

UP 431: Urban Transportation Modeling

Spring 2023, Department of Urban and Regional Planning, University of Illinois at Urbana-Champaign

CLASS MEETINGS: Tuesdays and Thursdays, 11:00 pm – 12:20 pm

INSTRUCTOR: Bumsoo Lee, bumsoo@illinois.edu

OFFICE HOURS: 12:30 – 1:20 pm on Thursday and by appointment, TBH 227/M206

HOURS: 4 credit hours for **graduate** students and 3 credit hours for **undergraduate**; 3 contact hours (2 days/week for 80 minutes each)

COURSE OVERVIEW

“All models are wrong; some are useful.” – George Box

This course provides the foundational skills that planners use to study travel behavior and predict travel demand. Travel demand models are to guide and support decisions on transportation investments by producing precise estimates of trip-making patterns. However, how the models translate inputs to outputs is often opaque and relies on assumptions that may or may not mirror reality. While you will learn practical skills in travel demand modeling applications in this course, you will also learn to understand and critique these models using knowledge of travel behavior theory, methods, and problem-solving skills.

Learning objectives

By the end of the course, you will be able to:

- Apply behavioral theory and discrete choice analysis to understand travel behavior
- Describe transportation data sources and collection methods
- Explain how travel demand models work
- Analyze planning scenarios using travel demand modeling software

COURSE AT A GLANCE

Week	Dates	Topic	Assignment Due
1	Jan 17, 19	Introduction; Travel behavior fundamentals	
2	Jan 24, 26	Transportation data collection & analysis	
3	Jan 31, Feb 2	Review of statistics	Assignment 1
4	Feb 7, 9	Discrete choice analysis	
5	Feb 14, 16	Discrete choice analysis	Assignment 2
6	Feb 21, 23	TDM and Modeling software; Guest lecture	Grad term paper study plan
7	Feb 28, Mar 2	Trip generation	Assignment 3
8	Mar 7, 9	Trip generation & distribution	
Spring Break			
9	Mar 21, 23	Trip distribution	Grad progress report
10	Mar 28, 30	Mode choice	
11	Apr 4, 6	Trip assignment	
12	Apr 11, 13	Evaluating alternatives and related models	Assignment 4
13	Apr 18, 20	Grad term paper presentations	
14	Apr 25, 27	Grad term paper/Final project presentations	
15	May 2	Final project presentations	
			Final project report (May 8, Noon)
			Grad term paper (May 12, Noon)

PREREQUISITE

UP 430 or CEE 417, or consent of instructor. **Junior standing** required. Familiarity with basic statistics (e.g. regression analysis) and R programming is required for the success in UP 431.

EVLUATION

	Undergraduate students	Graduate students
Four homework assignments	60 %	40 %
Final (travel demand forecast) project	30 %	30 %
Term paper research	-	20 %
Participation and attendance	10 %	10 %

Graduate students are required to conduct an empirical study on travel behavior, using the NHTS or other travel survey data, in addition to common course requirements. Detailed guidelines will follow.

RUBRIC:

A: Demonstrates original thought and synthesis of ideas and cogent analysis, and is clearly written and presented. Outstanding work.

B: Presents above average analysis with appropriate evidence to support ideas, and is clearly written or presented. Good work.

C: Shows a basic level of understanding, with analysis limited to obvious arguments. Writing is competent. Adequate work.

D: Misunderstands or misrepresents the material, or is so poorly written or presented as to obscure the analysis. Inadequate work.

Transformation of numerical grade to letter grade will be according to the schedule below:

A+	97-100		
A	93-96.9	C+	77-79.9
A-	90-92.9	C	73-76.9
B+	87-89.9	C-	70-72.9
B	83-86.9	D+	67-69.9
B-	80-82.9	D	60-66.9

COURSE REQUIREMENTS

Homework Assignments (All Students): Four homework assignments will be given throughout the semester. All homework assignments are due by **11am** on due dates unless noted otherwise. Late submission of homework assignments will be penalized by 10% per day, up to 30%.

Travel Demand Forecast Team Project (All Students): Students will forecast and analyze future travel demand in the Champaign-Urbana region for the horizon year 2040 based on different alternate scenarios for the region. Students will work in a team of three to four students, will present their project outcomes in class, and will submit a final project report that describes the research process, the results of the model, and any issues found along the way. I suggest you build your team so that you have at least one graduate student member to lead the project team. Detailed guidelines will follow.

