

Fall 2020

## CE 360-103: Sustainable Civil Engineering Materials

Matthew Adams

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**Course Syllabus**  
**CE 360: Sustainable Civil Engineering Materials**  
**John A. Reif, Jr. Department of Civil and Environmental Engineering**

**Course Information**

Title: CE 360, Sustainable Civil Engineering Materials

Section: 103

Class Location: Synchronous Online Access class at <https://njit.webex.com/meet/adams>

Meeting Times: Wednesdays 6:00 PM – 8:50 PM

Credit Hours: 3 Credits

**Instructor**

Matthew P. Adams, Ph.D.

He/His Pronouns

Office: Working from home

E-mail: [adams@njit.edu](mailto:adams@njit.edu)

I respond to course e-mails twice a day,  
and do not check e-mails on Saturday or  
Sunday.

**Office Hours**

Tuesdays: 3:00 PM – 5:00 PM

Friday: 10:00 AM – 12:00 PM

Open door policy (if the door is open,  
come on by).

By appointment, skype appointments also  
available.

**Required Pre-requisites**

The required prerequisites for this course are MECH 237 and CHEM 121.

**Course Description**

The course provides instruction on civil and construction engineering materials used in the construction of civil engineering projects such as pavements, bridges, buildings, retaining walls, tanks, etc. Additionally, the fundamentals of sustainability within the context of civil engineering will be discussed. In particular, the course concentrates on the engineering properties of aggregates, wood, metals, portland cement concrete (PCC) and hot-mix asphalt (HMA) as well as the mixture design of PCC and HMA, as well as other advanced civil engineering materials. These materials will be used to discuss sustainability and sustainable design within civil engineering contexts.

Topics: Civil and construction engineering materials; aggregate, portland cement concrete, asphalt concrete, wood, metals. Standard test methods. Sustainability. Sustainable design. Chemistry, mechanics, and durability of materials.

**Learning Outcomes**

Upon completion of this course, students will be able to:

1. Define sustainability in their own words and relate how sustainability is defined in the context of new construction as well as renovation and rehabilitation.
2. Demonstrate concepts of life-cycle analysis including economic and sustainability aspects and apply these concepts to sustainable construction.
3. Identify key material properties important to the successful application of aggregates, asphalt concrete, portland cement concrete, wood and metals to a variety of civil works.

4. Specify aggregates, concrete and asphalt mixtures, metals, and wood for typical construction applications including the use of appropriate standards (i.e. ASTM) for testing and specification of said materials.
5. Design a PCC mixture and an HMA mixture using sustainability concepts that will be durable and meet the requirements of a particular construction project.

### **Required Reading Materials**

This course is an Open and Affordable Textbook course at NJIT, meaning all reading materials are available for free either through the internet, the library, or other means. You are expected to access the reading materials throughout the term.

#### **Required**

- A. ACI Committee 211.91: Standard Practice for Selecting Proportions for Normal Heavyweight and Mass Concrete. (Reapproved in 2009). This resource is available for free through a Free student membership from the American Concrete Institute. Directions for signing up for an ACI membership can be found at <https://www.concrete.org/membership/studentmembership.aspx>. Once you have signed up, you can navigate to the to the page for the ACI 211 standard practice and download it as a PDF.
- B. Pavement Guide Interactive: <http://www.pavementinteractive.org/> (free internet resource)
- C. Additional course reading materials will be posted on the Canvas course website throughout the term.

#### **Additional**

Virtual Superpave Laboratory: <http://training.ce.washington.edu/VSL/>  
Portland Cement Association: [www.cement.org](http://www.cement.org)  
American Concrete Institute: [www.aci-int.org](http://www.aci-int.org)

### **Course Equipment Expectations**

You are expected to have a working webcam, microphone, speakers and computer to participate in this course. If you do not have a webcam, microphone, speaker or computer, please contact the dean of students to obtain one.

### **Homework Assignment Requirements and Grading**

Homework assignments will be posted on the course website regularly throughout the term. Students will have at least 7 days to complete homework assignments from the date they are posted. Homework assignments are due by the end of class on the due date. Homework will be collected and graded in the following manner:

- All problems will be checked for completeness, but not graded for correctness. Honest attempts at completing a problem will result in full credit.
- All homework will be graded for being on time, professionalism, and legibility.
- Homework is graded out of 25 points.
- Rubrics will be provided for each homework to describe what is expected for each answer.

