University of Illinois at Urbana-Champaign
Department of Civil and Environmental Engineering

Pavement Evaluation, Maintenance, and Rehabilitation, CEE 508 (Fall 2023)

Instructor: Imad L. Al-Qadi E-mail: alqadi@illinos.edu
Office: 1207 NCEL (5-0427)
Office Hours: T & R: 9:30-10:30 AM
Lecture: T & R: 8:00-9:20 AM (3310 Newmark)

TA: Qingwen Zhou qingwen2@illinois.edu
M: 1:00-2:00 PM (Zoom, link on Compass)
W: 9:00-10:00 AM (B142 NCEL)

Class Notes: Reading assignments are provided including *Techniques for Pavement Rehabilitation Strategies for Highway Pavements* and selected published articles and reports

This course has been developed to address the urgent needs of the deteriorating roadway infrastructure. The main objective is to educate graduate engineering students about pavement deterioration assessment, efficient rehabilitation techniques, cost analysis, and environmentally conscious solutions. Sustainability assessment methodologies are introduced and cases studies for selecting the most efficient, environment-friendly, and cost-effective approaches are presented.

COURSE OBJECTIVES

Upon successful completion of this course, the student is expected to effectively:

1. Identify various deterioration aspects of roadway infrastructure,
2. Understand methods of pavement evaluation,
3. Identify various rehabilitation techniques for flexible and rigid pavements,
4. Understand roadway infrastructure sustainability assessment,
5. Conduct sustainability assessment for different purposes,
6. Incorporate sustainability assessment for pavement rehabilitation,
7. Define sustainable rehabilitation materials and rehabilitation techniques,
8. Recommend cost-effective and environmental-friendly rehabilitation techniques,
9. Recognize energy harvesting approaches,
10. Optimizing autonomous and connected truck platoons for pavements, and
11. Estimate service life improvement due to rehabilitation

POLICES AND PROCEDURES:

- The course outline will serve as a general guide for the order of the work. However, it is subject to change at the discretion of the instructor at any time during the semester.
- Class attendance is expected, and participation is encouraged.
- The important issues will be discussed in class; however, the student should be cognizant of the material in the reading assignments. Students are highly encouraged to participate in the class.
- Required homework will be due at the beginning of the class period on the due date (for both hardcopy or electronic submittal). All homework should be posted on Gradescope. Entry code is **745BK6**. If the assignment is to be completed in groups, one solution set per group is due. For group assignments, the cover page should include the name of the group leader followed by the names of other *participating* group members. *If a student's name appears on a solution set, it certifies that he/she has participated in solving some of the problems and understands all the solutions*. If this does not turn out to be the case, both the group leader and student in question will be considered to have violated UIUC's Honor Code.
- Late homework will be accepted up to one week after the due date and will receive a maximum grade of 50%. This privilege will be withdrawn if any individual abuses it.
- If you miss a test, you must have a pre-approval (provided for emergencies only) or a certified medical excuse. In that case, you may take a makeup exam at a date that is mutually agreed on between the student and the instructor.

- All submitted work shall be considered graded work, unless otherwise noted. The HONOR CODE will be enforced. All aspects of your coursework are covered by the HONOR SYSTEM. Be mindful that, honesty in your academic work will develop into professional integrity.
- Use of ChatGPT is not allowed for this class, unless directed by the instructor.
- A weighted grade will be assigned according to UIUC grading "letter" system. Tentative scale can be found here: https://blogs.illinois.edu/files/1499/114301/4395.pdf. There will be a *gray area* between each two letter grades in the final distribution (the lower side of a borderline grade), so two students getting the same weighted average grade could get two different letter grades. If you are in one of these *gray areas*, whether you get the higher or lower grade depends on (1) your performance in the class, and (2) whether your overall performance has been improving (tests and homework grades go up) or declining (tests and homework grades go down). But, no grade will be lowered for the above reasons.
- There will be two mid-term exams, a final report, and an oral presentation. Grades are distributed as follows:

