DEPARTMENT OF
Civil and
Environmental Engineering
UNIVERSITY OF WISCONSIN–MADISON

1. **COURSE NAME AND NUMBER**

   Civ Engr 678 Advanced Traffic Modeling and Computer Simulation

2. **CREDITS AND CONTACT HOURS**

   3 credits, 3 contact hours

3. **CANVAS COURSE URL**

   https://canvas.wisc.edu/courses/294955

4. **COURSE DESIGNATIONS AND ATTRIBUTES**

   This course carries the graduate course attribute.

5. **MEETING TIME AND LOCATION**

   T.R. 9:30 AM - 10:45 AM, ENGR HALL 1209

6. **INDICATE WHETHER THE COURSE IS REQUIRED, ELECTIVE, OR SELECTED ELECTIVE.**

   Elective

7. **INSTRUCTIONAL MODE**

   In-person

8. **SPECIFY HOW CREDIT HOURS ARE MET BY THE COURSE**

   Three hours (three 50-minute) of classroom or direct faculty/instructor instruction and a five hours of out of class student work each week over 15 weeks of the semester.

9. **REGULAR AND SUBSTANTIVE STUDENT-INSTRUCTOR INTERACTION**

   Substantive Interaction

10. **INSTRUCTORS AND TEACHING ASSISTANTS**

    a. **Instructor Title and Name**

       Bin Ran, Professor

       Yang Cheng, Assistant Researcher

    b. **Instructor Availability**

       Thursday 11AM-12PM.

    c. **Instructor Email/Preferred Contact**

       Bin Ran, Room 1212 Engr. Hall, (608) 262-0052, bran@engr.wisc.edu

       Yang Cheng, Room 1241 Engr. Hall, (608) 262-2524, cheng8@wisc.edu

d. Teaching Assistant

Keshu Wu, Yifan Yao

e. TA Office Hours

TBD

f. TA Email/Preferred Contact

Keshu Wu <kwu84@wisc.edu>; Yifan Yao <yyao66@wisc.edu>

11. OFFICIAL COURSE DESCRIPTION

As approved through governance, presented in the Guide.

12. REQUISITES

None

13. LEARNING OUTCOMES

a. Course Learning Outcomes

This course explores both the theoretical and practical perspective of traffic flow modeling with the focus on micro-simulation. All three major simulation software, CORSIM, VISSIM, and PARAMICS will be introduced. Students will have the opportunities to use and practice these tools through field-data based traffic flow modeling projects. The CARLA simulation platform for simulating automated driving will be introduced too.

Traffic flow modeling, aiming to replicate or predict traffic flow condition based on field collected traffic data, has been an active topic for both theoretical research and field practice for many years. It is an effective approach for quantifying the benefits and the limitations of different alternatives when applied in an effective and efficient manner. By working with simulation models, researchers and practitioners typically develop and calibrate a set of base models of existing conditions, extend the models to include design alternatives (generally using traffic demands projected for future years), and then generate conclusions on the basis of the modeling results. Therefore, it is very important to understand the basic concepts that are embedded in the packages, including proper calibration process.

Throughout the semester, students will learn the detailed information regarding recent enhancements in popular traffic simulation packages and have a chance to use these simulation modeling packages based on real-world projects. This class also provides for the opportunities to explore the core models behind these simulation software using the data and models used in the NGSIM (Next Generation Simulation Package) project.

b. ABET Student Outcomes

In this course, students will attain:

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

(n) an ability to understand common failure mechanisms of a component, process, or system and their causes and prevention

13. BRIEF LIST OF TOPICS TO BE COVERED

traffic flow modeling; traffic micro-simulation and software

14. DISCUSSION SESSIONS

Week	Date	Topic
1	1/25	Introduction to Major Transportation Engineering Models & Packages
	1/27	Perspectives of Traffic Flow Modeling
2	2/1	Microscopic Simulation Modeling
	2/3	Car-following
3	2/8	Introduction to CORSIM
	2/10	CORSIM Lab 1
4	2/15	CORSIM Lab 2
	2/17	Introduction to VISSIM and PARAMICS
5	2/22	VISSIM Lab 1
	2/24	VISSIM Lab 2
6	3/1	VISSIM Lab 3
	3/3	VISSIM Lab 4
7	3/8	VISSIM Lab 5
	3/10	Team Presentation 1
8	3/15	Spring Break
	3/17	Spring Break
9	3/22	Introduction to Macroscopic Traffic Flow Modeling – Fundamental Diagram and Continuum Models
	3/24	Introduction to NGSIM

10	3/29	NGSIM Lab 1
	3/31	NGSIM Lab 2
11	4/5	NGSIM Lab 3
	4/7	NGSIM Lab 4
12	4/12	Team Presentation 2
	4/14	Introduction to CARLA simulation
13	4/19	CARLA Lab 1
	4/21	CARLA Lab 2
14	4/26	CARLA Lab 3
	4/28	CARLA Lab 4
15	5/3	CARLA Lab 5
	5/5	Team Presentation 3

