Summer 2019

CE 341A-141: Soil Mechanics Laboratory

Catarina Pereira

NEW JERSEY INSTITUTE OF TECHNOLOGY

CIVIL AND ENVIRONMENTAL ENGINEERING DEPARTMENT

CE 341A - Soil Mechanics Laboratory (Room 314, Colton) Summer 2019
Sections: 141 & 142

Text: Das, Braja, Soil Mechanics Laboratory Manual, **9th Edition**, Oxford University Press, ISBN: 9780190209667

Instructors: TA - Catarina Pereira, e-mail - cb373@njit.edu
TA – Ehsan Mehryaar, e-mail – em355@njit.edu

Course Objectives

1. Learn index properties of soils and laboratory methods of soil classification,
2. Learn Compaction and hydraulic conductivity tests
3. Learn principles of Consolidation and shear strength and
4. Learn to design and analyze a custom experiment

Course Outline

Week	Experiment*	Chapter
1	Introduction/Orientation	Notes
2	Sieve Analysis	4
3	Hydrometer Analysis (combined report with sieve anal.)	5
4	Atterberg Limits	6,8
5	Field Compaction	11
6	Compaction	10
7	Constant Head Permeability Test	13
8	Custom Design Experiment	Handout
9	Consolidation Test	17
10	Consolidation Calculations	Handout
11	Consolidation Write Up	
12	Unconfined Compression Test	16
13	Direct Shear Test	15
14	Make up **missed** experiment	

* Some modifications to schedule may be required to ensure that the laboratory sessions follow the lectures.
# Indicates the experiment number in the laboratory manual (**9th Edition**).

Policies and Instructions

- ✓ Attendance is mandatory and students must be in the laboratory on time (after 5 minutes the Professor will call by students' names, after 30 minutes of absence the students can't perform the experiment and the report will not be corrected).
- ✓ Official documents regarding missing labs must be submitted to the Dean of Students and Campus Life Office to be subjected of approval
- ✓ Please read the laboratory manual and the handouts, if provided (moodle), before coming to class.
- ✓ Hand in report to the T/A when your name is called during the attendance period (after 5 minutes of the beginning of the class). Print 2 pages per sheet, 2-sided and flipped on the long edge
- ✓ Use only data sheets provided in the manual to record data. ABSOLUTELY NO SCRAP PAPER. If you do not have data sheets for a test please notify the Instructor. The sheets must be filled in pen, not in pencil
- ✓ If unsafe conditions are present, do not continue work until safe working conditions are restored.
- ✓ If you need equipment or tools, ask the TA or the instructor. Do not help yourself to other equipment in the laboratory. Do not borrow any equipment from other groups.
- ✓ If your assigned equipment is not functioning properly, please bring this to the attention of the Instructor/TA.
- ✓ Participation in conducting the experiment is required for the laboratory. It will count towards the grade as shown in the basis of grading section.
- ✓ The class will be divided into groups for conducting laboratory experiments.
- ✓ Individual Reports. Each group member will hand in an individual laboratory report that reflects their individual analysis and commentary. No group reports.
- ✓ Emails must include in the subject: [CE 341A] – "main purpose of the email"

General Procedure

In order to keep work benches clean **spread newspaper on the workbench and floor** when necessary.

1. Each student/group will be responsible for the equipment he/she will be using. Please make sure that the equipment is in proper working condition prior to and after completion of the experiment.
2. Students must clean and/or wash assigned equipment and place all the equipment and accessories at the proper locations (cabinets have been labeled) at the conclusion of their experiment. Before leaving, you must check with TA so that he can inspect your work area. **Not following this guideline will result in a penalty in the report grade (starting at 10 points).**
3. After the completion of an experiment, complete as much of the computation as possible (including name of group members and date), and have the instructor sign the data sheets before leaving. **These sheets (original) must be attached to the laboratory report.** Reports that do not include signed data sheets **will not be graded.**
4. Remove water content containers from the oven within 48 hours. Otherwise they will be discarded.
5. Keep wet samples in cans covered with lids until they have been weighed.
6. For drying, place the cans in a tray, making sure the lids are under the cans and not on top of them. Place a slip of paper in the tray. Write on the slip, the laboratory section number, date and group number. Do not write on cans or lids.
7. Be observant - if you see something that does not look right, do not continue with the test and consult the instructor. For example, while mixing soil with water, if you see some dark and light colored soil lumps, this means that the mixing has not been done properly.
8. No food and drinks inside the laboratory.
9. Proper attire must be worn while in the laboratory. No open toed shoes, short pants or skirts, etc.
10. No horseplay.
11. If the instructor sees any wrong behavior (including the previous points), all involved students will be asked to leave the lab and the report will not be graded.

