

## CE 3302: Transportation Engineering

Spring 2020

### UTA Civil Engineering Program

- Classes: Tuesday and Thursday, 9:30 – 10:50 am, 108 Nedderman Hall
- Professor: Dr. Kate Hyun  
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Office: Nedderman Hall 432  
Office Hrs: Tuesday and Thursday, 11-12:30pm, or by appointment
- Teaching Assistant: Sina Famili ([sina.famili@mavs.uta.edu](mailto:sina.famili@mavs.uta.edu)), NH B24 (Office hour: Monday 9AM – 12PM in NH 243)
- Textbook: **Required:** *Principles of Highway Engineering and Traffic Analysis, 6<sup>th</sup> Edition, Mannering et al*
- Software: Microsoft EXCEL or other spreadsheet
- Prerequisite: CE 2331; CE 3311/2313 or concurrent registration therein; and CE 3301 or IE 3301 or concurrent registration therein
- Grades:
- |                        |     |
|------------------------|-----|
| Group Project          | 10% |
| In-class Presentation  | 2%  |
| Quizzes                | 5%  |
| Journal Article Review | 8%  |
| Homework               | 10% |
| Exam I                 | 15% |
| Exam II                | 20% |
| Final                  | 30% |
- Course Context: This course provides an introduction to the diverse field of transportation engineering. Transportation directly affects the public on a daily basis, and the public will typically develop diverse opinions on methods to improve the transportation system. Other fields within the practice of civil engineering can experience these phenomena, but typically to a lesser extent in the United States.
- Course Goals:
1. Discuss the breadth, implications, and interactions present in transportation engineering
  2. Develop global awareness of issues affecting engineering problems.
  3. Explore the tools necessary to solve transportation engineering problems
  4. Preview future topics available in elective classes
  5. Improve problem-solving and analytical skills

## CE 3302 Schedule

Date	Topic	Text	Assignment Due
Jan 21	Course Intro., Transportation Systems	Chapter 1	
Jan 23	Road Vehicle Performance	Chapter 2	
Jan 28	Road Vehicle Performance	Chapter 2	
Jan 30	Geometric Design of Highways	Chapter 3	HW#1
Feb 4	Geometric Design of Highways	Chapter 3	Quiz 1
Feb 6	Geometric Design of Highways	Chapter 3	
Feb 11	Geometric Design of Highways	Chapter 3	HW #2
Feb 13	Geometric Design of Highways	Chapter 3	Quiz 2
Feb 18	Pavement Design	Chapter 4	
Feb 20	Pavement Design	Chapter 4	HW #3
Feb 25	Problem and Discussion	Handout	Quiz 3
Feb 27	<b>Exam I</b>		
Mar 3	Traffic Flow Theory	Chapter 5	
Mar 17	Traffic Flow Theory	Chapter 5	
Mar 19	Traffic Flow Theory	Chapter 5	HW #4
Mar 24	Capacity and Level of Service	Chapter 6	Quiz 4
Mar 26	Traffic Control	Chapter 7	Article Review Report Due
Mar 31	Traffic Control	Chapter 7	HW #5
Apr 2	Problem and Discussion	Handout	Quiz 5
Apr 7	<b>Exam II</b>		
Apr 9	Transportation Demand Analysis	Chapter 8	
Apr 14	Transportation Demand Analysis	Chapter 8	HW #6
Apr 16	Transportation Demand Analysis	Chapter 8	Quiz 6
Apr 21	Transportation Demand Analysis	Chapter 8	
Apr 23	Transportation Demand Analysis	Chapter 8	HW#7
Apr 28	Group Presentation		Quiz 7
Apr 30	Group Presentation		
May 5	Group Presentation		HW #8
May 7	Review for Final		Group Project Report Due

**\*\*-Handout or will be uploaded on Canvas**

*As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course.*

### Optional Topics

- Public Transit
- Environmental Impacts
- Intelligent Transportation Systems
- Freight

