

CEE 4803: Design & Construction of Historic Structures

Summer 2018, CEE London Study Abroad

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Course Description

This course examines some of the world's great buildings, bridges, and towers from an engineering and structural art perspective while integrating architecture and history-based concepts. It thematically examines the development of structural systems throughout history, providing the student with an understanding of how design principles, construction materials and methods, scientific and technological advancements, and communication of those complex designs have evolved into modern structural engineering design and construction. Through case studies of historical structures, the student will gain not only an understanding of how engineering principles were applied to historical structures, but also gain an appreciation for the creative vision of the builder and the historical context in which the structure came to be. Finally, because excellent written and oral communication skills are essential for engineers, this course is communication-intensive, requiring students to write and speak many times throughout the course.

Course Outcomes

Students will learn by actively participating in lectures, demonstrations, and field activities; by taking quizzes, and solving individual homework assignments; and finally, by leading seminar discussions and completing an engineering project as a member of a small team. Students who successfully complete the course will be able to:

- Explain how cultural and historical context, design principles, available construction materials, construction methods, and scientific and technological innovations have led to the design and construction of a significant historic structure.
- Explain how structures are examples of structural art.
- Apply principles of engineering mechanics to gain insights about significant historic structures.
- Describe various historical structural systems and elements and explain how each systems carries load
- Explain how design methods and procedures used by engineers and building designers have evolved.

- Explain how engineers throughout history have communicated complex designs to stakeholders and builders to result in a structure that meets the engineer’s vision.
- Demonstrate advanced written and oral communication skills.

Communication Component

This course will focus on two modes of engineering communication: writing and speaking. The assignments given will reflect the unique conditions under which the class is taught, which will be mostly outside of a conventional, indoor classroom. The students will first learn fundamental skills and then be given many opportunities to demonstrate competency in each mode of communication.

Required Textbook & Software

- David Billington, *The Tower and the Bridge – The New Art of Structural Engineering*, Princeton University Press, 1983.

Required Readings

Students will be assigned required readings for lectures from the course textbook (see Course Guide for assigned readings). These readings will supplement the material presented in lectures and contribute to the students’ ability to successfully complete homework assignments, quizzes, and course projects.

Seminars: Student-Led Discussions

In teams of three, students will lead a 30-minute discussion on a historically significant structure that ties into the themes of the instructor’s lectures. The objective of the seminars is two-fold: 1.) to familiarize students with prominent structures beyond those already being studied in class; and 2.) to allow students to learn how to prepare and lead discussions about engineered structures without creating conventional PowerPoint presentations. During their presentations, students must demonstrate excellent research skills, a sound understanding of engineering principles, and an ability to engage with an audience without the backup of a full-blown slide presentation. (See page 5-6 for full description of instructions/requirements).

Daily Quizzes

There will be short, daily quizzes on the reading to ensure students are keeping up with assigned readings.

Projects

Historic Structure Analysis Blog Project

The first project is collective written assignment to which students will individually contribute. A course blog about the structures students visit and study will be established, and students will be required to post entries and respond to other students’ entries on a set schedule. Students will learn the attributes of a successful blog and will be held to a high standard in their research and writing. Invited GT community members, friends, and family can access the blog and follow the activities and responses of the students as they visit historic structures in Atlanta and London. At the end of the five weeks, the students will have created a vivid, educational, personal, and enduring electronic artifact of their studies in London. (See pages 7-8 for full description of requirements).

Tour of Historic Structure

The second project is a semester-long, small group project that requires students to research and speak to the class about a significant historic structure in central London that has not been covered during lectures, on previous site visits, or in their own blog posts. In teams of three, students will research and analyze a historic structure in London, and then plan, coordinate, and lead the class on a 30-minute tour of the site and structure. Students will be held to a high standard in their tour, and the assignment will require students to demonstrate rigor in their technical understanding of the engineering principles and construction methods used to create the structure. The project will reflect the “living laboratory” nature

of the course: students will be outside, on-site at historic structures in and around the city, and the students will be responsible for teaching about the structures as life goes on around the group. (See page 9 for full description of requirements).

Leadership Component:

In addition to excellence in writing as speaking, students will be expected to demonstrate responsibility as a member of an engineering team. The class will establish the criteria for excellence, and final peer evaluations will constitute 5% of the final course grade. This is to say, if you are consistently identified as a non-contributing member of your team, you will not receive the same grade on the project as your group members do.

Grading

The grade will be determined from the grading scheme below. The communications component of the course will constitute 50% of the Seminar grade, the Blog Project grade, and Final Project grade.

- Seminar: Student-Led Discussion (25%)
- Daily Quizzes (15%)
- Historic Structure Analysis Blog Project (25%)
- Final “Tour” Project (30%)
- Leadership (5%)

Absences: Every unexcused absence—whether in the classroom or on the walking tours—will result in a full-letter-grade deduction from the final course grade.

Website

The website for this course is <https://canvas.gatech.edu>. Students are expected to check the site regularly for announcements and are responsible for all material posted. Emails to the class will be sent via Canvas to the email on record. It is the student’s responsibility to check email regularly.