15. LABORATORY SESSIONS

16. REQUIRED TEXTBOOK, SOFTWARE & OTHER COURSE MATERIALS

1. Advanced CORSIM Training Manual, Minnesota Department of Transportation, SEH No. A-MNDOT0318.00, September 12, 2003.
2. TSIS/CORSIM 6.1 user guide.
3. VISSIM User Manual
4. PARAMICS manuals
5. CARLA manuals

17. GRADING

Team Project 1 - 25%
Team Project 2 - 30%
Team Project 3 - 35%
Quiz - 10%

18. **TEXTS:** (Most texts will be available in PDF format on Canvas@UW.)

1. Advanced CORSIM Training Manual, Minnesota Department of Transportation, SEH No. A-MNDOT0318.00, September 12, 2003.
2. TSIS/CORSIM 6.1 user guide.
3. VISSIM User Manual
4. PARAMICS manuals
5. CARLA manuals

19. EXAMS, QUIZZES, PAPERS & OTHER MAJOR GRADED WORK

- There are three in-class quizzes, scheduled in February, March, and April, respectively. Close-book.
- There are three course projects, in which students are expected to participate in each project and presentation as a team of two. Students cannot work with the same partner in more than one project. Every team needs to turn in a report in addition to the presentation. The project is graded based on the report (50%) and presentation (50%).

20. HOMEWORK & OTHER ASSIGNMENTS

No homework.

21. OTHER COURSE INFORMATION

22. CAMPUS SPACES FOR VIRTUAL LEARNING & TESTING

Dedicated on-campus spaces with high-speed internet are available for students to reserve for any exam/quiz taken during the semester. Computers can also be requested.

23. Privacy of Student Information & Digital Tools: Teaching & Learning Analytics & Proctoring Statement

- The privacy and security of faculty, staff and students' personal information is a top priority for UW-Madison. The university carefully reviews and vets all campus-supported digital tools used to support teaching and learning, to help support success through learning analytics, and to enable proctoring capabilities. UW-Madison takes necessary steps to ensure that the providers of such tools prioritize proper handling of sensitive data in alignment with FERPA, industry standards and best practices.
- Under the Family Educational Rights and Privacy Act (FERPA which protects the privacy of student education records), student consent is not required for the university to share with school officials those student education records necessary for carrying out those university functions in which they have legitimate education interest. 34 CFR 99.31(a)(1)(i)(B). FERPA specifically allows universities to designate vendors such as digital tool providers as school officials, and accordingly to share with them personally identifiable information from student education records if they perform appropriate services for the university and are subject

24. RULES, RIGHTS & RESPONSIBILITIES

See the Guide's to Rules, Rights and Responsibilities

25. CAMPUS GUIDANCE ON THE USE OF FACE COVERINGS

Face coverings must be correctly worn on campus at all times and in all places (both outside and inside), except by students in their assigned residence hall rooms; by employees when alone in a private, unshared lab or office; when traveling alone in a private vehicle; and when exercising outside in a way that maintains 6 feet of distance from other people.

Students with disabilities or medical conditions who are unable to wear a face covering should contact the McBurney Disability Resource Center or their Access Consultant if they are already affiliated. Students requesting an accommodation unrelated to disability or medical condition, should contact the Dean of Students Office.

Students who choose not to wear a face covering may not attend in-person classes, unless they are approved for an accommodation or exemption. All other students not wearing a face covering will be asked to put one on or leave the classroom. Students who refuse to wear face coverings appropriately or adhere to other stated requirements will be reported to the Office of Student Conduct and Community Standards and will not be allowed to return to the classroom until they agree to comply with the face covering policy. An instructor may cancel or suspend a course in-person meeting if a person is in the classroom without an approved face covering in position over their nose and mouth and refuses to immediately comply.

26. QUARANTINE OR ISOLATION DUE TO COVID-19

Student should continually monitor themselves for COVID-19 symptoms and get tested for the virus if they have symptoms or have been in close contact with someone with COVID-19. Student should reach out to instructors as soon as possible if they become ill or need to isolate or quarantine, in order to make alternate plans for how to proceed with the course. Students are strongly encouraged to communicate with their Instructor concerning their illness and the anticipated extent of their absence from the course (either in-person or remote). The instructor will work with the student to provide alternative ways to complete the course work

27. ACADEMIC INTEGRITY

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to https://conduct.students.wisc.edu/academic-integrity/.

28. ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

McBurney Disability Resource Center syllabus statement: "The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information,

including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA."

http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php

29. DIVERSITY & INCLUSION

Institutional statement on diversity: "Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world." https://diversity.wisc.edu/

30. Academic Calendar & Religious Observances

See: https://secfac.wisc.edu/academic-calendar/#religious-observances