USP 587: Travel Demand Modeling

Portland State University, Winter 2026

Room and Times: URBN 220, Thursdays 9:00am-11:50am

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Office Hours: **Mondays 11am – 1pm**

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*, 5th Edition. Wiley, 2024. ISBN: 978-1119282358.

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

Assignments (60%): 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.

DataCamp Courses (15%): We will use the interactive courses on DataCamp to learn python for analysis and modeling. We will dedicate some of the class time to introduce python programming, but you're expected to finish them on your own time. There are no deadlines for these courses as long as you complete 3 of them by 03/13 (week 10). Use **this link** to register your account to get access to all DataCamp courses free of charge.

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: Course Overview and Introduction

Topics Covered: Overview of the Travel Demand Model; Overview of the Model Development Process

Reading:

1. Castiglione, J., M. Bradley, and J. Gliebe, 2015. Activity-Based Travel Demand Models: A Primer, Chapter 1 pp1-16.
2. McNally, M., 2007. “The Four Step Model,” in Handbook of Transport Modeling, 2nd Edition, D. Hensher and D. Button eds., Pergamon Press.

Week 2 (10/02): Transportation Data; Intro to Python Programming

Topics Covered:Transportation Data; Introduction to Python

Assignment: Homework 1 assigned (15%)

Reading:

1. [O] Chapter 2: Data
2. [O] Chapter 3: Zones and Networks
3. [optional] Think Python, available at https://allendowney.github.io/ThinkPython/

Week 3: Trip Generation

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

Readings:

1. NCHRP Report 365 Chapter 3 Trip Generation
2. [O] Chapter 4: Trip Generation Modeling

Week 4: Linear Regression Analysis

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

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: 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: 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: Discrete Choice Models

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: Traffic Assignment

Assignment: Homework 4 assigned (15%); 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: 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: 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

Assignment: final project due

Academic Integrity

Students are expected to be ethical not only in the classroom, but also out of the classroom. It is in all students' interest to avoid committing acts of academic dishonesty and to discourage others from committing such acts. Academic dishonesty includes, but is not limited to, the following examples: engages in any form of academic deceit; refers to materials or sources or uses devices not authorized by the instructor for use during any quiz or assignment; provides inappropriate aid to another person in connection with any quiz or assignment; engages in Plagiarism. Plagiarism is the act of claiming someone's work as your own through copying it without giving the creator of the work credit. Plagiarism can also include using another person's theories, ideas, or phrases without proper attribution. The simplest way to avoid plagiarizing is to always cite the sources from which you gather information or develop arguments – just cite anything you use from someone else (it actually makes your work stronger!). Plagiarism is a serious issue and is a violation of the PSU Student Conduct Code **http://www.ess.pdx.edu/OSA/osa_b.htm.**University policy requires instructors to report all instances of plagiarism and penalize the perpetrator(s) according to guidelines set. Please see University Writing Center if you ever have any questions about how to cite your work, or contact your Professor.

Use of Artificial Intelligence

Use of AI (e.g., Gemini, ChatGPT, Claude, etc.) is permitted in this course to augment your learning. For example, students have used AI to brainstorm project ideas or refine drafts they wrote for the project in this course. My goal is for you to learn to use these tools ethically and effectively as learning aids, not as substitutes for your own critical thinking.

To uphold academic integrity, the following rules apply:

Attribution: You must cite any AI-generated text or data used in your work. This includes in-text citations for direct quotes and clear references to data that is discussed or presented. Any use of AI beyond simple grammar checking must be disclosed in a brief, simple, "AI Use Statement" at the end of the assignment, explaining how the tool was used (e.g., "AI was used to generate an initial outline which I then expanded").

Accountability: You are 100% responsible for the accuracy of your submission. AI tools frequently produce "hallucinations" (confident but false statements). Submitting AI-generated errors will be treated the same as any other factual error and you will be held accountable.

Misconduct: Generating entire assignments through AI or failing to attribute AI-assisted content constitutes academic dishonesty.

Note that individual assignments may specify further restrictions on AI use according to my discretion.

Access and Inclusion for Students with Disabilities

PSU values diversity and inclusion; My goal is to create a learning environment that is accessible, equitable, inclusive, and welcoming. I am committed to fostering mutual respect and full participation for all students. If any aspects of instruction or course design result in barriers to your inclusion or learning, please notify me. Additionally, the Disability Resource Center (DRC) provides reasonable accommodations for students who encounter barriers in the learning environment. The DRC works with students who have physical, learning, cognitive, mental health, sensory, chronic illness, and other disabilities.

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.

If you already have accommodations, please contact me to make sure that I have received your DRC Faculty Notification Email so we can discuss your accommodations.

The DRC is located in 116 Smith Memorial Student Union, Suite 116. You can also contact the DRC at 503-725- 4150 or, drc@pdx.edu. Visit the DRC online at https://**www.pdx.edu/disability-resource-center.**

Discrimination and Harassment Notice

Portland State is committed to providing an environment free of all forms of prohibited discrimination and sexual harassment (sexual assault, domestic and dating violence, and gender or sex-based harassment and stalking). If you have experienced any form of gender or sex-based discrimination or sexual harassment, know that help and support are available. Information about PSU's support services on campus, including confidential services and reporting options, can be found on PSU's Sexual Misconduct Prevention and Response website at: **http://www.pdx.edu/sexual-assault/get-help** or you may call a confidential IPV

Advocate at 503-725-5672 or schedule Online at https://psuwrc.youcanbook.me . You may report any incident of discrimination or discriminatory harassment, including sexual harassment, to:

- PSU's Title IX Coordinator: Julie Caron by calling 503-725-4410, via email at titleixcoordinator@pdx.edu or in person at Richard and Maureen Neuberger Center (RMNC), 1600 SW 4th Ave, Suite 830
- Deputy Title IX Coordinator: Yesenia Gutierrez by calling 503-725-4413, via email at yesenia.gutierrez.gdi@pdx.edu or in person at RMNC, 1600 SW 4th Ave, Suite 830

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. However, the Title IX Coordinators will keep the information confidential and refer you to a confidential advocate. For more information about Title IX please complete the required student module Creating a Safe Campus in your Canvas.

Syllabus Disclaimer

All syllabi are subject to minor changes to meet the needs of the instructors, school, or class. Every effort will be made to avoid changing the course schedule but the possibility exists that unforeseen events will make syllabus changes necessary. The instructor reserves the right to make changes to the syllabus as deemed necessary. Students will be notified in a timely manner of any syllabus or schedule changes in class, and through the Canvas announcements and class email. Please remember to check your PSU email and the Canvas messages often.