Method of Collection. All homework will be collected via Canvas, the course website. Homework must be submitted by 11:59:59 PM on the day it is due. Please note the following items:

- Homework must be turned in as 1 single file. If you need to combine typed responses with hand written calculations, you must scan in your hand-written portions, and import them into the word document that you have typed or inserted as a page into the PDF. There are free apps such as TurboScan which can be used to do this.
- It is the student's responsibility to ensure that the homework is correctly uploaded to Canvas. If you are having issues with Canvas contact the Canvas help desk, the professor is not able to help with IT/Technical issues.
- Turning in the homework at 12:00:00 AM or after on the day after the homework is due will still count as a late homework. It is recommended you plan to turn in your assignment earlier than the deadline to ensure any uploading issues are able to be fixed and you can turn your homework in on time.

Homework assignments are expected to look professional and be legible. Up to 20% of each homework will include points for meeting the criteria below. Homework assignments will meet the following requirements:

- Each page will have a header that includes student name, date, course number, assignment, and page number.
- Assignments **do not** have borders around the pages or unnecessary cover pages.
- Written sections have correct grammar and spelling.
- Handwriting is legible
- Each question is clearly labeled, with the given information, what you are required to answer, and the solution clearly marked.

An example of a correctly formatted homework is attached at the end of this syllabus.

Solutions will be available 1 week after the due date.

Assignments must be submitted by 11:59:59 PM on the date they are due through [Canvas.njit.edu](https://canvas.njit.edu). Any assignment turned in later than this time be considered late unless prior arrangements are made with the instructor. **Late homework will be accepted for up to 1 week after the due date. 2 points off the total earned points will be taken off for each day that it is late with the first day starting at 12:00:00 AM the day after it was due (i.e. if your homework would have earned 22 pts when turned in on time, but you turn it in 7 days late, it will earn 8 points).** Assignments turned in more than 1 weeks late, the grade will automatically go to 0.

## Grade Determination

The course grade will be determined using the following point breakdown:

Homework Assignments	125 Points total (5 Homework assns. at 25 points each)
In-Class Work and Answers	50 Points total (Best 10 out of 14 in-class exercises)
Lecture Quizzes	50 Points total (Best 10 out of 14 online lecture quizzes)
Exam 1	75 Points total

Exam 2	75 Points total
Final Examination	125 Points total

The course is scored out of a total of 500 points. Grading will not be completed according to a curve Letter grades will be determined using the following guidelines:

A = 450 points and above  
B+ = 425 – 449 points  
B = 400 – 425 points  
C+ = 375 – 399 points

C = 350 – 374 points  
D = 325 – 349 points  
F = Below 325 point

### **Lectures and Attendance Policy**

This course will be a flipped classroom. The lecture portion of the class will be done through posted online videos. The actual course time will be devoted to discussion, in-class exercises, and example problems.

You will be expected to watch the lecture videos prior to coming to class and you will take a graded quiz to show that you watched the videos. 14 lecture quizzes will be administered for 5 points each. The top ten quiz scores will be used for your final grade.

The lectures can be found under the modules for each week. The quizzes will also be posted there. Quizzes and lectures will be available one week before the lecture period we will be using them for. **You are still expected to attend and participate in the online course.** You must log into each lecture and your video must be on. I will be tracking who is online and you will only get points for the in-class exercise if you are in the online lecture.

Courses will be held in webex and you can use the following link to join my room for each class: <https://njit.webex.com/meet/adams>

Video address: [adams@njit.webex.com](mailto:adams@njit.webex.com)

Pin: 1879 (Needed when calling in from a phone)

Students are expected to be on time for class, and to remain in class during the entire period. Chronic lateness or leaving of class for extended periods of time will result in poor performance. Regular attendance in class will greatly increase your ability to perform well on the exams, quizzes, homework, and class assignments. If a student must miss a class or an exam please contact the professor to discuss the issue at least 24 hours **prior** to missing the class. Students will not be allowed to makeup exams or quizzes if the professor is not contacted prior to the class. If a student had a serious medical issue, death in the family, or other excusable emergency absence, the student is required to obtain an excused absence from the Dean of Students prior to asking for a make-up.

### **In-class Exercises**

14 in-class question sessions (one for each class after the first day) will be done during the course. These will take place through a platform called Socrative. You can download the app through the iOS, Google or Android store or you can log in at <https://socrative.com>. You will be required to log-in using your name and student ID so I can track your responses.

## Course Exams

Three exams will be given during the term, two during the term and a final exam. Each regular exam will be out of 75 points, and the final exam will be out of 125 points. The final exam will be cumulative of the whole semester. Exams will include both a multiple-choice portion, calculation sections, and a written response portion. Exams are closed book. You will be provided with all the information you need on the exam sheet itself.

**Exams will require Respondus lockdown browser, the online browser lockdown software used by NJIT to ensure fidelity of the exam.** Information on using Respondus can be found here: <https://ist.njit.edu/respondus>. It is your responsibility to ensure that your system works with Respondus prior to the exam. There is a test quiz available on Canvas for you to try if you have not used Respondus beforehand. Any technical issues with Respondus must be reported to the professor immediately during the exam time.

