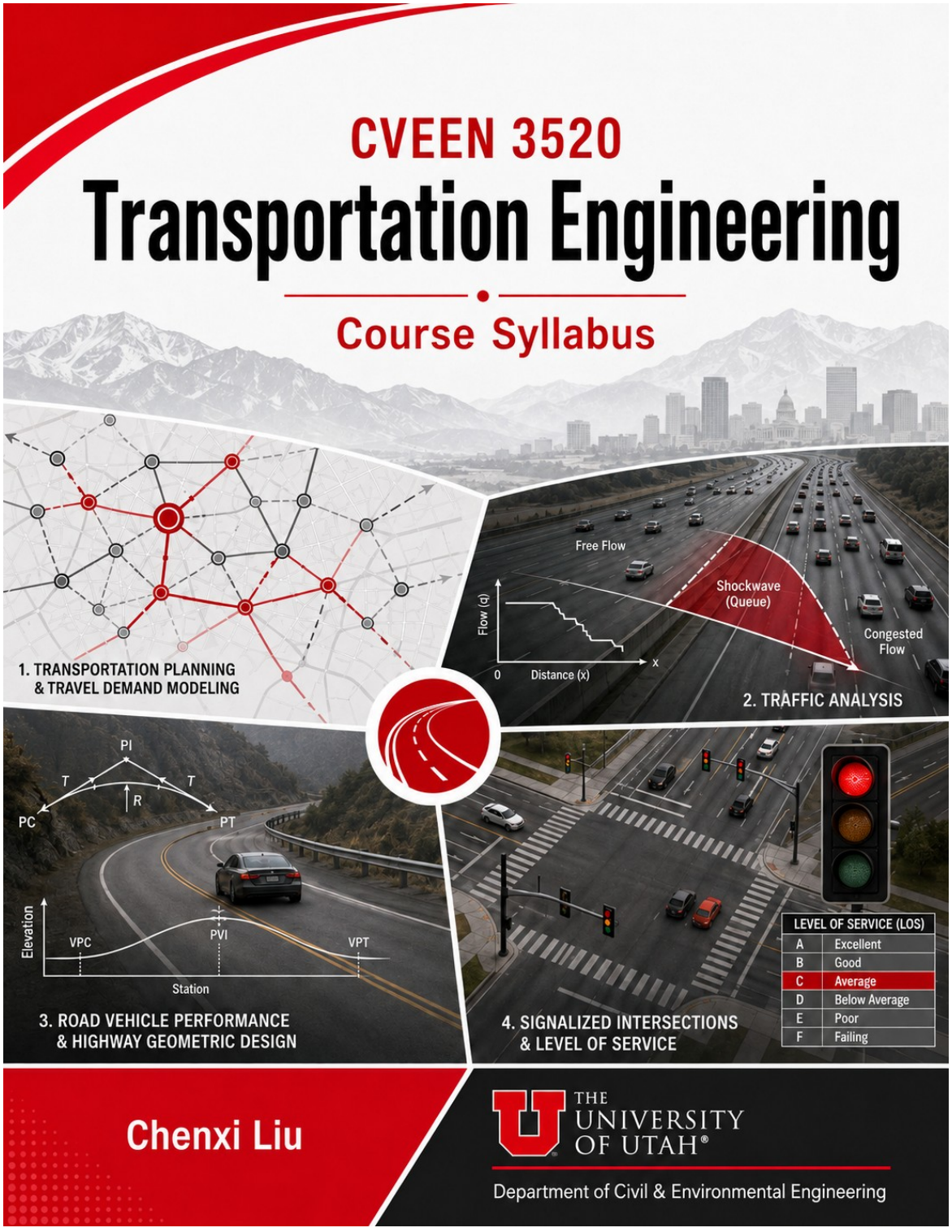
CVEEN 3520

Transportation Engineering

Course Handouts



Department of Civil & Environmental Engineering
THE UNIVERSITY OF UTAH

Course Syllabus

Class:	CVEEN 3520 (001): Transportation Engineering
Time:	Tuesdays and Thursdays, 12:25 PM – 1:45 PM
Location:	WEB L103
Website:	Canvas
Enrollment Requirement:	3 credit hours. "C" or better in ((CVEEN 2310 or ME EN 2550 or MATH 1040 or MATH 1070 or MATH 3070) or AP Statistics score of 3 or higher), and major status in Civil Engineering or Construction Engineering, and not on CVEEN academic probation. Corequisite: CVEEN 2140.
Objective & Outcomes	CVEEN 3520 introduces the analytical foundations of transportation engineering and the professional practice that rests on them. The material is organized into four modules that correspond to the core areas of the field: transportation planning, traffic analysis, vehicle performance and highway geometric design, and traffic signal control and level of service. Each module runs for about three weeks, carries one assignment, and closes with an in-class Practice Session. By the end of the course, students will be able to (1) apply the four-step travel demand model to generate, distribute, split by mode, and assign trips on a network; (2) analyze a traffic stream using flow, speed, and density relationships, shockwave theory, and deterministic and stochastic queuing models; (3) compute road vehicle performance quantities, including braking distance and grade and rolling resistance, and use them to determine stopping sight distance; (4) design vertical and horizontal alignments that satisfy sight distance and related geometric controls, and size a pavement structure for a projected traffic loading; (5) determine signal timing at an intersection and evaluate intersection and freeway level of service; and (6) carry an analysis from data through model to a defensible engineering recommendation, and state the assumptions and limitations under which that recommendation holds.
Description:	General Catalog description: Introduction to the design, analysis, and planning of road transportation systems: road vehicle performance; highway geometric design; traffic flow and queuing theory; traffic forecasting. Transportation systems underpin nearly every aspect of modern society, and the engineer who plans, designs, and operates them works with limited data, competing objectives, and