

Department of Civil & Environmental Engineering

Lafayette College

CE 462 Retaining Walls, Slopes and Earth Dams

Spring 2013

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Lectures: Tuesdays 1:10 – 4:00 pm in AEC 306

Office Hours: To Be Announced or by Appointment

Prerequisites: CE 361 – Geotechnical Engineering

Texts: No textbook required. As the alternative, supplementary book chapters and excerpts (pulled from several resources), published engineering design manuals, research articles, and relevant web site links will be distributed electronically during the term. Your text book from CE 361 may also be useful to you.

Course Overview:

All civil infrastructure projects, including buildings, bridges, dams, pipelines, highways, etc., have foundations in soil and/or rock. Often times, associated with these important projects are ancillary structures such as retaining walls and earth slopes that serve the purpose of providing a “transition” between one ground surface elevation and other. Concrete cantilever walls, bridge abutments, waterfront bulkheads, flood walls and sheet pile walls for temporary support of a building excavation are all examples of earth-retaining structures. The term “slopes” implies a range of structures that can be either man-made (such as roadway embankments, earth dams and levees or a proposed cut slope for a housing development) or that are natural (as in landslides). Slope failures and poorly designed earth-retaining structures often produce extensive property damage and occasional loss of life. It is therefore important that all civil engineers have a background in the fundamental concepts associated with design, analysis and evaluation of earth retaining structures and natural or man-made slopes.

The course covers classical earth pressure theories, effects of groundwater, surcharge loads and earthquakes on lateral earth pressure, landslide characteristics and terminology, limit equilibrium slope stability analyses (Bishop’s, Janbu, Spencer, Morgenstern & Price methods), effects of water on the stability of slopes, mitigation/remediation techniques for improvement, types of earth retaining structures, design and analysis of rigid cantilever walls, Cantilever sheet pile walls, Anchored sheet pile walls, braced cuts and open excavation stability and mechanically stabilized earth (MSE) walls. The course will make use of various software components available in analysis and design of several of the components listed here.

Goals and Outcomes:

This is an upper-level course in the area of geotechnical engineering that is focused on practice-oriented applications and design concepts. The primary goals of this course are for students to develop a background in the fundamental concepts of earth-retaining structure design and analysis of slope stability problems by utilizing basic principles of soil mechanics. After completing this course, a student should be able to do the following:

- Select appropriate conditions (drained or undrained) and strength parameters (c, ϕ) for performing design analysis;
- Describe the mechanism that allows soils to transition from drained to undrained conditions, or conversely, from undrained to drained conditions;
- Understand the basic principles of lateral earth pressure acting on retaining-structures and how to account for surcharge loads and groundwater effects;
- Understand and describe landslides and identify important characteristics and slope failures;
- Understand and describe the triggering mechanisms and loading conditions commonly associated with slope failures;
- Understand underlying assumptions, limitations and accuracies of limit-equilibrium analyses;

- Compute the factor of safety (FS) and define the critical failure surface for a given slope using a hand-calculation techniques and a slope stability software package.
- Explain how water effects slope stability as well as the different ways of incorporating water in slope stability analyses;
- Compare and contrast various techniques and practical measures for stability and repairing slopes;
- Evaluate the external stability of an earth—retaining wall structure;
- Understand the basic concepts of Sheet pile (cantilever and anchored) walls and how to design them;
- Understand the basic concepts of braced cut and open excavation stability and how to design them;
- Understand the basic concepts of mechanically-stabilized earth (MSE) wall works and how to design them.

Academic Integrity Statement: “Students are expected to be honorable, ethical, and mature in every regard” No form of scholastic misconduct will be tolerated. Academic dishonesty includes cheating, fabrication, falsification, plagiarism, complicity, and copying homework. It is the student’s responsibility to comply with the *Lafayette College Student Handbook* (www.lafayette.edu/student_life/) and to be familiar with the *Principles of Intellectual Honesty* (www.lafayette.edu/academics/honesty.pdf). Violations will be handled in accordance with the Procedural Standards in Disciplinary Proceedings stated in the *Student Handbook*.

Reading Assignments:

The main problem with a course such as this is that there is no single textbook that covers both retaining wall design and slope stability. These reading materials are meant to supplement lectures as well as to provide you with alternative resources to refer to when it comes time to studying. All reading assignments are recommended (not required), unless otherwise stated.

Homework Assignments:

Homework will “typically” be due within one-week of being assigned. Homework assignments are to be prepared following the guidelines of the Division of Engineering. Assignments that do not meet these criteria will receive no credit. NO LATE HOMEWORK WILL BE ACCEPTED.

Students may discuss homework assignments with other students, but the written work submitted for grading must be student’s own work.

Exams:

All exams during the semester will be held at night and will be closed book and closed notes (unless stated otherwise). The exams are comprehensive in so far as the material builds on itself. The material covered in the exam will focus mainly on that given in lecture.

Term Project:

A term project will be distributed around the third or fourth week of the course and will be due at the end of the term. Details of the project will be included with the project information package.

Attendance:

Attendance for lectures and computer lab sessions is STRONGLY recommended.

Incompletes:

An incomplete will only be given if the majority of the work in the course is completed and an emergency situation exists that prevents the student from completing the course by the time of the final examination.

Students with Disabilities:

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation or require assistance with academic concerns/accommodations, please contact the Office of the Dean of the College (610-330-5080) at Lafayette.

Course Communication:

E-mail will be used to communicate information about the course and any course cancellations. Also, there is a web site set up for this course <http://lafayette.parameterid.com/> that will provide additional information on assignments and readings.

The student work in this course is in full compliance with the federal definition of a four credit hour course. See the Lafayette College Office of the Registrar webpage for the full policy and practice statement.

Grading:

Homework:	15%
Mid-Term Exam:	35%
Final Exam:	35%
Term Project:	15%