

PPD 633: Methods and Modeling Tools for Transportation Planning

Course ID: 51272

Units: 4

Spring, 2020

Thursday 6-9:20pm

Location: VPD LL101

Instructor: Hsi-Hwa Hu, Ph.D.

Office:

Office Hours: After class & by appointment before class

Contact Info:

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COURSE DESCRIPTION AND OBJECTIVES

This is an introductory class for graduate students with special focus on the analysis of transportation modeling, transportation planning, data analysis, and model/tool application. This class is organized by two sessions.

Session 1 (Week 1 – Mid Term Exam)

This class starts with introducing the framework of an integrated land use-transportation plan. Since socioeconomic characteristics are main factors on 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/city, by aggregated and disaggregated level.

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

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

Session 2 (Mid Term Exam – Final Exam)

The focuses of Session 2 are on modeling tools, transportation data, and impact analysis. Though most students may not have opportunity to operate a travel demand model directly in the future career, however, understanding each step of a travel demand model will give students comprehensive understanding and capability to analyze the sources of transportation issues of a corridor, a city, or a region.

Traditional four-step trip based model (TBM) will be taught in this class: including model structure, theory, and application of each of four major model steps - trip generation, trip distribution, modal split, and assignment. This class will also bring an introductory to activity

based model (ABM). The instructor will introduce a newly developed SCAG ABM to this class. Due to disaggregated data format of ABM output, with the foundation of session 1 classes on household survey data, students will be easy to understand the concept and structure of ABM.

Most of travel demand models are too large or too complicated for local-level project analysis. For small scale analysis, this class will guide students to use several web tools and online data, including CTPP, LEHD OnTheMap, EPA MXD model, PeMS, HPMS, and Caltrans traffic count... etc. Last but not least, this class covers a discussion to the main California regulations that are related to Greenhouse Gas (GHG) Emission reduction. To help students understand the strategies to mitigate the GHG (or VMT) impact of local development projects, this class will review several off-model strategies and analysis.

At the end of session 2, students should have clear understanding about main components of trip based model and basic understanding to activity based model. Students should be familiar with those web tools application and online data analysis.

GRADING BREAKDOWN

Assessment Tool (assignments)	Points	% of Grade
8 Homework Assignments @ 50 points	400	40
Class Participation	100	10
Midterm Exam	250	25
Final Project	250	25
TOTAL	1000	100

GRADING SCALE

Course final grades will be determined using the following scale

A	950-1000
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

COURSE OUTLINE AND SCHEDULE OF TOPICS

	Topics/Class Activities	Reference / Suggested Readings	Assignments
Week 1 1/16/2020	Introduction 1. Course Overview / Introduction 2. Transportation Plan Framework: SCAG (Southern California Association of Governments) Long-Range Regional Transportation Plan	Slides provided in class SCAG Connect SoCal https://www.connectsocial.org/Pages/default.aspx	
Week 2 1/23/2020	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	Slides provided in class California DOF Data http://www.dof.ca.gov/Forecasting/Demographics/ SCAG Growth Forecast https://www.connectsocial.org/Documents/Proposed/pfConnectSoCal-Demographics-And-Growth-Forecast.pdf	Homework #1
Week 3 1/30/2020	Socioeconomic Data & Growth Forecast (Employment Variables) 1. Variable definition 2. Data source (US DOF, CA EDD, InfoUSA) 3. Growth forecast and projection methods (share approach) 4. Neighborhood land use characteristics and travel demand Introduction of Travel Survey 1. Trip diary 2. Survey procedure and design 3. Questionnaire 4. Main survey variables	Slides provided in class California EDD Data https://data.edd.ca.gov/ SCAG Growth Forecast Method https://www.connectsocial.org/Documents/Proposed/pfConnectSoCal-Demographics-And-Growth-Forecast.pdf SCAG 2011 Household Travel Survey https://www.nrel.gov/transportation/secure-transportation-data/tsdc-california-travel-survey-supplement.html	
Week 4 2/6/2020	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 Exercise 5. Students will install Python, Pandas, and PyCharm before next class	Slides provided in class Class materials: Python and PyCharm installation and test 2017 NHTS Documentation https://nhts.ornl.gov/	Homework #2

