



Orf 467

Transportation Systems Planning and Analysis v0

Fall 2017/2018

Course DescriptionEnrolled Students**Part 1. Perspective on the Transportation Sector of the Economy: Its Function, Its Players, Its Technologies, Its Policies, Its Information Sources****Week 0****Wed Sep 13**

Introduction and Survey of Course

Elements of the transportation sector of the economy, the player, the technologies, the information sources

Reading: [Smart Driving Car](#), [Street Smart](#) by Samuel Schwartz [Has Growth in Automobile Use Ended?](#)[2017 Motor Vehicle Crashes: 1st Half](#)[FATALITY ANALYSIS REPORTING SYSTEM \(FARS\) ENCyclopedia National Transportation Statistics:](#)[Basic background on Transportation in the US](#) (Pocket Guide 2017)[Travel Monitoring](#)[Highway Statistics Publication Archive](#)[Freight Facts & Figures 2015](#)[Commodity Flow Survey](#)[National Transportation Statistics 2017](#)Energy Flow Diagrams: [2016 Energy flow charts](#); [Total Energy wRejected 2016](#) [ClassicView](#) ; [Energy Consumption](#)Energy Outlook 2017: [https://www.eia.gov/outlooks/aeo/pdf/0383\(2017\).pdf](https://www.eia.gov/outlooks/aeo/pdf/0383(2017).pdf); World Oil Demand &Reserves: [BP Statistical Review of World Energy, June 2017](#)[WTI Crude](#)**Homework 1:** [The Last Drop or StreetSmarts or The coming of autonomous Taxis](#) ; Due Monday, Sep 18 **Class****Notes:** [Week 0](#), [Current News](#)**Week 1****Mon Sep 18**

Evolution of Urban transportation Technology: From the Omnibus to PRT (Personal Rapid Transit, “Transport System of the Future???”) History of PRT; Historical evolution of National Transportation Policy leading to current National Transportation Policy,

Readings: [Travel in London](#) ; [PRT@LHR](#); [Jerry Schneider’s Source Page](#), [PRT@LHR10Conf](#);[Podcar Stockholm 2011](#);[2GetThere/Masdar](#); Animations: [IndiaPRT](#) ; [Bath](#); NJ PRT [Academic](#) Look,**Class Notes:** [History Slides](#) , [Current News](#)http://orfe.princeton.edu/~alaink/PRT/Movies/DelhiIndiaPRT_Animation.mp4**Mon Sep 18 Precept**Discussion of “Last Drop” and Big Picture view of Transportation in the next 20 years ([be prepared to discuss this link!](#)) **Readings:** ; [Motor Fuel data and the Highway Trust Fund](#); [State Gasoline Taxes](#)

Wed Sep 20

autonomousTaxis, Evolution of Crashless Cars

Readings: [KPMG Report on Crashless Cars](#); [Chunka Mui's Series in Forbes](#); [Todd Litman](#); [state-wide autonomousTaxi](#); [Transportation in 2038???](#), [Smart Driving Car videos](#);

[Automation Workshop](#), [1st Princeton SmartDrivingCar Summit May 2016](#); [PAVE DARPA Story](#)

Class Notes: [The Case for SmartDrivingCars](#);

Part 2. Planning and Analysis Tools of Transportation Demand and Investment

Week 2

Mon Sep 26

Class Discussion on the Future of Transportation Technology, given Transitions that have happened over the past 150 year. Come prepared having looked at HW 2 & Class Notes

Homework 2: [How will the Mobility Environment Change by 2038?](#) ; Due Tuesday, Sep 27

Class Notes: Slides: [The Case for SmartDrivingCars](#), [Adam Jonas](#) Views of Future Mobility & Questions from HW2.

Precept Tue 27 7:30pm NOTE DAY Change from Monday

Modeling Transportation Systems; Development of a Formal Urban Transportation Planning (UTP) Process & Decision Making: The Central Jersey Transit Study ; Alternatives Analysis: Goals, Objectives, Metropolitan Planning Processes

Discussion of MyCity homework objectives

Ref.: [Class Notes](#) [MyCityTripGeneration](#)

Background reference: [NCHRP Synthesis 406 Advanced Practices in Travel Forecasting](#)

Ed Weiner, [Urban Transportation Planning in the US: An Historical Overview; 5th Edition](#) ; [Analytical Travel Forecasting NCHRP765](#)

Homework #2a,b [My City](#) Also See: [My City Trip Generation](#)

Examples: [MyCityEx1](#), [MyCityEx2](#), [CityOfEden](#), [CofEReport](#) [La Ville Report](#) [LaVille Data](#)

[MyCitysummaryTableOrf467F16.xlSX](#) Due: Mon. Oct 2 & Mon 3 Before Precept.

Wed Sep 27

Urban Travel & Transportation System Characteristics: Planning Studies and Methods: Travel Demand Surveys, Data Sources, Intro to Sequential Demand Forecasting Modeling Approaches; Relating the Travel Demand with Land Use: **Trip generation**; Activity-based demand models

Ref.: Cascetta, Ch. 4.1- 4.5 New York Met Area Study, (see Notes for links) Travel Modeling [Demand Modeling Notes](#)

Background & Data Reference: ;[LincolnTravelDemandModel SCAG Modelling](#) [TCRP B-15 Characteristics of Urban Travel](#) see especially: [Overall Trip Rates](#); Travel Surveys: <http://www.travelsurveymannual.org/>

Class Notes [Simple Demand Modeling](#), [LincolnTripGen](#) ;

Week 3

Mon Oct 2

Relating the Travel Demand with Land Use: **Trip Distribution**

Ref.: [The Gravity Model](#), [Example of Trip Distribution Mode Lincoln NEI](#) [SCAG](#)TripDistribution