Prerequisites

CEE 3051 or CEE 3055 or consent of instructor. CEE 3051 will be accepted concurrently if taken in CEE London.

Course Conduct

The Georgia Tech Honor Code is the standard of conduct for this course. The Honor Code is available at <http://www.honor.gatech.edu/>.

Office of Disability Services

The Georgia Institute of Technology has policies regarding disability accommodation, and these policies are administered through The Office of Disability Services. Students with disabilities should contact this office if they need to request classroom accommodations. <http://disabilityservices.gatech.edu/>

CEE4803: Design & Construction of Historic Structures
 Summer 2018 (CEE London) Schedule

Date	Lesson Topic	Assignments Due
Week 1 - Atlanta		
5/7 (M)	Quiz – The Tower and The Bridge Chapter 1 Lecture: Introduction to Structural Art	
5/8 (T)	Quiz – The Tower and The Bridge Chapter 2 Written Communication (Dr. Rosenstein)	
5/9 (W)	Quiz – The Tower and The Bridge Chapter 3 Lecture: Telford, Brunel, and British Metal Forms	
5/10 (Th)	Quiz – The Tower and The Bridge Chapter 4 Oral Communication (Dr. Rosenstein)	
5/11 (F)	Quiz – The Tower and The Bridge Chapter 5 Lecture: John Augustus Roebling and the Brooklyn Bridge	
Week 2 - Atlanta		
5/14 (M)	Quiz – The Tower and The Bridge Chapter 6 Lecture: The Eiffel Tower and the Washington Monument	
5/15 (T)	Quiz – Tower and The Bridge Chapter 7 Lecture: Eiffel’s Bridges, Eads Bridge, and Baker’s Firth of Forth	
Week 3 - London		
5/21 (M)	Quiz – The Tower and The Bridge Chapter 8 Lecture: George Washington Bridge and the Golden Gate Bridge Lecture: The Origins of Reinforced Concrete <i>Student Seminar #1: Saginaw Bridge</i>	Blog Post #1
5/22 (T)	Quiz – The Tower and The Bridge Chapter 9 Field Activity: ARUP Office Visit	
5/23 (W)	Quiz – The Tower and The Bridge Chapter 10 Lecture: The Origins of Prestressing <i>Student Seminar #2: Plougastel Bridge</i> Lecture: New Bridge Forms – Christian Menn	
5/24 (Th)	Field Activity: Forth Bridges, Queensferry Crossing, and Edinburgh Castle	Blog Response #1
Week 4 - London		
5/28 (M)	Quiz – The Tower and The Bridge Chapter 11 Lecture: Finding Forms – Laurent Ney Lecture: The Gothic Cathedral and the Skyscraper <i>Student Seminar #3: John Hancock Center</i> Historic Walking Tour: Bridges of London	Blog Post #2
5/29 (T)	Quiz – The Tower and The Bridge Chapter 12 Lecture: Fazlur Kahn and Concrete Buildings <i>Student Seminar #4: Brunswick Building</i> Lecture: Baker, Khan, and the SOM Tradition of Structural Art in Buildings Historic Walking Tour: Skyscrapers New & Old	
5/30 (W)	Quiz – The Tower and The Bridge Chapter 13 Lecture: Thin Shell Roof Forms <i>Student Seminar #5: Algeciras Market Hall</i> Lecture: Heinz Isler and Pier Luigi Nervi <i>Student Seminar #6: Kresge Auditorium</i>	
5/31 (Th)	Field Activity: Notre Dame Cathedral and the Eiffel Tower	Blog Response #2
Week 5 - London		
6/4 (M)	Final Project Practice Field Activity: Transport Museum	Blog Post #3
6/5 (T)	Historic Walking Tour: Brunel Tunnel	
6/6 (W)	Final Presentations (Groups 1-3)	Final Project
6/7 (Th)	Final Presentations (Groups 4-6)	Final Project Blog Response #3

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Seminars: Student-Led Discussions

Students will be organized into teams of three and be required to lead a 30-minute discussion on one historically important structure. Students should prepare a 30-minute oral presentation and be prepared to answer questions during the last 10 minutes. Please note: this is not a conventional PowerPoint presentation. The communication objective of these seminars is to give students the opportunity to engage directly with an audience as they talk about engineered structures. This skill will be essential for the final project when teams are outside, leading the class on their own tours.