### Course Learning Outcomes:

To successfully complete this course, a student should be able to

- a. Calculate minimum horizontal and vertical curve characteristics to meet design criteria
- b. Apply the basic tools and models associated with the 4-step planning process
- c. Use the Highway Capacity Manual to conduct operational analysis or recommend design requirements for a basic freeway segment
- d. Apply traffic flow models to characterize macroscopic flow, speed or density in a segment
- e. Identify poor infrastructure and operating conditions for bicyclists and pedestrians and recommend infrastructure improvements
- f. Use tools and techniques to solve transportation engineering problems
- g. Identify and explain contemporary issues in transportation engineering
- h. Deliver technical information using written and oral communication

Student Outcome	1	2	3	4	5	6	7
Course Learning Outcome	a(H) b(H) c(H) d(H) f(M)	e(L)	e(L) g(M) h(M)	e(M)	e(M)	e(L)	g(L)

### Missed Exams

If an exam is missed, I should be contacted immediately. If I do not hear from you on the test day, and you do not have an adequate medical emergency/family emergency (hospitalization/doctor's note/death certificate), you will be given an alternative test version that will definitely be more difficult than the original version or receive a zero on the exam.

### Quizzes (opened book)

In general, quizzes will cover basic concepts from the readings and lectures. There will be no big problem solving for the quizzes, just multiple choice, true/false and short-answer. We will discuss the solutions following the quiz. The lowest quiz score will be dropped.

### Homework

The homework should be submitted on the day that it is due. I need the homework turned in by this date so that I can return the solutions to you within a week. If the homework is not submitted by the due, the maximum score will degrade 10% of the total score per day.

### Exams and Final (open and closed book)

The exams will last one and a half hours, and the final will be two and a half hours. While each test will focus on a specific section, any of the course objectives that have been covered to that point may be addressed. All of the problem solving will be open book while other portions of the test will be closed book.

### Transportation Group Project

Each group (up to 3 people) will complete one project. The project has five sub-tasks:

1. Choose your topic (using a lab book)
2. Choose your study location
3. Design your own study tasks
4. Conduct the tasks and report the results
5. Recommended improvements or any further analytic outcomes to study area.

### **Article Review – Individual project**

Each student is expected to identify one newspaper or journal article each week (the date of the article should be clearly identified) that deals with transportation; a total of 8 articles are required to review. The student will identify the significance of the article in a short paragraph. The journal will be collected for grading by the due date identified in the schedule. Each student will select one article and make a two-minute presentation during the final group presentation.

### **Institution Information**

UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the [Institutional Information](http://www.uta.edu/provost/administrative-forms/course-syllabus/syllabus-institutional-policies.php) page (<http://www.uta.edu/provost/administrative-forms/course-syllabus/syllabus-institutional-policies.php>) which includes the following policies among others:

- Drop Policy
- Disability Accommodations
- Title IX Policy
- Academic Integrity
- Student Feedback Survey
- Final Exam Schedule

**Attendance:** At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, I allow students to attend class at their own discretion; however, there will be a few unannounced quizzes held during class throughout the semester. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Canvas. This date is reported to the Department of Education for federal financial aid recipients.

**Emergency Exit Procedures:** Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located through the doors to my left and to my right. After leaving through these doors, exits are available to both the left and right; out the door to the north an exit is also available along the north wall. When exiting the building during an emergency, one should never take an elevator

but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.

