
CIVE 5209/CVG 7100 Geotechnical Case Studies Winter 2024

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Course Dates:

Seminars: January 10 – April 12 Monday 18:05 – 20:55 Patterson Hall **Room 215**

Student presentations: April 3 & 10 Patterson Hall **Room 215**

Final examination: TBA

Course Description:

This course focuses on a series of historic case studies over the last several decades in order to understand how these contribute to the advancement of geotechnical knowledge. The evolution of slope stability methods is reviewed with focus on the reasons behind the development of subsequent solutions, with the aim of elucidating the thought process behind geotechnical research in general. Errors and assumptions of various methods are scrutinized to clarify the effects of these on the solutions and by extension on the conclusions we draw. Classical geotechnical case histories are reviewed to learn about common mechanisms of failure as well as consider the capacity of various solutions to capture these. Case studies of geotechnical best practices, including emerging best practices for tailings dams, are reviewed. Students will work on individual projects on a geotechnical topic of their choosing, aimed at either reviewing an exciting current development in the field or arguing for a solution for a modern-day problem. The presentation portion of their project will be graded by the instructor as well as their peers. The course includes an experiential learning component where students learn geotechnical software commonly used by the industry while replicating analyses of documented case studies.

The aspirational goal for this course is to teach students to think critically and creatively, in geotechnical research or elsewhere.

Grading

Reading Summaries:	10%
Assignments and Tutotials:	20%
Term Paper:	20%
Term paper presentation:	20%
Final Examination:	30%

Students who claim illness, injury, or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for alternate arrangements with the instructor and in all cases, this must occur no later than three (3) days after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. Consult Section 4.4 of the University Calendar.

Students missing deadlines or exams due to an illness must submit a Self-declaration for Academic Considerations Form to the instructor within three (3) days. Accommodations cannot be granted more than 72 hours after the deadlines. For final exams, students must submit the self-declaration form in addition to a deferral application (carleton.ca/registrar/deferral) and submit both forms to the Registrar's Office no later than 3 days after the scheduled examination or take-home due date. If an absence from an evaluation is deemed justified:

- 1) Assignments: the weight of a justified missed assignment will be transferred onto the remaining assignments.
- 2) Final exam: the student will have to consult the academic secretariat of the faculty for the procedure to follow.

Required Reading

1. Topic-specific reading materials are available on Brightspace for each seminar. Students are asked to familiarize themselves with these materials prior to the seminar.
2. Class notes are available on Brightspace.

Required Equipment for Experiential Learning

This course contains an experiential learning component involving computer modelling of slope stability problems using common industry software. As part of this course, students are required to have access to computers capable of running Bentley's PLAXIS LE. Students are required to install and test this software on their computers by no later than the first week of the classes. Instructions on how to access and install this software as well as gain academic license for it are found on Brightspace under module "SOFTWARE."

Assignment, Tutorial and Report Submission

All submissions must be made as a hard copy. While you may submit your assignments after the due date, a grade penalty will be applied as follows: -20% if submitted prior to the solutions being posted; and a grade of zero if submitted after the solutions are posted.

Plagiarism, self-plagiarism and cheating: students are advised that Carleton's policies regarding cheating and plagiarism are closely observed and enforced in this class. In addition, student submissions in this class must be

their original work that has not been previously published or submitted elsewhere. Failure to follow these rules will result in an automatic grade of 0 for the submission and may include other penalties including a final grade of “F”, at the instructor's discretion.

The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). Requests made within two weeks will be reviewed on a case-by-case basis. After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) for the deadline to request accommodations for the formally-scheduled exam (if applicable).

Reading summaries:

Reading summaries are weekly submissions starting with week 2. They consist of 1-paragraph (max. 10 lines) summaries of every paper and report posted with the previous week's lecture on Brightspace as reading material. They should not exceed 1-2 pages in all. These submissions are mandatory to get a passing grade in this course, i.e. they must all be submitted. Late submissions (up to 1 week late) will be graded as 0 but accepted for the purpose of passing this course.

