Information for Graduate Students

Geotechnical Engineering Program

Academic Year 2024-2025

COLLEGE OF ENGINEERING
THE CHARLES E. VIA, JR. DEPARTMENT OF
CIVIL AND ENVIRONMENTAL ENGINEERING
VIRGINIA TECH.

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CORE VALUES OF THE GEOTECHNICAL ENGINEERING PROGRAM

The faculty and staff welcome you to the Geotechnical Engineering Program. We will strive to make your experience here fulfilling. The program has a long–standing commitment to excellence and enjoys recognition for being one of the top programs in the nation.

Our *Core Values* are stated below. These were adopted in May 2008 and serve as guiding principles for the program. We encourage you to adopt these values and apply them in your daily routine.

1. Excellence in teaching, research, and service.
2. Mutual respect and support toward all stakeholders.
3. Appreciation of the relevance and importance of our work to society and the environment.
4. Solid grounding in the elements of geotechnical engineering, as well as opportunities for broader technical, professional, societal, and interdisciplinary training and experience.

LOGISTICAL INFORMATION

Address and Phone Information

Give your local address, phone number and email address to Ms. Penny Kay Lytton (Room 120 Patton Hall, pkl16@vt.edu) right away. If you do not have all the information called for, *fill in what you have now*, and give the rest to Ms. Lytton later. Do this before the end of the first week of classes. *Use your @vt.edu email address for all official email communications.*

Desks and Keys

As many graduate students as possible will be assigned desks on campus. Desk assignments are posted on the door of Room 20 Patton Hall. If you have not been assigned a desk and you would like one, ask Ms. Lytton to put your name on the waiting list. If you have been assigned a desk and you will not need it, let Ms. Lytton know so it can be reassigned.

See Ms. Lytton once you have your Hokie Passport. She will need to see your Hokie Passport and then have you fill out a form so that you can be added to the new electronic lock system. This will allow you to access Patton Hall before and after working hours at the readers located on the front and rear exterior doors. The exterior doors are locked from 11 pm – 7 am, Monday – Friday, and locked all weekend. Doors to the Patton teaching laboratories and Ozawa Library are equipped with a combination lock. You will be given the combination to those locks if necessary.

Mail

Each student will have a mailbox in Ms. Lytton's office. Please check for notices and mail in your box on a frequent basis.

TEACHING ASSISTANTS AND RESEARCH ASSISTANTS

Students who have a Graduate Teaching Assistantship (GTA) or a Graduate Research Assistantship (GRA) should see the Graduate Coordinator (Ms. Sarah Martin, shmartin@vt.edu) in 211D Patton Hall to verify your arrival and Ms. Sue Snow (suesnow@vt.edu) in Room 200 to have your payroll information entered in the campus computer accounting system. Otherwise, you will not be paid. Additionally, all students "involved in duties and responsibilities associated

with our courses (e.g., overseeing a lab section, grading student assignments, holding office hours, etc.)" (i.e., GTAs) are required to attend a GTA workshop (GRAD 5004) before classes begin to receive training in teaching techniques and student interaction. The workshop comprises Phases I and II. Phase I consists of morning and afternoon sessions to be held on a single day, **Tuesday, August 20, 2024** for the F24 semester and **Thursday, January 16, 2025** for the S25 semester; all new GTAs must attend this workshop (see Ms. Sarah Martin, shmartin@vt.edu, about registering for this workshop). Scheduled throughout Fall 2024 or Spring 2025 semesters (usually late afternoon or early evening), Phase II of the GTA workshop is made up of smaller sessions from which students will select what best fits their interests and needs. Enrolled students will be informed about procedures to register for the individual Phase II sessions via e-mail.

Work Expectations for Teaching and Research Assistants

Teaching and research assistants receive financial support in return for working with a faculty member in teaching a course or conducting research. We have the same basic expectations of you as any employer: professional conduct and high ethical standards. Keep in mind that this is a job, and you will receive periodic performance evaluations as you would with any other job. Please realize that working hard at performing your assistantship duties will potentially open opportunities for you in the future. On the contrary, if your job performance is unsatisfactory, you can lose your assistantship.

Assistantship contracts cover given periods of time during each semester at an agreed level of support. A full-time assistantship requires 20 hours per week of effort, while part-time assistantships have a work week requirement that is in the same proportion as their assistantship (e.g., 50% assistantship requires 10 hours per week). If you have a research assistantship and you are receiving academic credit for work done on your project, your time contribution should be greater (generally by a factor of two or more) than just the assistantship hours. The reason for this is that you work your paid hours for your advisor and your unpaid hours for your academic credit. (Note: This is not unique to the Geotechnical Group or Virginia Tech, but rather is standard policy at most universities, whether formally stated or not.)

It is normally not required that assistants submit time records to their supervisors each week. Assistants must be aware that some weeks will require less than the specified number of work hours, but some weeks will require that more hours be worked. In the end, it is in your best interest to see that your job is complete and the client (your supervisor) is satisfied.

The following are important expectations for TA's and RA's:

1. It is expected that all TA's and RA's be on-campus and ready for work during the full period of the assistantship. For academic year appointments, contracts start on August 10th and end on May 9th.
2. Semester breaks are not automatically "days off." Even though class is not being held, you are still being paid and are obligated to work.
3. Discuss any necessary absences with your supervisor well in advance of the travel dates and before making travel arrangements. Requests to travel are not guaranteed to be granted.

PROGRAM REQUIREMENTS AND ACADEMIC INFORMATION

The Geotechnical Engineering Program welcomes students with diverse academic backgrounds. However, students entering the program should have a "core" knowledge of math, science, and engineering. This knowledge base incorporates courses generally taken in

undergraduate engineering or physical science programs, and includes: general chemistry (with lab), engineering math (including linear algebra, multivariable calculus, and introductory differential equations), physics, geology, fundamental mechanics (statics, deformable bodies), fluid mechanics, and introductory soil mechanics/geotechnical engineering. See the listing of core knowledge courses. In special cases, students lacking some of core knowledge will be considered for admissions into the program, but these students are required to take the appropriate courses that cover the areas of deficiency before completing their degrees in our program. Also, note that introductory soil mechanics/geotechnical engineering is a prerequisite to most of the graduate courses.

Please review the program requirements below for your degree goal, complete the Verification of Core Knowledge worksheet, and meet with your advisor (or temporary advisor) to discuss any needed core knowledge material, and plan your courses.

MS Degree

Courses included in Master's Degree Programs must conform to the following requirements:

	MS (course work only)	**MS (project and report)**	**MS thesis**
4000-Level Courses	6 units max	6 units max	6 units max
5000-Level Courses	21 units min	21 units min	12 units min
4984 or 5984 (Special Study) or 5974 (Independent Study)	6 units max	6 units max	5 units max
5904 (Project and Report)	0 units	3 to 6 units	0 units
5994 (Research and Thesis)	0 units	0 units	6 to 10 units
Total	30 units min	30 units min	30 units min

PH.D. Degree

Courses included in Ph.D. degree programs must conform to these requirements:

4000-Level courses (must be outside the major field)	6 units max
5000-Level courses	27 units min
4984 and 5984 (Special Study) and 5974 (Independent Study)	9 units max
7994 (Research and Ph.D. Dissertation)	30 to 60 units
Total	90 units min

Transfer Credit

1. For MS students, the Graduate School's policy applies. This policy states that no more than 50 percent of the graded credit hours needed to satisfy the minimum degree requirements may be transferred from another accredited university. For MS thesis and project report options this limit is 12 hours. For coursework-only MS degrees this limit is 15 hours.
2. PhD students are required to be responsible for knowledge across the full breadth of the Geotechnical Program, and that they can gain that knowledge by taking courses for credit, or by auditing courses. Programs of study must satisfy University rules, but the details are up to the student and his advising committee.

Each graduate student should become familiar with "Expectations for Graduate Study," "Graduate Policies and Procedures," and "Course Catalog" on the Graduate School's website. The CEE Department's "Graduate Policies and Procedures Manual" is revised each year and the latest version is at the following page of forms for graduate students. Read this manual,

as well as the following information, to be sure that your plan of study meets the requirements and deadlines for your degree program.

Advisors

Each graduate student in Geotechnical Engineering is assigned a **temporary academic advisor** by the Program Coordinator or Ms. Penny Kay Lytton to help you in your first semester with enrollment procedures, core knowledge base verification, and class selection. We attempt to inform all incoming students of their temporary advisor by email. However, if you do not know who your temporary advisor is, please see Ms. Lytton (Room 120 Patton Hall, pkl16@vt.edu).

A **permanent advisor** will guide the formation of your program of study and serves as the Chair of your MS oral or thesis exam, or the Ph.D. oral and dissertation defense. A permanent advisor is not assigned to you but is a faculty member that either supervises your research or is someone that mutually agrees to serve as your academic/research supervisor. If you do not select a permanent advisor, the temporary academic advisor assigned to you at the beginning of your first semester can act as your permanent advisor for the completion of your degree, however this does not need to be the case.

Plan of Study

The Geotechnical Engineering Program offers the MS (course work & thesis), MS (course work & project and report), MS (course work only), and Ph.D. degrees. See the CEE Department's "Graduate Policies and Procedures Manual" for detailed information on each degree. The majority of Geotech MS students follow one of the MS non-thesis degree paths (i.e., course work & project and report, or course work only) versus the MS (thesis) option to complete their degrees. However, the MS thesis & course work path may be required for some students funded as GRA's, depending on the funding source for the assistantship and the Research Advisor's preference. Also, some MS research projects could be of sufficient scope to make the MS thesis path the best route, even if not required by the assistantship funding source.

Each student needs to have an approved Plan of Study filed with the Graduate School *prior to completing 15 credit hours of courses (i.e., typically before completion of your second semester)*. The Plan of Study is developed with the help and advice of your permanent or temporary academic advisor.

To develop a Plan of Study, during your second semester or as recommended by your advisor, develop a tentative list of courses you will take. Schedule a meeting with your permanent advisor no later than the end of the second semester to go over and finalize your Plan of Study for your graduate degree.

An example Plan of Study is at the end of this document. The Geotechnical Engineering program does allow Seminar to count toward the credits required for completing your degree. Therefore, both Fall- and Spring-semester Seminar courses should be listed under 5000 level and higher courses. *See the example plan of study for the correct way to list Seminar.*

Final Programs of Study need faculty approval as follows:

1. MS Course Work & Thesis. The research advisor and two other committee members are required. Committee members for the *MS Thesis* will normally be faculty that have expertise in your area of research and will serve as your examining committee at the defense. Your research advisor will also be your permanent advisor and will normally help you select committee members.