Exam #1:	20%
Exam #2:	30%
Homework & Quizzes:	20%
Report and Presentation	30%

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COURSE OUTLINE

Week	Date	Lecture	Lecture Topic*
1	8/22 8/24	1 2	Introduction to Transportation Infrastructure Importance of Pavement Monitoring, Rehabilitation, and Sustainability
2	8/29 8/31	3 4	Pavement Materials and Testing I – AC Pavement Materials and Testing II – PCC
3	9/5 9/7	5 6	Flexible Pavement Deterioration and Rigid Pavement Deterioration Electric Trucks and Platoons and Their Impact on Pavements
4	9/12 9/14	7 8	Falling Weight Deflectometer - Theory Principles of GPR and Pavement Assessment
5	9/19 9/21	9 10	Stress Wave Propagation: Methods and Applications Pavement Friction and Pavement Noise
6	9/26 9/28	11 12	Pavement Roughness Demonstration of Field Measurements and Analysis
7	10/3 10/5	- 13	**Exam # 1** Pavement Instrumentation and APT/ *Project Discussion*
8	10/10 10/12	14 15	Sustainability Assessment - Transportation Life Cycle Assessment - Framework and Example
9	10/17 10/19	16 17	Impact Assessment, PCRs, and EPDs Life Cycle Cost Analysis – Framework and Example
10	10/24 10/26	18 19	Pavement Maintenance and Preservation Cold Milling, In-Place/ Plant Recycling, Full Depth Reclamation
11	10/31 11/2	20 21	Special Overlays: OGFC, Rubberized Asphalt, SMA, WMA Green Rehabilitation: Use of RAP, RAS, Plastics, and Biomaterials
12	11/7 11/9	22 23	PCC Rubblization & Full Depth Repair of PCC PCC Pavement Recycling and Ultra-thin Whitetopping Overlays
13	11/14 11/16	24 -	Reflective Cracking Mechanisms and Treatment **Exam # 2**
14	11/21 11/23	- -	**Thanksgiving Break**
15	11/28 11/30	25 26	Life Cycle Assessment & Life Cycle Cost Analysis – Tool Presentation Pavement Energy Harvesting
16	12/5 12/7	27	Introduction to Pavement Management System No Class: Reading Day
			Please reserve **Saturday December 2 8am-12pm** for Project Presentations **Room: Newmark 3310**

* **Reading assignments are available on Compass**

Online Participation:

- A copy of the lecture will be available at https://echo360.com/ after the lecture. Log-in with your student information to access the content.
- Any student registered as in person who is not able to attend class for any reason must discuss their situation with the instructor to make lecture available for the duration of their excuse.

COVID-19 Guidelines:

- Following University policy, all students are required to engage in appropriate behavior to protect the health and safety of the community. Students are also required to follow the campus COVID-19 protocols.
- Students who feel ill must not come to class. In addition, students who test positive for COVID-19 or have had an exposure that requires testing and/or quarantine must not attend class. The University will provide information to the instructor, in a manner that complies with privacy laws, about students in these latter categories. These students are judged to have excused absences for the class period and should contact the instructor via email about making up the work.
- Students who fail to abide by these rules will first be asked to comply; if they refuse, they will be required to leave the classroom immediately. If a student is asked to leave the classroom, the non-compliant student will be judged to have an unexcused absence and reported to the Office for Student Conflict Resolution for disciplinary action. Accumulation of non-compliance complaints against a student may result in dismissal from the University.
- In order to implement COVID-19-related guidelines and policies affecting university operations, instructional faculty members may ask students in the classroom to show their Building Access Status in the Safer Illinois app or the Boarding Pass. Staff members may ask students in university offices to show their Building Access Status in the Safer Illinois app or the Boarding Pass. If the Building Access Status says “Granted,” that means the individual is compliant with the university’s COVID-19 policies—either with a university-approved COVID-19 vaccine or with the on-campus COVID-19 testing program for unvaccinated students.
- Students are required to show only the Building Access Screen, which shows compliance without specifying whether it was through COVID-19 vaccination or regular on-campus testing. To protect personal health information, this screen does not say if a person is vaccinated or not. Students are not required to show anyone the screen that displays their vaccination status. No university official, including faculty members, may ask students why they are not vaccinated or any other questions seeking personal health information.
- All students, faculty, staff, and visitors are required to wear face coverings in classrooms and university spaces. This is in accordance with CDC guidance and University policy and expected in this class.
- Please refer to the University of Illinois Urbana-Champaign’s COVID-19 website for further information on face coverings. Thank you for respecting all of our well-being so we can learn and interact together productively.