consequences that are measured in safety, delay, and cost. This course builds the analytical toolkit that work requires, moving from regional travel forecasting down to the geometry of a single curve and the timing of a single signalized intersection. Methods are introduced in a consistent sequence: the physical or behavioral phenomenon first, then the model that represents it, then the calculation the engineer actually performs, then the conditions under which the model fails. The course meets twice a week in person. Most sessions pair a concept with immediate hands-on practice, and each module closes with an in-class Practice Session in which a realistic, open-ended problem is worked in class with the instructor and the teaching assistant present.
Instructor:	Chenxi Dylan Liu

	Office: Office hours: Phone: Email:	2032 MCE 2:00 PM – 3:30 PM every Tuesday, or by appointment (801) 585-0476 chenxi.liu@utah.edu (Preferred)
TA/Grader:	TBD	
Grading Policy:	• Assignments: 4*10% = 40% • In-Class Practice Session: 4*2.5% = 10% • Mid-term Exam: 25% • Final Exam: 25%	

CVEEN 3520 Transportation Engineering

Course Schedule – Fall 2026

Week	Day	Date	Topics	Note
1	Tu	Aug. 25	Lecture 0: Course Introduction	Team Setup
1	Th	Aug. 27	Lecture 1: Travel Demand Forecasting and Trip Generation	Module #1 Start Assignment #1 Out
2	Tu	Sep. 1	Lecture 2: Trip Distribution: The Gravity Model	
2	Th	Sep. 3	Lecture 3: Mode Choice: Utility and Logit Models	
3	Tu	Sep. 8	E-learning and Online Practice	E-Learning
3	Th	Sep. 10	Lecture 4: Traffic Assignment (I): Networks, Shortest Paths, and Link Performance	Team Setup Due
4	Tu	Sep. 15	Lecture 4: Traffic Assignment (II): User Equilibrium and System Optimum	
4	Th	Sep. 17	In-Class Practice Session 1: Transportation Planning	Module #1 End Practice #1 Out
5	Tu	Sep. 22	Lecture 5: Traffic Flow Fundamentals	Module #2 Start Assignment #1 Due Assignment #2 Out
5	Th	Sep. 24	Lecture 6: Shockwave Analysis	Practice #1 Due
6	Tu	Sep. 29	Lecture 7: Queuing Theory (I) (D/D/1)	
6	Th	Oct. 1	Lecture 7: Queuing Theory (II) (M/M/1, M/D/1, M/M/N)	
7	Tu	Oct. 6	In-Class Practice Session: Traffic Analysis	Module #2 End Practice #2 Out
7	Th	Oct. 8	Mid-term Exam: Transportation Planning and Analysis Time: **12:25 PM – 1:45 PM**; Location: **WEB L103**	Assignment #2 Due
8	Tu	Oct. 13	Fall Break	
8	Th	Oct. 15	Fall Break	
9	Tu	Oct. 20	Lecture 8: Road Vehicle Performance	Module #3 Start Practice #2 Due Assignment #3 Out

