CE 463/563 Traffic Flow and Capacity Analysis (Spring 2009)

Dept. of Civil Engineering and Engineering Mechanics
University of Arizona

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Meeting: TTh 11:00-12:15 pm at CE201
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Course Descriptions:

This course is to introduce to students the advanced theories and techniques in traffic flow and capacity analysis as applied to urban highway network (including freeways, arterials and intersections) operations and management. Upon completing of this course, the students should:

(1) Understand the basic properties of traffic flows,
(2) Understand the nature and causes of traffic congestion,
(3) Have the experience in traffic data collection and analysis,
(4) Be able to apply traffic flow theories and related engineering techniques to formulate possible solutions for traffic congestion problems,
(5) Understand the concepts and analysis approaches of capacity of facilities in a urban highway transportation system, and,
(6) Be able to apply both analytical and simulation-based approaches to analyze and improve transportation system capacity and efficiency.

Prerequisites:

Undergraduate students should have completed CE363; those who didn't should spend extra time to understand the traffic flow basics covered by CE363. Students need to feel comfortable about calculus, MS Excel or some basic programming languages, MS Word, basic statistic analysis techniques, computer simulation packages.

Expectation:

Students are expected to have genuine interest in traffic engineering as the course materials are highly specialized. Students should review the course materials before coming to the class. Students should be ready to be intellectually challenged in this class and be ready to undertake the course requirements set by the instructing professor.

Topics:

The course outlines are summarized as follows. Slight deviation may be likely per the student learning progress in the semester.

	Description	Schedule	Readings/Tools/Software
Module 1	Review of traffic flow basics • Review of basic traffic flow properties • Measurement of q, k, v • Fundamental diagrams – properties and calibration • First-order conservation law • Shockwaves		▪ (FHWA, 2000a) Ch. 2, 7, 8 ▪ Papacostas, C. S. and P. D. Prevedouros (2001) or equivalent ▪ (May, 1990)

Module 2	Microscopic models		▪ (May, 1990)
	First mid-term exam	3/2	
Module 3	Highway capacity analysis (Analytical) - Basic segment, ramp junction, weaving area - Multilane highway capacity analysis		▪ (FHWA, 2000a) Ch. 21, 22, 23, 24, 25
	Spring break no class	3/14-3/22	
Module 4	Highway capacity analysis (Simulation) - Basic segment, ramp junction, weaving area - Multilane highway capacity analysis - Traffic analysis toolbox		▪ (FHWA, 2003a) ▪ (FHWA, 2003b) ▪ (FHWA, 2004)
	Second mid-term exam	4/7	▪
Module 5	Intersection capacity analysis and signal design		▪ (FHWA, 2000b) ▪ (FHWA, 2003a) ▪ (FHWA, 2003b)
Module 6	Integrate highway network performance analysis		▪ (FHWA, 2003a) ▪ (FHWA, 2003b)
	Final exam	5/11-5/15	

Homework Assignments

- Several homework assignments will be given throughout the semester. The **worst homework grade will be dropped** from the final grade calculation.
- Homework is due at the beginning of the class on the day it is due.
- Homework handed in late will have the following penalties: Up to 1 class late: 5 points; up to 2 classes late: 10 points; up to 3 classes late: 30 points. No credit will be given after the homework solution is posted on D2L. Prior approval from the instructor is needed for a student to be exempted from the above policy for a particular assignment.
- Appeal of homework grade needs to be submitted to the professor through the D2L e-mail **one week within the homework return date**. No appeal would be accepted if the appeal is delivered verbally or if the appeal passes the due date.
- Homework needs to be presented in a professional manner. Each assignment should have a title page indicating name, date, course, and assignment number. Partial credit will be given for solving the problem using the correct method but not yielding the correct answer. No credit will be given to problems with answer but no clearly written calculation. Final answers should be clearly identified. Page numbers should be clearly indicated. Submitting the homework through D2L is preferred but the students have the option to submit in person.
- Discussing with peer classmates is encouraged. However, each student needs to produce his/her own solutions. Copying another person's work, without attribution, including copying of any part or the whole of computer files or material from the Internet, is considered plagiarism. It will be prosecuted as a violation of the University of Arizona Student Code of Conduct, in accordance with the Code of Academic Integrity. This code is published on-line at http://dos.web.arizona.edu/uapolicies/. It is the student's responsibility to be familiar with these Codes.
- For group homework assignments, each group needs to elect **a group leader for each assignment**. Only the group leader needs to submit the group homework. For each homework assignment the group leader needs to submit a one-paragraph journal summarizing the participation of each group member. To recognize the group leader's extra work, the group leader receives additional 5% points for each group assignment.

Exams

Two 75-min mid-term exams will be given during the semester. Makeup exams are not usually given except unexpected special extenuating circumstances. However, for a legitimate schedule conflict and

with the instructor's approval, a student may be able to take the exam at a different time. Scaling of exam grade may be permitted for the entire class. However, no scaling will be performed for the final grade calculation. Graduate students may be given additional questions at the exam. If this occurs, the total points will be scaled to the same as those for the undergraduate students after adding the additional questions.

Term Project Report

Term project report is required only for graduate students. The graduate students should submit a one-page proposal for approval by February 12, 2008. Detailed report requirements will be given separately at a later time.

Grading Policy

Different grading policies apply to undergraduate and graduate students as follows.

	Undergraduate	**Graduate**
Homework	30%	25%
Mid-term Exam	30%	25%
Final Exam	40%	25%
Term Project Report	--	25%

Additional maximum 5.0 points to the final grade will be given to those who finish the following reading and write a 3,000-word essay about the Grand Challenges for Engineering, published by National Academy of Engineering (http://www.engineeringchallenges.org/). More instructions will be given later in the semester. The actual received grade on this task depends on the quality of the submitted report.

This course will be graded on a straight scale with the following grade thresholds. The professor reserves the right to make final adjustments.

Total percentage of points earned	Final Grade
90 -100 %	A
80 – 89.9 %	B
70 – 79.9 %	C
60 – 69.9 %	D
< 60%	F

Course Materials

Course materials can be accessed through D2L. Other additional readings may be announced during the semester.

FHWA (2000a). Highway Capacity Manual 2000. Washington, D.C., FHWA.
FHWA (2003a). Traffic Software Integrated System (TSIS). Version 5.1.
FHWA (2003b). TSIS Manuals and Documentation. Washington, D.C., FHWA.
FHWA (2004). Traffic Analysis Toolbox Volume I: Traffic Analysis Tools Primer. McLean, VA, Turner-Fairbank Highway Research Center**:** 34.
May, A. D. (1990). Traffic Flow Fundamentals. New Jersey, Prentice Hall.
Papacostas, C. S. and P. D. Prevedouros (2001). Transportation Engineering & Planning, Prentice Hall (or equivalent)

Computer software

CORSIM v5.1 (http://mctrans.ce.ufl.edu/featured/TSIS/Version5/)
HCS 2000