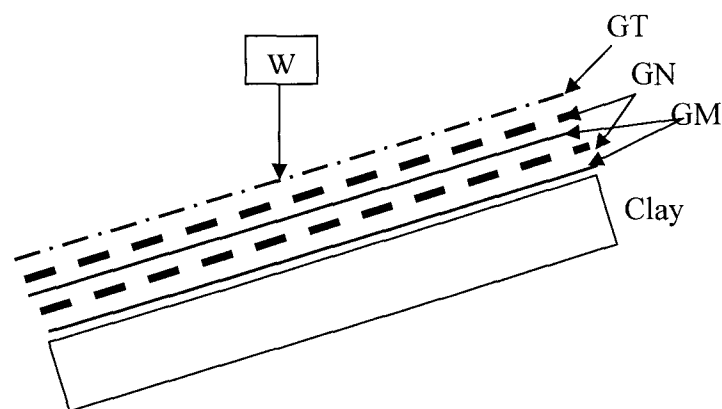
2. Calculate the shear stresses and tensile forces on each of the interfaces of the components shown in the multilayer liner system on the slope of a landfill in the following sketch. The slope is 3H:1V with a 10-ft lift height of waste weighing 80 lb./ft.<sup>3</sup>. The components and friction angles are follow :

- Friction angle of waste = 38 deg.
- Total landfill height = 100 ft.
- Geotextile (needle-punch nonwoven): GT to GN,  $\delta = 35$  deg.
- Geonet (3/8 in. thick-foamed): GN to GM,  $\delta = 11$  deg.
- Geomembrane (60-mil HDPE): GM to GN,  $\delta = 15$  deg
- Geonet (1/4 in. thick-solid): GN to GM,  $\delta = 15$  deg.
- Geomembrane (45-mil HDPE): GM to clay,  $\delta = 10$  deg.

The allowable tensile strength of the different geosynthetics are as follows:

- Geonet-foamed: 300 lb./in.<sup>2</sup>
- Geonet-solid : 400 lb./in.<sup>2</sup>
- Geomembrane- HDPE: 2200 lb./in.<sup>2</sup>

(10 points)



3. Calculate the tensile strain in a GCL as it deforms in an out-of-plane mode (as per the example problem of Section 6.3.3) for deformations of 0.10, 0.20, 0.30, 0.40 and 0.50 m. and plot the factor of safety. The allowable tensile strain of GCL is 14 %. The radius of the depression remains constant at 1.50 m. (10 points)

4. Consider a 6 m. pavement in an area with an extremely high rainfall intensity of 150 mm./hr. for a 10-year rainfall intensity. The runoff coefficient is 0.45. The infiltration coefficient from subgrade is 0.25. The release factor from an open graded stone base to be 1.0. Use a roughness coefficient of 0.010 for smooth interior pipe.

4.1 Determine the quantity of flow at a 90 m. distance. (5 points)

4.2 Determine the diameter of pipe (Slope is 100H:3V). (5 points)

5. Consider a  $180 \times 360 \text{ m}^2$  landfill cell with a tentative primary leachate removal system, (i.e. perforated pipe system as shown in Figure 7.13) The cell is uniformly sloped to the sump at 2 % for both header and feeder pipes. The landfill is located in an area with a rainfall intensity of 70 mm./hr. for a 10-year rainfall intensity. Given  $h_c = 0.3 \text{ m.}$  and  $k = 1.0 \text{ cm./sec.}$

5.1 Determine the pipe spacing. (4 points)

5.2 Determine the pipe size required before waste is placed in the cell. (6 points)