TIME TABLE

Date:	Seminar Topic:	Due:
January 10	REVIEW OF SLOPE PERFORMANCE METHODS	
January 17	ROLE OF CASE STUDIES IN GEOTECHNICAL RESEARCH – Classic case studies (Lodalén, Drammen, Bakklandet) – The Jackfield slide EXPERIENTIAL LEARNING: TUTORIAL #1 LEM SLOPE STABILITY 2D – Replication of IRP's (2015) back-analysis of the failure at the Mount Polley TSF	Assignment #1: Infinite Slope (Mon., Jan. 23 @ 4pm)
January 24	3D SLOPE STABILITY EFFECTS – Theory – Case studies: Lodalén, Jackfield, Scrapsgate – Magnitude of 3D stability effects – Impact on analysis – Some reasons for erroneous interpretation of strength in 2D analyses EXPERIENTIAL LEARNING: TUTORIAL #2 LEM SLOPE STABILITY 3D – Replication of 3D LEM analysis by IRP (2015), Zabolotnii (2020) of the failure at the Mount Polley TSF	Term Paper Topic submission: Jan. 30. Tutorial #1 Report: 2D LEM Slope Stability (Mon., Feb. 6 @ 4pm)
January 31	SENSITIVITY IN CLAYEY SOILS – Theory <ul style="list-style-type: none"> ○ Sensitivity ○ Progressive failure – Failures in clays deposited in marine environment <ul style="list-style-type: none"> ○ The Rissa slide – Failures in lightly sensitive soils <ul style="list-style-type: none"> ○ The Scrapsgate case study ○ The failure at the Congress St., Chicago 	
February 7	COMPLEX MECHANISMS OF FAILURE – The case study of the failure of the Mount Polley TSF embankment – Asynchronous mechanisms of mobilization of shear strength – LEM vs. FEM – The meaning of the Factor of Safety in geotechnical engineering	Tutorial #2 Report: 3D LEM Slope Stability (Mon., Feb. 13 @ 4pm)
February 14	LIQUEFACTION IN TAILINGS DAMS – Theory – The Fundao Dam failure – The Cadia Dam failure	Term paper abstract due Feb. 19
February 21	WINTER BREAK	
February 28	MODES OF FAILURES IN DAMS – Theory	

		<ul style="list-style-type: none"> - Case studies of piping failures: the Teton Dam failure - Case studies of overtopping: the Vajont Dam failure 	
March 6		Landfill failures: <ul style="list-style-type: none"> - Mechanical failure (slope instability) - Liner failures - Cover failures 	
March 13		Case studies of best geotechnical practices: <ul style="list-style-type: none"> - Performance based design - The Panama Canal slope stability - The Alameda dam case study - Land reclamation case studies 	
March 20		Experiential Learning: Landform analysis intro	
March 27		Student presentations	
April 3		Student presentations	
April 10		Student presentations	Student term paper due on April 10

Term Paper and Presentation Requirements

Students are asked to prepare a 5,000 word (+/-750 words) individual term paper on a geotechnical case study of their choosing that is in line with the general description below. In the two last seminars of the course, the students will present their paper in a 15-minute presentation followed by a 5-minute question period.

Term Paper Topic

The students are asked to identify a geotechnical topic, technology involving a geotechnical aspect, and/or a project or case study with a geotechnical component, that inspires them and makes them feel excited about geotechnical engineering in general, and their future as geotechnical engineers. Let the rest of the class know why geotechnical engineering is interesting, cool or inspiring, in your opinion!

Topics must be submitted to the instructor for approval prior to January 31, 2022.

Term Paper Format

The paper must closely follow the Canadian Geotechnical Journal's journal paper format (see instructions to the authors). It must include an abstract, introduction, theory, findings/results, discussion and conclusions section, followed by references, appendices if applicable. The 5,000 word count applies to the whole paper excluding the appendices.

