CE 599 – Data Science for Transportation
Units: 4
Term: Fall 2021
Schedule: Wednesday 2:30 - 5:50 pm
Location: TBA

Instructor: Roxana Javid, Ph.D.
Office: KAP 200A
Office Hours: Mon 10:00 am-12:00 pm and
Wed 1:30-2:30 pm, 6:00 pm-7:00 pm and
by appointment
Email: rjavid@usc.edu

Teaching Assistant: N/A

Draft Catalogue Course Description
Investigating, analyzing, and incorporating different data sources and case studies for road transportation using statistical tools and methods.

Expanded Course Description
The objective of this course is to introduce concepts, techniques, and tools for transportation data science and analysis. This course provides students with the knowledge and analytical skills to cope with exploratory data analysis and data mining in the field of land transportation and logistics. Topics to be covered include descriptive statistics and data visualization, regression analysis, panel data, structural equation modeling, and logistic regression. The data sets used in this course are selected from a wide range of data sources and case studies in various aspects of transportation planning, safety, and economics in order to support a practical understanding of the modeling techniques.

Learning Objectives and Outcomes
The complexity, diversity, and random nature of transportation problems requires a broad analytical approach. It is critical to learn a wide range of analytical methods and data science techniques to describe the transportation problems, evaluate the alternatives and policies, and propose solutions for the problems. The necessary skills students need to learn to be able to define, model, and solve transportation problems are:

- Distinguish different sources of transportation and other related data sources
- Collect and combine different data sources to address transportation problems
- Formulate statistical models and perform required statistical tests in R
- Interpret, analyze, and visualize different types and categories of data
- Formulate a transportation related scenario and develop a collaborative research term paper

The learning objectives will be assessed using assignments, homework, exams, and the paper

Prerequisite(s): None   **Co-Requisite(s):** None   **Concurrent Enrollment:** None

Recommended Preparation: Data analysis experience such as statistics on the level of CE 408, ISE 220, or PPD 303 is recommended, but not required. Previous coursework in transportation is not required, but exposure introductory transportation at the level of CE 471 or PPD 360would be beneficial.

Course Notes
All the course materials including assignments, lecture slides, homework, solutions, and scores will be posted on the class Blackboard website.

Technological Proficiency and Hardware/Software Required
Software requirements for this course is R and RStudio, which is available free, and Microsoft Excel.

Readings and Supplementary Materials
Washington, S.P., Karlaftis, M.G., Mannering, F.L., "Statistical and Econometric Methods for Transportation Data Analysis", 2nd Edition, *CRC Press*, 2011.
Textbook may be purchased in the USC Bookstore.

Description and Assessment of Assignments
The following components are used to assess the outcomes:

Homework (15%): At the end of each topic, homework will be available and they are due one week from the assignment date, unless otherwise indicated. homework will be assigned either from the textbook or from other sources. They must be clearly handwritten or typed and show all steps. Homework will be graded based on organization, neatness, accuracy, and effort.

Class Assignments (15%): Class activities areevaluated using class assignments, which are open book and consist of computational questions. Grades will be based on the involvement in these class activities and the quality of the solutions.

Research Paper (20%): Students will be required to complete a research paper. The topic can be chosen from a list of proposed research topics provided by the instructor. Students are also welcome to suggest their own topic title, but the instructor must approve this. The research should be completed in groups of three to five students. Paper tasks and timeline are available in class. Grades are assigned based on the paper tasks and details will be discussed with you in class. Students will receive feedback on each task. The final research paper shall be in the style of an academic paper with citations following the APA technical reference style, be 3500 to 5000 words long and is due in the last week of the class. All the groups will present their research findings and share their results with the rest of the class.

Mid-Term Exam (25%): There will be one mid-term exam. The exam is a combination of computational questions, multiple-choice and/or short-answer questions. Students need acsess to a computer with required software. Midterm exam is scheduled to be on **Wednesday October 6th**.

Final Exam (25%): The final exam is take home, comprehensive, and mandatory. It will be a combination of computational questions, multiple-choice and/or short-answer questions. Students need acsess to a computer with required software. The date and time will be discussed later in class.

Grading Breakdown
Final grades will be calculated as follows:

Assignment	% of Grade
homework	15%
Class Assignments	15%
Research Paper	20%
Mid-Term Exam	25%
Final Exam	25%
TOTAL	100%

Grading Scale
Course final grades will be determined using the following scale:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
95-100	90-94	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	59 and below

This scale is presented for the sake of completeness. Courses in which students earn grades below a C cannot be presented for credit toward graduation in a USC graduate program, though the course grade remains part of the students graduate GPA.

Assignment Rubrics
The rubric for the oral presentation, the research paper outline including the tasks and timeline as well as homework will be available when each item is assigned.

Assignment Submission Policy
Homework: homework should be solved independently. If there is any evidence of cheating, relevant Viterbi and University policies and regulations will be applied. No late homework will be accepted.

