USP 587: Travel Demand Modeling

Portland State University, Fall 2023

Room and Times: URBN 220 & Remote, Mondays 10:00am-12:50pm

Instructor: Liming Wang, PhD

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Office Hours: Tues 11:00am-1:00pm or by appointment

Course Website: https://canvas.pdx.edu

Synopsis: This course provides an introduction to travel demand analysis and forecasting. Students will understand travel demand models from a theoretical, applied and practical perspective. Students will become familiar with the traditional four-step travel forecasting process, including model development, application, and interpretation of outputs. Instruction and practice in econometric model formulation, model estimation, and use of models in transportation data analysis and prediction will be included. Practice problems are assigned to provide experience in data handling, model formulation, estimation, and interpretation.

Prerequisite: College-level algebra and introductory probability and statistics (i.e., regression analysis, hypothesis testing, etc.). The most critical elements of this material will be reviewed in class.

Format: Classes will be a combination of lecture and discussion. Students are expected to read assignments *before* class and to participate in class discussions. Homework assignments will be given and analysis of these assignments will be the basis for some class discussion during the class immediately following their due date, so it is essential to complete assignments on time .

Textbook and Reading: There is no specific textbook for the class. The course will draw on materials from a wide range of sources and will provide students with book excerpts, technical reports, and journal papers as appropriate to supplement lecture notes. The following textbook is recommended as a general reference to transportation planning modeling and analysis:

[O] Ortúzar, Juan de Dios and Luis G. Willumsen. *Modelling Transport*, 4th Edition. Wiley, 2011. ISBN: 978-0470760390.

Grading: The course requirements include assigned readings, four assignments, attendance and class participation, and a final project.

Assignments (65%): Four homework assignments that involve completing analytical exercises designed to build skills in travel demand modeling and to reinforce concepts discussed in the lectures. Clarity in writing and presentation will be taken into account in grading. Students may collaborate on the approach to and analysis of homework assignments but are expected to prepare and present results and interpretations independently.

Peer Evaluation (10%): You will evaluate the assignments submitted by your peer classmate.

Course Project (25%): For the final project we will use a travel demand model to do a traffic analysis.

Late assignments will be penalized by a full letter grade per class late; so that an 'A' would become a 'B' after one class period, a 'C' after two class periods. Assignments more than two classes late will not be accepted. However, if you have a serious conflict with another class, software problems, or some other personal issues, deadlines can be extended when a request for such an extension is made *before* the due date.

Lecture Schedule (Subject to adjustment):

Week 1 (09/25): No class

Reading: Castiglione2015, pp1-16

Week 2 (10/02): Introduction & Overview of Travel Demand Model

Assignment: Homework 1 assigned (15%)

Topics Covered: Overview of the Four Step Model; Overview of the Model Development Process

Reading:

1. McNally, M., 2007. "The Four Step Model," in Handbook of Transport Modeling, 2nd Edition, D. Hensher and D. Button eds., Pergamon Press.

Week 3 (10/09): Trip Generation and Linear Regression Analysis

Topics: Overview of Trip Generation, Factors Affecting Trip Generation, Categorical Analysis, Using Trip Rates, Regression Model of Trip Generation, Linear Regression Estimation Readings:

1. NCHRP Report 365 Chapter 3 Trip Generation
2. Devore, J. L., 2011. *Probability and Statistics: for Engineering and the Sciences* , 8th Edition. Duxbury Press. Chapter 12: Simple Linear Regression and Correlation.
3. (optional) [O] Chapter 4: Trip Generation Modeling

Week 4 (10/16): Linear Regression Analysis (Computer Lab)

Assignment: Homework 2 assigned (15%); Homework 1 due.

Location: TBA

Topics: Hypothesis Testing, Market Segmentation, Non-Linearity, Aggregation Issues, and Estimating Linear Regression Models Reading:

1. Devore, J. L., 2011. *Probability and Statistics: for Engineering and the Sciences* , 8th Edition. Duxbury Press. Chapter 12: Simple Linear Regression and Correlation.
2. Ewing, R., Greenwald, M., Zhang, M., Walters, J., Feldman, M., Cervero, R., Frank, L., and Thomas, J. (2011). ”Traffic Generated by Mixed-Use Developments—Six-Region Study Using Consistent Built Environmental Measures.” J. Urban Plann. Dev., 137(3), 248–261.

