CE 367G: Design & Evaluation of Ground-Based Transportation Systems

Spring 2021 (unique #16185/16190)

Lectures: Tu/Th 12:30 to 1:45 pm, via Zoom (in Canvas) & in 1.202 ECJ (when requested)
Laboratory Section: Mondays 3:30-5:30 pm, via Zoom (&, if needed, in 1.202 ECJ)

I. Office Hours for Instructor, Dr. Kara Kockelman

Mondays & Tuesdays 2-3:30 pm, via Zoom (& in 6.904 ECJ, if helpful)
& by phone: 512-471-0210 (office), email kkockelm@mail.utexas.edu or appointment

Note: PhD student Jooyong Lee (jylee3302@utexas.edu) will serve as the course TA and lab instructor, with some support by Yantao Huang. His office hours will be held at a time that works best for the group (& for him), via Zoom (& perhaps at times in person, if needed). He also can answer questions by email. Local professionals Robert Ramon (at JMT) & Michael Skoviera (at ATKINS) will helps with OpenRoads instruction & review of final project submissions.

II. Prerequisites

According to the College of Engineering Catalog, CE321, Transportation Systems, is a prerequisite for undergraduates intending to enroll in CE367G; the consent of the instructor may waive this requirement.

III. Grading

For purposes of grading, the performance of students enrolled in CE367G will be assessed using the following scoring system:

Design Assignments	20 to 25% of score/grade
Project Work	40%
First In-Class Exam	15%
2nd In-Class Exam	20 to 25%

Note: The instructor reserves the right to consider Class Participation & Quizzes in the evaluation of a student's performance, where participation score is based on participation in the class (including attendance, in cases where attendance is poor). These two items may contribute up to 8% of a student's grade, falling uniformly across categories.
Lab participation will count toward the Design Project's grading. Pluses and minuses will be used. Exam dates are discussed below.

IV. Design Assignments

Design-focused assignments will often tie to laboratory activities and are structured to help students develop the necessary skills to successfully complete final course projects. These assignments will be assigned regularly and must be handed in at the *beginning* of the period in which they are due. After this time, they will be considered late and given *no credit*. However, ***all*** *assigned problems* ***must*** *be completed* (within 3 weeks of their due date and at least one week before the final exam) or a student's participation score will be adversely impacted. Please note all questions for the grader on your homework before re-submitting it, for added review.

Homework Solutions & Academic Dishonesty: The use of unauthorized sources of homework solutions (e.g., websites like cramster, previous semester student solution copies, & instructor texts) is considered scholastic dishonesty, plagiarism and a violation of UT's Standard of Academic Integrity. Please see the University Honor Code at http://registrar.utexas.edu/catalogs/gi09-10/ch01/index.html and http://deanofstudents.utexas.edu/sjs/acint_student.php, and let me know if you see this happening.

More academic honor details are provided below.

V. Examinations[*]

The two in-class exams are *tentatively* scheduled for the following times. (The **final exam period, Wednesday, May 12, 9 am to noon**, will be reserved for student-team presentations of final design projects to the class and several practicing professionals. Final reports will be due several days before final presentations, for evaluation & sending to Judges.)

Exam 1	Tuesday, March 9 (tentative)
Exam 2	Tuesday, April 27 (tentative)

[*] The instructor reserves the right to periodically administer, grade, and use in student evaluation "pop"/unannounced *quizzes*. Students should come to class prepared to contribute to each class's lecture and discussion by staying up-to-date with homeworks and reading.

Make-up exams will *not* generally be given to any student. If a student is absent from a scheduled exam due to medical or other problems beyond her/his control and can plainly demonstrate this, the instructor can choose to give the student a completely different exam, additional assignments, and/or change the weighting of the student's various graded contributions.

VI. Laboratory Sections

The laboratory sections are intended for additional depth in important technical areas, to hone abilities useful for analysis of multi-faceted projects, and application in the course's final design project. There will be demonstrations & some hands-on learning of computer-aided design (CAD) software and the MS Excel Solver tool in one or two of these lab times (using Bentley's OpenRoads assignments, with software access Guide here: https://communities.bentley.com/communities/other_communities/be_careers_network_for_academia/b/news/posts/studentserver-guide). In the final 5 or so weeks of the semester, the lab slots will be exclusively reserved for teamwork on each team's selected capstone project. Other reading of interest includes the ITE *Trip Generation Manual*, TRB's *Highway Capacity Manual*, and *Manual on Uniform Traffic Control Devices*.

VII. Design Project, Course Objectives, Academic/Learning Goals

A number of courses in the Civil Engineering program curriculum have been designated as "design synthesis" courses. This is one of those courses, so your final project requires recognition of engineering standards of safety and quality, alongside various real-world constraints, including economic, environmental, social, political, ethical, and public health factors, demand for transportation system services, constructability and sustainability.