**Drop Policy:** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://wweb.uta.edu/ses/fao>).

**Electronic Communication:** UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

**Campus Carry:** Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit <http://www.uta.edu/news/info/campus-carry/>

**Final Review Week:** A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

**Title IX:** The University of Texas at Arlington (“University”) is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the

Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit [www.uta.edu/titleIX](http://www.uta.edu/titleIX) or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or [jmhood@uta.edu](mailto:jmhood@uta.edu).*

**Student Feedback Survey:** At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory shall be directed to complete a Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

**Non-Discrimination Policy:** *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit [uta.edu/eos](http://uta.edu/eos).*

**Academic Integrity:** All students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

*I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

*I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

Instructors may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

**Disability Accommodations:** UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA)*, *The Americans with Disabilities Amendments Act (ADAAA)*, and *Section 504 of the Rehabilitation Act*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of a **letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting: **The Office for Students with Disabilities, (OSD)** [www.uta.edu/disability](http://www.uta.edu/disability) or calling 817-272-3364. Information regarding diagnostic

criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability).

Counseling and Psychological Services (CAPS) [www.uta.edu/caps/](http://www.uta.edu/caps/) or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

**Student Support Services:** UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include [tutoring by appointment](#), [drop-in tutoring](#), [etutoring](#), [supplemental instruction](#), [mentoring](#) (time management, study skills, etc.), [success coaching](#), [TRIO Student Support Services](#), and [student success workshops](#). For additional information, please email [resources@uta.edu](mailto:resources@uta.edu), or view the [Maverick Resources](#) website.

**The IDEAS Center** (2<sup>nd</sup> Floor of Central Library) offers **free** tutoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. To schedule an appointment with a peer tutor or mentor email [IDEAS@uta.edu](mailto:IDEAS@uta.edu) or call (817) 272-6593.

**The English Writing Center (411LIBR):** The Writing Center Offers free tutoring in 20-, 40-, or 60-minute face-to-face and online sessions to all UTA students on any phase of their UTA coursework. Our hours are 9 am to 8 pm Mon.-Thurs., 9 am-3 pm Fri. and Noon-6 pm Sat. and Sun. Register and make appointments online at <http://uta.mywconline.com>. Classroom Visits, workshops, and specialized services for graduate students are also available. Please see [www.uta.edu/owl](http://www.uta.edu/owl) for detailed information on all our programs and services.

The Library's 2<sup>nd</sup> floor Academic Plaza offers students a central hub of support services, including IDEAS Center, University Advising Services, Transfer UTA and various college/school advising hours. Services are available during the library's hours of operation. <http://library.uta.edu/academic-plaza>

**Librarian to Contact:** [Martin Wallace](#), [martin.wallace@uta.edu](mailto:martin.wallace@uta.edu), 817-272-3924, [Office Hours](#)

**Active Shooter:** <https://police.uta.edu/crime-prevention/active-shooter-resources.php>

<p><b>Emergency Phone Numbers:</b> In case of an on-campus emergency, call the UT Arlington Police Department at <b>817-272-3003</b> (non-campus phone), <b>2-3003</b> (campus phone). You may also dial 911. Non-emergency number 817-272-3381</p>
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## Objectives:

The student should be able to:

