

SLOPE STABILITY AND RETAINING STRUCTURES

CIVE 553 – Spring 2015

General Information

Instructor: Christopher Bareither, PhD, PE
Email: christopher.bareither@colostate.edu
Office: A219 Engineering Building
Office Hours: Tuesday 1 pm to 2 pm

Meeting Time: Lecture – Tuesday and Thursday 8:00 – 9:15 am
Meeting Place: Engineering Building B4
Prerequisites: CIVE 355 (Introduction to Geotechnical Engineering) or consent
Course Webpage: Not Applicable
Text: No required text. Technical papers will be made available.
References: Das, B. J. (2010). *Principles of Geotechnical Engineering*, 7th Ed., Cengage Learning, Stamford, CT.
Duncan, J. M. and Wright, S. G. (2005). *Soil Strength and Slope Stability*, John Wiley & Sons Inc., Hoboken, New Jersey.
NAVFAC DM 7.01 (1986). *Soil Mechanics, Design Manual 7.01*, Naval Facilities Engineering Command, Alexandria, VA.
NAVFAC DM 7.02 (1986). *Foundations and Earth Structures, Design Manual 7.02*, Naval Facilities Engineering Command, Alexandria, VA.
Federal Highway Administration Manuals:
http://www.fhwa.dot.gov/engineering/geotech/library_listing.cfm

Purpose

This course will provide students with a comprehensive understanding of slope stability and retaining structure applications in Geotechnical Engineering practice. Students will gain an understanding of the theory, design, and analysis necessary to evaluate slope stability and retaining structure problems.

Objectives

1. Understand variability in geologic conditions encountered in geotechnical problems, and select soil parameters pertinent for geotechnical design considerations.
2. Compute earth pressures for analysis of retaining structures and slope stability.
3. Evaluate externally and internally stabilized retaining structures, local and overall stability of structures, and anchorage and bracing systems for structural support.
4. Develop the ability to solve analytical and numerical analyses of slope stability for natural and man-made slopes.
5. Understand the role of seepage and fluctuating groundwater conditions on retaining structures and slope stability.

Grading

Homework. Homework assignments will be provided throughout the semester and will have a defined due date identified on the assignment. Homework will be due at the start of class on the due date indicated. **Late homework will not be graded.** All students must turn in individual work that will be graded for correctness, completeness, and professionalism. This is a graduate-level course and students are expected to complete their work in a neat and orderly manner and provide logical documentation of the necessary equations, definitions, assumptions, example calculations, references, and any additional supporting material used in solving the problems.

Exams. The course will include two exams during the semester, a mid-term exam and a final exam. Each exam will be two hours in length and administered in the classroom. Exams will be closed notes and closed book unless otherwise noted in class. Content on the exams will include quantitative (e.g., calculation problems) and qualitative (short answer) assessments. The distribution of the quantitative and qualitative portions may vary, but will be announced prior to the exam date. The mid-term exam will be scheduled at a time either overlapping with or outside of the lecture period that is convenient to all students. The final exam will be administered on Thursday May 14, 2015 from 6:20 to 8:20 pm in accordance with the university schedule.

Grading. This course is worth 3-credits, and course grades will be based on the following:

- Homework = 45%
- Project = 10%
- Exams (2 x 20%) = 40%
- Participation and professionalism = 5%

Grades in this course will be based on the following straight-grading scale:

$96.7\% \leq A^+ \leq 100\%$
$93.3\% \leq A < 96.7\%$
$90.0\% \leq A^- < 93.3\%$
$86.7\% \leq B^+ < 90.0\%$
$83.3\% \leq B < 86.7\%$
$80.0\% \leq B^- < 83.3\%$
$76.7\% \leq C^+ \leq 80.0\%$
$70.0\% \leq C < 76.7\%$
$60.0\% \leq D < 70.0\%$
$F < 60.0\%$

Exam grades and final course grades will be based on the above straight-grading scale when the class average is above a 75%. If the average is below 75%, the grading scheme will reflect the actual class average. Borderline decisions will be made by examining the student's motivation and quality of work (i.e., participation and professionalism).