To this end, upon completion of this course, students should have the following skills:

- The ability to identify existing or emerging deficiencies within a transportation system.
- The ability to generate, evaluate and select a preferred project alternative through technical analysis.
- The ability to develop a comprehensive project design while implementing a preferred transportation project alternative.
- The ability to successfully operate in a project team setting.
- The ability to justify analysis results and design choices through written and oral means.

The design project for this course involves the specification and evaluation of a significant transportation investment (costing at least $1 million, and potentially several hundred million dollars). Each four-person design team will decide the scope of their unique project in consultation with the course instructor and TA. These may be a transit-oriented development, the neighborhood(s) around a light- or heavy-rail line, a major highway interchange, a heavily used urban corridor, a suburban neighborhood, a town bypass, and/or a tolled freeway. Each team will design the best features (e.g., interchange type, cross slope, ramp locations, turn radii, sight distances, and path widths) they can into their project, subject to cost, safety, demand, emissions, noise, maintenance and/or other considerations. The design project will constitute a significant component of the course, and final team scores will be individually adjusted to reflect student evaluations of teammates.

Students will undergo a multi-stage iterative design process in the development of their project. This will consist of three major phases: 1) A *preliminary project proposal*, outlining the proposed project and scope of work; 2) an *intermediate analysis and design report*, including a comprehensive project alternative analysis and preliminary design work; and 3) a *final project design*. Students will be responsible for peer-review of other teams' intermediate reports and will be graded based upon their feedback and insight. Students will be expected to address issues in their proposals and intermediate reports as noted by the instructor, TA and other students. An oral presentation (before several practicing engineers) and a written report of the design project will be completed by each student team for the final project design portion of this course.

*Note: This course carries the **Independent Inquiry** flag. Such courses are designed to engage students in the process of inquiry over the course of a semester, providing them the opportunity for independent investigation of a question, problem, or project. Hence, a substantial portion of this class' grade (40%) comes from independent investigation, project design, and presentation of student work, via the course's design project activities.*

VIII. Text/Reader and Course Notes

A hard copy of the Course Packet can be purchased for approx. $50 (vs. $220 new) via Canopy Course Notes' Jerome Kubala, at 512-497-6662 (cell for texting). The Packet consists of selected pages from Garber and Hoel's (G&H's) *Traffic and Highway Engineering* (Fourth Edition, 2009), which thoughtfully presents many of the ideas present in AASHTO's "Green Book" – or *Policy on Geometric Design of Highways and Streets* (including all key tables for horizontal and vertical alignment designs). The Packet also contains a great deal of Green Book content & several sections of the *Highway Safety Manual*. The Green Book is also available online, via the UT library system. Both our **tests are open notes, open book**, so you will want to have hard copies of key tables with you at both exams.

Lecture slides are available online as well (at Canvas) for students to print (3 or 6 slides per page and double-sided is best). Other valuable reading may include additional content from the PET Guidebook and the Transportation Research Board's *Highway Capacity Manual* (HCM). Some reading assignments listed below are found on-line at the Victoria Transport Policy Institute (VTPI) http://www.vtpi.org/tca/.

IX. Add/Drop Dates

From the 1st through the 12th class day, an undergraduate student can drop a course via the web and receive a refund, if eligible. From the 13th through the university's academic drop deadline, a student may Q drop a course with approval from the Dean, and departmental advisor.

X. Evaluation Plan
UT's Course/Instructor Survey form will be used as the basic evaluation tool. All students are encouraged to submit written comments during this survey. Other formal assessment opportunities are likely to arise mid-semester; and students are strongly encouraged to provide feedback at any time during the course, in person, via other students or anonymously, to the TA and/or the instructor.

XI. Other
1. The University of Texas at Austin provides, upon request, appropriate academic accommodations for qualified students with disabilities. For more information, contact the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259 (voice) or 410-6644 (video phone) or http://ddce.utexas.edu/disability/.

2. A student who misses classes or other required activities, including examinations, for the observance of a religious holy day should inform the instructor as far in advance of the absence as possible, so that arrangements can be made to complete an assignment within a reasonable time after the absence.

3. Students in this section of CE367G are encouraged and authorized to work on homework assignments together and prepare for exams together. However, all written work handed in by a student is considered to be his/her own work, prepared without *unauthorized* assistance. To ensure your actions never compromise your and our class's integrity, please visit http://catalog.utexas.edu/general-information/appendices/appendix-c/student-discipline-and-conduct/. Students who violate University rules on scholastic dishonesty (*e.g.*, anything which gives unfair academic advantage to a student) are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced. An "F" grade will be the recommended penalty in most cases of scholastic dishonesty. One should refer to the Student Judicial Services website at http://catalog.utexas.edu/general-information/appendices/appendix-c/student-discipline-and-conduct/ to access the official University policies and procedures on scholastic dishonesty as well as further elaboration on what constitutes scholastic dishonesty.

4. *Math & statistics tutors* and other learning assistance can be obtained via the Learning Skills Center (Jester Center, 471-3614). See https://ugs.utexas.edu/slc/support/one-on-one.