Term Paper Research & Presentation (Graduate Students): Graduate students are required to conduct and present term paper research, and submit a 10-page paper. The term paper must be an empirical study that investigates people's travel behavior, using travel survey data. While students can choose a travel behavior topic of their own interest, they are encouraged to apply a discrete choice model that they learned in class. Detailed guidelines on the term paper will follow.

Schedules for term paper deadlines:

[Feb 21] One-page study plan (abstract).

[Mar 21] Three-page progress report documenting what have been done and what need to be done, expected findings, and expected content in the final paper.

[April 18-] Term paper research presentations.

[May 12] Term paper due by Noon.

POLICIES

SPECIAL ACCOMMODATIONS

This course will accommodate students with documented disabilities. Please refer to <https://www.disability.illinois.edu/academic-accommodations-and-supports/academic-accommodations> for more information and provide the appropriate documentation at the beginning of the semester.

ACADEMIC INTEGRITY

This course follows the guidelines set forth by the University student code. See <https://studentcode.illinois.edu/article1/part4/1-401/> for specific guidelines, examples, and punishment associated with academic dishonesty.

PLAGIARISM

Plagiarism in this class is unacceptable. Any accidental or willful use of words, work, or ideas of another without attribution (e.g. quotation and citation) will be penalized by a failing grade on the paper and/or a failing grade in the course. Please see the definition of plagiarism here: <https://studentcode.illinois.edu/article1/part4/1-402/>. Be reminded that all your submissions to the Canvas will go through plagiarism checking.

CLASS CLIMATE

The Department of Urban and Regional Planning (DURP) is committed to creating an environment of inclusion and opportunity that is rooted in the very goals and responsibilities of practicing planners. Conduct that interferes with the rights of another or creates an atmosphere of intimidation or disrespect is inconsistent with the environment of learning and cooperation that the program requires. By enrolling a course in the Department of Urban and Regional Planning, students agree to be responsible for maintaining a respectful environment in all DURP activities, including lectures, discussions, labs, projects, and extracurricular programs. We will be governed by the University Student Code. See Student Code Article 1—Student Rights and Responsibilities, Part 1. Student Rights: §1-102 In the Classroom.

EMERGENCY RESPONSE RECOMMENDATIONS

The Department of Homeland Security and the University of Illinois at Urbana-Champaign Office of Campus Emergency Planning recommend the following three responses to any emergency on campus: **RUN > HIDE > FIGHT**
For more information, <https://police.illinois.edu/em/run-hide-fight/>.

COUNSELING CENER

The Counseling Center is committed to providing a range of services intended to help students develop improved coping skills in order to address emotional, interpersonal, and academic concerns. The Counseling Center provides individual, couples, and group counseling. All of these services are paid for through the health services fee. The Counseling Center offers primarily short term counseling, but they do also provide referrals to the community when students could benefit from longer term services.
<https://counselingcenter.illinois.edu/>

READING ASSIGNMENTS

Notes:

NCHRP 716 = National Academies of Sciences, Engineering, and Medicine. 2012. *Travel Demand Forecasting: Parameters and Techniques*. Washington, DC: The National Academies Press. NCHRP Report 716. <https://doi.org/10.17226/14665>.

Ortuzar & Willumsen (2011) = de Dios Ortúzar, Juan, and Luis G. Willumsen. 2011. *Modelling Transport*. West Sussex, UK: Wiley. [Available as e-book from the University Library] https://i-share-uuu.primo.exlibrisgroup.com/discovery/fulldisplay?docid=alma99656043812205899&context=L&vid=01CA_RLI_UIU:CARLI_UIU&search_scope=MyInstitution&tab=LibraryCatalog&lang=en.

Koppelman & Bhat (2006) = Koppelman, Frank S. and Chandra Bhat. 2006. *A Self Instructing Course in Mode Choice Modeling: Multinomial and Nested Logit Models*. Pdf posted on Canvas.

Giuliano & Hanson (2017) = Giuliano, Genevieve and Susan Hanson. 2017. *The Geography of Urban Transportation*, 4th ed. New York and London: The Guilford Press.

Week 1: Introduction to travel demand models and planning; travel behavior fundamentals

Giuliano & Hanson (2017), Miller, Harvey. Ch 5 Theories and models in transportation planning, 113-138.

