

CEE 8813-A:

Construction Equipment and Methods

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Prerequisite: None

Course Books (optional):

- 1) Construction Methods and Management, 8th edition, S.W. Nunnally, Pearson Prentice Hall, ISBN 0-13-500079-3
- 2) CONSTRUCTION EQUIPMENT MANAGEMENT 2nd edition, John E. Schaufelberger, Prentice-Hall, 2019.

Course Objectives:

This is a heavy/highway construction course that teaches construction equipment and selected heavy civil construction methods. It is intended for all CEE students and highly recommended for those who expect to work in heavy/civil projects in the future, either from a design or construction perspective. The topics introduced include site development, earthmoving materials, equipment economics, excavation, stability of excavations, loading and hauling, cranes, computer simulation, equipment safety, automated construction, and field demonstration.

Upon completion of this course, the student is expected to be able to:

- 1) Understand the types and functions of the most commonly used equipment in heavy construction.
- 2) Understand the elements of equipment cost and evaluate investment alternatives.
- 3) Develop a basic understanding of unit price and earthwork quantities.
- 4) Plan and sequence safe site development, earthwork, and lifting operations.
- 5) Optimize a spread of multiple types of equipment to perform specific operations under schedule and cost constraints.
- 6) Properly select heavy equipment based on applications, utilization, productivity, and other factors through a computer simulation tool
- 7) Experience state-of-the-art construction technologies, including 3D reconstruction, virtual reality, augmented reality, and construction automation.

Grading Scheme:

Percentage	Grade
90.00-100	A
80.00-89.99	B

70.00-79.99	C
60.00-69.99	D
59.99 or lower	F

Grading Criteria:

Participation (10%) Quizzes & Homework (20%)	30%
2 Tests @ 20%	40%
Final Project @30%	30%

Tentative Course Schedule*:

Week	Topics	Remarks (*HW release dates)
1	Course Introduction Site Investigation	
2	Excavation Protection (safety)	HW#1 (Excavation)
3	Ownership & Operation Cost	HW#2 (O&O)
4	Equipment Cost Estimating Introduction to CAT Performance Handbook	CAT Handbook in-class practice
5	Fundamentals of Earthmoving-I Exam #1 review	HW#3 (Soil Properties)
6	Mega Excavator Fundamentals of Earthmoving-II Exam #1	HW#4 Equipment power
7	Tractors/ Loaders Excavator	HW #5 Tractor & Loader
8	Scrapers Trucks	HW#6 Trucks
9	Crane, Crane safety Crane rigging estimation	
10	Exam review, Group Project Introduction Exam #2	
11	No class	Spring Break (March 18-22)
12	Steel Construction: case study 5 minute-rating	
13	Intro to computer simulation Discrete Event Simulation (DES) vs. Continuous simulation	Group Project Abstract due
14	Intro to simulation modeling tools	
15	Group Project Discussion Automated Construction Equipment	Group project deliverables deadline (April 19)
16	Course Wrap-up & Final Group Presentation	

*The outline contents are subject to change at the discretion of the instructor (e.g., guest speakers, field trips)

** Exam dates can be rescheduled based on the class progress.

Final Group Project Guideline

Utilizing Simulation for Decision-Making in Real-World Applications

Objective:

In this assignment, you will work in a team to identify a real-world construction application facing a specific problem that could be addressed through a simulation-based solution (e.g., cycle times, cost, productivity). You will develop a simulation model to tackle the identified problem and demonstrate how this model enhances decision-making processes for stakeholders involved in the application.

Project Timeline:

1) April 1: 2-page Abstract Submission

Each team must submit a 2-page abstract via Canvas, outlining the selected project's key details:

- Project title
- Team members and their designated roles
- Objectives of the project
- A brief description of the real-world application and the identified problem

2) April 19: Final Report and Simulation Model Submission

- By 3:00 PM, teams are required to submit their final report and the developed simulation model(s) via Canvas.
- The final report should be concise, spanning a maximum of 10 pages, and must include:
 - Introduction to the project and improvement needs
 - Description of the simulation model and its key components
 - Methodology employed for the simulation
 - Presentation of simulation results and analysis
 - Discussion on the implications of simulation results on decision-making
 - Conclusion and any potential recommendations for further improvements

• April 22: Group Presentation Slides

- Before noon, each group must submit their presentation slides, with a maximum duration of 15 minutes per group, via Canvas.
- The presentation should cover essential aspects of the project, including:
 - Brief overview of the selected application and its problem
 - Explanation of the simulation model's structure and design

- Summary of key findings and outcomes from the simulation
- Demonstration of how the simulation model supports decision-making in the real-world application
- Time for Q&A from the instructor and other students
- Project Guidelines:
- Real-World Application Selection:
 - Choose a real-world construction operation applications that faces an identifiable problem.
 - Ensure the problem is suitable for addressing using simulation techniques.
- Team Formation:
 - Form teams with a maximum of three members.
 - Assign specific roles to each team member to ensure efficient collaboration.

Simulation Model Development:

- Design and develop a simulation model that accurately represents the real-world application and the identified problem.
- Utilize appropriate methodologies and tools to construct the simulation.
- Enhanced Decision-Making
- Show how the simulation model supports stakeholders involved in the real-world application in making informed decisions.
- Discuss the benefits and limitations of the simulation-based approach.

Grading:

- The quality and relevance of the selected real-world application and problem (10%)
- Effectiveness and accuracy of the simulation model (30%)
- Clarity and thoroughness of the final report (20%)
- Professionalism and effectiveness of the group presentation (20%)
- Collaboration and teamwork (e.g., well-distributed roles) (10%)
- Adherence to deadlines (10%)