1. Discuss and assess the implication of current events in the transportation field (especially at the local and state level)
2. Describe the role transportation has played in the development of communities and societies.
3. Measure vehicle headways and calculate average headways.
4. Distinguish between volume and flowrate and explain how to convert from one to another.
5. Display and quantify the variability of traffic flow.
6. List and classify techniques and technologies for measuring traffic flow characteristics.
7. Explain how vehicle speeds are measured and used.
8. Design an experiment to determine traffic density.
9. Distinguish between density and occupancy and explain how to convert from one to the other.
10. Explain how loop detectors work.
11. Derive and explain the relationships involving speed, flow and density.
12. Fit traffic data to one proposed model of traffic flow.
13. Design and conduct activities to measure traffic stream characteristics.
14. Analyze field data and estimate values for traffic stream parameters.
15. Build a standard traffic flow model to fit observed traffic data.
16. Determine the level of service on a basic freeway segment under specified traffic characteristics.
17. Identify, quantify and discuss the relationship between land use and transportation activity.
18. Calculate estimates of the number of trips “generated” by a particular land use.
19. Explain the purpose of traffic analysis zones (TAZ’S)
20. Explain the role Traffic Generation plays in the four-step travel modeling process.
21. Distinguish between the standard traffic generation methods and estimate trip end totals from each site-based, zone-based, and house hold based.
22. Explain the role mode choice plays in the 4 step modeling process.
23. Answer the question, “How many travelers will choose each mode of transportation?”
24. List the four steps in the traditional travel demand modeling process.
25. Explain the two-way relationship between land use and travel.
26. Estimate the number of trips that will be generated to and from a specified area.
27. Calculate the number of trips that can be expected to go to any particular destination from a specified origin.
28. Determine the proportion of travelers who will choose each transportation mode that satisfy equilibrium conditions.
29. Explain equilibrium and use that concept to calculate the flow patterns that satisfy equilibrium conditions.
30. Discuss the strengths and limitations of standard travel demand models as the basis for major public investment decisions.
31. Explain the role Trip Assignment plays in the 4-step travel modeling process.
32. Answer the question, “Which route do trip makers choose, once they have chosen their destinations and modes.
33. Calculate and apply performance measures needed to analyze a transportation system.
34. Discuss the negative effects of traffic congestion.
35. Be able to explain the role and characteristics of various transportation modes.
36. Explain how travel demand modeling fits into the transportation-planning process.
37. Explain how the transportation-planning process is used to help make public investment decisions.
38. List stakeholders who should be involved in the planning process.
39. Perform a benefit-cost analysis on alternative transportation projects.
40. Rank projects with non-quantifiable benefits or costs.
41. Explain the importance of involving stakeholders in the decision process.
42. Describe the challenges involved with comparing alternatives with multiple objectives, some of which are non-quantifiable.
43. Evaluate the relationship between several alternatives.
44. Use human factors in the design and analysis of highways for safety.
45. Evaluate and design roadway sections for safe stopping sight distance.
46. Apply prescribed standards in the use of roadway signs and markings.
47. Be able to design a phasing plan for a two-phase, three-phase or four-phase traffic signal.
48. Describe study of “Human Factors.”

49. Explain how human factors analysis may assist the design of transport system components.
50. Be able to apply vision requirements and solve a stopping distance problem.
51. Explain how human factors and vehicle performance are the principal factors to consider in highway design.
52. Explain and classify traffic control devices.
53. Develop criteria for sight distance situations.
54. Examine parameters for stopping distance.
55. Specify the appropriate marking of a two-lane road with passing.
56. Determine the elevation of specified points along a vertical curve.
57. Calculate the key dimensions of a horizontal curve.
58. Design vertical and horizontal curves for passing/no passing marking for a rural two-lane road.
59. Determine the appropriate bank angle (superelevation) for safe travel around a horizontal curve.
60. Analyze the sight distances at an intersection for possible installation of stop or yield signs.
61. Design signal settings for intersections so that drivers will not face a dilemma zone.
62. Determine whether a dilemma zone exists on the approach to a signalized intersection.
63. Be able to describe terminology associated with intersections and traffic signals.
64. Be able to apply signal warrants.
65. Be able to analyze and calculate change and clearance intervals
66. Be able to explain two ways an actuated signal phase may end.
67. Be able to calculate the level of service for a basic freeway segment.
68. Be able to evaluate the presence or absence of traffic signal coordination.

### Potential Additional Objectives

69. Be able to explain the elements of geometric design.
70. Be able to describe and apply geometric design controls and criteria
71. Be able to describe the role of various traffic control devices.
72. Be able to recognize different types of at-grade intersections and interchanges
73. Be able to design the settings for a traffic-actuated signal.
74. Be able to design a coordination strategy for an arterial system that maximizes bandwidth.
75. Be able to conduct a lab/study for traffic, transit, planning or parking issues.
76. Be able to determine intersection lost time and explain a good MOE for intersection performance
77. List the factors that affect pavement design
78. Describe the impact that trucks have on pavement
79. Explain Load Equivalency Factors
- 80.