PPD 633: METHODS AND MODELING TOOLS FOR TRANSPORTATION PLANNING

PPD 633, Spring 2022
Day/Time: Tuesday, 6 p.m. – 9:20 p.m.
Room: CPA 157

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Office Hours: Tuesdays, 5 p.m. - 6 p.m.

COURSE DESCRIPTION:

This is an introductory methods course for graduate students with a focus on the profession of transportation planning, including data science methods and the application of modeling tools. This course is organized into two sessions.

Session 1 (Week 1 – Week 8)
This course starts with introducing the framework of an integrated land use-transportation plan. Since socioeconomic characteristics are some of the main factors for travel behavior analysis and growth forecast is the first step to estimate future travel demand, this class will go over growth forecast methods and analysis, socioeconomic variables, and data sources - from region to county to city, at the aggregated and disaggregated level.

Household travel survey data is commonly used for the analysis of travel behavior and the development of transportation plans. This course will train students to use Python to process and analyze disaggregated data and big data, such as a typical household travel survey. Full samples of the 2017 NHTS (*National Household Travel Survey*) will be used for hands-on data analysis.

At the end of Session 1, students should have a clear understanding about how travel behavior is related to individual and household socioeconomic attributes as well as neighborhood land use characteristics and the built environment. The hands-on exercise of using Python to analyze household travel survey data will give students a solid foundation for analyzing travel patterns and estimating future travel demand.

Session 2 (Week 9 – Week 17)
Session 2 focuses on modeling tools, other forms of transportation data, and project impact analysis. Although most students may not have the opportunity to work directly with a travel demand model in their future career, understanding each step of a travel demand model will give students a comprehensive understanding and capability to analyze the sources of transportation issues at the corridor, city, or regional level.

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The Four-Step Model (FSM): The traditional trip-based, FSM will be taught in Session 2: including model structure, theory, and application of each of four major model steps – (1) trip generation, (2) trip distribution, (3) modal split, and (4) assignment. This course will also present an introductory to the Activity Based Model (ABM), which many agencies are switching to for long-range planning. The instructor will introduce a newly developed ABM for SCAG – the regional MPO for Southern California. The disaggregated nature of the ABM data outputs should be comprehensible given the foundation built in Session 1 using the household travel survey data.

Most travel demand models are too large or too complex for local-level project analysis. For small scale analysis, this class will guide students to use several web tools and online open data platforms, including LADOT's VMT Calculator, LEHD OnTheMap, EPA MXD model, PeMS, and SCAG's newly developed regional data platform.

Last but not least, this course covers a discussion of the main California regulations that are related to Greenhouse Gas (GHG) emissions reduction – specifically SB 743, which now replaces LOS with VMT under CEQA. To help students understand the strategies to mitigate the potential GHG (or VMT) impact of local development projects, this course will review several off-model strategies and analysis methods.

At the end of Session 2, students should have a clear understanding about the main components of a trip-based model, as well a basic understanding of the activity-based model. Additionally, students should become knowledgeable of the available open-source web tools and data platforms -and their appropriate use cases.

LEARNING OBJECTIVES:

Students will learn:

1. The key theories that undergird land use – transportation interactions,
2. How an understanding of land markets and the derived-demand approach to travel behavior provide useful frameworks for growth forecasts,
3. Hands-on data processing and analysis using the National Household Travel Survey,
4. Travel data collection methods, with a focus on emerging technologies, as well as open-source analytical tools for project level assessment, and
5. Understand the main components of the trip-based, FSM, as well as a basic, fundamental understanding of ABM.

GRADES:

Grades will be distributed as follows:

ASSIGNMENT	TOTAL POINTS	PERCENT OF GRADE (%)
8 total homework assignments @ 50 points each	400	40%
Mid Term Exam	250	25%
Final Group Project	250	25%
Class Participation	100	10%
TOTAL	1,000	100%

GRADE SCALE:

Course final grades will be determined using the following scale

		A	950-1,000	A-	900-949
B+	870-899	B	830-869	B-	800-829
C+	770-799	C	730-769	C-	700-729
D+	670-699	D	630-669	D-	600-629
		F	590 and below		

LATE ASSIGNMENTS:

The due dates will be shown on the syllabus or clearly indicated in class assignments. Assignments will be submitted in-person at the start of class or turned in via Blackboard before class per the instructions. Exceptions will only be granted in cases of illness (with a health care provider's note) or extraordinary emergencies (again with written documentation of the emergency, including evidence that the event could not have been anticipated in advance.) If you are ill and cannot attend class, you can make it up by doing a written memorandum summarizing the week's reading assignment. While I want you in class, I don't want you to risk bringing an illness and germs into the class or pushing yourself when you are sick and should be getting well. More generally, class participation is part of your course grade, so I expect excellent attendance and participation, allowing for the occasional illness.

