CIV E 354: GEOTECHNICAL ENGINEERING II

Course Information – Winter 2001

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Required Text and Notes

Coduto, D.P. 2001. Foundation Design: principles and practices. Prentice-Hall Inc., NY.

Class Notes. Available at the Copy Centre

Web site: http://www.civil.uwaterloo.ca/cources/cive354

Supplementary References

- Bowles, J. E. 1996. Foundation Analysis and Design. 5th Ed. MacGraw-Hill, NY.
- Coduto, D.P. 1999. Geotechnical Engineering: principles and practices. Prentice-Hall, NY.
- Craig, R.F. 1992. Soil Mechanics. Chapman & Hall, NY.
- Cernica J.N. 1995. Geotechnical Engineering: foundation design. John Wiley & Sons, NY.
- Canadian Foundation Engineering Manual. 1992. 3th Ed. Canadian Geotechnical Society, Technical Committee on Foundations. BiTech Publishers Ldt. BC.
- CivE-354 Course Notes. By B. LeLievre and E.L.

Assignments and Solutions

- Every week.
- Distributed on Tuesdays and due a week later.
- Assignments will **only** be marked for completeness.
- Solution sets will be available at the web site after due date.

Exams and Grades [1]

Final Exam [2]	60%
Midterm	25%
Assignments	5%
Design project	10%

[1] The instructor reserves the right to adjust the class average on exams.

[2] If the final exam mark is **less than 50%**, the 5% of assignments **will not** be included in the final mark of the course. In this case, the final will be considered as 65%.

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COURSE OUTLINE

1. Introduction

Geotechnical Problems
Design Philosophy (21-1)
Design Loads (2.1)
Review of Soil Mechanics (Chapter 3):
Effective stresses, Shear strength: drained and undrained, Mohr circle

2. Retaining Walls (Chapter 22, 23)

Earth Stresses at Rest (K_o condition) (23.1)
Rankine's Theory of Active and Passive Pressure (23.1, 23.2, 23.3, 23.6, 23.7)
Stability of Retaining Walls (24.1)
Coulomb Wedge Method (23.2, 24.1)
Seepage Forces
Non-uniform Surcharge
Reinforced Earth
Anchors

3. Shallow Foundations

Design Loading (5.1, 5.2, 5.3)
Ultimate Bearing Capacity (6.1, 6.2, 6.3)
Net Foundation Pressure
Settlement (7.1, 7.2, 7.4, 7.6)

4. Flexible Earth Retaining Walls

Braced Trenches
Inclined Supports
Sheet-Pile Walls

5. Stability of Slopes

Infinite Slopes
Stability of Finite Slopes
Ordinary Method of Slices
Bishop's Method of Slices
Stability Coefficients

6. Use of Plasticity Theory

Upper and Lower Bound Solutions
Prandtl Bearing Capacity Mechanism
Strip Footing on Sand

7. Single Piles. Static Capacity (Time permitting)

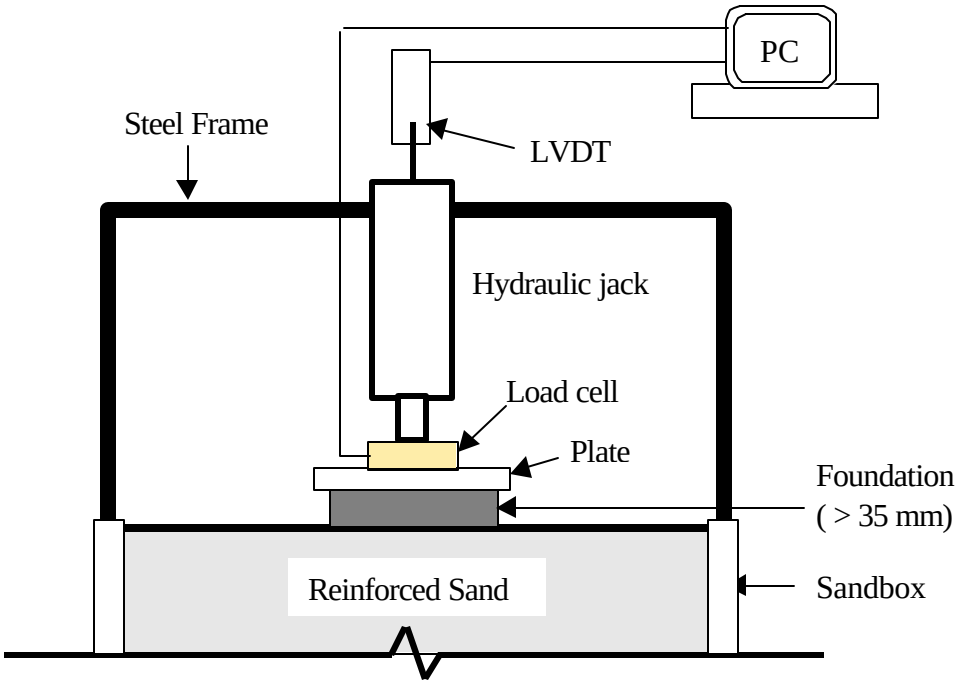
Timber, Concrete, and Steel piles
Static Pile Capacity
Pile Skin Resistance Capacity

DESIGN PROJECT: Design and Test of a 25 cm^2 Foundation

Students will participate in a group of maximum four members in the design and test of a 25 cm^2 foundation on dry sand. The name of the group and names of the members should be submitted by **January 9**. The main factors to design are the shape of the foundation and the configuration of 18-Popsicle sticks for site reinforcement. The sticks may not be glued, interwoven, or notched together, and cannot be in contact with the foundation at any time during testing. The reinforcement should be located at least 30 mm beneath footing. The sand should be dry. Each group will perform at least three different tests: 1) square footing on compacted sand, 2) proposed footing on compacted sand, and 3) proposed footing on compacted and reinforced sand.

By March 9, each group will test their proposed foundation on compacted and reinforced sand. By March 9, each group should have already the results for tests 1 and 2. **By March 16**, each group will submit a short report including: letter of submittal (signed by all members), introduction (problem, background information, proposed solution, and main conclusion), literature review, experimental setup and methodology, material characterization (shear strength, void ratio, grain size distribution), test results (load-deformation curves for tests 1, 2, and 3), analysis of results (shape-design considerations, reinforcement-design considerations, comparison of measured values with predicted values),and conclusions.

The group that obtains the maximum normalized load (maximum load of test 3 / maximum load of test 1) with minimum settlement will be the winner of the competition and will get **2%** extra in the final mark. The general test setup is shown below. There are six different sands that will be assigned to the groups. Each group will be responsible for characterizing the sand: e_{min}, e_{max}, grain size distribution (available), and shear strength from direct shear test (available). Any other properties that the groups consider appropriate for the design project can be obtained using the lab facilities. Groups using the same sand could share the lab work.



TEST SETUP