<p>Week 5 2/13/2020</p>	<p>Introduction to Pandas & PyCharm on Data Analysis</p> <ol style="list-style-type: none"> 1. Check Pycharm installation to each student's laptop and test Pandas with small data sample 2. In-class Exercise: analyze 2017 NHTS household data: descriptive statistics, groupby, household trips by household size, household income, Tract density, ... etc. 	<p>Slides provided in class</p> <p>Pandas Home Page https://pandas.pydata.org/docs/reference/frame.html</p> <p>2017 NHTS Documentation https://nhts.ornl.gov/</p>	
<p>Week 6 2/20/2020</p>	<p>Pandas / NHTS Data Analysis</p> <ol style="list-style-type: none"> 1. Basic Pandas DataFrame functions for data summary and analysis 2. Understand NHTS variables by household file, person file, and trip file 3. Using Pandas to analyze and summarize travel data from NHTS person file and trip file 4. in-Class Exercise 	<p>Slides provided in class</p> <p>Pandas https://pandas.pydata.org/docs/reference/frame.html</p> <p>2017 NHTS Documentation https://nhts.ornl.gov/</p>	Homework #3
<p>Week 7 2/27/2020</p>	<p>Pandas / NHTS Data Analysis</p> <ol style="list-style-type: none"> 1. More Pandas DataFrame functions in data analysis 2. Using Pandas to analyze and NHTS person file and trip files <p>Overview of Travel Demand Models</p> <ol style="list-style-type: none"> 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 	<p>Slides provided in class</p> <p>Pandas https://pandas.pydata.org/docs/reference/frame.html</p> <p>2017 NHTS Documentation https://nhts.ornl.gov/</p>	
<p>Week 8 3/5/2020</p>	<p>Mid-Term (90 minutes)</p> <p>Model Socioeconomic Input</p> <ol style="list-style-type: none"> 1. Aggregated / Zonal data 2. Disaggregated / Synthesized data 3. IPF method 	<p>Slides provided in class</p> <p>SCAG Trip Based Model Validation Report http://www.princeton.edu/~alaink/Orf467F16/SCAG_RTDM_2012ModelValidation.pdf</p>	
<p>Week 9 3/12/2020</p>	<p>Trip Based Mode 1: Model Input & Trip Generation</p> <ol style="list-style-type: none"> 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: AOC and trip rate calculation (Pandas) 	<p>Slides provided in class</p> <p>SCAG Trip Based Model Validation Report http://www.princeton.edu/~alaink/Orf467F16/SCAG_RTDM_2012ModelValidation.pdf</p>	Homework #4

Week 10 3/19/2020	Spring Recess - No Class		
Week 11 3/26/2020	Trip Based Mode 2: Trip Distribution & Modal Split 1. Trip Distribution: 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	Slides provided in class SCAG Trip Based Model Validation Report http://www.princeton.edu/~alaink/Orf467F16/SCAG_RTDM_2012ModelValidation.pdf	Homework #5
Week 12 4/2/2020	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	Slides provided in class SCAG Trip Based Model Validation Report http://www.princeton.edu/~alaink/Orf467F16/SCAG_RTDM_2012ModelValidation.pdf	Homework #6
Week 13 4/9/2020	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	Slides provided in class PeMS http://pems.dot.ca.gov/ HPMS https://dot.ca.gov/programs/research-innovation-system-information/highway-performance-monitoring-system Caltrans Traffic Data https://dot.ca.gov/programs/traffic-operations/census	Homework #7
Week 14 4/16/2020	Project Impact Analysis and Tools 1. EPA MXD Trip Generation Model 2. LEHD OnTheMap Tool 3. CTPP Web Tool 4. In-Class Exercise	Slides provided in class 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/	Homework #8

<p>Week 15 4/9/2020</p>	<p>Analysis and Tools</p> <ol style="list-style-type: none"> 1. Accessibility: Concept and Application 2. VMT Reduction strategies and analysis 3. Induced Travel 4. EMFAC Emission Model Web Tool 5. In-Class Exercise 	<p>Slides provided in class</p> <p>SB743: check California OPR http://opr.ca.gov/ceqa/updates/sb-743/</p> <p>NCST Induced Travel Calculator https://blinktag.com/induced-travel-calculator/</p> <p>EMFAC Web Database https://arb.ca.gov/emfac/2017/</p>	
<p>Week 16 4/30/2020</p>	<p>Activity Based Model Introduction</p> <ol style="list-style-type: none"> 1. Framework and major components: Long-term Choice, Activity Generation & Scheduling; Travel Formation (Tour & Trip). 2. Review of PPD633 3. Final Exam Review 	<p>Slides provided in class</p> <p>Activity-Based Travel Demand Models: A Primer https://www.nap.edu/catalog/22357/activity-based-travel-demand-models-a-primer</p> <p>SCAG Activity Based Model Validation Report</p>	
<p>FINAL 5/7/2020</p>			

Statement on Academic Conduct and Support Systems

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.

Support Systems:

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.symplcity.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.

Campus Support & Intervention - (213) 821-4710

campussupport.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.