CE 463/563 Traffic Flow and Capacity Analysis (Spring 2017)

Dept. of Civil Engineering and Engineering Mechanics
University of Arizona

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GoToMeeting Link:
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Access Code: 392-365-373

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 or other equivalent courses. Students need to feel comfortable with 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 in the analysis of traffic data. 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 instructor.

Topics:

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

	Description	Readings/Tools/Software
Module 1	Review of traffic flow basics • Review of basic traffic flow properties • Measurement of q, k, v	▪ (FHWA, 2000a) Ch. 2, 7, 8 ▪ Papacostas, C. S. and P. D. Prevedouros

	• Fundamental diagrams – properties and calibration • First-order conservation law • Shockwaves	(2001) or equivalent ▪ (May, 1990)
Module 2	Microscopic models	▪ (May, 1990)
Module 3	Highway capacity analysis (Analytical) - Basic segment, ramp junction, weaving area - Multilane highway capacity analysis	▪ (FHWA, 2000a) Ch. 21, 22, 23, 24, 25
	Mid-Term Exam	
	Spring break no class	
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)
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)
	Last Class	
	Final exam	

GoToMeeting Sessions

- It is anticipated that the instructor may substitute a few in-class room sessions with either live or recorded GoToMeeting sessions during this semester due to other research or administrative commitments. Any change to the regular session will be announced beforehand. Students taking this class need to be able to accommodate this possible session changes.

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 within **one week after posting of homework grade**. No appeal would be accepted if the appeal is delivered verbally or if the appeal passes the due date. It is the student's responsibility to regularly check the posting of grades.
- 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 https://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity. 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.
- The instructor reserves the right to **randomly choose** which homework assignment to grade. In other words, **not all homework assignments will be graded and the choice of graded homework is at the instructor's discretion**.
- Only the graded homework assignments are to be included in the final grade calculation.

Exams

One 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.

The final exam may be in in-class or take-home exam format. The instructor will make the final determination and announcement before the final exam period. The final exam may include the course materials taught in the entire semester.

Term Project Report

Term project report is required only for graduate students. 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	40%	25%
Mid-term Exam	25%	25%
Final Exam	35%	25%
Term Project Report	--	25%

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 others equivalent)

Mannering, F.L. et al (2009) Principles of Highway Engineering and Traffic Analysis, 4th ed., Wiley (or others equivalent.)

Computer software CORSIM v5.1 or 6.0
(http://mctrans.ce.ufl.edu/featured/TSIS/Version5/)
HCS 2000