Missed examinations will not be allowed to be made up without prior consent from the professor. If a student will be missing an examination, please contact the professor at least **24 hours prior** to missing the exam.

If you have an emergency and miss an exam without prior approval from the professor, you must contact the Dean of Students who will review your case and determine whether an absence should be allowed.

## Plagiarism and Copying

Plagiarism and copying will \*not\* be tolerated in this course. While it is encouraged that you discuss and work together on homework problems, direct copying of each-others answers is prohibited. Many homework assignments require written responses and each student is expected to write their own response.

Plagiarism is also not tolerated. Plagiarism is when you use someone else's words, ideas, assertions, data, or figures and do not acknowledge that you have done that (i.e. pass it off as your own original work). If you use the words, ideas, or even phrases from someone else or any published material you must:

1. Use quotation marks around the copied words or phrases AND cite the source; or
2. Paraphrase or summarize using your own words and phrases AND cite the source.

Any charts, graphs, data, images, or numerical information used from another source or published material must also be cited. If you are not familiar with citations please work with an NJIT librarian to learn more. This is all material that should have been covered in your first-year writing courses.

Student assignments will be submitted via a plagiarism detection software. Any evidence of plagiarism, copying, or cheating during exams, on homeworks, or on quizzes will result in an immediate grade of zero for the assignment and will be reported to the dean of students. A second instance of this will result in a failing grade for the course.

## Extra Credit

No extra credit will be offered for the course. The grading is designed to give students many chances to do well in the course. For more information why extra credit is not offered please review the following website:

<https://www.math.uh.edu/~tomforde/NoExtraCredit.html>

## **Course Reading**

You are required to complete the readings for the course prior to each class. The reading has been chosen to support the material given in class and should be given full attention.

## **Course Schedule**

Note: Course schedule is tentative and may change throughout the term. The instructor will communicate any changes. Class time is provided for topics of particular interest to students, or to provide additional instruction if class is running behind. Students wishing to suggest a special topic should speak with the instructor. (Note: Lectures are based on a twice per week, 1.5 hour class period, 14 week schedule). The course schedule is attached at the end of this syllabus.

## **Students with Disabilities**

NJIT is committed to providing students with documented disabilities equal access to programs and activities. If you have, or believe that you may have, a physical, medical, psychological, or learning disability that may require accommodations, please contact the Coordinator of Student Disability Services located in the Center for Counseling and Psychological Services, in Campbell Hall, room 205, (973) 596-3414. Further information on disability services related to the self-identification, documentation and accommodation processes can be found on the webpage at: (<http://www.njit.edu/counseling/services/disabilities.php>)

## **Academic Dishonesty and Student Conduct**

(Taken from the NJIT Academic Integrity Code linked below)

New Jersey Institute of Technology is an institution dedicated to the pursuit of knowledge through teaching and research. The university expects that its graduates will assume positions of leadership within their professions and communities. Within this context, the university strives to develop and maintain a high level of ethics and honesty among all members of its community.

Imperative to this goal is the commitment to truth and academic integrity. This commitment is confirmed in this NJIT University Code on Academic Integrity. The essential quality of this Code is that each student shall demonstrate honesty and integrity in the completion of all assignments and in the participation of the learning process. Adherence to the University Code on Academic Integrity promotes the level of integrity required within the university and professional communities and assures students that their work is being judged fairly with the work of others. For more information on the code of academic integrity please see: <http://www.njit.edu/education/pdf/academic-integrity-code.pdf>

## **Class Behavior**

While the university is a place where the free exchange of ideas allows for debate and disagreement, all classroom behavior and discourse should reflect the values of respect and civility. Behaviors that are disruptive to the learning environment will not be tolerated and students will be asked to leave the classroom. This includes but is not limited to aggressive behavior, sleeping in class, disruptive behavior, use of electronic devices for activities not related to coursework, racist, sexist, ableist, or homophobic language, and inappropriate or crude language.

Any student that prefers to use a particular pronoun should let the professor know so that this can be accommodated.

**E-mail communication with the professor and each other is expected to be professional.** Any e-mails received by the professor that are not professionally formatted and stated will not be answered. Examples of professional e-mail etiquette can be found at the following links:

<http://www.wikihow.com/Write-a-Formal-Email>

<http://englishlive.ef.com/blog/write-perfect-professional-email-english-5-steps/>

<https://owl.english.purdue.edu/owl/resource/636/01/>

### **Legal Disclaimer**

Students' ability to meet outcomes listed may vary, regardless of grade. They will achieve all outcomes if they attend class regularly, complete all assignments with a high degree of accuracy, and participate regularly in class discussions.

