CE 3302: Transportation Engineering

Spring 2015
UTA Civil Engineering Program

Classes:	Tuesdays and Thursdays, 9:30 – 10:50 am, 111 Nedderman Hall
Professor:	Dr. Stephen Mattingly
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Fax:	272-2630
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Office:	Nedderman Hall 432
Office Hrs:	Tuesdays and Thursdays, 11-12 and 1-3, and Friday 11-12 or by appointment
Teaching Assistant:	Ziaur Rahman (ziaur.rahman@mavs.uta.edu), NH B24
Textbook:	**Required:** *Fundamentals of Transportation Engineering: a Multimodal Systems Approach*, Fricker and Whitford, 1st Edition
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 and Peer Evaluation	10%
Quizzes	5%
Current Event Journal/Presentation	10%
Homework	15%
Exam I	16.25%
Exam II	16.25%
Final	27.5%

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 facets within transportation engineering
4. Preview future topics available in elective classes
5. Improve problem-solving and analytical skills

CE 3302 Schedule

Date	Topic	Text	Assignment Due
Jan 20	Course Intro., Transportation Basics	Chapter 1	-
Jan 22	Traffic Flow: Theory and Analysis	Chapter 2, omit 2.4 & 2.6	-
Jan 27	Traffic Flow: Theory and Analysis	Chapter 2, omit 2.4 & 2.6	-
Jan 29	Traffic Flow: Theory and Analysis	Chapter 2, omit 2.4 & 2.6	HW#1 Handout**
Feb 3	Highway Design for Performance	Chapter 3, omit 3.1	-
Feb 5	Highway Design for Performance	Chapter 3, omit 3.1	HW#2: Handout**
Feb 10	Modeling Transportation Demand and Supply	Chapter 4	-
Feb 12	Modeling Transportation Demand and Supply	Chapter 4	HW#3: Handout**
Feb 17	Modeling Transportation Demand and Supply	Chapter 4	-
Feb 19	Modeling Transportation Demand and Supply	Chapter 4	HW#4: Handout**
Feb 24	Planning and Evaluation for Decision Making	Chapter 5, omit 5.5	-
Feb 26	Planning and Evaluation for Decision Making	Chapter 5, omit 5.5	HW#5: Handout**
Mar 3	Supplementary Material		
Mar 5	**Exam I**		
Mar 10	Spring Break	-	-
Mar 12	Spring Break	-	-
Mar 17	*Safety on the Highway	Chapter 6	-
Mar 19	*Safety on the Highway	Chapter 6	5.1, 5.4, 5.8, 5.12
Mar 24	*Highway Design for Safety	Chapter 7	HW#7: Handout**
Mar 26	*Highway Design for Safety	Chapter 7	
Mar 31	*Highway Design for Safety	Chapter 7	HW#8: Handout**
Apr 2	Design of Intersections for Safety and Design	Chapter 8	HW#9: Handout**
Apr 3	**Last Day to Drop Class**		
Apr 7	Design of Intersections for Safety and Design	Chapter 8	Project report
Apr 9	Design of Intersections for Safety and Design	Chapter 8	8.1, 8.4, 8.5, 8.7
Apr 14	Supplementary Material		
Apr 16	**Exam II**		-
Apr 21	Pavement Design	Chapter 9, omit 9.4 & 9.5	
Apr 23	Pavement Design	Chapter 9, omit 9.4 & 9.5	8.10, 8.14, 8.19, 8.23
Apr 28	Air Transportation and Airports	Chapter 11	-
Apr 30	Air Transportation and Airports	Chapter 11	9.3, 9.5, 9.7, 9.13
May 5	Air Transportation and Airports	Chapter 11	-
May 7	Supplementary Material		11.6, 11.12, 11.15, 11.16
May 14	**Final, 8-10:30 am**	-	-

*** - Current AASHTO Formula differs for Stopping Sight Distance**

****-Handout or will be uploaded on Blackboard**

Optional Topics

- Public Transit
- Bicycles and Pedestrians
- Environmental Impacts
- Intelligent Transportation Systems
- Freight

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 (closed book)

In general, quizzes will be held infrequently, and will cover basic concepts from the readings and lectures. There will be no 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 the maximum score will degrade in the following manner with each deduction associated with class meetings (90%, 70%, 40%).

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.

Group Project and Peer Evaluation

Each group (2-4 people) will complete one project. The project specifics will be distributed in late February or early March. Each group will also complete a debriefing interview or survey associated with their project.

Current Event Journal with Presentation

Each student will keep a current event journal throughout the course. Each student is expected to identify one newspaper article each week (the date of the article should be clearly identified) that deals with transportation and add it to his or her journal; a total of 10 articles will be sufficient. The student will identify the significance of the article in a short paragraph. The journal will be collected for grading at least twice, and notice will be provided one week in advance. Each student will be selected without notice to make a three minute presentation of one of the articles that a previous student has not presented.

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 on both my left and right. After leaving through these doors, the closest exit to the left down the corridor; however, if this exit is blocked, turn right and proceed to the end of the corridor where there is another exit. 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.

Attendance: At The University of Texas at Arlington, taking attendance is not required. Rather, 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.

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.

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.

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.