2. MS Course Work & Project and Report and MS Course Work Only. Your temporary or permanent advisor, who should be your research advisor if you are performing research, and two other committee members are required. The committee members do not have to have expertise in your area of research. Students following this degree path may select one of the two remaining committee members of their choice following the steps below:

   Step A. Through mutual agreement with your temporary/permanent advisor, you select one committee member. You need to schedule appointments with the faculty members so that you can ask them in person to serve on your committee. They can sign your plan of study while you are there, so please have it (correctly) completed. The department's Graduate Coordinator is Ms. Sarah Martin (shmartin@vt.edu, Room 211D); she can answer any questions that you may have.

   Step B. Visit Ms. Penny Kay Lytton (pkl16@vt.edu) in 120 Patton and let her know who your committee chair and first committee member will be. Ms. Lytton will then assign the third committee member.

All Students: Complete your plan of study by obtaining the signature of all committee members and submit the form to the departmental Graduate Coordinator (Ms. Sarah Martin, shmartin@vt.edu, Room 211D Patton Hall).

Meetings for *Thesis Students*. The student must meet with the graduate committee at least three months prior to the defense or oral exam. In many instances, the student can prepare a written summary of the research progress and submit this to each committee member. The student then meets with each committee member to answer questions that arise from the summary.

3. Ph.D. Degrees. Your research advisor, who is also your permanent advisor, and a minimum of three additional committee members must approve the program of study. It is recommended (but not required) that at least one member of the committee be from outside the Ph.D. student's graduate program area, either coming from another CEE graduate program area or from another academic department outside CEE.

After the members of your committee have approved your program of study, take it to Ms. Sarah Martin (shmartin@vt.edu) in 211D Patton Hall. She will have it reviewed by the Department Head and will file it with the Graduate School after it has been approved.

Credit Hour Requirements

Virginia Tech requires that graduate students who have a department/college/university fellowship or scholarship must register for a minimum of 12 credit hours per semester. Students who have a graduate assistantship (Teaching or Research Assistantship) must register for a minimum of 18 credit hours per semester. Unfunded students must take a minimum of 9 credit hours per semester to be considered full-time. International students should verify the minimum number of credit hours required to meet visa requirements. Maximum permissible credit hour loads are listed in the CEE "Graduate Policies and Procedures Manual".

The experience of graduate students in the geotechnical program is that three, 3-credit-hour courses and the 1-credit-hour Geotechnical Graduate Seminar (i.e., a total of 10 credit hours per semester), and possibility the 1-credit-hour seminar on Graduate Student Success in

Multicultural Environments (ENGE 5304) and the 1-credit-hour GTA Workshop (GRAD 5004), is a reasonable load for students who have teaching or research assistantships that require 15 or more hours of work per week. Only in extraordinary cases have students been able to perform at an acceptable level when taking four, 3-credit-hour courses and working 15 or more hours per week on an assistantship. Consequently, in order to satisfy the university requirement that students on assistantships must register for at least 12 or 18 credit hours per semester, the geotechnical faculty recommend that students on assistantships that require 15 or more hours per week do not register for more than three, 3-credit hour courses and the seminars/workshop. The remaining credits will be composed of "program hours," which you register for as Project and Report (CEE 5904) hours under your temporary or permanent advisor's name. *The "program hours" are only used to complete the 12-credit-hour or 18-credit-hour university requirement and do not count towards the required 30 credit hours to obtain a master's degree in the geotechnical program, hence the name "program hours." Also, note that the credits for ENGE-5304 and GRAD 5004 do not count toward the 30 credit hours needed to obtain a master's degree, but they do count towards the 12 or 18-credit-hour registration minimum.* Thus, for example, a master's degree student with a 15-hour-per-week teaching assistantship might take three 3-credit-hour courses, the 1-credit-hour Geotech Graduate Seminar, the 1-credit-hour ENGE 5304 seminar, and one to seven "program hours" of CEE 5904 under their temporary/permanent advisor's name. Note that not all CEE 5904 credit hours are necessarily "program hours." For example, if you are a research assistant, whether funded or unfunded, and are working on a project that forms the basis of the Project and Report requirements, then you would register for up to eight CEE 5904 credit hours, some of which should count towards the required 30-credit-hour MS degree. The CEE 5904 credit hours that count toward your degree (i.e., the ones you earn by performing research) are actual hours, not "program hours." If you have questions regarding "program hours," please see your advisor.

Grading of Research Credits

Students performing research under the direction of a faculty member must register for either CEE 5904, CEE 5994, or CEE 7994, depending on their degree path. These credit hours are graded and counted on the plan of study toward the required degree hours as described above.

By accepting to be a GRA, whether funded or unfunded, a commitment is made by the student to the advisor to deliver an intellectual product (e.g., a report, a set of experimental data, etc.) on or before an agreed upon date. At the end of each semester, the advisor will determine if research progress is acceptable. If progress is acceptable, then a grade of "EQ" is entered, and the corresponding number of hours are credited toward graduation. If the performance is not acceptable, the advisor will assign a grade of "I" if the work was not completed due to extenuating circumstances or illness. Still, there is an expectation the work will be completed as soon as possible. If the assigned research tasks are not completed due to other issues, the advisor will assign a grade of "NG." Typically, receiving a grade of "NG" will result in the termination of the GRA position, whether the student was funded or unfunded.

Additionally, scenarios may arise where a student receives an "EQ" as the grade for the first semester of a two-semester project, for example, but the student never completes the project (e.g., the student decides during the second semester that they are no longer interested in performing research). In such cases, the student's committee (to include the research advisor) will decide whether the credits received for the first semester of research will appear in the student's plan of study and count towards the required degree hours or whether these credits will be considered as "program hours." This applies regardless of whether the student was a funded or unfunded GRA.

A graduate degree will not be awarded until all "I" and "NG" grades are converted to the "EQ" grade. This will only occur if the advisor agrees that the scope of work is complete. Students must meet with their advisor on a regular basis to ensure that progress is satisfactory.

Courses Not Counting Toward Graduation

Certain courses required by the Graduate School or offered by CEE or other departments may not provide acceptable engineering content. As a result, they may not count as graduation credits and, in such cases, should be listed as "Supporting Courses" on the Plan of Study. Supporting Courses do not count toward the minimum credit hours required for graduation. When these courses have credit hours associated with them, they will count toward full-time enrollment in the semester that they are taken. Examples of courses that do not count as graduation credits include:

ENGE-5304-Graduate Student Success in Multicultural Environments (1 cr.)
GRAD 5004-Teaching Assistant Training Workshop (1 cr.)
GRAD 5944-Graduate Cooperative Education Program (1 cr.)
GRAD 7944- Graduate Cooperative Education Program (1 cr.)
Responsible Conduct of Research (no credit hours)

Check with your advisor if you are uncertain whether a given course may be counted for graduation credit.

Required Core Courses

The faculty developed a list of "core" courses that provide a strong fundamental background in geotechnical engineering. It is required that all students take these courses. However, the advisory committee can approve alternate courses if the student has sufficient background in one or more of these areas or is performing interdisciplinary research that requires core knowledge outside of geotechnical engineering.

CEE 5514 *Soil Behavior (Advanced Shear Strength)*	(3 credits - Fall)
CEE 5534 *Foundation Engineering I*	(3 credits - Fall)
CEE 5544 *Foundation Engineering II*	(3 credits - Spring)
CEE 5564 *Seepage and Earth Structures*	(3 credits - Spring)
CEE 5594 Geological Engineering	(3 credits – Fall)
CEE 5944 *Seminar*	(1 credit each, Fall and Spring)

One credit is earned towards the degree requirement for completing CEE 5944-Geotechnical Seminar for each the Fall and Spring semesters (2 credits maximum); these credits do count as graduation credits. The seminars provide an opportunity to develop good communication skills.

GEOTECHNICAL ENGINEERING COURSES AND SEMESTER OFFERED

The following courses are applicable towards graduate degrees in geotechnical engineering. Note that for those pursuing the Dual and/or UG/G Status programs, only one 4000 level course is allowed to be taken as part Dual and/or UG/G Status programs (any of the 4000 level courses listed below are eligible for the Dual or UG/G Status programs). Eligible 5000 level courses for the Dual and/or UG/G Status programs are designated following the course description.

CEE 4544: *Design of Earth Structures (Dove)* – Application of geotechnical engineering principles in the design and construction of earth structures. Subsurface models, shear strength of soil, slope stability, earth fills, earth retention, ground improvement, sustainability

considerations, geotechnical reporting. Team-based design project. C- or better in 3514. Pre: 3514. (3H,3C). SPRING.

CEE 4554: *Natural Disaster Mitigation (Rodriguez-Marek)* – Causes, mechanics, classification, and forces associated with tornadoes, hurricanes, floods, earthquakes and landslides. Resistance evaluation for existing ground, facilities and structures. Hazard-resistant design of new facilities. Risk and reliability assessment and decision analysis. Strategies and designs for natural disaster risk mitigation. Emergency response for protection of life and property and restoration of lifelines. Includes an interdisciplinary team project. Pre: C- or better in each of the following: CEE 3304, CEE 3514, and CEE 3684; (3H, 3C). SPRING.

CEE 4984: *Machine Learning Applications in CEE (Vantassel)* – This course introduces students to machine learning (ML) and its applications in Civil and Environmental Engineering (CEE). Students will learn to use publically-available, real-world data to solve CEE-type problems with ML. Course topics include data preprocessing, supervised learning, unsupervised learning, model evaluation, and model interpretation (see Course Schedule for full details). The course will also touch on how to best utilize large language models (like GPT4) and deep learning in a CEE context. (3H, 3C), FALL.

CEE 5500: *Numerical Modeling in Geotechnical Engineering (Yerro-Colom)* – Introduction to numerical methods and types of geotechnical numerical modeling, analytical closed-form solutions, finite difference method and examples, finite element method and examples, numerical solution schemes, commercially available geotechnical software: capabilities and limitations, examples, selection of modeling input parameters, concepts of verification and validation, calibration. This course is eligible to be taken as part of the Dual and/or UG/G Status programs. Pre: 5514 (3H, 3C) or consent of instructor. SPRING.

CEE 5504: *Risk Analysis in Geotechnical Engineering (Rodriguez-Marek)* – Basic concepts of probability, reliability analysis, geo-statistics, and risk analysis; application of these concepts to problems in geotechnical engineering. This course is eligible to be taken as part of the Dual and/or UG/G Status programs. (3H, 3C), FALL.

CEE 5510: *Thermal and Energy Geotechnics (Abdelaziz) –* Thermal properties of soils. Laboratory and in-situ thermal tests. Temperature effects on soil behavior. Design of thermo-active foundations. Pre: 5514, 5544. (3H, 3C), FALL.