Week 5 (10/23): Trip Distribution

Topics: Overview of Trip Distribution, Gravity Model, Balancing Trip OD-Matrices Readings:

1. NCHRP Report 365 Chapter 4 Trip Distribution
2. [O] Chapter 5: Trip Distribution Modeling
3. (Optional) Wang, L., P. Waddell, M.L. Outwater , 2011. "Incremental Integration of

Land Use and Activity-Based Travel Modeling: Workplace Choices and Travel Demand." Transportation Research Record: Journal of the Transportation Research Board, 2255, 1-10.

Week 6 (10/30): Mode Choice and Discrete Choice Models

Assignment: Homework 3 assigned (15%); Homework 2 due.

Topics: Overview of Mode Choice, Modal Split, Binary Choice Models, Multinomial Choice Models

Readings:

1. NCHRP Report 365 Chapter 6 Mode Choice Analysis.
2. (Optional) [O] Chapter 6: Modal Split and Direct Demand Models
3. Koppelman, F. and C. Bhat, 2006. "Self-Instructing Course in Mode Choice Modeling: Multinomial and Nested Logit Models", FHWA.

Week 7 (11/06): Discrete Choice Models (Computer lab)

Topics: Destination Choice Models, Interpreting Discrete Choice Models, Elasticity Values, Value-Of-Time, and Hypothesis Testing Readings:

1. [O] Chapter 7: Discrete Choice Models
2. Koppelman, F. and C. Bhat, 2006. "Self-Instructing Course in Mode Choice Modeling: Multinomial and Nested Logit Models", FHWA.

Week 8 (11/13): Traffic Assignment

Assignment: Homework 4 assigned (20%); Homework 3 due.

Topics: Overview of Traffic Assignment, Concept of Equilibrium, User-equilibrium Readings:

1. NCHRP Report 365 Chapter 9: Traffic Assignment Procedures.
2. (Optional)[O] Chapter 10: Assignment

Week 9 (11/20): Activity-based Model

Assignment: Final project handed out (25%);

Topics: Travel demand models in practice; Model calibration, validation, and reasonableness check

Readings:

1. Castiglione 2015, Chapter 3
2. ActivitySim User Guide (Users Guide — ActivitySim 1.2.0)

Week 10 (11/27): Activity-based Model and Miscellaneous Topics

Assignment: Homework 4 due

Topics: Innovations in travel demand modeling; integrated land use – transportation models; activity-based travel models

Readings:

1. McNally, M., 2007. "The Activity-based Approach" in *Handbook of Transport Modeling* , 2nd Edition, D. Hensher and D. Button eds., Pergamon Press.
2. Waddell, P., 2011. "Integrated Land Use and Transportation Planning and Modelling: Addressing Challenges in Research and Practice". *Transportation Reviews* , 31 (2). pp 209-229.

Finals week (12/04)

Assignment: final project due

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PSU values diversity and inclusion; we are committed to fostering mutual respect and full participation for all students. My goal is to create a learning environment that is equitable, useable, inclusive, and welcoming. If any aspects of instruction or course design result in barriers to your inclusion or learning, please notify me. The Disability Resource Center (DRC) provides reasonable accommodations for students who encounter barriers in the learning environment.

If you have, or think you may have, a disability that may affect your work in this class and feel you need accommodations, contact the Disability Resource Center to schedule an appointment and initiate a conversation about reasonable accommodations. The DRC is located in 116 Smith Memorial Student Union, 503-725-4150, drc@pdx.edu, https://www.pdx.edu/drc.

- If you already have accommodations, please contact me to make sure that I have received a faculty notification letter and discuss your accommodations.
- Students who need accommodations for tests and quizzes are expected to schedule their tests to overlap with the time the class is taking the test.
- Please be aware that the accessible tables or chairs in the room should remain available for students who find that standard classroom seating is not useable.
- For information about emergency preparedness, please go to the Fire and Life Safety webpage (https://www.pdx.edu/environmental-health-safety/fire-and-life-safety) for information.

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Office of the Dean of Student Life.

Please be aware that all PSU faculty members and instructors are required to report information of an incident that may constitute prohibited discrimination, including sexual harassment and sexual violence. This means that if you tell me about a situation of sexual harassment or sexual violence that may have violated university policy or student code of conduct, I have to share the information with my supervisor, the University's Title IX Coordinator or the Office of the Dean of Student Life. For more information about Title IX please complete the required student module Creating a Safe Campus in your D2L.