



CE 330: Transportation Engineering

Term: Fall 2026

Credits: 3.0

Lecture Times & Location: Tuesday & Thursday 4:00–5:15 p.m., Rowan Engineering Center 110

Modality: In-Person

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Instructor Information

- **Instructor:** Dr. Olivia Hart (Assistant Professor of Civil & Environmental Engineering)
- **Email:** ohart@university.alkimi.ai
- **Office:** Rowan Engineering Center 310
- **Office Hours:**
 - Monday & Wednesday: 3:30–5:00 p.m. (In person, Rowan Engineering Center 310)
 - Friday: 10:00–11:00 a.m. (Virtual via Zoom; link posted in Canvas)
 - Also available by appointment.

Course Description

Traffic flow, highway geometric design, intersection capacity and signal timing, pavement design, and transportation planning. CE 330 introduces the planning, geometric design, traffic analysis, and structural pavement design of highway transportation facilities. Students examine macroscopic and microscopic traffic flow theory, level-of-service evaluations per the Highway Capacity Manual (HCM), and horizontal and vertical roadway alignment per AASHTO Green Book standards. The course also addresses intersection capacity, signal timing optimization, flexible and rigid pavement design using AASHTO empirical methods, and the classical four-step travel demand modeling process.

Prerequisites

CE 250 and MATH 141.

Measurable Student Learning Outcomes

Upon successful completion of CE 330, students will be able to:

1. **Analyze Traffic Stream Characteristics:** Apply macroscopic traffic flow relationships (Greenshields, Greenberg) to compute flow rates, mean speeds, densities, and shock-wave propagation velocities in highway traffic streams.
2. **Determine Level of Service:** Calculate passenger car equivalents, free-flow speed, flow rates, and density to determine Level of Service (LOS) for basic freeway segments and multilane highways using the Highway Capacity Manual.
3. **Design Geometric Alignments:** Design horizontal curves with appropriate superelevation and transition spirals, and compute vertical crest and sag curves satisfying stopping and passing sight distance requirements per AASHTO standards.

4. **Optimize Traffic Signal Timing:** Develop multi-phase signal timing plans for isolated intersections, calculate critical lane volumes, determine saturation flow rates, and compute optimal cycle lengths using Webster's method.
5. **Design Pavements and Forecast Demand:** Size flexible and rigid pavement cross-sections using AASHTO equivalent single-axle load (ESAL) methods and apply the four-step travel demand model (generation, distribution, mode choice, assignment).

Required Course Materials & Approximate Costs

1. **Mannering, Fred L., and Scott S. Washburn. *Principles of Highway Engineering and Traffic Analysis*. 7th ed., Wiley, 2020.** Approx. \$75 digital rental (\$180 purchase; reserve copies available in Alkimi Library).
2. **AASHTO *A Policy on Geometric Design of Highways and Streets (Green Book)* reference extracts and TRB Highway Capacity Manual (HCM) modules.** Free digital course reserve access via Alkimi Library.
3. **Total estimated cost:** Approx. \$0 (library reserve & digital extracts) to \$75 (textbook rental).

Generative AI Policy (AI Level 2: AI Permitted with Disclosure for Specified Tasks)

In accordance with Alkimi University Academic Policies (Student Handbook §5.8), CE 330 operates under **AI Level 2**.

- **What is permitted:** Students may use AI tools to generate spreadsheet or Python formulas for calculating traffic stream shock waves, automating Webster cycle length calculations, and cross-referencing AASHTO Green Book geometric tables.
- **What is prohibited:** AI models must not be used to perform assigned highway horizontal and vertical alignment designs, generate intersection signal timing sheets on homework, or draft planning reports. No AI tools or internet-enabled devices may be used during exams or quizzes.
- **Disclosure:** Any computational spreadsheet, Python script, or alignment CAD model submitted for the highway design project must contain an explicit AI disclosure statement documenting tools consulted, prompts entered, and manual verification calculations.

Grading Components and Weights

- **Weekly Problem Sets:** 15% (Due Wednesdays at 11:59 p.m. in Canvas (weeks 2–14; lowest dropped))
- **Biweekly Concept & Alignment Quizzes:** 10% (Administered in class on alternate Thursdays (weeks 3, 5, 9, 13; lowest dropped))
- **Midterm Exam 1 (Traffic Flow & Highway Capacity):** 20% (In class, Thursday, October 1)
- **Midterm Exam 2 (Geometric Alignment & Earthwork):** 20% (In class, Thursday, November 5)
- **Highway Geometric Design & Signal Timing Project:** 10% (Due Friday, November 20 at 11:59 p.m.)
- **Comprehensive Final Examination:** 25% (Thursday, December 17, 2026, 3:30–5:30 p.m.)

Grading Scale (Alkimi University Standard)

- **A:** 93–100% | **A-:** 90–92%
- **B+:** 87–89% | **B:** 83–86% | **B-:** 80–82%
- **C+:** 77–79% | **C:** 73–76% | **C-:** 70–72%
- **D+:** 67–69% | **D:** 60–66% | **F:** Below 60%
- **Extra credit:** No individual extra credit assignments are available in CE 330.