CEE 5514: *Soil Behavior (Green)* – Core Course: Behavior of soil examined from a fundamental perspective. Review of methods of testing to define response, rationale for choosing shear strength and deformation parameters for soils for design applications. Pre: 3514 or equivalent; (3H, 3C). FALL

CEE 5524: *Advanced Soil Testing for Engineering Purposes (Castellanos)* – Methods of testing and analysis of soil for engineering properties including compressibility, strength in triaxial, simple, and direct shear, permeability; and stability. Pre: 3514 or equivalent; (1H, 6L, 3C). FALL.

CEE 5534: *Foundation Engineering I (Abdelaziz, Rodriguez-Marek)* – Core Course: Behavior and design of retaining walls and shallow foundations. Earth pressures, bearing capacity and settlement. Stress distribution and consolidation theories. Settlement of shallow foundations. This course is eligible to be taken as part of the Dual and/or UG/G Status programs and should be taken in place of CEE 4534. Pre: 3514 or equivalent; (3H, 3C). FALL

CEE 5544: *Foundation Engineering II (Abdelaziz)* – Core Course: Consolidation theory, applications, and numerical analysis. Secondary compression. Analysis and design of drive piles and drilled shafts to resist vertical and lateral loads. This course is eligible to be taken as part of the Dual and/or UG/G Status programs if the student has previously taken CEE 5534. Pre: 5534 or approval of the instructor; (3H, 3C). SPRING.

CEE 5554: *Soil and Site Improvement (Green)* – Interrelationship among soil origin, soil mineralogy, and soil classification. Behavioral differences between coarse- and fine-grained soils. Concepts related to admixture stabilization, soil compaction, deep improvement methods for cohesive and cohesionless soils, and soil grouting. This course is eligible to be taken as part of the Dual and/or UG/G Status programs. Pre: 3514 or equivalent; (3H, 3C). SPRING.

CEE 5564: *Seepage and Earth Structures (Yerro-Colom, Castellanos)* – Core Course: Seepage through soils. Permeability of soils. Embankment design. Compaction, earth pressures and pressures in embankments. Slope stability analyses. Settlements and horizontal movements in embankments. Landslide stabilization. Pre: 3514 or equivalent; 5514; (3H, 3C). SPRING.

CEE 5584: *Geotechnical Aspects of Earthquake Engineering (Green, Rodriguez-Marek)* – Earthquake basics; seismic hazard analyses; specification of seismic ground motion design parameters in building codes; site response analyses; liquefaction evaluation; analysis and design of slopes, embankments, and earth retaining structures for seismic loading. Pre: 3514 or equivalent; (3H, 3C). FALL.

CEE 5594/GEOS 5594: *Geological Engineering. (Fisher)* – Core Course: Mechanical and hydraulic properties of rock masses; analysis and design of rock foundations, slopes, tunnels and other forms of civil infrastructure; rock reinforcement. This course is eligible to be taken as part of the Dual and/or UG/G Status programs. Pre: 3514 or equivalent (3H, 3C). FALL.

CEE 5814: *Sediment-Structure Interaction in the Coastal Zone (Beemer)* – Introduction to sediment-structure interaction in subaqueous environments. Basic concepts of scour; scour around man-made structures; scour in the vicinity of ship propellers; the impact of liquefaction on scour. Pre: 3514 or equivalent; (3H, 3C). TBD.

CEE 5864: *Coastal and Estuarine Morphodynamics (Beemer)* – Sediment transport in marine environments; shoreline change; tidal inlet morphodynamics, barrier island processes; storm erosion; delta development; beach dynamics; slope and canyon evolution in the coastal zone; wetland evolution and development. Pre: 3514 or equivalent; (3H, 3C). TBD.

CEE 5874: *Coastal and Marine Geotechnics (Beemer)* – Geotechnical aspects of coastal and marine engineering and subaqueous sediment dynamics. Introduction to the coastal zone as a working environment; in-situ geotechnical methods and complementary techniques for investigation in the coastal zone and the marine environment; survey strategies. This course is eligible to be taken as part of the Dual and/or UG/G Status programs. Pre: 3514 or equivalent; (3H, 3C). TBD.

CEE 5944: *Seminar* – Core Course: Presentations and discussion of current research and consulting activities by students, faculty, and guest speakers. PASS/FAIL ONLY. (1H, 1C). FALL and SPRING. *Note: The seminar meets once per week during the Fall and Spring Semesters and counts for a total of two credits of 5000 level coursework toward graduation (1 cr. per semester). When we have an outside speaker, you should plan to attend whether you are taking it for credit or not. If you do take it for credit, sign up on a "pass-fail" basis.*

CEE 6504: *Introduction to Constitutive Modeling of Soil (Green)* – Mathematical preliminaries; review of continuum mechanics; overview of fundamentals of elasticity; elastic constitutive laws; overview of fundamentals of plasticity; plastic constitutive laws. Pre: 5514 (3H, 3C). On Demand (must have PhD standing to take for A-F; MS students are welcome to audit this course)

CEE 6514: *Advanced Soil Dynamics (Green)*– Determination of dynamic soil properties; dynamic behavior of soil; introduction to vibrations; machine foundation dynamic soil-structure interaction. Pre: 5584 (3H, 3C). On Demand (must have PhD standing to take for A-F; MS students are welcome to audit this course)

EXAMINATIONS

Official examinations *must be scheduled through the Graduate School*, in accordance with the requirements and timetable described in the publication entitled "Graduate Policies and Procedures Manual". When students schedule an oral exam, they also need to schedule a room in which to hold the exam. See Ms. Lytton (pkl16@vt.edu) in Room 120 Patton to reserve a room for your exam.

Master's Degree Exam Formats, Procedures, and Suggestions

All Master's Degree students must take a final oral examination, which is administered by three faculty members. Students must schedule the exam with Ms. Lytton (120 Patton,pkl16@vt.edu). The exam is to be held within the last 4 weeks of the semester of intended graduation. You must have a cumulative GPA of at least 3.0 to take the final exam. The goals of the Master's Degree oral exam include the following:

- To motivate students to complete a thorough review of the material in all their courses before they leave Virginia Tech.
- To provide an opportunity for students to exercise oral presentation skills. This includes the skill of "thinking on your feet," as you will have occasion to do in engineering practice.
- To provide the faculty with the opportunity to assess the student's general competency in geotechnical engineering prior to granting a master's degree.
- To provide the faculty with feedback on how well we are doing in teaching the essentials of geotechnical engineering to our students.

In order to achieve the above goals, the following formats have been established for students in the non-thesis and in the thesis options.

Master's Degree Oral Exam for Students in the Non-Thesis Option

- Each student will prepare a 7 to 10-minute presentation based on each Geotechnical Engineering Program course (except for the Seminar) that is listed on the Plan of Study. The focus of your presentations should be on 1 or 2 of the most important things that you learned in each course. Give concise presentations that demonstrate your knowledge and understanding. You should also be able to say why you believe your selected topic(s) is(are) important.
- In the oral exam, you will be asked to make presentations for two courses. You will not know which two until you get into the exam. This way, you will be motivated to perform a comprehensive review of all the courses you have taken.
- The only visual aid you will be able to use is the chalk/white board. The main intent behind this requirement is to facilitate additions and modifications to material on the board during the question time that follows your presentation. We want to give you an opportunity to respond to questions without referring to slides or other pre-prepared visuals.
- You may refer to notes while making your presentation. We strongly encourage you to practice your presentations in advance so that reliance on your notes is kept to a minimum, but you do not have to memorize all the presentations that you prepare.
- You must stick to the 7 to 10-minute time frame for each presentation. We will not interrupt you during your presentations, except to request clarification of points, if

needed. This will give you the opportunity to get relatively comfortable in the exam setting by being able to deliver a "canned" presentation before we begin asking questions.

- After each presentation, we will ask you questions about that presentation and other content in that course. It is possible that the questions will "stray" into material covered by other courses, or into other basic material in geotechnical engineering, but the focus will be on the courses you present. You will not be permitted to look at your notes during the question-and-answer portion of the exam.

Based on the exams that have been held using this format, we can offer the following suggestions:

- The best presentations have used the following approach: begin by giving a very short introduction stating what course will be presented and what particular topics you will address in your presentation. It is impossible to completely cover an entire semester-long course in 7 to 10 minutes, so you should choose 1 or 2 significant topics from the course to present on. Cover the basics and key points of these topics, but it is also important that you show us technical details. Your objective is to convey to us that you understand the material. Do not just recite lists. Expect questions from the examiners based on your presentations and other information from that course, and possibly related topics from other courses. We recommend that you try to anticipate likely questions and work out responses ahead of time.
- There is no need to write everything you say on the chalk/white board. We are not going to take notes. The principal use of the chalk/white board should be to draw graphs. Remember to label axes on graphs. For some topics, it may also be appropriate to use the chalk/white board for writing equations or illustrating procedures.
- It is very important to stick to the time limits. Going under creates an impression that you do not understand the material. *We will usually stop you if you go over the 10-minute limit*, so you need to have covered what you want to cover by that point.
- Practice your presentations beforehand. Get comfortable speaking and working on the chalk/white board. Start at the upper left and work to the lower right. Break a new piece of chalk in half to help prevent the sound of the chalk scratching on the board. Practice writing on both chalk and white boards; they are different, and to write clearly on them requires practice. Also, using the board effectively requires forethought. Think through ahead of time how you will use the board space to achieve legibility and clarity and avoid overcrowding of information.
- Take responsibility for your presentations. Get there early and if necessary, thoroughly clean the board. Verify that there are markers/chalk that are in good condition (consider bringing your own, just in case). As a last resort, you can usually get help with these from the main desk in 200 Patton. The main thing is to take full responsibility and get everything ready ahead of time.
- If you do not know the answer to a question, reason your way through it (we will help you); do not try to fake your way through it. It is better to admit you do not know and try to reason your way through it, than it is to guess or just to say "I don't know" and stop there.

Master's Degree Oral Exam for Students in the Thesis Option

For students in the research thesis option, presentation of course summaries are not required. Rather, the student's presentation will focus on the research the student performed that comprised their thesis. However, the student could be asked questions on subjects covered in courses that are related to their research topic.

Repeating the Master's Degree Exam

If you do not pass the exam for the thesis or non-thesis options, you must wait at least 15 weeks before retaking the exam. Please see your advisor/committee if you do not pass, and we will try to help you overcome weak areas. Remember that you can only take the exam twice.