Title IX: The University of Texas at Arlington is committed to upholding U.S. Federal Law "Title IX" such that no member of the UT Arlington community shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity. For more information, visit www.uta.edu/titleIX.

Americans with Disabilities Act: The University of Texas at 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).* 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 that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

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, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at www.uta.edu/resources.

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.

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. Evaluate the performance of a roadway by using standard procedures.
17. Determine the level of service on a basic freeway segment under specified traffic characteristics.
18. Answer “Kara’s question” clearly and concisely.
19. Identify, quantify and discuss the relationship between land use and transportation activity.
20. Calculate estimates of the number of trips “generated” by a particular land use.
21. Explain the purpose of traffic analysis zones (TAZ’S)
22. Explain the role Traffic Generation plays in the four-step travel modeling process.
23. Distinguish between the standard traffic generation methods and estimate trip end totals from each site-based, zone-based, and house hold based.
24. Explain the role mode choice plays in the 4 step modeling process.
25. Answer the question, “How many travelers will choose each mode of transportation?”
26. List the four steps in the traditional travel demand modeling process.
27. Explain the two-way relationship between land use and travel.
28. Estimate the number of trips that will be generated to and from a specified area.
29. Calculate the number of trips that can be expected to go to any particular destination from a specified origin.
30. Determine the proportion of travelers who will choose each transportation mode that satisfy equilibrium conditions.
31. Explain equilibrium and use that concept to calculate the flow patterns that satisfy equilibrium conditions.
32. Discuss the strengths and limitations of standard travel demand models as the basis for major public investment decisions.
33. Explain the role Trip Assignment plays in the 4-step travel modeling process.
34. Answer the question, “Which route do trip makers choose, once they have chosen their destinations and modes.
35. Calculate and apply performance measures needed to analyze a transportation system.
36. Discuss the negative effects of traffic congestion.
37. Be able to explain the role and characteristics of various transportation modes.
38. Explain how travel demand modeling fits into the transportation-planning process.
39. Explain how the transportation-planning process is used to help make public investment decisions.
40. List stakeholders who should be involved in the planning process.
41. Perform a benefit-cost analysis on alternative transportation projects.
42. Rank projects with non-quantifiable benefits or costs.
43. Explain the importance of involving stakeholders in the decision process.
44. Describe the challenges involved with comparing alternatives with multiple objectives, some of which are non-quantifiable.
45. Evaluate the relationship between several alternatives.
46. Use human factors in the design and analysis of highways for safety.
47. Evaluate and design roadway sections for safe stopping sight distance.

48. Apply prescribed standards in the use of roadway signs and markings.
49. Describe study of “Human Factors.”
50. Explain how human factors analysis may assist the design of transport system components.
51. Be able to apply vision requirements and solve a stopping distance problem.
52. Explain how human factors and vehicle performance are the principal factors to consider in highway design.
53. Explain and classify traffic control devices.
54. Develop criteria for sight distance situations.
55. Examine parameters for stopping distance.
56. Calculate passing sight distance for a two-lane road and table.
57. Specify the appropriate marking of a two-lane road with passing.
58. Determine the elevation of specified points along a vertical curve.
59. Calculate the key dimensions of a horizontal curve.
60. Design vertical and horizontal curves for passing/no passing marking for a rural two-lane road.
61. Determine the appropriate bank angle (superelevation) for safe travel around a horizontal curve.
62. Develop design for determining spiral length.
63. Determine length of the runoff curve from curve to tangent section.
64. Find a critical gap for an unsignalized intersection approach.
65. Analyze the sight distances at an intersection for possible installation of stop or yield signs.
66. Design signal settings for intersections so that drivers will not face a dilemma zone.
67. Determine gaps in traffic that are acceptable to motorists
68. Determine whether or not to install a stop sign to yield sign based on critical approach speed
69. Determine whether a dilemma zone exists on the approach to a signalized intersection.
70. Explain the effect that soil has on pavement strength
71. Determine the loading that vehicles exert on the highway pavement system
72. Design a section of flexible pavement.
73. Discuss the AASHTO equation and some of its shortcomings
74. List components in a pavement system
75. List the factors that effect pavement design
76. Describe the impact that trucks have on pavement
77. Explain Load Equivalency Factors
78. Identify truck types by axle configurations

Potential Additional Objectives

79. Be able to explain the elements of geometric design.
80. Be able to describe and apply geometric design controls and criteria
81. Be able to identify and describe components of cross-section design.
82. Be able to design a phasing plan for a two-phase traffic signal.
83. Be able to describe the role of various traffic control devices.
84. Be able to recognize different types of at-grade intersections and interchanges
85. Be able to describe terminology associated with intersections and traffic signals.
86. Be able to design the settings for a traffic-actuated signal.
87. Be able to design a coordination strategy for an arterial system that maximizes bandwidth.
88. Be able to apply signal warrants.
89. Be able to analyze and calculate change and clearance intervals
90. Be able to explain two ways an actuated signal phase may end.
91. Be able to evaluate the presence or absence of traffic signal coordination.
92. Be able to conduct a lab/study for traffic, transit, planning or parking issues.
93. Be able to determine intersection lost time and explain a good MOE for intersection performance
94. Be able to calculate the level of service for a basic freeway segment.