Giuliano & Hanson (2017), Boarnet, Marlon. Ch 7 Land use, travel behavior, and disaggregate travel data, pp. 164-182.

Week 2: Transportation data collection and analysis

NCHRP 716, Chapter 3. Data needed for modeling, pp. 14-26.

Federal Highway Administration. 2018. Chapters 1-3 in *2017 NHTS Data User Guide*. Washington DC: US Department of Transportation. <https://nhts.ornl.gov/assets/2017UsersGuide.pdf>

[Optional] **Ortuzar & Willumsen (2011)**, Chapter 3. Data and Space.

Week 3: Review of statistics-Ordinary least square (OLS) regression

Welch, S. and J. Comer. 2006. *Quantitative Methods for Public Administration: Techniques and Applications 3rd ed.* Long Grove, IL: Waveland Press. Chapters 8 & 9, pp. 212-259.

Weeks 4 & 5: Introduction to discrete choice analysis

Levinson, David, et al. n.d. "Choice Modeling." In *Fundamentals of Transportation*. Wikibooks. https://en.wikibooks.org/wiki/Fundamentals_of_Transportation/Choice_Modeling.

Koppelman & Bhat (2006), Chapters 3 & 4.

[Optional] Wang, Yiyuan, Bumsoo Lee, Andrew Greenlee. 2021. The role of smart growth in residential location choice: Heterogeneity of location preferences in the Chicago region. *Journal of Planning Education and Research*. May 2021. doi:10.1177/0739456X211017652.

[Optional] Kim, Junghwan and Bumsoo Lee. 2021. Campus commute mode choice in a college town: An application of integrated choice and latent variable (ICLV) model. Submitted to *Travel Behavior and Society*.

Week 6: TDM and Introduction to modeling software

Giuliano & Hanson (2017), Sciara, Gian-Claudia and Susan Handy. Ch 6 Regional transportation planning, pp. 113-138.

CCRPC Modeling Suite and LRTP 2045: <https://ccrpc.gitlab.io/lrtp2045/vision/model/>;
<https://ccrpc.gitlab.io/lrtp2045/>

Review Citilabs Learning Center for relevant resources. <http://www.citilabs.com/support/learning-center/>.

[Optional] Miller and Meyer. 2001. “Chapter 5. Demand Analysis”. In *Urban Transportation Planning*, 2nd edition. New York: McGraw-Hill. [Come back to this over the next 5 weeks.]

Weeks 7 & 8: Trip generation/distribution

NCHRP 716, Sections 4.3 and 4.4.

[Optional] Chapter 4 in **Ortuzar & Willumsen (2011)**.

Weeks 8 & 9: Trip generation/distribution

NCHRP 716, Sections 4.5 and 4.6.

[Optional] Chapter 5 in **Ortuzar & Willumsen (2011)**.

Week 10: Mode choice

NCHRP 716, Section 4.7

[Optional] Chapter 6 in **Ortuzar & Willumsen (2011)**.

Week 11: Trip assignment

NCHRP 716, Sections 4.8, 4.9, 4.11, and 4.12.

[Optional] Chapter 10 in **Ortuzar & Willumsen (2011)**.

Week 12: Evaluating alternatives and related models

Bartholomew, Keith and Reid Ewing. 2008. Land use-transportation scenarios and future vehicle travel and land consumption: A meta-analysis. *Journal of the American Planning Association*, 75 (1), 13-27.

Cervero, Robert. 2006. Alternative approaches to modeling the travel-demand impacts of smart growth. *Journal of the American Planning Association*, 72 (3), 285-295.

Clifton, K.J., Singleton, P.A., Muhs, C.D., and R.J. Schneider. 2016. Representing pedestrian activity in travel demand models: Framework and application. *Journal of Transport Geography*, 52, 111-122.

[Optional] NCHRP 716, Chapter 6. Emerging modeling practices

[Optional] Aoun, A. et al. 2015. *Bicycle and Pedestrian Forecasting Tools: State of the Practice*. Pedestrian and Bicycle Information Center. http://www.pedbikeinfo.org/resources/resources_details.cfm?id=4931.

Week 13: Graduate student term paper presentations

Week 14: Graduate student term paper/Final project presentations

Week 15: Final project presentations

Final project report due—Noon on May 8th

Graduate student term paper due—Noon on May 12th