Class Assignments: All class assignments are open-book. Time is allotted during each class period to discuss and solve the class assignment questions. Solutions should be turned in by the deadline.

Research Paper: All the team members should write a short, individual statement summarizing what they contributed to the team and what they learned from the assignment. All the students are required to participate in the final research presentation.

Midterm and Final Exams: In case the mid-term exam is missed, an official, acceptable, and verified excuse must be presented to be able to make up the exam as early as possible. This excuse must be recorded within 24 hours after student returns. An unexcused failure to take any exam will result in a in a zero for the exam. There is no makeup for the final exam. Phones are not allowed during the exams.

Grading Timeline
Grades will be posted on class web page within two weeks after each assignment submission.

Additional Policies
Students are expected to assist in maintaining a classroom environment, which is conducive to learning. In order to assure that all students have an opportunity to gain from time spent in class, unless otherwise approved by the instructor, students are prohibited from using cellular phones and MP3 players in class, laptops for nonrelated class activities, or engaging in any other form of distraction. Inappropriate behavior in the classroom shall result in, minimally, a request to leave class. Attendance is required and will be monitored throughout the semester. Each student is required to be on time. Incidences of excessive absence will be dealt with in a manner consistent with University policy and procedures.
Online environment:
Acknowledging that class dynamics are substantially compromised without the ability to see the people in class, camera-on is encouraged. If you are facing challenging situations, such as internet connectivity, illness, or home environments that make this difficult or impossible please contact the instructor to for accomodation.
To avoid "constsnt gaze" and "zoom fatigue", there will be mini breaks during the sessions, so everybody can get up, move around a bit, and look away from the screen.

Course Schedule: A Weekly Breakdown
*This schedule serve as a guideline. It may be changed at the instructor's discretion

	Topics/Daily Activities	Data Sources	Readings	Deliverables
Week 1 8/25	**Introduction** - Review of the rules			
Week 2 9/1	**Descriptive statistic** - Summarizing data	Fleet and household data from the National Household Travel Survey (NHTS)	Text book- Chapter 1	
Week 3 9/8	**Descriptive statistic** - Measures +Project discussion	Fleet and household data from the National Household Travel Survey (NHTS)	Text book- Chapter 1	HW1
Week 4 9/15	**Descriptive statistic** - Data visualization +Writing workshop	Infrastructure and energy data from the Bureau of Transportation Statistics and the National Renewable Energy Laboratory (NREL)	Text book- Chapter 1	HW2
Week 5 9/22	**Inferential statistic** - Fundamentals of regression model	Trip, socioeconomic, and emission data from California Household Travel Survey (CHTS) and National Renewable Energy Laboratory (NREL)	Text book- Chapter 3	
Week 6 9/29	**Inferential statistic** - Manipulating regression model	Trip, socioeconomic, and emission data from California Household Travel Survey (CHTS) and National Renewable Energy Laboratory (NREL)	Text book- Chapter 3	HW3
Week 7 10/6	**Midterm Exam**			
Week 8 10/13	**Inferential statistic** - Categorical predictors in regression model	Trip, socioeconomic, and emission data from California Household Travel Survey (CHTS) and National Renewable Energy Laboratory (NREL)	Text book- Chapter3	
Week 9 10/20	**Inferential statistic** - Panel data summary	Crash data from Caltrans Performance Measurement System (PeMS)	Text book- Chapter 6	
Week 10 10/27	**Inferential statistic** - Panel data modeling	Crash data from Caltrans Performance Measurement System (PeMS)	Text book- Chapter 6	HW4
Week 11 11/3	**Inferential statistic** - Principles of logistic regression	Freight data from the National Household Travel Survey (NHTS)	Text book- Chapter 12	
Week 12 11/10	**Inferential statistic** - Logistic regression modeling	Freight data from the National Household Travel Survey (NHTS)	Text book- Chapter 12	HW5
Week 13 11/17	**Inferential statistic** - Logistic regression modeling	Freight data from the National Household Travel Survey (NHTS)	Text book- Chapter 12	
Week 14 11/24	**Thanksgiving Holiday**			
Week 15 12/1	**Research Paper Presentations**			Research Paper Draft

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:

Technical Blackboard and Zoom Assistance
https://keepteaching.usc.edu/

Campus Support and Intervention
https://campussupport.usc.edu/

Kortschak Center for Learning and Creativity
https://kortschakcenter.usc.edu/

USC Libraries
https://libraries.usc.edu/covid-19-library-support-online-teaching-and-research

USC writing Center
https://dornsife.usc.edu/writingcenter

Student Health Counseling Services - (213) 740-7711 – 24/7 on call
engemannshc.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 Services (RSVP) - (213) 740-4900 – 24/7 on call
engemannshc.usc.edu/rsvp
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086
equity.usc.edu, titleix.usc.edu
Information about how to get help or help a survivor of 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.

Bias Assessment Response and Support - (213) 740-2421
studentaffairs.usc.edu/bias-assessment-response-support
Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation 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
studentaffairs.usc.edu/ssa
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.