9	Th	Oct. 22	Lecture 9: Stopping Sight Distance	
10	Tu	Oct. 27	Lecture 10: Road Geometric Design (E-learning, video lectures)	E-Learning
10	Th	Oct. 29	Lecture 12: Horizontal Sight Distance and Cross Section (E-learning, video lectures)	E-Learning
11	Tu	Nov. 3	Lecture 11: Pavement System Design	
11	Th	Nov. 5	In-Class Practice Session: Vehicle Performance and Geometric Design	Module #3 End Practice #3 Out
12	Tu	Nov. 10	Lecture 13: Intersection Control and Signal Fundamentals (I)	Module #4 Start Assignment #3 Due Assignment #4 Out
12	Th	Nov. 12	Lecture 13: Intersection Control and Signal Fundamentals (II)	Practice #3 Due
13	Tu	Nov. 17	Lecture 14: Delay and Level of Service at Signalized Intersections	
13	Th	Nov. 19	Lecture 15: Signal Coordination	
14	Tu	Nov. 24	E-learning and Online Practice	E-Learning
14	Th	Nov. 26	Thanksgiving Break	
15	Tu	Dec. 1	Lecture 16: Uninterrupted Flow: Freeway Capacity and LOS	
15	Th	Dec. 3	In-Class Practice Session: Signalized Intersection and Level of Service	Module #4 End Practice #4 Out
16	Tu	Dec. 8	Guest Lecture: TBD	Assignment #4 Due
16	Th	Dec. 10	Lecture 17: Course Review and Future of Transportation	Practice #4 Due
*	M	Dec. 14	**Final Exam: ALL contents in the course.** **Time: 10:30 AM – 11:50 PM; Location: WEB L103**	

Note: The syllabus is not a binding legal contract. The instructor may modify it when the student is given reasonable notice of the modification.

CVEEN 3520 Course Expectations and Policy

Expectations for Course Work

How This Course Works

This course meets twice a week, **Tuesday and Thursday, 12:25 PM to 1:45 PM in WEB L103**. The material is organized into four modules: transportation planning, traffic analysis, vehicle performance and geometric design, and signalized intersections and level of service. Each module carries one assignment and closes with an in-class Practice Session. Most sessions begin with the concept and a worked example, followed by problems that you work in class.

Practice Teams

You will work in a small practice team during the in-class Practice Sessions and the hands-on portion of regular sessions. Teams are formed during the first few weeks of the semester.

In-Class Practice Sessions

Each module closes with an in-class Practice Session, **four** in total over the semester. Please bring a laptop to these sessions. If you do not have one, the Marriott Library lends laptops to students free of charge (https://lib.utah.edu/services/knowledge-commons/checkout-equipment.php). The Practice assignment is handed out during the session and submitted as a team through Canvas.