If you have any questions regarding the oral examinations, please feel free to discuss them with any of the geotechnical engineering faculty.

Ph.D. Examinations-Formats and Procedures

The Graduate School recognizes and requires two Ph.D. Examinations: The *Preliminary Exam* and the *Final Exam* (http://graduateschool.vt.edu/graduate_catalog/policies.htm). Students *Advance to Candidacy* after passing the Preliminary Exam. Departments and programs in the University stipulate the requirements for these two exams and may require other exams in addition to the two required by the Graduate School. The information below sets out the Ph.D. Exam requirements for students in the Geotechnical Engineering program.

The Ph.D. Examinations for Geotechnical Engineering are three-fold:

(1) Qualifying Exam, (a) written and (b) oral;
(2) Preliminary Exam (proposal defense);
(3) Final Exam (dissertation defense).

The Qualifying Exam (#1a and #1b below) is administered by the Geotechnical Engineering program and the CEE Department. The Preliminary and Final Exams (#2 and #3) correspond to the Graduate School requirements and must be scheduled through the Graduate School.

A student must have a cumulative GPA of at least 3.5 for courses taken after being admitted into the Ph.D. program in order to take any portion of the Ph.D. examination.

Qualifying Exam

The Qualifying Exam has two parts: (a) a 3-day, open-book, written exam; and (b) an oral exam. Subject-matter for both the written and oral exam portions will include the student's coursework from Virginia Tech as well as core knowledge in several key areas. The purpose of the Qualifying Exam is to test subject mastery. Questions may require synthesis, interpretation, analysis, and creativity beyond that required in individual courses the student has taken. Regardless of courses taken, students should be prepared to answer questions in the following subject areas:

- Soil mechanics (e.g., shear strength, consolidation, etc.)
- Geotechnical engineering (e.g., foundation engineering, slope stability, geotechnical earthquake engineering, etc.)
- Engineering geology
- Field and laboratory investigation and testing

Timetable

The written and oral portions of the Qualifying Exam should be completed within the first two years after the student enters the PhD program. Students must pass both the written and oral

portions of the Qualifying Exam before being allowed to take the Preliminary Exam (Proposal Defense).

1a. Written Exam

The written portion of the Qualifying Exam is a 72-hour, open-book, take-home exam. The written exam is comprehensive and typically consists of seven questions, of which the student chooses six to answer. Certain questions may be required (i.e., the student has to answer these questions). The questions are designed to each take about 6 hours to complete. A passing score on the written exam is 70%, calculated as the average of the scores on individual questions. Each question will state the resources that the student is allowed to use to answer the question. The student is responsible for asking for clarification on what resources can be used if ambiguity exists, rather than just assuming they can use a certain resource.

Scheduling the Written Exam

The written part of the Qualifying Exam is typically offered twice each year, in January and August/September. Students may petition the faculty to take the exam at another time; such requests will be considered on a case-by-case basis.

Students should take the written part of the Qualifying Exam as soon as they are ready and no later than 24 months after beginning their doctoral studies. Students must pass the written part before taking the oral part. A student who fails the written part and wishes to retake it must do so the next time it is offered. In such cases, the above-mentioned 24-month limit will be extended if necessary. The written part cannot be taken more than twice.

Written Exam Committee

The examining body for the written portion of the Qualifying Exam is usually the Geotechnical Engineering faculty or a subset thereof but may, in some cases, include one or more external members. One or more external members may be asked to join the committee if the student's coursework includes courses outside the geotechnical program that are important components of the student's program of study. The student, in consultation with their advisor, may request inclusion of external committee members.

Answer Format Expectations

- Typewritten (word-processed) *summary* responses to each question are required.
- Supporting materials, such as plots, equations, and calculations, can be created either electronically or by hand, at the student's choice, so long as the work is neat, complete, and easy to follow.
- Responses to each question must be kept on separate pages
- Transmittal memos are not required.

Asking Questions

Students will be informed which professor generated each question. Should a student feel that clarification of a question is needed, they may contact the authors of any such questions by sending email, visiting offices, or telephoning offices. They should also feel free to contact the exam coordinator.

Confidentiality
The written part of the Qualifying Exam is confidential. Questions on qualifying exams are not to be discussed by students before, during, or after taking the exam, except for discussions with the Geotechnical Engineering faculty.

1b. Oral Exam
The oral portion of the Qualifying Exam will focus on the subject areas identified in the leading paragraphs and bullets under [1. Qualifying Exam]. If the exam is likely to cover material outside the geotechnical material discussed above, the student will be informed of this by their advisor. The student's prior performance on course work and on the written portion of the Qualifying Exam may influence, to some extent, the scope and nature of questions asked on the oral portion of the Qualifying Exam. For example, if the student has done very well on course work and on the written portion of the Quals, then the oral exam may be brief, but not necessarily so. Unless requested to do so by their advisor, students are not expected to prepare presentations on coursework for the oral exam. Typically, the oral exam will take no more than 2 hours.

Scheduling the Oral Exam
After a student passes the written portion of the Qualifying Exam, the composition of the oral exam committee is determined and the student and advisor work with the exam committee to schedule the oral portion of the Qualifying Exam. The oral exam should ideally be taken within a month after the student is notified of a passing grade on the written exam.
If a student fails the oral portion of the Qualifying Exam, he/she should ideally take it again within a month. The oral exam cannot be taken more than twice.

Oral Exam Committee
The oral exam committee will typically be three in number and may include external members (i.e., members external to the geotechnical faculty). The student's oral exam committee is distinct from the student's Ph.D. Advisory Committee. The composition of the oral exam committee will be determined by the geotechnical faculty.

2. PRELIMINARY EXAM (PROPOSAL DEFENSE)

The Geotechnical Engineering program faculty considers the proposal defense to be the official Ph.D. Preliminary Examination, as recognized and required by the Graduate School for all Ph.D. students. Once a student receives a pass on the proposal defense, he/she advances to Candidacy.

Examining Body for the Prelims

The examining body for the Preliminary Exam (proposal defense) is the student's Ph.D. advisory committee.

Research Proposal

The student, working closely with their advisor, prepares a well-organized, succinct research proposal. Students can ask their advisor for examples of previous well-written proposals. Many effective proposals have been 20 pages or less in length.

The main purpose of the proposal is to help the student define their research goals and plans. A well written proposal is of great value and will serve as a guide document throughout the

research (although it is likely to evolve as the study progresses). The proposal also conveys to the committee the student's preparation and discipline as a researcher.

Most proposals will have structure and components similar to the following, although *headings will vary and sections may be omitted, combined or rearranged depending on the nature of the work and stylistic preferences.*

MAIN SECTIONS

- Cover page - identifying writer, institution, department, advisor, committee members, degree, exam date, and title of the dissertation
- Project Summary (1 page)
- Table of Contents
- Project Description

ELEMENTS OF PROJECT DESCRIPTION

1. Introduction – including motivation, overall goals of the research, relevant background, significance of proposed work
2. Literature review – concise, yet thorough and in-depth where most relevant to the proposed work
3. Research objectives – key research questions to be addressed, purpose of study (be specific), hypotheses
4. Research plan – mapping from research tasks to objectives
5. Initial results, if applicable
6. Intellectual Merit – expected significance. Why is this important in terms of advancing the field? This section might not be necessary, particularly if it is addressed in the Introduction.
7. Broader Impacts – why does this work matter to society? What benefits do you foresee? This section might not be necessary, particularly if it is addressed in the Introduction.
8. Schedule/timeline showing work already finished, work to be completed, and plans for disseminating results
9. References

Distributing the Proposal and Scheduling the Committee Meeting

After receiving the go-ahead from their advisor, the student distributes the proposal to the advisory committee. The day on which this is done is the "proposal distribution date," referred to below. At this time, the student also schedules a formal advisory committee meeting. The committee meeting should be scheduled to occur approximately four weeks after the time the proposal is given to the advisory committee.

Formal Committee Meeting (Two Possibilities)

After reading the proposal, the committee will decide whether or not the student is ready for the proposal defense. This decision will be relayed to the student in a formal committee meeting, the focus of which will be one of the following:

1. An advisory meeting with a focus on providing comments on the proposal and outlining required changes. In this case, the committee will determine the timeline to implement changes, the schedule for any subsequent formal advisory committee meetings, and the schedule for the Preliminary Exam (proposal defense).

2. The Preliminary Exam (proposal defense). After the committee has reviewed the submitted proposal, it may be determined that the student is ready for the

Preliminary Exam (proposal defense). If this is the committee's decision, the Preliminary Exam will be held at the time scheduled for the formal advisory committee meeting, and the student should immediately schedule the Preliminary Exam for this time with the Graduate School (which requires two weeks' advanced notice of the Prelims).

The committee chair will inform the student within 10 days after the proposal distribution date as to whether the committee meeting will serve as (1) an advisory meeting, or (2) the Preliminary Exam.

If the former (1), the student revises the proposal after the advisory committee meeting and waits until she/he receives the go-ahead from their advisor to distribute the newly edited proposal to the committee – and the process is repeated. In the latter case (2), **it is the responsibility of the student to schedule the Preliminary Exam as soon as possible through the Graduate school (see below).**

Scheduling the Preliminary Exam

With the approval of their advisor, the student first coordinates the time and place for the Preliminary Exam with their advisor and the advisory committee members; and secondly schedules the Preliminary Exam time and date with the Graduate School.

The Graduate School requires that

- The Preliminary Exam must be taken at least six (6) months before the Final Examination.
- The REQUEST TO ADMIT CANDIDATE TO PRELIMINARY EXAMINATION form is submitted to the Graduate School at least two weeks prior to the exam. **This is a requirement of the Graduate School and is the responsibility of the student.**

Graduate School policy requires that the Preliminary Exam be completed at least 6 months before the Final Exam (Dissertation Defense). However, it is recommended that the Prelims be taken as soon as possible after passing the Qualifying Exam. If a student fails the Preliminary Exam, he or she must wait one semester before taking it again. The Preliminary Exam cannot be taken more than twice. Upon successful completion of the Preliminary Exam (Proposal Defense), the student advances to doctoral candidacy.

Format of Preliminary Exam (Proposal Defense)

The proposal defense normally begins with the student presenting a condensed version of their research proposal in an appropriate medium (such as PowerPoint). It is important that the presentation includes the following components:

- Introduction, including motivation and background
- Key prior work
- Goals, objectives, and/or hypotheses to be tested
- Research plan, including percent complete for each task
- Initial results, if applicable
- Expected results
- Plans for disseminating results

This presentation should be planned for about 20 to 30 minutes but will probably take longer because of questions during the presentation. After the presentation, committee members may

ask further questions and make suggestions regarding the proposed research. There are no course-work questions during the proposal defense.

