

Spring 2024

## **CE 614 - 102, 852: UNDERGROUND CONSTRUCTION**

Alan Slaughter

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## DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

# CE 614-852    Underground Construction    Spring 2024

### Introduction

Welcome to the course in Underground Construction. The purpose of the course is to more than introduce the student to the art of tunneling. This course will address terminology, what equipment will be most useful, methods of evaluating the soil and rock to be able to design an appropriate tunnel for the circumstances. Existing tunnels (infrastructure) and new tunnels all need engineers to fix, construct and maintain them.

### Course Description

This course covers the various aspects of underground construction, including rock and soft ground tunnel construction, shaft construction, inspection and rehabilitation of existing structures, open cut construction, blasting and immersed tube tunnel construction.

### Course Mode

This course will be taught online. For more information, please see [NJIT's Modes of Instructional Delivery](#).

### Instructor

Alan R. Slaughter, P.E., P.P.

Email: [slaughte@njit.edu](mailto:slaughte@njit.edu)

Email: Turnaround time for emails will be up to 36 hours:

Since this is an online course there will be no office hours per se. Just email me if you have questions or want to set up a meeting.

### Professor Introduction

Welcome to the course, and I hope you enjoy the course as much as I do. By way of introduction, I have included a bit of information about myself.

I have served as an adjunct professor for the Civil and Environmental Department at NJIT for 20 years, teaching Construction Management courses at both the undergraduate and graduate levels. I have spent 47 years as a consultant working for civil engineering firms, owners, and contractors. I have worked at various engineering levels from draftsman (with pens, pencils, and T-squares) to Senior Associate and Resident Engineer. My work, of course, involves tunnel design, inspection, and construction as well as work on highways, bridges, historic structures, dams, and commercial development.

It is my intention that by the time this course is over, you will be knowledgeable enough on the equipment and the methods used for underground construction that when going on a construction site, you will be familiar enough with the various aspects of this type of work to understand what is going on and the equipment being used.

### **Course Learning Outcomes**

By the end of the course, students will be able to...

- Outcome 1: Identify and explain tunnel terminology.
- Outcome 2: Evaluate blast patterns, layouts of worksites, and methods of muck excavation.
- Outcome 3: Research a topic related to tunneling and write a report.
- Outcome 4: Explain the equipment and methods used in tunnel construction.
- Outcome 5: Recognize the risks of tunneling and methods of mitigation.
- Outcome 6: Explain why the field of tunneling is so important today and recognize what tunnels provide to society.
- Outcome 7: Recognize the importance of geotechnical investigation.

### **Required Course Material**

**Text:** Introduction to Tunnel Construction, 2<sup>nd</sup> Edition

**Authors:** Chapman, Metje and Stark

**Publisher:** CRC Press; Paperback

**ISBN-13:** 978-1-4987-6624-1

Students can purchase either a physical copy of the textbook or the electronic version. Students should have a calculator and access to a computer with Wi-Fi.

### **Prerequisites**

Prerequisites include an undergraduate course in soil mechanics.

## **Course Navigation**

The following procedure recommended for navigating this course is suggested here for use. Initially, the assigned reading should be done. This should be followed by the lectures assigned for that week. Subsequently, any homework or discussion assignments or activities should be completed within the required timeframe. Should the homework or activity not be completed within the permissible timeframe the professor reserves the right to reduce the points allowed for the work. The number of deducted points depends on how many days the work is late. Generally, the deduction will be determined at the time of grading. This does not include any points deducted for wrong answers.

Canvas will be used for assignments, exams, discussions, and general information.

## **Discussions**

Discussion questions will be posted each week on Monday. A one to two paragraph comment on the question is to be submitted by Thursday at 11:59 pm. Two one paragraph comments on other student responses are due by 11:59 pm the following Sunday.

## **Online Exam and Proctoring Policy**

There will be two tests for this course. A midterm on 10/29 and a final exam on 5/12/17. These exams will be online, and you will need a computer with a strong internet connection, a microphone, and a webcam. The tests will be proctored using ProctorU Record +.

This proctoring method does not require signing up for the test ahead of time. You will need to get online a few minutes ahead of the scheduled exam to log in. You will not be monitored by an observer during the exam, but you will be documented during the exam and this monitoring will be reviewed after the exam is taken. Any potential issues will be noted and forwarded to me for my review and action, if necessary. This includes talking to others or having other people in the room glancing away from the screen during the exam or using references not allowed on the exam. One additional item is that you must have your NJIT school ID ready to show to the computer.