Teams and lecture assignments will be determined during Lesson 1. The student-led discussions are as follows:

Number	Date	Structure
1	5/21	Saginatobel Bridge
2	5/23	Plougastel Bridge
3	5/28	John Hancock Center
4	5/29	Brunswick Building
5	5/30	Algeciras Market Hall
6	5/30	Kresge Auditorium

Requirements:

1. Teams will give go over their presentation with the TA **at least 24 hours prior** to leading the class. Earlier review is strongly encouraged. There is no prescribed format for the review. This objective is simply to ensure that teams are addressing all of the key points in the assigned lesson.
2. As a minimum, each student-led discussion should address the following:
 - a. Historical context within which the structure was designed and built.
 - b. Biographical information of the designer. What aspects of the designer's personal and professional background influenced the completed structure?
 - c. Describe the structural system. What was unique or innovative about it?
 - d. What materials were used? Why were they appropriate for the structural system?
 - e. Describe how the structure demonstrates (or does not demonstrate) structural art.
 - f. Describe any noteworthy construction methods used to build the structure.
 - g. How did this structure influence future structures?
3. Teams may use any visual aids (slides, physical models, demonstrations) they feel are appropriate to properly illustrate concepts, but this is not a conventional 20-minute PowerPoint presentation.
4. All members of the team must lead a portion of the discussion.

Metrics for Grading the Seminars:

- Thorough research of historical context and biographical information
- Thorough analysis and explanation of structural systems used
- Thorough analysis and explanation of the demonstration of structural art
- Ability to explain engineering concepts without text slides
- Ability to engage an audience directly—without relying excessively on technology
- Ability to meaningfully answer questions

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Historic Structure Analysis Blog Project

Students will create their own login password to www.ceelondonblogs.ce.gatech.edu. Each student will post a total of three unique blog entries and respond to questions or comments about their posts.

Requirements:

1. Each student will be responsible for posting one blog entry per week in Weeks 3, 4, and 5 that describes and analyzes one of the structures not discussed in class. Students should choose an Atlanta-based structure for the blog entry due in Week 3.
2. Each student will be responsible for meaningfully responding to another student's blog post once per week, and answering any questions that are directed toward his or her own posts.
3. The schedule for blog post submissions and responses is as follows:

Week	Blog	Due	Response	Due
3	Blog 1	6pm, 5/21	Response #1	6pm, 5/24
4	Blog 2	6pm, 5/28	Response #2	6pm, 5/31
5	Blog 3	6pm, 6/4	Response #3	6pm, 6/7

Each blog entry must include the following information, in the following order, using the given headings:

- 1. Structure Information (10% of grade)**
 - a. Name/location/date(s) constructed
 - b. Provide a picture
 - c. Purpose of building
 - d. Who designed it?
 - e. Who funded it?
- 2. Historical Significance (10% of grade)**
 - a. Innovative structural engineering design?
 - b. First time a certain construction technique was used?
 - c. Best existing example?
 - d. Model for future buildings?
- 3. Cultural Significance (10% of grade)**
 - a. Who lived/worked/died here?
 - b. What happened here?
 - i. Major historical events
 - ii. Small, personal events
 - c. Was it loved/hated when it was built?
 - d. What was the human cost in building it?
 - e. How is it used today?

4. Structural Art (10% of grade)

- a. How does the structure demonstrate structural art?
- b. How does the structure not demonstrate structural art?

5. Structural Analysis (50% of grade)

- a. Identify and explain the design principles, construction materials, and construction methods used by the engineer and builder
- b. Identify the structural systems employed
- c. Provide 2-3 pictures and/or models of the structural system
- d. Explain how the structural system carries load
- e. Apply principles of engineering mechanics to analyze significant components of the structure
- f. Explain how design drawings and/or models were used to communicate the design to stakeholders

6. Personal Response (10% of grade)

- a. What did you learn by actually looking at and/or being in the building that you could not have learned from a book or video?
 - i. "I never realized..."
 - ii. "Now I understand..."

Note on References: Please provide a list of References. Use ASCE or IEEE style.

CEE4803C: Design & Construction of Historic Structures

Course Project: Historic Structure Guided Tour

Students will research and prepare a 30-minute guided tour of a significant structure. In assigned teams of 3, students will select one of the following structures in central London to research and analyze:

- Hammersmith Bridge
- Royal Albert Hall
- Leadenhall Building
- King's Cross / St. Pancras Station
- Barbican Centre "Concrete Jungle"
- Shard

Required Content:

As a professional tour guide and expert on the site and structure, the student must be knowledgeable in both the historical context of the structure and the technical details, able to answer questions from the group, and ensure the group is engaged throughout the tour. As a minimum, each guided tour must include the content listed below.

1. Structure (10%)

- a. Name/location/date(s) constructed
- b. Purpose of building
- c. Who designed it?
- d. Who funded it?
- e.

2. Structural Art (10%)

- a. How does it demonstrate or not demonstrate structural art?

3. Historical Significance (10%)

- a. Innovative structural engineering design?
- b. First time a certain construction technique was used?
- c. Best existing example?
- d. Model for future buildings?

4. Cultural Significance (10%)

- a. Who lived/worked/died here?
- b. What happened here?
 - i. Major historical events
 - ii. Small, personal events
- c. Was it loved/hated when it was built?
- d. What was the human cost in building it?
- e. How is it used today?

5. Structural Analysis (60%)

- a. Identify and explain the design principles, construction materials, and construction methods used by the engineer and builder
- b. Identify the structural systems employed
- c. Provide appropriate handouts to explain complex structural systems
- d. Explain how the structural system carries load