CIVL 4151
Spring 2015
Homework 4

1. For the Proctor test data given below (G_s = 2.68):

   (a) Plot the compaction curves.

   (b) Establish the maximum dry density and optimum water content for each test.

   (c) Compute the degree of saturation at the optimum point for each test.

   (d) Plot the 80%, 90%, and 100% saturation curves.

Standard		Intermediate		Modified	
w (%)	γ_d (kN/m³)	w (%)	γ_d (kN/m³)	w (%)	γ_d (kN/m³)
9.9	15.96	8.3	16.86	7.9	17.42
11.3	16.12	10.8	17.17	10.0	17.67
13.4	16.52	13.3	17.49	12.2	18.08
16.1	16.87	16.6	17.41	15.0	17.99
19.1	16.75	19.8	16.80	17.7	17.36
21.7	16.16	22.0	16.16	19.6	16.97

2. For the soil in Problem 1, determine the moisture content range permitted if a contractor must achieve 90% of the Modified Proctor maximum density.

3. If the soil in the previous problem has a moisture content of 10% when it was obtained from the borrow pit, how much water (in liters) must be added to a cubic meter of soil to bring it to the optimum moisture content so it can be placed and compacted?

4. The values of e_{max} and e_{min} for a clean sand (G_s = 2.70) are 0.42 and 0.71, respectively. What is the corresponding range in dry unit weight? If the soil is compacted in the field to a wet unit weight of 19.40 kN/m³ at a moisture content of 10.2% what is the relative density in the field?

5. You have just performed a sand cone test in a compacted fill made of the soil shown in Example 5.1 in your textbook. The soil removed from the hole had a mass of 2675 g and a 131.2-g sample of that soil lost 17.1 g of mass upon drying. Below are the relevant data recorded from the sand cone:

   - Calibrated dry density of the Ottawa sand = 1570 kg/m³
   - Calibrated mass of sand to file the cone and plate = 645 g
   - Initial mass of sand cone apparatus = 8456 g
   - Final mass of sand cone apparatus = 5639 g

   (a) What are the dry unit weight and water content of the compacted fill?

   (b) Referring to Example 5.1 in your textbook, what relative compaction did the contractor achieve?

   (c) If the compaction specifications call for a minimum of 95% relative compaction at a moisture content between w_{opt} + 1% and w_{opt} − 3% did the contract meet the specifications?