Course Schedule (Fall 2026)

Week	Dates	Topics & Readings	Assignments & Deadlines
Week 1	Aug 27	Introduction to Transportation Systems: Role of transportation engineering, public infrastructure modes, vehicle dynamics,	<i>First day of classes: Wed Aug 26.</i>

Week	Dates	Topics & Readings	Assignments & Deadlines
		road resistance, tractive effort, and braking distance formulations. <i>Reading: Mannering & Washburn Ch. 1–2</i>	
Week 2	Sep 1, 3	Traffic Flow Fundamentals: Microscopic vs. macroscopic traffic streams, time headway, space headway, time-mean speed vs. space-mean speed, and flow-density-speed relationships. <i>Reading: Mannering & Washburn Ch. 5.1–5.3</i>	<i>Wed Sep 2: Add/section change deadline.</i>
Week 3	Sep 8, 10	Traffic Flow Models and Shock Waves: Greenshields linear model, Greenberg logarithmic model, capacity flow, traffic bottlenecks, and kinematic wave theory with shock-wave analysis. <i>Reading: Mannering & Washburn Ch. 5.4–5.6</i>	<i>Mon Sep 7: Labor Day (no classes). Wed Sep 9: Census date (last day to drop without a W).</i>
Week 4	Sep 15, 17	Highway Capacity and Level of Service: Highway Capacity Manual (HCM) methodology, base conditions, free-flow speed adjustments, passenger car equivalents, and LOS determination for freeways. <i>Reading: Mannering & Washburn Ch. 6.1–6.4</i>	—
Week 5	Sep 22, 24	Multilane Highways and Interrupted Flow: Analysis of multilane rural and suburban highways, two-lane rural highways, passing zones, and introduction to interrupted-flow characteristics. <i>Reading: Mannering & Washburn Ch. 6.5–6.7</i>	—
Week 6	Sep 29, Oct 1	Sight Distance and Midterm Exam 1: Perception-reaction time, stopping sight distance (SSD), passing sight distance (PSD), decision sight distance (DSD), and Midterm Exam 1 in Thursday class. <i>Reading: Mannering & Washburn Ch. 3.1–3.2</i>	Midterm Exam 1 (Traffic Flow & Highway Capacity) (in class).
Week 7	Oct 6, 8	Horizontal Alignment: Circular Curves and Superelevation: Circular curve geometry (radius, degree of curvature, tangent, chord), side friction, maximum superelevation rates, and transition runoff length design. <i>Reading: Mannering & Washburn Ch. 3.3</i>	—
Week 8	Oct 15	Spiral Transitions and Sight Obstructions: Clothoid spiral transition curves, lateral clearance on horizontal curves to clear roadside sight obstructions, and curve safety enhancements. <i>Reading: Mannering & Washburn Ch. 3.3.4–3.3.5</i>	<i>Oct 12–Oct 13: Fall break (no classes).</i>
Week 9	Oct 20, 22	Vertical Alignment: Crest and Sag Curves: Parabolic vertical curve geometry, rate of vertical curvature (K-values), crest curve length for stopping sight distance, and sag curve headlight criteria. <i>Reading: Mannering & Washburn Ch. 3.4</i>	—
Week 10	Oct 27, 29	Roadway Cross-Sections and Earthwork Analysis: Lane and shoulder widths, crown slope, cross-section cut and fill areas, average end-area method, and mass haul diagrams for haul optimization. <i>Reading: Mannering & Washburn Ch. 3.5</i>	—
Week 11	Nov 3, 5	Unsignalized Intersections and Midterm Exam 2: Two-way stop-controlled (TWSC) intersections, all-way stop-controlled (AWSC) intersections, modern roundabouts, and Midterm Exam 2 in Thursday class. <i>Reading: Mannering & Washburn Ch. 7.1–7.3</i>	<i>Fri Nov 6: Last day to withdraw (W) or elect Pass/No Pass.</i> Midterm Exam 2 (Geometric Alignment & Earthwork) (in class).
Week 12	Nov 10, 12	Signalized Intersection Timing and Phasing: Traffic signal warrants, clearance intervals (yellow change and red clearance intervals), phase plans, saturation flow rates, and lost times. <i>Reading: Mannering & Washburn Ch. 7.4–7.6</i>	—
Week 13	Nov 17, 19	Webster Optimal Signal Design and Progression: Webster's minimum delay cycle length formula, green allocation, lane group capacity, and time-space diagrams for arterial signal progression; Project due Friday. <i>Reading: Mannering & Washburn Ch. 7.7–7.9</i>	Highway Geometric Design & Signal Timing Project due Fri Nov 20 at 11:59 p.m.
Week 14	Nov 24	Pavement Design: Flexible and Rigid: Pavement layer functions, soil subgrade support (CBR/resilient modulus),	<i>Nov 25–Nov 27: Thanksgiving break (no classes).</i>