For more information, please visit the [Online Course Exams and Proctoring](#) page.

## **Course Schedule**

See the Course Schedule document in the Course Introduction module.

## **Grading Policy**

### **Final Grade Calculation**

Final grades for all assignments will be based on the following percentages:

Homework	20%
Midterm	20%
Discussions	20%
Project	20%
Final	20%

### **Course Work**

**Homework: (20% of grade)** Homework assignments will be given weekly to offer you an opportunity to apply course concepts for that week. The homework is also designed to help you prepare for exams. Homework will be graded on a bi-weekly basis.

**Midterm & Final Exams: (40% of grade)** Each exam will be cumulative to that point in the semester. The exams will include multiple choice, true and false, matching, and possibly essay questions. Exams will be proctored using Record+. Grades will be available a week after the exams are closed.

**Discussions: (20% of grade)** Discussion topics have been developed to have you comment on them with your personal opinion on the topic. The responses to two other students will provide you with an opportunity to respond to other ideas and concepts expressed. The discussions and responses will be graded the week following the due date.

**Project: (20% of grade)** The purpose of the project is to encourage you to look beyond the limits of the course and to study a topic of your interest. These topics may range from construction methods, to equipment, to the people who were or are important to the underground construction industry. The project will be graded within one week of your submission. Please do not do a project on either the Lincoln or Holland Tunnels. Over the years, I have probably received at least 25 submissions of each.

## Grading Scale

Grades	Range	Significance
A	90 - 100%	Excellent
B+	85 - 89%	Good
B	80 - 84%	Acceptable
C+	75 - 79%	Marginal Performance
C	70 - 74%	Minimum Performance
F	0 - 69%	Failure

I	Incomplete
W	Approved Withdrawal
AUD	Audited (no academic credit)
S or U	Satisfactory or Unsatisfactory
P	Passing for completion, defense and final submittal of a Master's Thesis or Doctoral Dissertation

## Policy for Late Work

Homework Assignments: Homework will be due the Sunday following the week it is assigned. If the homework is late, it should still be submitted, but it will receive a reduced grade.

Exams: If you are unable to take the exam when scheduled, it is necessary for you to contact me ahead of time to let me know. Then contact me after the exam to set up a new date. If an exam is missed, it can still be taken later with a reduction of points, at the professor's discretion. By the way, a really good reason will be necessary for a postponement of the exam.

## Feedback

I will deliver feedback on each assignment using the comments feature in Canvas, as necessary.

## **Academic Integrity Statement**

“Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that can be found [here](#).

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing, or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students office at [dos@njit.edu](mailto:dos@njit.edu).”

## **Withdrawals**

Student requests for withdrawals after the deadline will not be permitted unless extenuating circumstances (e.g., major family emergency or substantial medical difficulty) are documented. The course Professor and the Dean of Students are the principal points of contact for students considering withdrawals. April 3rd is the last day to withdraw from classes. For more details, please visit the [Spring 2024 Academic Calendar](#).

## **Syllabus Information**

The dates and topics of the syllabus are subject to change; however, students will be consulted with and must agree to any modifications or deviations from the syllabus throughout the course semester.

## **Netiquette**

Throughout this course, students are expected to be courteous of classmates by being a polite, active participant. Students should respond to discussion forum assignments in a timely manner so classmates have adequate time to respond to your post. Respect opinions, even those that differ from your own and avoid using profanity or offensive language.

## **Additional Information and Resources**

- Requesting Accommodations
  - If you need accommodations due to a disability please contact Scott Janz, Associate Director of the [Office of Accessibility Resources and Services](#), Kupfrian Hall 201 to discuss your specific needs. A Letter of Accommodation Eligibility from the office authorizing student accommodations is required.
- [Canvas Accessibility Statement](#)
- [Canvas Orientation for Students](#)
- [NJIT Services for Students, Including Technical Support](#)



### Outcomes Course Matrix

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
Student Learning Outcome 1:			
	1	3	Tests
Student Learning Outcome 2:			
	7	1	Term Paper
Student Learning Outcome 3:			
	4	2	Homework

### CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Our Program Educational Objectives are reflected in the achievements of our recent alumni:

1. **Engineering Practice:** Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward safe, practical, sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.
2. **Professional Growth:** Alumni will advance their technical and interpersonal skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration, and continuing education; some graduates will transition into other professional fields such as business and law through further education.
3. **Service:** Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving, and other humanitarian endeavors.

Our Student Outcomes are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze, and interpret data and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies