PP-M221/ UP-M253

Travel Behavior Analysis

Fall 2022 | Lecture Tues/Thurs 12:30p – 1:45p
Classroom: Boelter Hall 3760

Professor Tierra Bills | Civil and Environmental Engineering | tsbills@ucla.edu
Office: 6381 Public Affairs Building

Description:
This course provides an introduction to analysis and forecasting of passenger travel demand. The course objective is for students to understand the fundamentals of discrete choice models, as these are the building blocks for travel demand modeling. By analyzing case studies and participating in a group project, students will also understand how these models are applied in practice for analyzing travel behavior and how these behaviors can be expected to change in future scenarios. The range of topics for this course includes an introduction to urban travel patterns, fundamentals of behavioral modeling and utility theory, theories of behavior, binary, multinomial, and nested Logit (discrete choice) models, survey data collection and sampling, scenario analysis, and demand forecasting.

General Outline of Topics

Topics	Time Frame	Readings
1. Course Introduction and Overview 2. Characteristics of Urban Travel 3. Intro to Behavioral Modeling and Analysis 4. Theories of Behavior	2 - Weeks	• Inside the Blackbox: Making Transportation Models Work for Livable Communities • Rasouli, S., & Timmermans, H. (2014). Activity-based models of travel demand: promises, progress and prospects. *International Journal of Urban Sciences*, *18*(1), 31-60. • Math Refresher • Thaler RH, Sunstein CR (2008) Nudge: Improving Decisions About Health, Wealth, and Happiness. Yale University Press, New Haven and London. Introduction and Chapters 1, 5, and 12. • Aizen I (1991) The Theory of Planned Behavior. Organizational Behavior and Human Decision Processes 50, 179-211. • TCRP Report 123 (2008) Chapters 4&5 • Nicholson W, Snyder CM (2007) Microeconomic Theory: Basic Principles and Extensions. SouthWestern College Pub. Chapters 3, 4. • Ben-Akiva M, Lerman S (1985) Discrete Choice Analysis. MIT Press. Chapter 3.
1. Introduction to Discrete Choice Modeling; Derivation 2. Specification and Estimation	4 - Weeks	• Train K (2009) Discrete Choice Methods with Simulation, Second Edition. Cambridge University Press. Chapters 2, 3.

3. Binary, Multinomial, and Nested Logit Modeling 4. Statistical Tests 5. Model applications, forecasting, and simulation		• McFadden D (2001) Economic Choices. The American Economic Review 91(3), 351-378.
1. Data Collection and Survey Design 2. Data types (Stated Preference vs. Revealed Preference) 3. Experimental Design 4. Emerging Data Sources and limitations	2 - Weeks	• Rea LM, Parker RA (2005) Designing & Conducting Survey Research: A Comprehensive Guide. 3rd Edition. Jossey-Bass. (Chapters 2 and 3.) • Lee, R. J., Sener, I. N., & Mullins III, J. A. (2016). An evaluation of emerging data collection technologies for travel demand modeling: from research to practice. *Transportation Letters*, 1-13. • Carrel, A., Sengupta, R., & Walker, J. (2015). The San Francisco Travel Quality Study: Tracking trials and tribulations of a transit taker. *Transportation*.
1. Special Topics: Land use/ environmental considerations, transportation equity, Modeling limitations, research needs.	2 - Weeks	• Waddell, P. (2002). UrbanSim: Modeling urban development for land use, transportation, and environmental planning. *Journal of the American Planning Association*, *68*(3), 297-314. • Bills, T. S., & Walker, J. L. (2017). Looking beyond the mean for equity analysis: Examining distributional impacts of transportation improvements. *Transport Policy*, *54*, 61-69.

Course Prerequisite:

Students are required to have taken a basic probability and statistics course, a microeconomics course, and have some working knowledge of a programming language; as we will use Python in this course. Discrete choice models are probabilistic in nature and the model formulations, estimation, and forecasting processes taught in this course will require a basic understanding of descriptive statistics, linear regression, probability distributions, conditional probability, and statistical inference. Note that we will refresh on much of the critical foundational materials through course lectures and additional readings. Please use the "Math Refresher" (Posted in on the course website) as a gauge for familiarity with the math and statistics concepts used in the course.

Course Outcomes:

In this course, the following *ABET* Outcomes will be assessed:

a. An ability to apply knowledge of mathematics, science, and engineering

e. An ability to identify, formulate, and solve engineering problems

g. An ability to communicate effectively

h. The broad education necessary to understand the impact of engineering solutions in a global and societal context.

j. A knowledge of contemporary issues.

To successfully complete this course, you will be required to learn, develop, and ultimately demonstrate these five outcomes in relation to the specific course outcomes:

- Obtain a basic understanding of how to develop discrete choice models (a, e)
- Obtain a basic understanding of survey design and data collection (e, j)
- Obtain a basic understanding of the drivers influencing travel behavior (a, e, h)
- Learn basics of the significance of travel behavior in influencing travel conditions (a, e, h)
- Obtain a basic understanding of forecasting travel demand (a, e, j)

Grading:
Grading will be based on the following:

- Problem sets (60% of final grade): Will include a total of 4 problem sets.
- Midterm exam (20% of final grade)
- Term (group) Project (20% of final grade)
  - Design and execute behavioral analysis for an engineering, planning or policy strategy (based on available/provided datasets. Deliverables include a 5-8 page memo and a presentation during the week of final examinations.

Readings:
The primary readings for this course will come from Train (2009), which is available for free online (http://elsa.berkeley.edu/books/choice2.html). **The other readings will either be posted on the course website, or a URL will be provided**. Note that the list of readings above is tentative and adjustments may be made. Detailed readings for each course topic are in available via the course website: "Course Shedule.xlsx".

Software:
The estimation software used for in-class demonstrations will be *Biogeme* by Michel Bierlaire (https://biogeme.epfl.ch/). However, students may use their preferred discrete choice estimation software.

For Students with Disabilities:
Students needing academic accommodations based on a disability should contact the Center for Accessible
Education (CAE) at (310)825-1501 or in person at Murphy Hall A255. When possible, students should contact
the CAE within the first two weeks of the term as reasonable notice is needed to coordinate accommodations.
For more information visit www.cae.ucla.edu.

Academic Honesty:
UCLA is a community of scholars. In this community, all members including faculty, staff and students alike
are responsible for maintaining standards of academic honesty. As a student and member of the University

community, you are here to get an education and are, therefore, expected to demonstrate integrity in your
academic endeavors. You are evaluated on your own merits. Cheating, plagiarism, collaborative work, multiple
submissions without the permission of the professor, or other kinds of academic dishonesty are considered
unacceptable behavior and will result in formal disciplinary proceedings usually resulting in suspension or
dismissal.