Week	Dates	Topics & Readings	Assignments & Deadlines
		equivalent single-axle loads (ESALs), and AASHTO structural number pavement design. <i>Reading: Mannering & Washburn Ch. 4</i>	
Week 15	Dec 1, 3	Transportation Planning: Four-Step Travel Forecasting: Urban transportation planning process: trip generation (regression models), trip distribution (gravity model), mode choice (logit model), and traffic assignment. <i>Reading: Mannering & Washburn Ch. 8</i>	—
Week 16	Dec 8	Safety, Emerging Mobility, and Course Review: Highway safety manual (HSM) crash prediction, autonomous vehicle impacts, multimodal complete streets, and final examination preparation. <i>Reading: Review Mannering & Washburn Ch. 1–8</i>	<i>Wed Dec 9: Last day of classes. Thu Dec 10: Reading Day.</i>
Finals	Dec 17	Comprehensive Final Examination: Thursday, December 17, 2026, 3:30–5:30 p.m., Rowan Engineering Center 110.	Comprehensive.

Course Policies

Attendance Policy

Class attendance at every lecture is required. Highway geometric calculations and signal timing problems involve sequential algorithmic standards from AASHTO and the HCM that require collaborative classroom practice. If an unavoidable illness or university event conflict arises, notify Dr. Hart prior to class. Students who miss the first two class meetings without notifying the instructor may be dropped. Students may miss class for religious observance without penalty if they notify the instructor in writing within the first two weeks of the semester (by Wednesday, September 9, 2026). Absences for university-sponsored activities (athletics, performances, conferences) are excused with a letter from the sponsoring office at least one week in advance.

Late Work Policy

Homework problem sets submitted past the Wednesday deadline incur a 15% penalty per 24 hours up to 48 hours late, after which solutions will be released and zero credit awarded. The lowest homework set score and lowest quiz score are dropped to account for unanticipated personal conflicts.

Final Exam Policy

The final examination (Thursday, December 17, 2026, 3:30–5:30 p.m.) is scheduled by the University Registrar and can't be moved without the Dean's written approval (Faculty Handbook §5.5). A student with three or more final exams on the same calendar day may reschedule one of them. Requests go to the instructor of the middle exam by the last day of classes. For this term, send the request by Wednesday, December 9, 2026 (Student Handbook §6.4).

Academic Integrity

Alkimi University is an academic community devoted to rigorous scholarship, open intellectual inquiry, and uncompromising ethical conduct. All students are subject to the regulations of the Alkimi University Academic Integrity Policy. Academic dishonesty—including plagiarism, cheating on examinations, unauthorized collaboration, fabrication of empirical data, and unauthorized submission of academic work generated by artificial intelligence—undermines the integrity of the university and carries severe disciplinary sanctions. Sanctions range from a failing grade on an assignment or exam to an administrative course failure recorded as an 'XF' on the official transcript, academic suspension, or expulsion. Suspected violations are formally investigated and resolved through the Office of Academic Integrity in accordance with Faculty Handbook §6. For detailed information, consult the Office of Academic Integrity, Lovell Hall 315, (555) 555-0163, integrity@university.alkimi.ai.

Accessibility Services

Alkimi University is committed to providing equitable educational access and reasonable accommodations for all students with documented disabilities, including physical, sensory, psychological, learning, and chronic health conditions. Students requesting academic accommodations must formally register with the Office of Accessibility Services, Harlan Hall 204, (555) 555-0155, access@university.alkimi.ai. Once approved, students will receive an official Faculty Accommodation Letter detailing approved accommodations. Students should present this letter to the instructor as early in the semester as possible, and at least one week prior to any exam or assignment requiring accommodation. Accommodations cannot be applied retroactively.

Student Wellness and Mental Health

Your physical health, psychological well-being, and mental health are essential to your academic success. If you experience heightened stress, anxiety, depressive symptoms, personal trauma, or academic burnout, free, confidential counseling and medical care are available through the Hollis Health & Counseling Center, located in the Hollis Center. Routine appointments are available Monday–Friday 8:00 a.m.–6:00 p.m. and Saturday 10:00 a.m.–2:00 p.m. during the semester by calling (555) 555-0190 or emailing health@university.alkimi.ai. Urgent, 24/7 crisis psychological counseling is accessible immediately at (555) 555-0199.

Campus Student Support Services

- **Academic Advising Center:** Lovell Hall 101 | (555) 555-0158 | advising@university.alkimi.ai
- **Writing Center:** Whitcombe Library 3rd Floor | Free consultations on papers, reports, and research projects at any stage.
- **Whitcombe Library:** Whitcombe Library, Main Floor | (555) 555-0170 | askalibrarian@university.alkimi.ai
- **Hollis Health & Counseling Center:** Hollis Center | (555) 555-0190 | 24/7 Counseling Line: (555) 555-0199 | health@university.alkimi.ai
- **Transportation & Civil Design Peer Tutoring:** Rowan Engineering Center 140 | Drop-in assistance for highway geometric calculations and traffic software available Tuesday and Thursday 3:30–6:00 p.m.