Using a Balance

1. Check the capacity of an electronic balance before using it. Never load a balance beyond its posted capacity.
2. Perform the zero correction before weighing.
3. Use the same balance for weighing during an experiment.
4. For water content determination, use a balance that has an accuracy of 1/100 of a gram (0.01).
5. For samples weighing between 200g and 2000g, use a balance that has an accuracy of 1/10 of a gram (0.1).
6. For samples weighing more than 2000g, use a balance with an accuracy of 1 to 5 gm
7. After using the balance turn off the balance

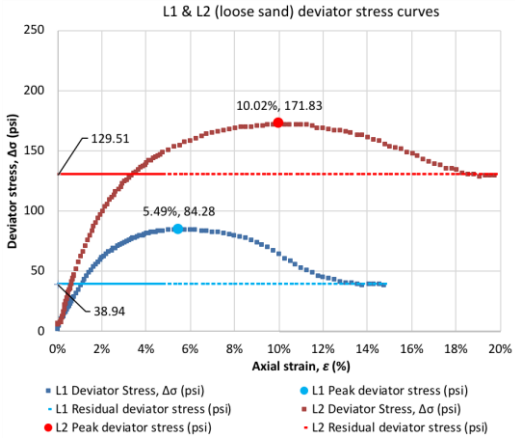
Format and Basis of Grading of Laboratory Reports

Pretest Summary and Attendance[1]	15%
Title Page[2]	5%
Introduction[3]	10%
Sample Calculations[4]	10%
Results including graphs and tables[5]	20%
Discussion[6]	20%
Summary and Conclusions[7]	10%
References[8]	0%
Quality of Presentation, graphs, tables etc.	10%
Total	100%

Footnotes:

1. Pretest summary (1/2 to 1 page) should include the information that can answer the following questions: why run the test? How to run it? What kinds of results are expected and how to get them (principles of the test should also be briefly summarized and what standards will be used). Pretest summary should be written **in your own words**. Attendance will be taken 5 minutes after class starts. If students are not on time or a pretest summary is not delivered, 15% will be deducted on the report's final grade. References on pretests are mandatory, if students use information that was not developed by them.
2. The title sheet should contain title, the full names of the members of the group who were present during the lab exercise, course number and section, date of the experiment, date of report, team number and team logo. The report should be typed and bind on the left hand side. No double space, font Arial or similar and size 10, justified.
3. In the introduction (1/2 to 1 page), the aim and the main procedure (not full procedure – only the steps you have performed) of the test should be summarized. Additionally, different types of soils and the equipment used should be clearly stated, and an example of a practical application of the experiment. State the relevant ASTM and AASHTO standards for the test. Specific questions might be asked during the classes that need to be answered accordingly in this chapter.
4. Show one sample calculation (formulas and values used), similar to that shown in the manual, for each experiment. If you need to use any tables' values an explanation should be included. If you use symbols, they must have a label (e.g. "*e*" is the void ration).

5. Results should include the completed observation sheets (with instructor's signature), tabulated results and/or graphs, and computer output sheets (when applicable). Tables and graphs must have captions and must be well labeled (titles, units, points of interest, etc.).



