

Fall 2018

CE 599: Transportation Systems Analysis (4 units)

Sonny Astani Department of Civil and Environmental Engineering
University of Southern California

This 4 unit course, geared towards Masters and PhD students, discusses economic and system level aspects in general that are central to transportation systems, with emphasis on theoretical and analytical tools. Topics to be covered include economic theories of the firm, the consumer, and the market, demand models, discrete choice analysis, cost models and production functions, and pricing theory. The objective is to enable students to apply these concepts for congestion pricing, technological change, resource allocation, market structure and regulation, revenue forecasting, public and private transportation finance, and project evaluation. It is the intention to present the material agnostic to any specific mode of transportation.

Course Instructor

Ketan Savla, KAP 254A, 213 740 0670, ksavla@usc.edu.
Office hours: Tuesdays 11:30 am - 1:30 pm

Class location, hours, and website

Wednesdays 3:00 pm – 6:20 pm, location KAP 159

The class will use the blackboard website at USC, <https://blackboard.usc.edu/>, as the primary medium for distribution of course material and announcements.

Prerequisites

- Basic Optimization (e.g., ISE 330)
- Principles of Transportation Engineering (e.g., CE 471)

Grading

- 30% Homeworks
There will be a total of six homeworks in this course.
- 30% Midterm exam (tentatively October 17, 2018)
- 40% Final exam (tentatively December 12, 2018)

The course material will be derived primarily from the following books. Note that [1] can be accessed online via USC libraries.

Required Textbooks

[1] E. Cascetta. *Transportation Systems Analysis*. Springer, 2009. 3

[2] Kenneth A. Small and Erik T. Verhoef. *The Economics of Urban Transportation*. Routledge, 2 edition, 2007.

Tentative Course Schedule

The tentative schedule of the course is shown in Table 1. The list of topics expected to be covered during each class are listed below:

1. Introduction and Consumer Theory: Choices, Complexity, Demand Elasticity, Preferences, Utility Function, Consumer Surplus, Uncertainty
2. Discrete Choice Models: Basic Logit Models, Rank-ordered Models, Extreme Value Models, Mixed Logit, Model Estimation, Value of Time and Reliability
3. Demand Modeling: Mode Choice, Path Choice, Trip-Chaining, Activity-based, Freight Transportation Demand Models
4. Supply Modeling: Fundamentals of Traffic Flow Theory, Network Models, Flows, Cost Functions, Application to Continuous Service and Scheduled Service
5. Traffic Assignment: Supply/Demand Model, Network Performance, Assignment for Congested and Uncongested Networks, Basics of Dynamic Assignment
6. Theory of Firm: Production Functions, Profit Maximization and Cost Minimization, Average and Marginal Costs
7. Cost Modeling: Cost Functions for Public Transit, Elements of Cost Studies, Dynamic Congestion Models, Short-Run vs. Long-Run Costs, Intermodal Cost Comparisons
8. Pricing: Congestion Pricing, Second Best Pricing, Network Aspects, Pricing of Parking and Public Transit, Incentive Effects of Subsidies
9. Transportation Supply Design: Design of Layouts, Capacities, Road vs. Transit, Pricing Design, Algorithms for Solving the Design Problems
10. Investment: Capacity Choice for Highways, First-Best and Second-Best Capacities, Cost-Benefit Analysis, Demand and Cost Forecasts, Discounting Future Costs
11. Transportation Providers: Private Highways, Heterogeneous Users, Private Toll Lanes, Private Transit Services, Market Structure, Efficiency of Public and Private Providers
12. Comparison of Transportation System Projects: Impact Factors, Benefit-Cost and Revenue-Cost Analysis, Methods for Impact Analysis

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 Section 11, *Behavior Violating University Standards* <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://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://adminopsnet.usc.edu/department/department-public-safety>. 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

Lecture #	Topics	Reading	HW # out	HW # due
1	Overview and Discrete Choice Models	[1]: Ch.1 [1]: 3.1 – 3.3.2		
29 Aug	Discrete Choice Models		1	
5 Sep	Demand Modeling I			
12 Sep	Demand Modeling II and Supply Modeling I		2	1
19 Sep	Supply Modeling II			
26 Sep	Traffic Assignment		3	2
3 Oct	Theory of Firm			
10 Oct	Cost Modeling		4	3
17 Oct	Mid Term Exam			
24 Oct	Pricing			
31 Oct	Transportation Supply Design		5	4
7 Nov	Investment			
14 Nov	Transportation Providers		6	5
21 Nov	Comparison of Transportation System Projects			
28 Nov	Airline Revenue Management			6

Table 1: Tentative Course Schedule

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. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.