This syllabus is subject to change at the discretion of the instructor throughout the term.

### **Class during a pandemic**

I understand that this is a stressful time for all of us, and that emergencies happen with more frequency these days. If you are experiencing hardship please contact me and we can work together to ensure that you can meet the course requirements. If you get sick during the term, please contact me and the Dean of Students as soon as possible so we can figure out if you will be able to make up the time while you are out sick. Your health, both physical and mental, is your first priority. I am here to help, but I can't help if you come to me after the fact. Honest and open up front communication will go a long way to us all having a good semester.



# Sample Homework Layout

## Question 1

### Given:

List the resources and emissions associated with the life of a washing machine. Provide both the resources input to each step, and the emissions output. Your answer should be in the form of a cycle diagram as done in class.

### Solution:

Figure 1 presents the inputs and outputs from the manufacture of a washing machine.

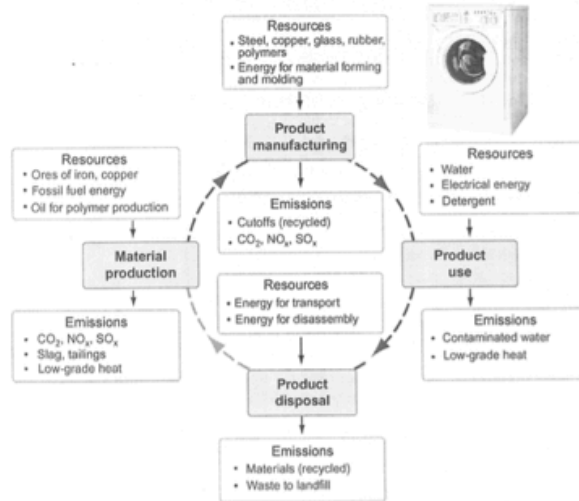


Figure 1: Inputs and outputs from the manufacture of a washing machine [Ashby 2014]

This image shows the resources required and emissions from each step of the manufacture of a washing machine. Significant greenhouse gas emissions can be noted during the material production and product manufacturing phase and energy is required as an input for each phase of the cycle.

### References:

Ashby, Michael F., 2014, Materials and the Environment: Eco-informed Material Choice, Elsevier Science, St. Louis

**Matrix – CE 360 Sustainable Civil Engineering Materials**

<b>Strategies, Actions and Assignments</b>	<b>ABET Student Outcomes (1-7)</b>	<b>Program Educational Objectives</b>	<b>Assessment Measures</b>
<b>Objective 1. Define sustainability in their own words and relate how sustainability is defined in the context of new construction as well as renovation and rehabilitation.</b>			
Discuss what sustainability is in the context of construction and construction materials.	1, 3, 4, 7	1, 3	Homework, quizzes, exams, in-class exercises
Write a cohesive definition that incorporates the ideas of the three pillars of sustainability.	1, 2	1	Quizzes, exams
<b>Objective 2. Demonstrate concepts of life-cycle analysis including economic and sustainability aspects and apply these concepts to sustainable construction.</b>			
List and explain the various steps of completing a life cycle analysis.	2, 4	1	Quizzes, Exams
Describe the different types of life cycle analyses and the reasons why someone may choose a particular method.	1, 4	1	Quizzes, Exams
<b>Objective 3. Identify key material properties important to the successful application of aggregates, asphalt concrete, portland cement concrete, wood and metals to a variety of civil works..</b>			
List and define the key components of aggregates, concrete, asphalt, wood, and metals.	1, 4, 7	1	Quizzes, Exams
Describe the different material properties that affect fresh properties, mechanical properties, and durability properties.	2, 4	1, 2	Quizzes, Exams
<b>Objective 4. Specify aggregates, concrete and asphalt mixtures, metals, and wood for typical construction applications including the use of appropriate standards (i.e. ASTM) for testing and specification of said materials.</b>			
Identify the properties needed for specific applications of each material.	1, 4	1	Homework, In-Class Exercises, Exams
Discuss the various service and environmental loadings that a constructed element may experience and what properties are needed to resist those loadings.	2, 3	1, 2	Homework, Exams, Quizzes, In-class exercises
<b>Objective 5. Design a PCC mixture and an HMA mixture using sustainability concepts that will be durable and meet the requirements of a particular construction project.</b>			
Design a concrete mixture using the volumetric method.	1, 2	1, 2	Homework, Exams, In-Class Exercises
Choose materials for and design an asphalt mixture according to the Superpave process	1, 2	1, 2	Homework, Exams, In-Class Exercises

## **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 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 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

Revised: 2/13/18