Independent Assignments

There are **four** independent assignments, one for each module, which are independent, individual efforts as described in CVEEN Homework Assignments: Process of Solution and Formatting Requirements (effective 9/1/2004):

"*The completed homework assignments that you turn in for credit must be substantially your own work. It is permissible to discuss the basic concepts and how to solve the problem in a general sense with others prior to working on the assignment. Once you have started a problem, you may ask questions of other students, but the questions should be limited to specific aspects of a problem that you do not understand. It is not acceptable to work on the assignments with another person or in a group where the assignments are worked entirely together. You may get as much help from the Teaching Assistant and Professor for the class as they can legitimately give you during their regularly scheduled office hours or via e-mail (if the Teaching Assistant or Professor is willing to communicate via e-mail). It is not permissible to use either solution manuals or solutions from past classes for homework assignments that are turned in for credit. All assignments must have the following signed pledge at the front of the assignment*:

On my honor as a student at the University of Utah, I have neither given nor received unauthorized aid on this assignment.

If the pledge is missing or is not signed, the assignment will not be graded."

Assignments are due by **12:00 PM on the due date** and must be submitted through Canvas. Assignment deliverables must follow the Departmental formatting and style requirements given in CVEEN Homework Assignments: Process of Solution and Formatting Requirements.

Practice teams apply to the in-class Practice Sessions only and do not extend to the assignments. Assignments are graded by hand with partial credit, so your reasoning, assumptions, units, and presentation are graded along with the numerical answer.

Examinations

There are **two** examinations, a Mid-term Exam and a comprehensive Final Exam. Each is **closed-book and closed-note except for one sheet of A4 paper**, handwritten or printed on both sides, that you prepare yourself and bring to the exam. Calculators are allowed, while the use of the internet, electronic devices, and AI tools (such as ChatGPT, Gemini, Claude, etc.) is strictly prohibited during the examinations.

Examinations are held at the scheduled time and are **NOT** rescheduled for personal convenience, travel, or conflicting work commitments. University regulations require that a make-up be arranged for absences arising from officially sanctioned University activities, government obligations such as military service or jury duty, disability accommodations, pregnancy accommodations, and accommodations for religious or conscience beliefs under Rule R6-100B; if your absence falls into one of these categories, notify the instructor in writing as far in advance as possible and provide the supporting documentation from the relevant University office. Any other request must be submitted as a written petition with documentation to the Department of Civil and Environmental Engineering, and a make-up will be arranged only if that petition is approved.

College of Engineering Guideline

The College of Engineering Semester Guidelines contain important dates regarding adding, dropping and withdrawing from classes as well as the College Policy regarding repeating courses. For this semester-length class the last day to add, drop, or audit is Friday, September 4, 2026, and the last day to withdraw and elect CR/NC is Friday, November 13, 2026.

Please refer to the details here: https://www.coe.utah.edu/students/current/semester-guidelines/

Accessibility

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations. (www.hr.utah.edu/oeo/ada/guide/faculty/)

Professional Responsibilities

Students should read the “Student Code” (Policy 6-400: Code of Student Rights and Responsibilities) carefully and know they are responsible for the content. The Policy is located at the following link: http://www.regulations.utah.edu/academics/6-400.html

All students are expected to maintain professional behavior in the classroom setting. Students have specific rights in the classroom, detailed in Section II of the Student Code. The Student Code also specifies academic misconduct, including, but not limited to, cheating, misrepresenting one's work, inappropriately collaborating, plagiarism, and fabrication or falsification of information. The process for resolving any violations of the Student Code, including academic sanctions, is also described.

Course Policies

Class Attendance.

You are encouraged to attend all class sessions for this course. However, attendance is not mandatory and will not be graded. Credit for the Practice Sessions is based on the work your team submits, not on attendance.

Academic Integrity Policy

You are expected to uphold the highest standards of academic honesty in all your work. Any form of academic misconduct, such as cheating, copying, or plagiarism, will not be tolerated. Misconduct includes, but is not limited to, the following:

- Copying from another student's work or allowing your work to be copied.
- Submitting someone else's work as your own, or using AI tools or external resources in a manner not permitted under the Collaboration and Use of AI Tools policy below.
- Using unapproved materials, internet access, or AI tools during an exam.