Other Important Items

Travel. On occasion, my academic duties require that I must travel (e.g., attend conferences and meetings, present seminars, etc.). I will try to let you know as far in advance as possible. In all cases, we will make up any postponed classes, such that the full semester of lectures will

be provided. Thus, I need everyone's course schedules for the semester to determine mutually agreeable dates and times to hold make-up classes.

Make-up Exams. Make-up exams will not be given, except in extraordinary situations and only if I have been notified well in advance of the original exam date.

Course Webpage. All handouts and homework assignments will be placed on the course website. I do not plan on posting solutions to homework or exams; however, you are welcome to compare your answers with mine should a conflict arise.

Change in Assignment. A change in the date of a homework or exam during the semester may be necessary. When such changes are needed, they will be announced in class. If you are absent, you are responsible for finding out what changes, if any, have been made.

Cell Phone Policy. Cell phones will not be allowed during exams. Please turn off or silence phones and store phones out of sight during class.

Academic Integrity Policy. Colorado State University adopted an Academic Integrity Policy in the Fall of 2011 and faculty members are responsible for the following items:

- 1) *"Each course instructor shall state in his or her course syllabus that the course will adhere to the Academic Integrity policy of the Colorado State University General Catalog (page 7) and the Student Conduct Code."*
- 2) *"By the end of the second week of the course and/or in the course syllabus, the course instructor shall address academic integrity as is applied to his or her course components, such as homework, written assignments, lab work, group projects, quizzes, and exams. Examples of items to address include, but are not limited to, the use of class notes, study sheets, and solutions manuals; appropriate uses of sources, internet or otherwise; receiving assistance from others; and the use of prior work."*

Assessment Methods and Student Outcomes

- 1) Homework is to evaluate how students are learning course content and to provide the instructor feedback on student progression in the course.
- 2) Exams are to determine the students' level of understanding of basic definitions, concepts, and engineering methodologies and calculations presented in the text, handouts, lectures, and laboratory sessions.

Outline and Tentative Schedule¹

Week	Date	Lecture Topic	Homework ^a
1	Tue, 1/20	Course intro + soils review	HW1 out
	Thu, 1/22	Shear strength review + intro to slopes	
2	Tue, 1/27	Intro to slopes + stability considerations	HW2 out
	Thu, 1/29	Infinite slope stability	HW1 due (5)
3	Tue, 2/03	Block slides	
	Thu, 2/05	Rocscience - computer tools	HW3 out
4	Tue, 2/10	Circular arc failures 1	HW2 due (5)
	Thu, 2/12	Circular arc failures 2	
5	Tue, 2/17	Circular arc failures 3	HW4 out
	Thu, 2/19	Embankments	
6	Tue, 2/24	Non-circular arc failure	HW3 due (6)
	Thu, 2/26	Progressive failure & residual strength	
7	Tue, 3/03	Case study	
	Thu, 3/05	Slope stabilization & reinforced slopes	HW4 due (6)
8	Tue, 3/10	Open period (review)	
	Thu, 3/12	Exam 1	
9	Tue, 3/17	<i>No Class - Spring Break</i>	
	Thu, 3/19		
10	Tue, 3/24	Intro to retaining structures	HW5 out
	Thu, 3/26	Rankine analysis	
11	Tue, 3/31	Coulomb analysis	HW6 out
	Thu, 4/02	Earth pressure review + example problem	
12	Tue, 4/07	Gravity retaining walls	HW5 due (5)
	Thu, 4/09	Examples: gravity & cantilever	HW7 out
13	Tue, 4/14	Sheet piles (unanchored)	HW6 due (6)
	Thu, 4/16	Sheet piles (anchored)	
14	Tue, 4/21	Examples: sheet piles	HW8 out
	Thu, 4/23	Excavation bracing	HW7 due (6)
15	Tue, 4/28	MSE walls	
	Thu, 4/30	MSE walls	
16	Tue, 5/05	Student presentations	HW8 due (6)
	Thu, 5/07	Student presentations	
17	Tue, 5/14	Exam 2: 6:20 pm - 8:20 pm	

^a Percentages in parentheses are estimates of homework contribution to final grade.

¹ All dates, lecture content, homework assignments subject to change.