USC DISABILITY SERVICES

I am always happy to work with USC's Office of Disability Services to accommodate student needs. Students should contact the Office of Disability Services in the first two weeks of the semester, or prior to the semester. I allow accommodations as recommended by the Disability Services office, but I will only allow accommodations specifically recommended by that office in writing and in advance of assignment due dates. Please allow enough time for coordination between the Disability Services office and me. Consult this web page for more information: http://scampus.usc.edu/disability-services/.

Academic Honesty
Students should consult USC's academic honesty guidelines, available at http://www.usc.edu/student-affairs/student-conduct/grad_ai.htm and http://www.usc.edu/student-affairs/SJACS/forms/GradIntegrity.pdf. Penalties for violations of academic honesty will be as severe as are allowed by USC's guidelines, and typically involve a minimum of a zero grade for the assignment for minor infractions, with larger penalties for more serious cases. Cutting and pasting material from the web is only acceptable if the material is indicated to be a direct quote, with the source attributed. All ideas and information from external sources must be properly attributed to that source.

Academic Conduct
Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Support Systems
A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students.

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention and Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED)- (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following *protected characteristics*: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations. The university also prohibits sexual assault, non-consensual sexual contact, sexual misconduct, intimate partner violence, stalking, malicious dissuasion, retaliation, and violation of interim measures.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710
uscsa.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.

FINAL GROUP PROJECT:

Students will be divided into groups to work on an integrated group project. Anticipate groups of three or four students, although exact numbers and groupings will be determined during the first two weeks of class. Each group will develop a **proposal** for a 25-year, long-range transportation plan for a mid-size, semi-urban city in the United States. The proposal will have distinct components that students should integrate into a comprehensive vision for their region. Each plan [or vision] must strive to be grounded in theory and evidence while also being cognizant of the local context and the comprehensive nature of land use – transportation planning.

Each student will be responsible for covering a particular section of the proposal, with the final product consisting of a group presentation – to be given in an "interview" format. The proposal must include the following:

1. Project Understanding (*vision & context*)
2. Project Team (*including bios & qualifications*)
3. Project Approach (*scope & deliverables*) with goals, strategies, & performance metrics
4. Community & Stakeholder Engagement Plan (*CESP*) -innovation and efficiency
5. Budget ($250K) & Schedule (1.5 years)

Groups will present their final proposal in a professional manner, using PowerPoint and, as appropriate, other visual aids, virtually online during the last week of class. Each group will have approximately 25 minutes for this presentation (or "interview") -followed by 5 minutes of Q&A.

Course Outline and Schedule of Topics

Session 1	Topics/Class Activities	Reference / Suggested Readings	Assignments
Week 1 1/18/2022	1. Introduction / Course Overview 2. *Transportation Planning Framework*: SCAG (Southern CA Association of Governments) Long-Range Regional Transportation Plan 3. COVID-19 Planning Implications	Read the course syllabus before class SCAG Connect SoCal: http://scag.ca.gov/connect-socal COVID-19 Transportation Impacts: scag.ca.gov/post/snapshot-covid-19-transportation-impacts-scag-region	None
Week 2 1/25/2022	*Socioeconomic Data* (SED) *& Growth Forecast* (Demographic Variables) 1. Variable definition 2. Data sources (CA DOF, Census, ACS) 3. Growth forecast and projection methods 4. Demographic data, travel demand, and travel behavior	California Dept. of Finance (DOF) Data: dof.ca.gov/Forecasting/Demographics/ SCAG Growth Forecast: scag.ca.gov/sconnectsocal_demographics-and-growth-forecast.pdf Boarnet, M. et al paper on travel behavior and the built environment to be posted to the Blackboard (BB) 2020 Census: https://data.census.gov/cedsci/	Homework #1
Week 3 2/1/2022	*SED & Growth Forecast* (Employment Variables) 1. Variable definition 2. Data source (US DOF, CA EDD, InfoUSA) 3. Growth forecast & projection methods (share	California EDD Data: data.edd.ca.gov/ SCAG Regional Data Platform: https://storymaps.arcgis.com/stories/42984065691d4006852e4b02e5475452 Download Jupyter Notebook & Anaconda: Python and Anaconda installation and test: https://www.anaconda.com/products/individual-d	

	approach) 4. Neighborhood land use characteristics and travel demand *Introduction to 2017 National Household Travel Survey* 1. Trip diary 2. Survey procedure & design 3. Questionnaire 4. Main survey variables *Students will install Python & Jupyter Notebook before next class*		
Week 4 2/8/2022	Travel Analysis with *2017 National Household Travel Survey* (NHTS) Online Tool 1. Introduction of 2017 NHTS: Get familiar with file structure and variable definition 2. NHTS Explorer Tool 3. Travel Behavior analysis with NHTS Explorer Tool 4. In-class visualization exercise	2017 NHTS Documentation: nhts.ornl.gov/documentation Jupyter Project Page: https://jupyter.org/try Pandas dictionary: https://pandas.pydata.org/docs/reference/frame.html Data visualizations: https://kepler.gl	Homework #2
Week 5 2/15/2022	*Introduction to Python & Jupyter Notebook on Data Analysis* 1. Check Jupyter installation, introduction, and	2017 NHTS Documentation https://nhts.ornl.gov/ Jupyter Project Page: https://jupyter.org/try	Homework #3