3. FINAL EXAM (DISSERTATION DEFENSE)

The Final Exam consists of a dissertation defense before the advisory committee. The defense begins with a presentation of the student's research, which should be planned for about 35 to 45 minutes, but will probably take longer because of questions during the presentation. After the presentation, the faculty may ask further questions about the research. No course-work questions will be asked during the Final Exam.

Scheduling the Final Exam (Dissertation Defense)

The Graduate School requires that

- The Final Exam be scheduled no earlier than six months after the successful completion of the Preliminary Examination.
- The REQUEST TO ADMIT CANDIDATE TO FINAL EXAMINATION form be submitted to the Graduate School at least two weeks prior to the exam. **This is a requirement of the Graduate School and is the responsibility of the student.**

Additionally, the student shall submit the dissertation to the committee members at least two weeks before the defense. However, the submission date of the dissertation may be more or less than two weeks before the defense, as agreed upon by the entire committee. [Note that the default submission date to the committee is two weeks prior to the defense, and changes to this date are a committee decision, not the sole decision of the student or the advisor.]

Honor System

Virginia Tech has a campus-wide graduate honor system. However, the system allows flexibility in what a course Instructor considers as acceptable/unacceptable conduct in each course. Accordingly, ensure that your conduct in each course is in accord with what the instructors consider acceptable; acceptable/unacceptable conduct will be outlined at the beginning of each course. The Geotechnical faculty generally encourages graduate students to cooperate and to learn from each other; this is not necessarily the case for courses outside the Geotech program. However, copying someone else's homework or exam is a clear violation of the honor code. Also, discussing problems on a take-home exam with someone other than the course instructor and/or using material from previous semesters are clear violations of the honor code. For reports, papers, theses, essays, etc., submitting someone else's work, or even their ideas, without clearly indicating the source is plagiarism, which is a very serious violation of the honor code. **Always indicate clearly the source of anything you submit in any course or for your research.** This includes existing and to-be-developed generative artificial intelligence (AI) tools such as ChatGPT and other related technologies, if these resources are allowed to be used on an assignment/exam. The student is responsible for asking for clarification on what resources can be used if ambiguity exists, rather than just assuming they can use a certain resource. The Geotech faculty take honor code violations very seriously and will do everything possible to have violators removed from the program. The complete Honor Code is here.

GENERAL RESOURCES

Student Office Space

Room 20 Patton is the primary office space for master's students. Rooms 19 and 111 Patton are the offices for Ph.D. students. Desk assignments are posted on the door of Room 20 Patton. If you have not been assigned a desk and you would like one, ask Ms. Lytton (pkl16@vt.edu) to put your name on the waiting list.

Room 22 Patton is the Geotechnical Program conference room and is just outside of Dr. Castellanos and Hosseini's offices. Use of the conference room must be scheduled with Dr. Castellanos.

Ozawa Library

The Ozawa Geotechnical library is in Room 18 Patton (enter through Room 20), and it contains the physical resources described in the next paragraph, a conference table and television, three computers, and multiple printers, all available to be used by the graduate students. Rooms 18 and 111 Patton have combination locks, and Room 19 requires a key to open. If given a combination or a key, guard it, do not write down the combination, and do not give it to anyone who is not a member of the Geotechnical Graduate Program.

The Ozawa Geotechnical Library and Room 22 contain valuable sources of information related to the field of geotechnical engineering. These resources, which are available to all students and faculty, include magazines, journals, ASCE publications, conference proceedings, theses, and textbooks covering numerous topics. Textbooks are organized by author and are located in the conference room area of the library. Journals and conference proceedings can be found in the Ozawa Geotechnical library annex in Room 22.

The library operates on an honor system. In order to maintain the availability of these resources, the policy for checking out items from the Ozawa Library is as follows:

1. Textbooks and other materials marked with the "DO NOT REMOVE FROM THE OZAWA LIBRARY" sticker may be taken to your desk and returned as soon as you are finished with them. You may also take them to a photocopier if necessary, as long as you return them as soon as possible. Please do not take these materials home.
2. All other materials may be checked out from the Ozawa Library for the day or overnight as follows:
    - Sign the item out on the check-out sheet provided.
    - On the sheet, write your name, the date of checkout, the title and author of the item, and the call number of the item (the 4-digit number in the lower right-hand corner of the white sticker on the cover). See the example below:

Your Name (first & last)	Checkout Date	Date Returned	Title	Author (last, first)	Call Num.
John Smith	2/5/23		Collapse of Dry Sand	Shopek, Petr	6669

    - Return the material by 10:00 AM the following morning to the "RETURN BOOKS HERE" shelf and write in the date returned. Please do not re-shelve material yourself. The Librarian will return the materials to their proper locations.

Electronic Journal Access

Virginia Tech's libraries contain a large number of full-text electronic journals, e-books, electronic access to ASTM Standards, and more. As a consequence, the extensive collection of paper journals and proceedings in the Ozawa library and Newman Library are an invaluable resource to students and faculty.

Computers

General use computers are intended for Geotechnical Program students and undergraduates that are working with a faculty member on undergraduate research. Please get instructions on use of any hardware or software with which you are unfamiliar. Do not make illegal copies of copyrighted software and do not upload "bootlegged" software to the hard drives. Please do not

use a computer for more than 1 hour when others are waiting. You may save your personal files under the "C:\USERS" directory after creating your own personal folder in the "USERS" directory. Please do not store personal files in any directory other than in "USERS." It is best to use your university-supplied Google Drive space to store your files. There is limited space available on the hard disks and periodically files will be erased to increase disk storage space, including files in the "USERS" directory. A notice will be posted before these files are erased. Always back up your important files on removable USB flash drives or on your Google Drive space.

INSTRUCTIONAL AND EXPERIMENTAL RESEARCH FACILITIES

The Geotechnical Engineering Laboratories used for teaching are located in Rooms 17, 24, and 25 in Patton Hall. The off-campus facilities, the W.C. English Geotechnical Research Laboratory and the Price's Fork Geotechnical Laboratory, are used primarily for research.

Note: Computers within instructional and research laboratories are for class or research use only and not for "general use" by graduate or undergraduate students unless authorized by the supervisor of that laboratory.

Patton Hall Instructional Labs

The instructional laboratories used for CEE 3514 (Patton 17 and Patton 24) are under the administrative supervision of Dr. Joseph Dove, Patton 110 and English Lab 04, jodove@vt.edu. Only under special arrangement with Dr. Dove may these rooms be used for research tests. The health and safety administration of these labs is under the control of the Laboratory Manager.

Room 17 is used for soil preparation and index testing for undergraduate and graduate courses.

Room 24 is used for hands-on laboratory instruction for CEE 3514.

Room 25 is the graduate teaching laboratory used by CEE 5524, and for advanced tests in CEE 3514. This laboratory is outfitted for shear strength and compressibility testing of soils.

W.C. English Geotechnical Research Laboratory

The facilities and equipment in geotechnical engineering cover application areas from drilling and state of the art laboratory testing to virtual environments. The English Geotechnical Research Laboratory was completed in December 2002 and dedicated in September 2003. It has 6,100 square feet of high-quality research space.

Four laboratories are housed in the English Lab. These include the James K. and Virginia W. Mitchell Soil Behavior Laboratory, the Ray and Carol Martin *In Situ* Testing Laboratory, the Virginia Geotechnical Services Interface and Models Laboratory, the Thomas L. Brandon Strength and Compressibility Laboratory. Other facilities include the Arthur W. and Jerry S. McKinney conference room, a humid room for the storage of soil samples, and offices for faculty and students. It is fully compliant with the Americans with Disabilities Act.

Soil Testing

A major effort has been made to equip the English Laboratory with extensive capabilities for strength and compressibility testing of soils. Conventional tests can be conducted according to ASTM specifications and a wide array of unconventional and unique tests can be performed as

needed to support our research. The labs have pluviation devices for coarse-grained soil, slurry consolidometers for fine-grained soil, and many tools necessary to perform research testing. Test capabilities are described below.

1. Triaxial Tests. Eight automated research triaxial stations (Geocomp and GeoTAC) are available to perform stress path tests on soil specimens from 1.4 inches in diameter to 6 inches in diameter. Four cyclic triaxial test stations, a CKC electro-pneumatic system, a Geocomp electronic linear actuator system, a GCTS servo-hydraulic system, and an MTS servo-hydraulic system, are used to perform resilient modulus tests and to simulate earthquake loading and other vibration effects on soil.
2. Simple Shear Tests. Both static and dynamic simple shear tests can be performed on soil specimens. Five NGI-style apparatuses are available for performing static tests on 2.5 to 3.0-inch diameter specimens. Two cyclic simple shear apparatus (electro-pneumatic and servo-hydraulic) are available for research liquefaction and/or seismic compression testing.
3. Consolidation Tests. A wide assortment of consolidation test apparatuses is available in the geotechnical engineering laboratories. The inventory includes six lever-arm incremental stress apparatuses, five pneumatic consolidometers, and ten fully-automated consolidometers. In addition, two instrumented odeometers that measure horizontal stress are available.
4. Direct Shear and Ring Shear Tests. Eleven direct shear apparatuses and two ring shear apparatuses are used to measure the shear strength of coarse and fine-grained soil. Specimen sizes from 2” × 2” to 18” × 28” can be accommodated.
5. Resonant Column Tests. The GDS Resonant Column Apparatus (GDSRCA) is a true fixed free resonant column where one end of a confined solid or hollow cylindrical soil specimen is excited and the other is fixed. From the resonant frequency, small strain stiffness can be found.

<u>Shallow and Deep Water Soil Characterization and Imaging</u>

1. Seafloor imaging. Several GoPro Hero 3 underwater video cameras are available for underwater video recording. A Kongsberg MesoTech rotary side scan sonar allows acoustic 360° seafloor imaging at high resolution. The device can also be used in pencil beam mode for bathymetric surveying.
2. Scour assessment. A Nortek Scour Monitor five beam echo sounder is available for long-term scour assessment.
3. Flow velocity measurements. A Nortek AquaDopp HR is available for 3D high resolution flow velocity measurements.

<u>Non-Invasive, Non-destructive Site Characterization</u>

1. Two 24-channel geometrics Geode seismographs with 48-4.5 Hz vertical and 48-4.5 Hz horizontal geophones from Geospace Technologies for active-source studies [e.g., Multi-Channel Analysis of Surface Waves (MASW)].
2. 10 broadband (120 s to 100 Hz) seismometers from Nanometrics for measurements of ambient noise [e.g., Microtremor Array Measurements (MAM), Horizontal-to-Vertical Spectral Ratio (HVSR)].
3. 125, 3-Component 5 Hz nodal stations from SmartSolo for spatially distributed sensing on 2-dimensional surface grids for active-souce and passive-wavefield imaging studies (e.g., Full Waveform Inversion (FWI)].