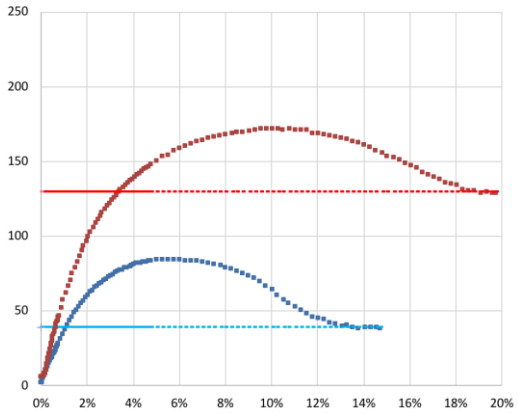


Figure 1: Deviator stress curves for sample 1 and 2

Correct Wrong

Correct table

Table 1: Results obtained per type of sample

ID	Void ratio (-)	Relative density Dr (%)	Confining pressure σ3 (psi)	Deviator stress Δσ (psi)	Peak stresses ratio σ1/σ3 (-)	Vol. strain ΔV/V (%)	Axial strain ε (%)

Wrong table

ID	e	Dr	σ3	Δσ	σ1/σ3	ΔV/V	ε

6. In the Discussion comment on the accuracy of your results and compare your results with those of others (not those of your class) in identifying your sample of soil and its properties. Comment on

deviations from the prescribed procedure (do not write the procedure), limitations of equipment, and explanation of sources of error, and how all of these affect (or not) the results. (1 to 2 pages). Specific questions might be asked during the classes that need to be answered accordingly in this chapter. When commenting/discussing the results explain why.

7. A brief summary of your laboratory exercise is to be provided. Include conclusions (values of interest that were analyzed in the discussion chapter). (1/2 to 1 page).
8. References if any shall be provided in standard ASCE format (see ASCE citation style guide[1]). In the References' chapter, the detailed information of each reference used must be included: if information is used from any website/book/lecture notes/etc., but the credits are not given to the author (in the report and pretest summary), points will be deducted from the report's final grade. There are two types of copying:

    - Direct copying – when information is directly copied without changing author's words. Quoting symbols ("XXX") and references must be used

    - Indirect copying – when information is rewritten in students' own words. References must be used:
      e.g. - According to Bareither et al. (2008), it is believed…

In Short:

- Perform all tests and submit completed reports to obtain a grade.
- Individual reports.
- Reports must be written in proper English and with the scientific names learned in classes. If not, points can be deducted
- Test reports will be due at the start of the next laboratory period.
- The reports must be uploaded on Moodle. The TA will note the date and the time of submission. Reports by email are not acceptable. A hardcopy can be asked by your instructor
- Late reports will be subjected to a penalty of 25% per day.
- (In)direct copied reports will be score as zero. First occurrence: the students will get a warning, second and next occurrences: the reports will be scored zero and an email will be sent to the Dean of Students.
- Each report will be 100 points.

[1] https://www.canterbury.ac.nz/library/support/citations-and-referencing/asce-citation-style/

Outcomes Course Matrix – CE341A Soil Mechanics Laboratory

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
Student Learning Outcome 1: Test and analyze the properties of soil.			
Show different test equipment used to measure engineering properties of soils.	1	1	Attendance, class participation.
Measure engineering properties of soils using different test equipment.	1	1	Attendance, class participation.
Interpret the test data to obtain engineering properties of soils.	1	1	Attendance, class participation.
Present the test results in the form of a laboratory report.	3	1, 2	Final report
Student Learning Outcome 2: Determine ranges of numerical values expected from soil tests.			
Interpret the test data to obtain engineering properties of soil.	6	1	Attendance, class participation.
Compare the calculated results with typical soil data.	6	1	Final report
Present the test results in the form of a lab report	3	1, 2	Final report
Student Learning Outcome 3: Recognize how to use those properties in geotechnical designs.			
Compare the calculated results with typical soil data.	1	1	Final report.
Present the test results in the form of a laboratory report.	3	1, 2	Final report.
Student Learning Outcome 4: Design and complete a custom experiment, analyze data and draw conclusions.			
Based on the experience gained, plan a set of tests that will yield answers to the problem at hand.	3, 6	1	Verbally presenting their approach and solution to the instructor and final report.

CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Our program educational objectives are reflected in the achievements of our recent alumni:

1 – Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

2 – Professional Growth: Alumni will advance their skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.

3 – Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Our Student Outcomes are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Revised: 2/13/18