Sharing of Course Materials is Prohibited: No materials used in this class, including, but not limited to, lecture hand-outs, videos, assessments (quizzes, exams, papers, projects, homework assignments), in-class materials, review sheets, and additional problem sets, may be shared online or with anyone outside of the class unless you have my explicit, written permission. Unauthorized sharing of materials promotes cheating. It is a violation of the University's Student Honor Code and an act of academic dishonesty. We are well aware of the sites used for sharing materials, and any materials found online that are associated with you, or any suspected unauthorized sharing of materials, will be reported to Student Conduct and Academic Integrity in the Office of the Dean of Students. These reports can result in sanctions, including failure in the course.

Class Recordings: Class recordings are reserved only for students in this class for educational purposes and are protected under FERPA. The recordings should not be shared outside the instructor's courses in any form. Violation of this restriction by a student could lead to Student Misconduct proceedings.

COVID Safety: To help keep everyone at UT and in our community safe, it is critical that students

report COVID-19 symptoms and testing, regardless of test results, to University Health Services, and faculty and staff report to the HealthPoint Occupational Health Program (OHP) as soon as possible. Please see this link to understand what needs to be reported. In addition, to help understand what to do if a fellow student in the class (or the instructor or TA) tests positive for COVID, see this University Health Services link.

Wearing a recommended protective, cloth face mask over **both nose and mouth at all times** when inside university buildings will be **mandatory** except when alone in a private office, eating in a campus dining facility or when students are in their own residence hall rooms. UT will encourage compliance by increasing awareness and fostering a spirit of cooperation. Students who refuse to follow directives to wear a mask will be referred to Student Conduct and Academic Integrity in the Office of the Dean of Students for disciplinary action. Please be sure to **cover your face extra-well if you need to sneeze or cough** (e.g., using a sweatshirt or shirt over your mask, with your hands), and try to exit the building before doing such things. More information on how you can help keep our campus healthy this Fall can be found here: "Protect Texas Together."

IX. Course Content & (Tentative) Outline of Topics and Order of Presentation

CE 367G covers various aspects of transportation relating to the design of ground-based transportation systems (emphasizing roadway and non-motorized travel). The course *objectives* are that students are able to design safe, cost-effective, and sustainable networks, are familiar with design standards, and are comfortable with various tools for project evaluation. Primary topics include physical design for safe and efficient transport to meet passenger and freight needs, multi-modal and multi-objective planning, crash prediction, cost considerations, environmental impacts, and operational analysis. A great variety of other topics apply as well. A tentative scheduling of the course topics is shown below.

Lesson # & TOPICS TO BE COVERED	**Relevant Reading in G&H, AASHTO's Green Book (GB), & VTPI website**
1 Introduction of Course	G&H Ch. 1 & 2: pp. 3-52
2 Methods for Evaluating Transp. Alternatives: Engineering Economics	G&H Ch. 13: 653-684
3 Anticipating Project Costs & Benefits	VTPI's Transport. Cost & Benefit Analysis: Ch 5.6 at http://www.vtpi.org/tca/
4 Sight Distance Calculations: Stopping, Passing and Intersection	G&H Ch. 3: pp. 88-94, & Ch. 7: pp. 301-320; GB: 3-1 to 3-18, 3-106 to 3-111, 9-28 to 9-54
5 Horizontal Alignment Design: Circular Curves & Superelevation	G&H Ch. 15: pp. 770-783; GB: 3-18 to 3-58
6 Design of Superelevation Development	G&H Ch. 15: pp. 783-787; GB: 3-59 to 3-84
7 Vertical Alignment Design	G&H Ch. 15: pp.756-770; GB: 3-149 to 3-164
8 Design of Roadway Cross Sections & Roadsides	G&H Ch. 5: pp.195-200, & Ch. 15: pp.745-754; GB: 4-1 to 4-36
****** Exam 1 *** (approx. timing)***	
9 Complete Streets, Context-Sensitive Design, and Pedestrian Facilities	G&H Ch. 5: pp.203-208; GB: 4-56 to 4-74 ITE Journal Sept 2011 articles: (1) Walkable Urban Thoroughfares & (2) Roundabouts as Context Sensitive Solns

**** Design Project Overview ****	
10 Intersection Design	G&H Ch. 7: pp.265-322; GB: 9-55 to 9-114
11 Interchange Design	G&H: Ch. 8: pp.327-378; GB 10-1 to 10-62
12 Anticipating Crash Counts & Severity as a Function of Design Decisions	G&H Ch. 5: pp. 151-208, plus ***Highway Safety Manual*** pages in course reader
13 Key Traffic Variables for Evaluating System Level of Service	G&H Ch. 6: pp.213-258, & Ch. 9 & 10: pp. 381-528
****** Exam 2 *** (approx. timing)***	
14 Regulatory Controls Impacting Transportation Project Plans	G&H Ch. 11: pp. 551-586
Final Exam Slot (Weds., May 12, 2021, 9-noon) for **Final Presentations**	