Tables and Figures: Include tables, figures and captions in the body of the term paper on the appropriate pages.

Language: the paper must follow technical writing standards.

The term paper abstract is due by February 18, 2022.

The term paper is due on April 8, 2022.

Term Paper Grading:

- | | |
|---|--------|
| 1. Adherence to formatting requirements: | 15/100 |
| 2. Language & style: | 10/100 |
| 3. Findings/results: | 25/100 |
| 4. Discussion/conclusions: | 30/100 |
| 5. Overall organization of information and effectiveness: | 20/100 |

Some advise on your term paper (optional):

Have a clear idea about your topic before writing. Develop an outline including all sections (you can modify this later, but it is important to start early). Start filling in the results/findings section as you identify them – this is a tedious task if left to the last minute. Fill in the information in various sections as ideas come to you.

If you are facing a writer's block, convince yourself to write just one sentence a day. Once you have the sentence down, you can decide if you wish to continue or leave it for another day. Remember, we all procrastinate when it comes to papers!

Presentation Requirements:

Students will present their work to their peers in the format of their choosing (examples include PowerPoint presentations, videos, combinations thereof etc). It is the student's responsibility to ensure that the chosen format will work with Zoom in the classroom environment.

There is a strict time limit of 15 minutes per presentation – no exceptions.

The presentations will be graded by the instructor (50% of the grade) and by their peers (50% of the grade).

All students must submit their grades for their peers' presentations, or lose up to 20% of their own presentation grade. Grading will be done according to the following criteria:

1. How easy is it to follow your colleague's presentation? (/3)
Ex. does the colleague speak clearly, is the presentation well-paced or rushed, are the visual aids effective?
2. Quality of content (/4)
Was the technical quality of the presentation good? Was the technical aspect treated well? Were the answers to questions adequate in your view?
3. Effectiveness of presentation (/3)
Is the content of your colleague's presentation interesting, modern, inspirational? Did you feel like you wanted to know more, or perhaps work on something related to the presented topic?

The instructor reserves the right to discard presentation grades that are too far from the median. This is done to discourage unethical and strategic grading, and encourage a fair treatment of your peers.

Some advise on presentations

The 15/5 minute presentation format is typical for conferences, and you will encounter it often as grad student and professionals. In those settings, you will be judged by your peers.

This course's presentation emulates this format and is intended to prepare you for these instances.

There are several pieces of general advice addressing common mistakes in student presentations. Following some or all of these points is not mandatory, but in your instructor's opinion, it can be very helpful.

1. Do not overload your presentation with information. The rule of thumb is, one slide per 1-2 minutes – so ~10-12 slides in all. Otherwise you will not meet your time limit.
2. Do not rush your speech, do not slur your words to fit in more information, and do not overload slides. You wish to speak clearly and rather slowly! You wish to have one or two things per slide – do not have 10 graphs and paragraphs of text – no one will read that. When it comes to text in presentation slides, less is more. Remember, your peers are not familiar with your topic and there is only so much that they can comprehend in 15 minutes – this has nothing to do with how smart we are, that is just how we process new information!
3. Prepare your speaking notes in advance and rehearse. You will reach a point when you will no longer need your notes as your crutch, but preparation is key.
4. Test your presentation over Zoom to avoid technical issues AND to ensure that your text size is readable.
5. If you are shy and have trouble with public speaking, pay special attention to point (3): I promise, it helps a great deal.

How to study for the final exam:

This is a graduate level class. This means that we study things that have not yet been absorbed into textbooks as mainstream knowledge. This knowledge is available in good quality research papers and industry reports. Each class has a number of research papers and other reading materials posted on Brightspace. Please read them – if possible, in advance of the class. Do not leave this task to the last days before the exam – you will not be able to read this much in just a few days.