

Concrete Durability

CGN 6504

Class Periods: T U Period 5&6 (11:45-1:40)

Location: Tuesday MAEB 229; Thursday MCCA G186

Academic Term: Spring 2025

Instructor:

Kyle Riding

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352-294-1628

Office Hours: T U 2-3 pm, 460C Weil Hall

Course Description

Mechanisms, test methods, and mitigation methods for concrete deterioration. Mechanisms covered include cracking, freeze-thaw, reinforcing steel corrosion, alkali silica reaction, sulfate attack, chemical attack, and abrasion.

Course Pre-Requisites / Co-Requisites

Undergraduate-level civil engineering materials course; analysis and design in reinforced concrete.

Course Objectives

1. Describe the benefits and challenges of implementation of concrete performance specifications
2. Explain the mechanisms of concrete degradation
3. Explain the benefits and issues with current performance tests for common concrete durability problems
4. Design concrete mixtures for a desired service life

Materials and Supply Fees

None.

Required Textbooks and Software

None Required

Recommended Materials - References

- ACI 201.2R-16, "Guide to Durable Concrete," ACI International, 2016. ACI 224.1 "Control of Cracking in Concrete Structures," ACI International, 2008.
Can get access by getting a free student E-membership to ACI at <https://www.concrete.org/membership/studentmembership.aspx>
- RILEM TC 211 State-of-the-Art Report, Performance of Cement-Based Materials in Aggressive Aqueous Environments (available through UF library)
- Poursaee, A., Corrosion of Steel in Concrete Structures, Woodhead Publishing Series in Civil and Structural Engineering: Number 61, 2016, 295 pp. (Available as an ebook from UF library)
- Other material including notes and published papers will be designated with access provided through the UF Library

Course Schedule: Topics

Dates for topics, assignments, quizzes, and exams will be posted on the course CANVAS site.

- 1: Specifications
- 2: Hydration
- 3: Permeability and Transport
- 4: Corrosion
- 5: Service Life Modeling
- 6: Cracking
- 7: Hot Weather Concreting
- 8: Mass Concrete
- 9: Freeze-thaw
- 10: Freeze-thaw test methods
- 11: Salt Scaling
- 12: ASR
- 13: Sulfate Attack
- 14: Chemical Attack
- 15: Abrasion

Attendance Policy, Class Expectations, and Make-Up Policy

Students are expected to watch video lectures, do reading, and take quizzes as preparation to attend class. In-class discussion, problems, case studies, practical examples, and projects, will be given during class. Students must bring laptops to class for some in class activities. To aid in long-term learning, the following steps are expected of students:

- 1) Watch and review recorded lectures and notes
- 2) Read assigned documents and papers
- 3) Take quiz BEFORE attending class
- 4) Attend class and complete class activities
- 5) Review for examinations

Class attendance is expected. Excused absences are consistent with university policies in the undergraduate catalog: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx> and requires appropriate documentation.

Evaluation of Grades

UF policies for grading will be followed. <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx> Late homework will not be accepted without **prior** arrangements with the instructor. Students are encouraged to work on homework in groups, but homework must be done individually. The standard for homework is that you must be able to explain what was done each step in the homework problem turned in and why it was done that way. As part of the term project, students in groups will develop specifications for a given project to provide a given service life, design concrete mixtures that can meet those specifications for the project, demonstrate that the mixtures can meet the service life through modeling. Groups present a summary of their proposed solution, while individual reports are submitted of the work. The exams will focus mainly on the material covered after the previous exam, however, because each class builds on previous material, students should be prepared to answer questions about any previously covered topic. Students are responsible for keeping returned homework, quizzes, and exams to be able to correct problems with recording of scores. All grades on exams, quizzes and homework becomes final 2 weeks after being returned to the class (a student not picking up an exam or homework does not constitute an extension to this deadline).

Assignment	Percentage of Final Grade
Homework	25%
Term Project	15%
Exam 1	20%
Exam 2	20%
Exam 3	20%

	100%
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Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.ufl.edu/public-results/>.

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session. Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

Class Demeanor

Students are expected to arrive to class on time and behave in a manner that is respectful to the instructor and to fellow students. Please avoid the use of cell phones and restrict eating to outside of the classroom. Opinions held by other students should be respected in discussion, and conversations that do not contribute to the discussion should be held at minimum, if at all.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Conduct Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:
Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>;<https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.