Price's Fork Geotechnical Laboratory

The geotechnical program has an off-campus laboratory located about three miles from the Virginia Tech Campus at the Price's Fork Research Station. This laboratory houses the Instrumented Retaining Wall Facility, the *In Situ* Test Instrument Calibration Chamber, and two drill rigs.

The Instrumented Retaining Wall Facility has been developed to study both the factors that control the magnitudes of earth pressures induced by compaction and the influence that wall movements have on earth pressures. The wall, which is 7 feet high and 10 feet long, is instrumented with load cells and pressure cells so that the normal loads, shear loads, and normal pressure distribution on the wall can be measured.

The *In Situ* Test Instrument Calibration Chamber allows the evaluation of *in situ* test instruments under carefully controlled conditions. The chamber accommodates a soil specimen 5 feet in diameter by 5 feet tall. The chamber consists of a steel cylinder, with bottom and top plates that are bolted onto the cylinder. The soil specimen is contained within a cylindrical flexible liner, and confining pressure may be applied using either water or air in the annulus between the sample and the cylinder walls. Vertical stress is applied independently through air pressure bags which act on the free-floating base plate beneath the sample. Stresses of up to 100 pounds per square inch can be applied to the test specimen. A cone penetrometer can inserted through a centrally located hole using a 5 ton, constant rate of displacement, hydraulic ram.

There are two drilling rigs with the necessary equipment for employing a variety of sampling and *in situ* testing techniques. Our Mobile B-80 drill rig is mounted on a four-wheel-drive Ford F-700 chassis and is capable of drilling to depths exceeding 300 feet in soil. We have both solid-stem and hollow-stem augers for use with the rig. Our Sprague-Henwood, skid-mounted drill rig is designed for taking core samples of rock. This rig is portable and is ideally suited for remote applications.

Our inventory of *in situ* and ancillary test equipment includes the following:

- 5 – 4.2 cm^2 cone penetrometers (developed at Virginia Tech)
- 10 cm^2 standard cone penetrometer (Fugro)
- 10 cm^2 piezocone (Hogentogler)
- 15 cm^2 standard cone penetrometer (Hogentogler)
- 2 Marchetti Dilatometers
- Dynamic cone penetrometer
- 4 in O.D. Cambridge Self-Boring Pressuremeter
- 3 in O.D. 9-arm Cambridge Self-boring Pressuremeter
- 12 channel signal enhancement seismograph (EG&G Geometrics)
- Magnetometer (EG&G Geometrics)
- 3 offshore portable free fall penetrometers (BlueDrop), one with on board cameras
- 4 wave gauges and field pore pressure sensors

Geosynthetic pullout device. This test device consists of a 3 × 5-foot plan dimension by 1-foot-high soil volume. Dual hydraulic rams can apply up to 20,000 pounds of horizontal pullout force at less than 0.04 inches per minute displacement rate.

LABORATORY SAFETY POLICY

Introduction

The Virginia Tech geotechnical program is committed to providing a safe research environment. Experimental research in the program spans a wide range of activities. A few examples of the types of research activities are listed below:

- Strength and compressibility testing using automated equipment
- Calibration chamber testing requiring the use of an overhead crane
- Field-scale load tests of embankments or foundations

Each of these testing activities has its own set of safety challenges and requirements. The goal of this policy to outline the training required for all students and faculty performing experimental research in geotechnical engineering at Virginia Tech. Additional safety training requirements, not specified in this policy, may be identified for particular projects. In every case, the primary responsibility for safety lies with the research team and the individual performing the tests. Everyone must accept responsibility for acting in a safe manner.

The following research facilities covered by this policy:

- Patton Hall Rooms 17, 23, 24, and 25
- W.C. English Geotechnical Research Laboratory
- Price's Fork Laboratory
- Kentland Farm Research Area

The following program personnel are responsible for maintaining and implementing this policy.

- Laboratory Manager: Dr. Bernardo A. Castellanos, Patton 23 and English Lab 03, bernardo@vt.edu

Safety Training Procedure

The steps outlined in this section are required **BEFORE** starting experimental research at any of the program's research facilities. Individuals participating in research in the facilities of other departments, program areas, or universities must inquire about and adhere to their safety procedures.

Introductory Meeting

The first step is a brief in-person meeting between the student, the advisor/project principal investigator (PI), and the Laboratory Manager and/or Director. The purposes of this meeting are to introduce the student to the Laboratory Manager and Director, to explain laboratory use and safety policies, to discuss the particular research project, to discuss and fill the laboratory safety acknowledgement sheet attached to this policy, and to identify project-specific safety training or personal protective equipment (PPE) requirements. This meeting must be repeated if the student starts a new research project or the scope of a project changes significantly.

Laboratory Tour

The second step is a brief tour of the laboratory areas where the research will be performed. The student will be shown the following:

- Location of emergency contact lists
- Location of first aid kits
- Location of eye-wash stations
- Location of fire extinguishers
- Overview of testing equipment in the laboratory

Online Safety Training

All Students

Safety training for students is provided through the university's Environmental Health and Safety (EHS) office. This training is provided online by EHS (http://www.ehss.vt.edu/training/) and is free. At a minimum, students are required to take the following classes:

- Personal Protective Equipment Awareness
- Electrical Awareness
- Portable Fire Extinguisher

Additional Training

During the introductory meeting, project specific research activities will be discussed. Additional training may be assigned at this time or later in the project, as needed. Types of additional training include but are not limited to:

- General Laboratory Safety (reqd. for use of chemicals)
- Overhead/Mobile Crane Safety (reqd. for work at Prices Fork Lab)
- Respirator (reqd. for work with silica or other dust producing processes)
- Hand and Power Tool Safety
- Ladder Safety
- Fall Hazard Awareness
- Excavation Awareness
- First Aid/CPR/AED-Pediatric (reqd. for individuals involved in remote locations or field work)
- Nuclear gauge
- Bobcat/Powered Industrial Vehicle
- Confined Space Awareness (reqd. for work at Prices Fork Lab)
- Confined Space Entrant/Attendant/Supervisor

The Laboratory Manager has the ability to monitor the classes that researchers take and to ensure that researchers are up-to-date with their training. These training classes are meant to introduce the student to the hazards involved in working in particular environments and to safe work practices. They do not necessarily provide practical training on the appropriate use of a particular piece of equipment.

Personal Protective Equipment

Personal protective equipment (e.g. gloves, safety glasses, hard hat, respirator, etc.) is an important part of safe experimental research. The Laboratory Manager has been trained by EHS as a PPE coordinator and is qualified to assign PPE to students for research activities. During the introductory meeting, the Laboratory Manager will perform a Hazard Assessment of the experimental procedures, using the appropriate EHS form. This assessment will identify the PPE required for the project. Limited PPE, such as insulated gloves for the ovens, may be supplied by the laboratory. The student and advisor must coordinate to obtain the required PPE.

Some soils, such as silica-based sandy soils, require the use of a respirator. Respirators and the accompanying training must be obtained from EHS and must not be purchased independently. Paper dust masks are only acceptable for nuisance dust and individual sensitivity, and must not be used in lieu of a respirator.

Laboratory Safety Rules

General

- Experimental research should be performed carefully and without haste.

- No one under the influence of drugs or alcohol is allowed to use the geotechnical research laboratories.

Appropriate Clothing

- Closed toe shoes must be worn in all laboratories. Boots with leather uppers should be worn for work at the Prices Fork and Kentland Farm facilities.
- Loose fitting clothing is not allowed.

Test Setup Area

- Testing areas should be kept clean and organized.
- Air lines, tubing, and cabling must be neatly strung and coiled. These must not permanently extend across the floor, creating a trip hazard.
- Extension cords should not be used in lieu of permanent wiring. Where an extension cord is needed for temporary use, the cord must be rated heavy or extra-heavy duty.
- Power strips must be plugged directly into an electrical outlet, not another power strip or an extension cord.
- Leaks or spills must be immediately cleaned up, and the Laboratory Manager should be informed.
- All containers (primary or secondary) should be clearly labeled with their ingredients, including water bottles.
- It is the responsibility of each laboratory user to maintain a safe test setup and warn others of potential safety hazards associated with test setup.

Hazardous Materials

- The project PI must be aware of hazards associated with any materials used in the research. The PI must inform the students and Laboratory Director and Manager of these hazards. If necessary, a Chemical Hygiene Plan must be implemented. For more information, PIs should speak with the Laboratory Director or Manager, or contact EHS.
- Hazardous materials and research related chemicals must not be disposed of in trash cans or the sink. The Laboratory Director or Manager must be contacted and will make arrangements with EHS for disposal.

Working Alone

- Students are permitted to work alone in the office areas of the laboratory.
- Some activities, such as operating power tools, moving heavy samples, and operating large soil testing equipment, pose additional hazard and should not be performed unless someone else is in the building (not necessarily working on the same project). These restrictions will be identified during the introductory meeting.
- In general, the research activities performed at the Prices Fork and Kentland Farm facilities prohibit working alone. The only exceptions are visits to obtain sensor readings and computer operation.

Accidents and Accident Reporting

- For serious injuries, call 911 immediately after assessing the situation.
- For less serious injuries requiring medical attention, the injured person may be transported to the Carilion Velocity Care clinic, the Montgomery hospital, or a similar facility. An injured person must not be allowed to take themselves to a medical facility.

- First aid kits are available in all the laboratories for use in responding to accidents.
- All accidents resulting in injury must be reported to the Laboratory Director or Manager. They will complete the appropriate process to document and/or investigate the accident. It is considered a major infraction not to inform the Laboratory Manager of injuries.

Laboratory Visitors

- The laboratories occasionally have visitors such as university personnel or project sponsors. These visits must be scheduled in advance with the Laboratory Manager and/or Director. The Laboratory Manager will then notify the laboratory users of the planned visit.
- At a minimum, visitors should wear closed toed shoes, and appropriate clothing.

Confined Space (Calibration Chamber)

The hole underneath the calibration chamber is considered to be a confined space. Accessing this hole is only required under very special circumstances and should not be done without first notifying the PI or the Laboratory Director or Manager. To enter this confined space, the entrant should have taken the Confined Space Entrant/Attendant/Supervisor training and should not do this alone. All the safety measurements should be taken prior to entering the confined space and the "Confined Space Entry Assessment" form should be completed. After exiting the confined space, the "Confined Space Entry Assessment" form should be signed by the entrant and the supervisor.

