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

Spring 2020 (unique #15525)
Lectures: Tu/Th 12:30 to 2:00 pm, in 1.222 ECJ
Laboratory Section: Mondays 3:30-5:30 pm, in 2.218 ECJ

I. Office Hours for Instructor, Dr. Kara Kockelman

Mondays & Tuesdays 2 pm-3:30 pm, 6.904 ECJ
Or by appointment: 471-0210 (office phone number) & kkockelm@mail.utexas.edu

Note: Yantao Huang (yantao.h@utexas.edu) will serve as the course TA & lab instructor, with some support by Murthy Gurumurthy (gkmurthy10@utmail.utexas.edu) & Jooyong Lee (jylee3302@gmail.com). His office hours will be held on Mondays, from 3:30 to 5:30 pm (& before lab on the weeks we have lab occupied with activities). He also can answer questions by email or in person at some other times.

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 to 20%
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 & minuses will be used. Exam dates are discussed below.

IV. Design Assignments

Design-focused assignments will often tie to laboratory activities & are structured to help students develop the necessary skills to successfully complete final course projects. These assignments will be assigned regularly & must be handed in at the *beginning* of the period in which they are due. After this time, they will be considered late & given *no credit*. However, ***all*** *assigned problems* ***must*** *be completed* (within 3 weeks of their due date & 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.

V. Examinations*

The two in-class exams are *tentatively* scheduled for the following times. (The **final exam period, Wednesday, May 13, 7-10 pm**, will be reserved for student-team presentations of final design projects to the class & several practicing professionals. Final reports will be due before final presentations, for evaluation & sending to Judges.)

Exam 1	Thursday, March 5 (tentative)
Exam 2	Thursday, April 23 (tentative)

[*] The instructor reserves the right to periodically administer, grade, & use in student evaluation "pop"/unannounced *quizzes*. Students should come to class prepared to contribute to each class's lecture & discussion by staying up-to-date with homeworks & 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 & can plainly demonstrate this, the instructor can choose to give the student a completely different exam, additional assignments, &/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, & application in the course's final design project. There will be demonstrations & some hands-on learning of computer-aided design (CAD) software in one or two of these lab times (with Microstation & GEOPAK assignments). 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.

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 & quality, alongside various real-world constraints, including economic, environmental, social, political, ethical, & public health factors, demand for transportation system services, constructability & 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 & 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 & design choices through written & oral means.

The design project for this course involves the specification & evaluation of a significant transportation investment (costing at least $1 million, & potentially several hundred million dollars). Each four-person design team will decide the scope of their unique project in consultation with the course instructor & 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, &/or a tolled freeway. Each team will design the best features (e.g., interchange type, cross slope, ramp locations, turn radii, sight distances, & path widths) they can into their project, subject to cost, safety, demand, emissions, noise, maintenance &/or other considerations. The design project will constitute a significant component of the course, & 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 & scope of work; 2) an *intermediate analysis & design report*, including a comprehensive project alternative

analysis & preliminary design work; & 3) a *final project design*. Students will be responsible for peer-review of other teams' intermediate reports & will be graded based upon their feedback & insight. Students will be expected to address issues in their proposals & intermediate reports as noted by the instructor, TA & other students. An oral presentation (before several practicing engineers) & 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, & presentation of student work, via the course's design project activities.*

VIII. Text/Reader & Course Notes

The Course Packet can be purchased for approx. $38 (vs. $220 new)at Canopy Course Notes' Jerome Kubala, at 512-497-6662. The Packet consists of selected pages from Garber & Hoel's (G&H's) *Traffic & Highway Engineering* (Fourth Edition, 2009), which thoughtfully presents many of the ideas present in AASHTO's 2011 (6th Ed) "Green Book" – or *Policy on Geometric Design of Highways & Streets* (including all key tables for horizontal & 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.

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

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

CE 367G covers various aspects of transportation relating to the design of ground-based transportation systems (emphasizing roadway & non-motorized travel). The course *objectives* are that students are able to design safe, cost-effective, & sustainable networks, are familiar with design standards, & are comfortable with various tools for project evaluation. Primary topics include physical design for safe & efficient transport to meet passenger & freight needs, multi-modal & multi-objective planning, crash prediction, cost considerations, environmental impacts, & 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 & 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, & 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
Wednesday, May 13, 7-10 pm (UT's default slot) **Final Presentations**	

X. Add/Drop Dates

From the 1st through the 12th class day, an undergraduate student can drop a course via the web & 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, & departmental advisor. After the academic drop deadline has passed, a student may drop a course only with Dean's approval, & only for urgent, substantiated, non-academic reasons.

XI. Evaluation Plan

An evaluation of the course & instructor will be conducted at the end of the semester using the approved UT Course/Instructor evaluation forms. All students are encouraged to submit written comments during this survey, & beforehand (directly to the instructor, but anonymously), at any time.

XII. Other Information

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 & Community Engagement, Services for Students with Disabilities, 512-471-6259 (Videophone: 512-410-6644) or http://www.utexas.edu/diversity/ddce/ssd.
2. According to The General Information Catalog "a student who is absent from a class or examination for the observance of a religious holy day may complete the work missed within a reasonable time after the absence, if proper notice of the planned absence has been given". 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 CE367G are encouraged & authorized to work on homework assignments together & 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 & our class's integrity, please visit http://deanofstudents.utexas.edu/sjs/acint_student.php to see information regarding **Academic Integrity** & the **University Honor Code**. 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 &/or dismissal from the University. Since such dishonesty harms the individual, all students, & 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://deanofstudents.utexas.edu/sjs/ to access the official University policies & procedures on scholastic dishonesty. For further elaboration on what constitutes scholastic dishonesty see http://deanofstudents.utexas.edu/sjs/scholdis_whatis.php

4. Math & statistics tutors & other learning assistance can be obtained via many resources. (See, e.g., http://www.engr.utexas.edu/undergraduate/97/4668-tutoring-information & the Academic Community Center at Jester West: http://www.engr.utexas.edu/undergraduate/services/tutoring/jester.)
5. All other university policies not explicitly included on this syllabus can be found the **General Information Catalog:** http://catalog.utexas.edu/general-information/.
6. Recommendations regarding emergency evacuation from the Office of Campus Safety & Security, 512-471-5767. http://www.utexas.edu/safety/:

- Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting & assembling outside (across the bridge).
- Familiarize yourself with all exit doors of each classroom & building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.
- Students requiring assistance in evacuation shall inform their instructor in writing during the first week of class.
- In the event of an evacuation, follow the instruction of faculty or class instructors. Do not re-enter a building unless given instructions by the following: Austin Fire Dept., The University of Texas at Austin Police Dept., or Fire Prevention Services office.
- Behavior Concerns Advice Line (BCAL) 512 – 232-5050. For more information visit the BCAL website: http://www.utexas.edu/safety/bcal/
- Link to information regarding emergency evacuation routes & emergency procedures can be found at: www.utexas.edu/emergency