SYLLABUS

CE 6500: Transportation Data Analysis and Modeling
Fall 2013

Instructor:
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VCTIR Room 342
Office hours by appointment

Tues/Thurs 3:30-4:45, MEC 345

Course Description
This course explores the unique modeling and analysis challenges faced by transportation engineers. Students will be introduced to these challenges in a wide range of transportation areas – ranging from traffic flow theory, to safety, to aviation. Data characteristics from these areas will be investigated, along with well-suited modeling and analysis techniques. Topics to be covered include descriptive statistics and data representation, fitting data to distributions, hypothesis testing, regression analysis, experimental design, and sampling. These methods will be used to gain an understanding of key concepts in traffic flow theory, considerations in the design of simulation experiments, safety analysis, and characteristics of non-highway modes.

Prerequisites:

There are no prerequisites for this course, however it is recommended that students also be enrolled in CE 6400 (Transportation Operations) or have taken an equivalent course. Previous coursework in statistics is not required, but some introductory statistics exposure would be beneficial.

Textbook
Washington, S.P., Karlaftis, M.G., Mannering, F.L., *Statistical and Econometric Methods for Transportation Data Analysis, 2nd Edition*, CRC Press, 2011.

Grading

Student performance will be primarily evaluated through the use of projects where the student will demonstrate their understanding of the material by analyzing real world data sets. Major deliverables during the semester include:

1. Class participation: Students are expected to perform the assigned reading prior to class, and fully participate in discussion of concepts.
2. Data analysis projects: Prof. Fontaine will provide (or students will be asked to collect) 3 data sets during the course of the semester. Students will individually analyze the data using the concepts from this class.
3. Paper critique: Each student will be responsible for leading a 20-30 minute discussion of one research paper during the semester. The student will select the paper and provide it to the class at least one week before the discussion. The discussion should focus on (1) any flaws in the methodology used, (2) good decisions in how the researchers analyzed the data, and (3) other methods that could have been used to improve the paper.

4. Final project: Students will conduct an independent research project where they either apply and extend concepts from this class or explore new statistical/analytical concepts to address a research question. The outcome of the project will be an article suitable for submission to a journal or conference.

Final grades will be calculated as follows:

- Class participation: 15%
- Paper critique: 10%
- Data analysis projects: 3 @ 15%
- Final paper:
    - Report: 25%
    - Presentation: 5%

Tentative Topic Areas and Techniques to be Covered

- Descriptive statistics, properties of estimators, data display methods
- Probe data and traveler survey work
    - Techniques: Data Sampling issues/central limit theorem
- Speed data and gap acceptance data
    - Techniques: Confidence intervals, hypothesis testing (t-test, ANOVA, non-parametric methods)
- Modeling arrivals of pedestrians and vehicles
    - Techniques: Applications of PDFs
- Traffic stream models
    - Techniques: Regression – assumptions, fundamentals, outliers, collinearity, goodness of fit
- Crash data characteristics
    - Techniques: Count data models – Poisson and negative binomial
- Mode choice modeling
    - Techniques: Logit modeling
- Simulation study design
    - Techniques: Design of experiments
- Queuing Models
    - Applications to Airport operations and toll facilities

Tentative Course Schedule (Subject to change!)

Date	Topic	Deliverables	Reading
8/27	Course Introduction		
8/29	Application discussion: Speed data, probe data		Chapter 1, pp 3-20
9/3	Methods discussion: descriptive statistics, properties of estimators, data display		
9/5	Methods discussion: Sampling/Central Limit Theorem	Speed data analysis project assigned	
9/10	Methods discussion: hypothesis testing		Chapter 2, pp 25-58
9/12	Methods discussion: hypothesis testing		
9/17	Application discussion: traffic stream models		
9/19	Methods discussion: Regression analysis	Speed data project due; Traffic stream model project assigned	Chapter 3, pp 63-116
9/24	Methods discussion: Regression analysis		
9/26	Methods discussion: Regression analysis	Tentative project topic due	Chapter 4, pp 123-142
10/1	Application discussion: arrivals of vehicles and pedestrians, gap acceptance		
10/3	Methods discussion: PDF/CDF use		
10/8	Methods discussion: Testing distributions	Traffic stream model project due; arrival/gap acceptance project assigned	
10/10	**Office hours - project discussions**		
10/15	**Fall break – No class**		
10/17	Application Discussion: Simulation/human factors experimental design		
10/22	Methods discussion: Experimental design	Project update due	Readings from Instructor
10/24	Methods discussion: Experimental design		
10/29	Application Discussion: Crash data modeling	Arrival/gap acceptance project due	
10/31	Methods discussion: Count data models/**Paper critiques**		Chapter 11, pp 283-300
11/5	Application/methods discussion: Queuing models in transportation		
11/7	**Paper critiques**		
11/12	Methods discussion: queuing models		
11/14	**Paper critiques**		
11/19	Application/Methods Discussion: Mode choice modeling/logit modeling		Chapter 12, 13, pp 303-342
11/21	**Paper critiques**		
11/26	**Office hours – project discussions**		
11/28	**Thanksgiving**		
12/3	**Research presentations (3 students)**		
12/5	**Research presentations (3 students)**	Research papers due	
12/9, 9-12 AM	**Research presentations** **(7 students - in VCTIR auditorium)**		