Violations

In order to use the geotechnical laboratories, students must complete the safety training outlined in this procedure and be eligible to perform experimental research as defined in the *Laboratory Use Policy (GEOT-001)*. Unqualified students found working in the laboratory will be asked to immediately leave the laboratory and will not be permitted to return until the appropriate qualifications have been met.

The following violations will result in the loss of laboratory privileges for one week for the first offense and one month for subsequent violations:

- Working without required safety training
- Working alone on restricted research tasks
- Failing to report accidents

The following violations will result in a warning for the first offense, the loss of laboratory privileges for one week for the second offense, and one-month loss of laboratory privileges for subsequent violations:

- Inappropriate clothing
- Missing or inadequate PPE
- Dangerously untidy work areas
- Unprofessional behavior

Laboratory Safety Acknowledgment Sheet

Geotechnical Research Laboratories
Virginia Tech

This form must be filled out and submitted to the Laboratory Manager by all students performing experimental research in Virginia Tech geotechnical laboratories. This form will be completed during the introductory meeting with the Laboratory Manager. The form will be kept with the Student Information Sheet in a secure location by the Laboratory Manager.

Student Name: _____

Advisor/Project PI: _____

Email: _____

Research Description: _____

_____

_____

Required PPE: _____

Restrictions on Working Alone: _____

_____

Completed Laboratory Tour: _____

Online Safety Training: Personal Protective Equipment Awareness: _____

Electrical Awareness: _____

Portable Fire Extinguisher: _____

Other: _____

By signing below, I acknowledge that I have read, understand, and agree to abide by the Virginia Tech Geotechnical Program's *Laboratory Safety Policy (GEOT-002)*. I intend to create and implement safe work procedures and test setups.

Student Signature: _____ Date: _____

LABORATORY USE POLICY

Introduction

The Geotechnical Program at Virginia Tech is proud to have state-of-the-art experimental research and teaching laboratory facilities. This purpose of this policy is to maintain that excellence and provide fair and safe access to those facilities to students and faculty. The Laboratory Safety Policy (GEOT-002) is an important complement to this policy and must be followed by all persons using the geotechnical laboratories for experimental research.

The teaching and research facilities covered by this policy include:

- Patton Hall Teaching Laboratory– Rooms 23 and 25
- W.C. English Geotechnical Research Laboratory
- Price's Fork Laboratory
- Kentland Farm Research Area

The following personnel are responsible for overseeing these laboratories. Questions and concerns regarding this policy should be directed to them.

- Laboratory Manager: Dr. Bernardo A. Castellanos, Patton 23 and English Lab 03, bernardo@vt.edu

This policy applies to all students and faculty that independently use the laboratory facilities, including those performing non-experimental research.

The teaching laboratories used for CEE 3514 (Patton 17 and Patton 24) are under the administrative supervision of Dr. Joseph Dove, Patton 110 and English Lab 04, jodove@vt.edu. Under special arrangement, these rooms may be used for research tests. The health and safety considerations for these labs are under the control of the Laboratory Manager.

Laboratory Use for Non-Experimental Research

The W.C. English Geotechnical Research Laboratory (English Lab) contains office space for both faculty and students. Those involved in experimental research at the English Lab have first priority for the use of this space. However, some students may be allowed to use the English Lab for non-experimental research as space allows. Use of the building in this way is limited to the office areas. In order to be eligible for this privilege, a student must:

- Read *Laboratory Use Policy (GEOT-001)* and complete the Student Information Sheet (attached).

Laboratory Use for Experimental Research

Eligibility

In order to be eligible to perform experimental research in the geotechnical laboratories, a student must:

- Read *Laboratory Use Policy (GEOT-001)* and complete the Student Information Sheet (attached);
- Complete the safety training procedure outlined in *Laboratory Safety Policy (GEOT-002)* and/or as indicated by the Laboratory Director or Manager;

- Be employed on an assistantship or on an hourly basis (in order to be covered by the University's workman's compensation insurance), OR sign the waiver attached with this policy and provide proof of insurance; and
- Be appropriately trained on all equipment and tests required for the research.

General Lab Use

The following general rules apply to all laboratory users. These rules are intended to help maintain a collegial and courteous work environmental for all.

Equipment and Supplies

- Expendables, such as membranes, vacuum grease, etc., are normally covered by the research project and not the laboratory. Coordinate with the principal investigator/advisor to obtain these items. The Laboratory Manager can assist you in ordering these materials.
- Parts required to keep general lab equipment (e.g., triaxial cells) functional and expendable such as paper towels and cleaning supplies will be provided by the laboratory.
- Be very careful to not introduce water into the vacuum pumps. If this happens, the pump oil must be changed or else the pump will be damaged. Contact the Laboratory Director or Manager if this happens.
- Do not create secret hordes of tools next to a testing station. All laboratory-owned tools must be put away at end of each work session. Only tools purchased by the research project may remain at a work station.
- Tools may not be taken from another test area without asking the laboratory user assigned to that area.
- Items in the laboratory drawers and cabinets are **NOT** available for general use. Contact the Laboratory Director or Manager for assistance locating equipment for research.
- Do not move chairs from the offices or the conference room into the lab rooms. There are adequate stools available in the lab.
- Porous stones must be stored submerged in water at all times. Do not allow them to dry out between tests.
- Most of the equipment setups use computerized data acquisition. The lab computers are not connected to the internet so viruses can only be transmitted to the computers by lab users. Removable devices such as flash drives must be checked for viruses prior to using them to obtain data from lab computers.
- Test apparatuses must be reassembled after each test is completed. Integral parts may be easily lost if the apparatus is not reassembled.
- Do not permanently modify equipment unless the equipment was purchased solely by your research project. Before making any modification to any lab equipment, contact the Laboratory Director or Manager.
- Equipment that is damaged during use or found damaged must be reported to the Laboratory Director or Manager. This includes overloading of load cells, pressure transducers, etc. Overloading may require that the sensor be taken out of service or recalibrated. It is considered a major infraction to fail to report such damages to the Laboratory Manager.
- It is better to ask questions than to break equipment. Ask as many questions as necessary until you feel comfortable with the use of the equipment.

- Do not leave soil samples in the equipment long after the tests is completed. Samples should be removed as soon as possible after the test is completed.
- Do not take pieces from any equipment to use on another setup. If your equipment is not working properly, please contact the Laboratory Director or Manager. It is considered to be a major infraction to remove parts from a functioning test setup.

Laboratory Courtesy

- Be aware of tests running to prevent damaging the tests. Inform other lab users if you disturb a test in progress.
- Do not wash soil down the sink. If a sink is draining slowly, please empty the sink trap beneath the sink.
- Do not prepare soil samples in any of the benches or spaces with nearby electronic equipment. Use only designated areas for this purpose. At the English Lab, all sample preparation should be done in Room 30. Special arrangement to have sample prepared in other rooms can be made by contacting the Laboratory Director or Manager.
- Clean up after yourself. Our janitorial contract does not include emptying of the trash cans or sweeping the lab floors. Lab users should cheerfully do these tasks.
- Water content samples left in the oven for longer than 5 days may be thrown out.
- Wash and dry water content tins or tares after use. Do not return them to the drawer dirty or wet.

Samples

- Any soil sample or admixture used in the laboratory should be properly identified using the form attached.
- Soil samples and admixtures are to be stored in designated spaces. Please contact the Laboratory Director or Manager to arrange the storage of your sample.
- No soil samples or admixtures are to be stored or kept around the electronic equipment areas unless approved by the Laboratory Director or Manager.

Cabinets and Drawers

- The cabinets and drawers in the lab will be locked all the time except for the ones that contain items of general use and those being currently used by students.
- Nothing should be stored in cabinets or drawers that are not assigned to you.
- To get a cabinet or drawer assigned, please contact the Laboratory Manager.
- Every item in the lab has an assigned cabinet or drawer. Items shall only be stored in their assigned space.

Strength and Compressibility Equipment

The geotechnical testing equipment used to measure strength and compressibility is specialized and requires appropriate training to use without causing harm to the user and/or equipment. The **preferred** method of training for this equipment is the successful completion of CEE 5524. Before beginning research on a particular piece of equipment, the Laboratory Director or Manager will perform an oral evaluation of the student's competency intended to refresh the student's knowledge of the equipment, safety concerns, and proper operation.

If necessary, a student may be allowed to receive training outside of CEE 5524. This training may be provided by their advisor, project principal investigator (PI), or another student, if that individual demonstrates competency with the test equipment and is approved by the Laboratory Director or Manager. After being trained on each piece of equipment required for the research, the Laboratory Director or Manager will perform an evaluation of the student's competency. If

the advisor, PI, or another student is unable to train the student, training may be available from the Laboratory Manager and will be billed to the research project at the laboratory manager's research billing rate.

Some of the laboratory's testing equipment is highly specialized (e.g. cyclic direct simple shear, resonant column, cyclic triaxial apparatus, etc.), and the specifics of its use lie outside the scope of CEE 5524. This does not excuse the student from obtaining training appropriate for the device. Principal investigators are strongly encouraged to obtain training for themselves, the Laboratory Manager and Director, and their students from the manufacturer when new equipment is purchased as part of a research project. After this type of equipment has been put in service, new students must be trained by the student, faculty, or staff currently assigned to the device. Again, training may be available from the Laboratory Manager and will be billed to the research project at the laboratory manager's research billing rate.

Keys / Door Codes

The last person to leave a research laboratory is responsible for locking the facility, turning the lights off, and/or closing the locked door.

Patton 25

The graduate teaching and research laboratory in Patton 25 is equipped with a combination door lock. The door code must not be given to anyone who is not an authorized laboratory user.

Off-Campus Facilities

Students approved to use the W.C. English Laboratory may be provided with keys to the facility. These keys are issued by the Laboratory Manager. The keys must not be loaned or given to other students. In order to maintain building security and appropriate records, keys must be returned to the Laboratory Manager when a student graduates or leaves Virginia Tech. Keys should not be passed down from student to student, or through faculty.

For access to other off-campus facilities, such as the Price's Fork laboratory, students should coordinate with their advisor/principal investigator or the Laboratory Director or Manager.

Working Alone

Use of the geotechnical research laboratories alone may be unsafe. The presence of another individual in the building, including office spaces, is sufficient to satisfy the requirements for not being alone. The following activities may not be performed alone:

- Any use of equipment at the Prices Fork laboratory or Kentland Farm facility other than a computer;
- Experimental procedures that require lifting or moving heavy test equipment or soil samples; and
- Any project specific, potentially dangerous experimental procedures identified by the student, principal investigator, and Laboratory Manager at the start of each research project.