Consequences for Violations:

- First Incident: If you are found to have engaged in academic misconduct on any assignment, Practice Session, or examination, you will receive a zero for that specific task.
- Second Incident: Any subsequent incident of academic misconduct will result in a failing grade for the entire course.

These incidents will be reported to the Office of Student Conduct, which may lead to further actions according to university policies.

Collaboration and Use of AI Tools

Generative AI tools may be used in the assignments and the Practice Sessions, and may **NOT be used during examinations**. Professional engineering practice increasingly involves these tools, and the aim of this course is to develop competent and accountable use rather than to prohibit use. Two conditions apply. First, you remain fully responsible for everything you submit and must be able to explain any calculation, assumption, or argument in your work. Second, submissions must include a brief statement of which AI tools were used and for what purpose.

Late Turn-ins.

You are required to turn in your assignments and Practice assignments on time. Late turn-ins can be accepted within **seven** days after the due date but will be discounted at **10% per day** it is late. For example, if an assignment is due on Sep. 22 and you turn it in on Sep. 24, it would amount to a deduction of 20% for this two-day late assignment. If you turn in on Sep. 30 or after, it will not be accepted, and no credit will be given.

Final Grade Determination.

Your final grade is determined by combining your scores on the assignments, the in-class Practice Sessions, and the two examinations using the following weights:

- Assignments (4 × 10%): 40%

- In-Class Practice Sessions (4 × 2.5%): 10%
- Mid-term Exam: 25%
- Final Exam: 25%

Letter	Scoring	Qualitative Description
A	100% - 92.5%	No to minor mistakes.
A-	92.49% - 90%	
B+	89.99% - 87.5%	
B	87.49% - 82.5%	
B-	82.49% - 80%	Several minor mistakes; almost no conceptual mistakes.
C+	79.99% - 77.5%	
C	77.49% - 72.5%	
C-	72.49% - 70%	Several mistakes, some major; conceptual mistakes.
D+	69.99% - 67.5%	
D	67.49% - 62.5%	
D-	62.49% - 60%	Many significant mistakes and conceptual errors.
E	59.99% - 0	Non-response or completely incorrect response.

Course Materials and References

Required Textbooks

The course follows Mannering, F. L., and Washburn, S. S., Principles of Highway Engineering and Traffic Analysis, 7th Edition, Wiley. The specific chapter or section assigned to each lecture is listed with that lecture in Canvas.

Professional Standards and Reference Manuals

The following are the documents a practicing transportation engineer actually works from. You are not expected to buy them, and exam questions are drawn from the textbooks rather than from these; the relevant excerpts are posted in Canvas. They are listed here because knowing which manual governs which decision is itself part of the professional competence this course is building.

- A Policy on Geometric Design of Highways and Streets, 7th Edition, AASHTO, 2018 (the "Green Book"). The governing reference for Module 3, including sight distance, vertical curve, and superelevation criteria.
- AASHTO Guide for Design of Pavement Structures (1993) and the AASHTO Mechanistic-Empirical Pavement Design Guide. The references behind the pavement thickness design procedure in Module 3.
- Highway Capacity Manual, 7th Edition, Transportation Research Board, 2022. The source of the level of service procedures used in Module 4 for signalized intersections and freeway segments.
- Manual on Uniform Traffic Control Devices for Streets and Highways, 11th Edition, Federal Highway Administration, 2023. The national standard for signs, signals, and markings referenced throughout Modules 3 and 4.
- Signal Timing Manual, 2nd Edition, NCHRP Report 812, Transportation Research Board, 2015. Practice-oriented guidance on the signal timing and coordination methods introduced in Module 4.
- Utah Department of Transportation Roadway Design Manual of Instruction and UDOT Traffic Signal Design Standards. The state-level criteria that apply to the Utah corridors used in the assignments and Practice Sessions.