	demo with small data sample 2. In-class Exercise: analyze 2017 NHTS household data: descriptive statistics, group by, household trips by household size, household income, and tract density		
Week 6 2/22/2022	*StreetLight Data* 1. Basic Pandas DataFrame functions for data summary and analysis 2. Understand NHTS variables by household file, person file, and trip file 3. Using Jupyter summarize and visualize travel data from NHTS person file and trip file 4. In-Class Exercise	Readings posted to BlackBoard Pandas https://pandas.pydata.org/docs/reference/frame.html 2017 NHTS Documentation https://nhts.ornl.gov/	Homework #4
Week 7 3/1/2022	*StreetLight Data* 1. More Pandas DataFrame functions in data analysis 2. Using Pandas to analyze and NHTS person file and trip files *Overview of Travel Demand Models*	Pandas https://pandas.pydata.org/docs/reference/frame.html Readings on Travel Demand Models posted to BB.	Prepare for mid-term

	1. Introduction and purposes of transportation models 2. Model development, estimation, calibration, and validation 3. Model input and output 4. Trip Based Model 5. Activity Based Model 6. Off-Model analysis		
Week 8 3/8/2022	*Mid-Term* (90 minutes) Model Socioeconomic Input 1. Aggregated / Zonal data 2. Disaggregated / Synthesized data	SCAG Trip Based Model versus new 2020 ABM	None
Week 9 3/15/2022	*Trip Based Mode 1: Model Input & Trip Generation* 1. Model input & Initialization Stage: SED, Network, Skim, Auto operating cost (AOC) 2. Household Vehicle Availability 3. Trip Generation: Production and Attraction 4. Regional model demo 5. In-class Exercise: building a trip gen table	SCAG Trip Based Model LADOT VMT Calculator: https://ladot.lacity.org/businesses/development-review	Homework #5
Week 10	Spring Recess - No Class		

3/22/2022			
Session 2	Topics/Class Activities	Reference / Suggested Readings	Assignments
Week 11 3/29/2022	Trip Based Mode 2: Trip Distribution & Modal Split 1. Trip Distribution: Gravity model concept, factors affect destination choice 2. Growth Factor methods: in-class exercise 3. Modal Split: model concept & factors affect mode choice 4. Travel cost and pricing strategies 5. OD matrix (PA to OD) 6. In-class exercise	Ortuzar, J. "Modelling Transport." Discrete choice modeling slides on BB	Homework #6
Week 12 4/5/2022	Trip Based Mode 3: Assignment 1. Traffic Assignment procedure 2. Route selection: Shortest Path 3. Link volume: All or Nothing, User Equilibrium 4. Volume Delay function 5. In-class exercise	McNally Lecture Notes	None
Week 13 4/12/2022	Traffic Analysis and Transportation Data 1. Network Performance Analysis 2. Online Transportation Data: HPMS, PeMS, Caltrans count book, City LA traffic data, ... 3. Private Vendors: GPS / Location Based, Streetlight, Teralytics, Airsage, Inrix, Here, Populus,... 4. In-class exercise	PeMS http://pems.dot.ca.gov/ LOS	Homework #7

Week 14 4/19/2022	Project Impact Analysis and Tools 1. EPA MXD Trip Generation Model 2. LEHD OnTheMap Tool 3. CTPP Web Tool 4. In-Class Exercise	EPA MXD Model https://www.epa.gov/smartgrowth/mixed-use-trip-generation-model LEHD OnTheMap Tool https://onthemap.ces.census.gov/ CENSUS Transportation planning Product Program (CTPP) https://ctpp.transportation.org/	
Week 15 4/26/2022	Analysis and Tools 1. Accessibility: Concept and Application 2. VMT Reduction strategies and analysis 3. Induced Travel 4. EMFAC Emission Model Web Tool 5. In-Class Exercise	SB743: check California OPR http://opr.ca.gov/ceqa/updates/sb- 743/ EMFAC Web Database https://arb.ca.gov/emfac/2017/	Homework #8
Week 16 5/3/2022	Transportation & Equity 1. Equity 101 slides 2. Review of PPD633 3. Final Project Review	Equity Indices: Accessibility https://www.transportation.gov/mission/health/connectivity Shaheen, S. on Policies: STEPS Mobility Hubs Suitability Index: Fehr & Peers	Prepare for Final Group Project Interviews
FINAL GROUP PROJECT 5/10/2022	Interview Presentations		