Violations of Laboratory Use Policies

Students found violating the provisions of this policy will lose their privilege to work in the laboratories for one week. A second violation, will result in the student losing their privilege to work in the laboratories for one month. Subsequent violations will require a meeting with the student's advisor and the Laboratory Director or Manager and the student can lose the privilege of using the laboratory, which may in turn, result in the student losing their assistantship.

Departure/Research Project Conclusion Meeting

At the end of a student's use of the laboratory facilities, a meeting must be scheduled between the student and the Laboratory Manager and/or Director. This includes students using the laboratories for non-experimental research. This meeting should be held at the facility(s) used by the student. Prior to this meeting, the student should remove all personal belongings, turn over all project related items (documents, soil samples, etc.) to the project PI or to continuing research students, dispose of or properly store used soil samples, and clean the work area thoroughly.

At the departure meeting, the student will (as applicable):

- Return any keys issued.
- Review their work area with laboratory personnel to verify that it is clean and that used soil samples have been properly disposed of or stored.
- Turn over unneeded chemicals for storage or disposal by the Laboratory Manager.
- Return all laboratory equipment used for the project.
- Verify with laboratory personnel that all of the equipment is in working order.

If a student fails to schedule this meeting or perform these duties, the student's project PI or advisor must take full responsibility for completing the tasks listed above.

Student Information Sheet

Geotechnical Research Laboratories
Virginia Tech

This form must be filled out and submitted to the Laboratory Manager by all students requesting access to the Virginia Tech geotechnical laboratories, including those students using the laboratories for non-experimental research (office space). The student must deliver this form to the Laboratory Manager in person, so that the Laboratory Manager is acquainted with all students who have independent to access the laboratories. The completed Student Information Sheets will be kept in a secure location by the Laboratory Manager.

Student Name: _____

Advisor/Project PI: _____

Email: _____

Performing Experimental Research (Y/N): _____

If Yes, briefly describe: _____

_____

_____

Key Issued? _____ Key Number: _____

By signing below, I acknowledge that I have read, understand, and agree to abide by the Virginia Tech Geotechnical Program's *Laboratory Use Policy (GEOT-001)*.

Signature: _____

Date: _____

Geotechnical Research Laboratories
Virginia Tech
Sample Identification

Content:

Student:

Advisor:

Semester:

Release, Waiver and Indemnification
Geotechnical Research Laboratories
Virginia Tech

I, _____, agree to indemnify, defend and hold harmless VPI & SU and their officers, agents and employees from any claim, damages and actions of any kind to nature, whether at law or in equity arising from _____volunteer activities, provided that such liability is not attributable to the sole negligence of the University.

I realize that some of the activities may subject me to certain stresses and hazards not all of which can be foreseen. I desire and consent by signing this form, to take part in all such activities. I assume all the ordinary risks normally incident to the nature of the activities and agree that the University or any of its officers, agents and employees conducting such activities will not be responsible for any damages or injuries resulting to me.

Furthermore, I also agree that I have appropriate health care coverage for this activity. My insurance Company is _____ and my policy number is _____.

_____
Signature

_____
Date

FACULTY AND STAFF CONTACT INFORMATION

FACULTY	OFFICE*	PHONE	E-MAIL
Sherif Abdelaziz Associate Professor	120D Patton	231-5477	saziz@vt.edu
Ryan Beemer *Assistant Professor*	111A Patton	231-xxxx	rbeemer@vt.edu
Thomas Brandon *Professor Emeritus*	-	-	tbrandon@vt.edu
Bernardo Castellanos *Research Scientist and Laboratory Manager*	22 Patton 03 English Lab	231-6091	bernardo@vt.edu
Alba Yerro-Colom *Associate Professor and PhD Written Exam Coordinator*	120A Patton	231-2036	ayerro@vt.edu
Joseph Dove *Professor of Practice, Director of Curriculum and Assessment, Undergrad Teaching Laboratory Supervisor*	110 Patton 04 English Lab	231-2307	jodove@vt.edu
Mike Duncan *University Distinguished Professor Emeritus and CGPR Director Emeritus*	-	-	jmd@vt.edu
George Filz *Professor Emeritus*	-	-	filz@vt.edu
Brendan Fisher *Adjunct Professor*	120E Patton	-	bfisher@fisherrocke ng.com
Russell Green *Professor and Program Area Co-Coordinator/Admissions Coordinator*	120B Patton	231-9826	rugreen@vt.edu
Reihaneh Hosseini *Research Assistant Professor*	22 Patton	231-xxxx	reihos@vt.edu
Ray Martin *Adjunct Professor*	-	-	rayemartineng@aol .com
Matthew Mauldon *Associate Professor Emeritus*	-	-	mauldon@vt.edu
Adrian Rodriguez-Marek *Professor* *CGPR Co-Director/Program Area Co-Coordinator*	120C Patton	231-5778*	adrianrm@vt.edu
Joseph Vantassel *Assistant Professor*	111B Patton	231-4308	jpvantassel@vt.edu

*Office numbers may change due to recent & upcoming relocations, however the phone number and email addresses listed will not change.

STAFF	OFFICE	PHONE	E-MAIL
Penny Kay Lytton	120 Patton	231-7406	pkl16@vt.edu
Sarah Martin	211 D Patton	231-6069	shmartin@vt.edu

OFFICES & LABS	LOCATION	PHONE
Grad Student Office	19 Patton	231-2037
Grad Student Office	7 English Lab	231-6121
Grad Student Office	111 Patton	231-2036
Ozawa Library	18 Patton	231-4417
Geotech Conf Rm	22 Patton	231-7378
Prices Fork Lab	Prices Fork	231-4588

STUDENT INFORMATION SHEET

Complete and return this information sheet to Penny Kay Lytton in 120 Patton

Date: _____

Name:

_____

Last First Middle

Email address (the one that you check on a regular basis): _____

Address (while at Virginia Tech):

_____

Street City State Zip

_____

Telephone

Permanent Address:

_____

Street City State Zip

_____

Telephone

Person to Contact in Case of Emergency:

_____

Name Relationship

_____

Street City State Zip

_____

Telephone

WORKSHEET FOR VERIFYING CORE KNOWLEDGE BASE

The Geotechnical Engineering Program welcomes students of diverse academic backgrounds. We believe that students must have a well-developed "core" knowledge base for successful graduate study and professional development. This form helps you identify if you have the appropriate background by one of two ways. Please complete this worksheet and meet with your advisor (or temporary advisor) to plan your courses.

Student Name (last, first):	

1. Students with an ABET-accredited Civil Engineering degree

   Graduates of ABET-accredited Civil Engineering programs are assumed to have the required knowledge base. If you are in this group, place a check in the box on the following line and write in the institution and year of your civil engineering degree.

Graduate of ABET accredited civil engineering degree program (✓ or x)			
		Institution	*Year*

2. All other students

   All students who have degrees from non-ABET-accredited Civil Engineering programs, in general, must complete the background courses in the table below or their equivalent. Enter course numbers, names and grades of equivalent courses already taken. This may involve reviewing transcripts from your former institution(s) in consultation with your advisor.

   Some of the missing courses (or equivalents) can be taken either before or after entering the graduate program, decided on a case-by-case basis. Courses at the 1000/2000 level can be taken pass-fail (P/F). Courses at the 3000 level or higher must be taken for a letter grade (A/F). Undergraduate background courses do not count toward graduate degree requirements. Note that a course in soil mechanics/geotechnical engineering is a prerequisite for most of the graduate courses.

VT Course	Cr. Hr.	**Course Equivalent**	**Grade** (or P/F)
Chemistry 1035-*General Chemistry*			
Chemistry 1045-*Gen. Chem. Lab*			
Math 1225-*Calculus*			
Math 1226-*Calculus*			
Math 2204-*Multivariable Calculus*			
Math 2214-*Differential Eqns.*			
Math 2114-*Intro. to Linear Algebra*			
Physics 2305-*Physics I*			
Geology 2104-*Elements of Geology*			
ESM 2104-*Statics*			
ESM 2204-*Mech. Deform. Bodies*			
CEE 3304-*Fluid Mechanics*			
CEE 3514-*Intro. Geotechnical Eng*.			
Note: If your career objectives include becoming licensed as a Professional Engineer, consider completing the following courses: ISE 2014: *Engineering Economy;* CEE 2814: *CEE Measurements;* CEE 3404: *Theory of Structures;* CEE 3424: *Reinforced Concrete; and* ESM 2304: *Dynamics*.			

EXAMPLE MS PLAN OF STUDY

PROPOSED GRADUATE PLAN
FOR
[Student's Name]
Leading to the Degree of M.S.
In
Civil Engineering

Research hours:

CEE 5904 – Project and Report	Fall 2022	1 Cr.
CEE 5904 – Project and Report	Spring 2023	2 Cr.
CEE 5904 – Project and Report	Fall 2023	2 Cr.

Total Research = 5 Cr.

5000 and Higher Level Courses from VT:

CEE 5514* – Soil Behavior	Fall 2022	3 Cr
CEE 5534* – Foundation Engineering I	Fall 2022	3 Cr
CEE 5584 – Geotechnical Earthquake Engineering	Fall 2022	3 Cr
CEE 5544* – Foundation Engineering II	Spring 2023	3 Cr
CEE 5554 – Soil and Site Improvement	Spring 2023	3 Cr
CEE 5564* – Seepage and Earth Structures	Spring 2023	3 Cr
CEE 5504 – Risk in Geot. Eng.	Fall 2023	3 Cr
CEE 5594* – Geological Engineering	Fall 2023	3 Cr
CEE 5874 – Coastal and Marine Geotechnics	Fall 2023	3 Cr
CEE 5944 – Seminar	Fall 2022	1 Cr
CEE 5944 – Seminar	Spring 2023	1 Cr

Core Course* **Total VT 5000 = 29 Cr.

4000 Level Courses-
NA

Total 4000 Level = 0 Cr.

Supporting Courses: (*Credits for supporting courses do not count toward graduation*)
GRAD 5004-Graduate Teaching Assistant Training Workshop
ENGE 5304-Graduate Student Success in Multicultural Environments

Total Graduate Hours = 34 Cr.

Signatures (and printed names) of Student's Advisory Committee

_____
Chair- Dr. Jefe (print name) Student Number: xxxxx1234

_____
Committee Member- Dr. Two (print name) Student Signature: _____

_____
Committee Member- Dr. Three (print name)

Student completed online departmental ethics training and quizzes in Canvas and completed the Responsible Conduct of Research (RCR) training through the Virginia Tech Office of Research and Innovation on _____ (date).