

MINING GEOTECHNICS

CIVE 559 – Spring 2018

General Information

Instructor:	Christopher Bareither, PhD, PE
Email:	christopher.bareither@colostate.edu
Office:	A219 Engineering Building
Office Hours:	T/TH 1:00 to 2:00 pm in A219
Meeting Time:	Lecture – Tuesday and Thursday 3:30 pm to 4:45 pm
Meeting Place:	Tuesdays = Engineering Building B2 Thursdays = Lory Student Center (see schedule)
Prerequisites:	CIVE 355 (Introduction to Geotechnical Engineering) or consent
Course Webpage:	Canvas
Text:	No required text. Recommended text: Blight, G. (2010). <i>Geotechnical Engineering for Mine Waste Storage Facilities</i> , CRC Press, Taylor & Francis Group, London, UK. Also, technical papers may be distributed as supplemental reading materials throughout the semester.

Description and Purpose

The purpose of this course is to provide students with a comprehensive understanding of geotechnical engineering related to mining practice. The primary focus of the course will be on engineering operation, design, and challenges related to mine waste. This course will be a case-study driven course and is interdisciplinary in that lecture topics will include aspects of geotechnical engineering, geology, hydrology, geochemistry, and others. Students will gain an understanding of the fundamentals, design, and analysis necessary to evaluate relevant geotechnical-related challenges facing the mining industry. Case studies will be integrated into the course via weekly seminars from consulting engineers who are active in the mining industry.

Objectives

1. Understand mechanical, hydrologic, and chemical characteristics of mine wastes generated in today's society and challenges associated with operation, management, and long-term maintenance.
2. Comprehend engineering challenges associated with the generation and storage of tailings and waste rock.
3. Comprehend engineering challenges associated with the design as well as short- and long-term stability of tailings impoundment facilities.
4. Provide students with an understanding of the state-of-art and state-of-practice related to mine waste.
5. Conceptualize multi-disciplinary problems related to mine waste and identify practical engineering solutions.

Grading

Quizzes. Quizzes will be administered weekly throughout the semester and will pertain to course content, case-study seminars, and assigned readings from the previous week. Quizzes will be given at the start of each Tuesday lecture period.

Projects. The course will include two projects: one presentation and one written report. The written report is anticipated to be administered during the first half of the semester and the presentation will take place during the scheduled final exam (or a different agreed-upon time outside of class). Guidelines for the two projects will be distributed during the semester.

Participation and Professionalism. The participation and professionalism is a qualitative assessment of your engagement, performance, and overall benefit to this course. All students will start the semester at more or less an 80% grade for participation and professionalism, and contributions or deductions to the end-of-semester grade will be based on interactions between the student and professor, student and other students, and student and guest lecturers.

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

- Quizzes (16 x 2.5%) = 40 %
- Projects (2 x 25%) = 50 %
- Participation and professionalism = 10 %

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

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

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

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 quizzes or 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) Quizzes are designed to assess students' ability to understand technical content for comprehension and be up-to-date in the course.
- 2) The projects are designed to assess students' communication skills (written and oral), ability to think independently and creatively, and general knowledge related to the specific mining geotechnics topic of interest.

Outline and Tentative Schedule

Week	Date	Lecture Topic	Guest Speaker	Room
1	Tue, 1/16	Course Overview & Introduction		Engr B2
	Thu, 1/18	Introduction to Mine Sites and Mine Waste	Carlo Cooper (Minebridge)	LSC 308-310
2	Tue, 1/23	Waste Rock - Characteristics and Management		Engr B2
	Thu, 1/25	Waste Rock Management & Reclamation	Dan Overton (Engineering Analytics)	LSC 322
3	Tue, 1/30	Tailings - Characteristics and Management		Engr B2
	Thu, 2/01	Overview of Tailings Storage Facility Design	Clint Strachan (Stantec)	LSC 308-310
4	Tue, 2/06	Site Characterization		Engr B2
	Thu, 2/08	Geotechnical Site Characterization	Shawn Steiner (ConeTec)	LSC 308-310
5	Tue, 2/13	Geochemistry of Acid Mine Drainage		Engr B2
	Thu, 2/15	Waste Rock Geochemistry	Patrick Williamson (INTERA)	LSC 304-306
6	Tue, 2/20	Mine Site Water Management		Engr B2
	Thu, 2/22	Mine Water Management	Dave Hoekstra (SRK)	LSC 308-310
7	Tue, 2/27	Tailings Rheology		Engr B2
	Thu, 3/01	Tailings Rheology and Transport	Matt Bachman (Paterson & Cooke)	LSC 324
8	Tue, 3/06	Tailings Dewatering		Engr B2
	Thu, 3/08	Filtered Tailings Case Studies	Brett Byler (AMEC)	LSC 322
9	3/13 & 3/15	Spring Break - No Class		
10	Tue, 3/20	Dams and Embankments		Engr B2
	Thu, 3/22	Fundamentals: Earth Dams & Tailings Dams	Dean Durkee (Gannett Fleming)	LSC 304-306
11	Tue, 3/27	Tailings Consolidation		Engr B2
	Thu, 3/29	Tailings Storage Facility Capacity	Jason Hilgers (AECOM)	LSC 322
12	Tue, 4/03	Static Stability of Mine Waste Storage Facilities		Engr B2
	Thu, 4/05	Static Slope Stability	Bryan Ulrich (Knight Piesold)	LSC 376-378
13	Tue, 4/10	Seismic Stability of Mine Waste Storage Facilities		Engr B2
	Thu, 4/12	Seismic Stability Analyses	?	LSC 322
14	Tue, 4/17	Barrier Systems for Waste Containment		Engr B2
	Thu, 4/19	Barrier Systems for Mine Waste	John Allen (CETCO / Minerals Tech.)	LSC 304-306
15	Tue, 4/24	Heap Leaching		Engr B2
	Thu, 4/26	Geotechnical Aspects of Heap Leaching	Brent Bronson (Golder)	LSC 322
16	Tue, 5/01	Risk Assessment		Engr B2
	Thu, 5/03	Understanding and Communicating Risk	Mike Henderson (BGC)	LSC 308-310