Class Notes: [Notes](#) Trip distribution [Current News](#)

Mon Oct 2 Precept

Presentation of MyCity Designs and Trip Generations

Wed Oct 4

Random Utility Theory and the modeling of **Mode Choice**

Ref.: **Class Notes** Cascetta, Ch. 3 [Class Notes](#), [ModeChoice](#), [SCAG ModeChoice](#) [LincolnModeChoice](#)

Homework #4 [Final Report for MyCity](#), [Current News](#)

Week 4

Mon Oct 9

Traffic Assignment and paths through networks; Network Analysis: Shortest Paths: Label Setting and Label Correcting, Shortest paths in Real Networks and Essentially Shortest Paths; Dijkstra's Algorithm **Readings:**

[DijkstraApplet](#); [Another Dijkstra Visualization](#)

<http://www.princeton.edu/~alaink/Orf467F17/LincolnTrafficAssignment.pdf> 5.1-5.3, Magnanti, Ch2, Ch4 (to be distributed)

Ref.: [Class Notes](#) [SCAG Networks](#) [SCAG TrafficAssignment](#) [LincolnTrafficAssignment](#)
http://www.scag.ca.gov/modeling/pdf/MVS03/MVS03_Chap04.pdf [Current News](#)

Mon Oct 10 Precept

Oral Presentations of Progress on MyCity: Work Trip Distribution + ...

[Comparisons of Orf467F10 My Cities](#)

Wed Oct 11

More on: Paths through networks; Network Analysis: Shortest Paths: Label Setting and Label Correcting, Shortest paths in Real Networks and Essentially Shortest Paths

Label Setting; Dial and Radix Heap Implementations of Dijkstra's; Label Correcting; real world networks and stochastic issues

Network Flow (Transportation Problem); Wardrop's 1st & 2nd Principles, Assignment Techniques and k-shortest paths

Additional Readings: [He, Kornhauser & Ran, "Essentially best routes in dynamic and stochastic networks"](#), [Zhan & Noon, "Shortest Path Algorithm : An Evaluation using Real Road Networks](#) [Current News](#)

Ref.: [Class Notes](#) Magnanti [Ch 4, especially 4.5 through 4.9](#); [Readings on Networks](#), , [FlowMapExamples](#); [Tharald Fongaard'15 Traffic Flow Display System](#)

[Transportation Network Design](#) ; [Hunt, Kornhauser, "Assigning Traffic Over Essentially-Least-Cost Paths"](#) [The transportation Problem](#)

Assignment: [Magnanti](#): 2.1, 2.2, 2.3, 2.4, 2.5, 2.30, 2.31, 2.43, 2.44, 2.45, 4.1, 4.14, 4.15 (These are straight forward. Do them with your partners; turn in one solution set per two person pair. Both work on all problems), **Due Friday, Oct 20.**

Week 5

Mon Oct 16

More on Networks and Princeton Trip Synthesizer

Ref.: [NJ Trip Synthesizer](#) ; **NationWideNetwork:** [Links](#), [Nodes](#), [ReadMe](#); [NationwideSynthesizedPersonTrips](#) [Current News](#)

Monday Oct 16 Precepts

Oral Presentations of Final Report of MyCity & Discussion about networks

Wed Oct 18

More on ..Princeton Trip Synthesizer: Nationwide Synthesizer

Ref.: [Current News](#), [The transportation Problem](#) [Transportation Network Design](#), [NJ Trip Synthesizer](#) ; [Tharald's Trip Display System](#),

Week 6

Mon Oct 23

More on NJ Trip Synthesizer. Modeling of the ride-sharing potential of aTaxi in NJ and the Nation

Reference: [NJPT04](#), [NJPT05](#), [NJPT07](#), [NJPT08](#), [NJPT09](#), [NJPTF10](#);

[SynthesizingIndividualTravelDemandInNJ](#) & the Nation

[A National Hybrid Activity/Agent-Based Demand Model to Characterize the Mobility of the United States](#), K. Marocchini, Jan 2017

Mufti: [TripSynthesizer](#);

http://orfe.princeton.edu/~alaink/NJ_aTaxiOrf467F14/Orf467F14Disaggregated_Pixels_View.pptx;

[HillWrough'14SeniorThesis](#) ; [Brownell TRB 2014Paper](#)

[Current News](#),

Tue Oct 24 Precept (Precept moved to Wednesday Oct 25 @ 4:30 in Friend 008)

Wed Oct 25

Special Seminar: [Autonomous Vehicles: Good, Bad, Ugly](#), Samuel I. Schwartz, President & CEO, Sam Schwartz Transportation Consultants, Author “[Street Smarts: The Rise of Cities and the Fall of Cars](#)”

[Comparisons of MyCity 2017](#)

@ 4:30pm Friend 008 Special Seminar: Joshua Herbach’08, Waymo Full Self-drivingCar Team “**Update on Waymo’s Full Self-Driving Cars**”

Term Break Oct 29 – Nov 5

Part 3 The Role of High Technology in Transportation

Week 7

Mon Nov 6

More on Modeling of Individual Person-trips in NJ and the Nation

[SynthesizingDailyPersonTripsWithImpicationsOnRidesharing.pptx](#)

[Pdf version](#)

[Disaggregated Pixel Views in NJ](#)

[Orf467National_aTaxiPixelGrid](#)

[Examples of some {Lat,Lon} <-> PixelCoordinates](#)

[NationWide Trip Data](#)

[Visualization of USA Person Trips](#)

[Current News](#)

Ref.:

[Earth Point: Excel To Kml – Display Excel Files in Google Earth](#)

[Driverless: Intelligent Cars and the Road Ahead](#) by Hod Lipson and Melba Kurma, MIT Press, 312 pp

Assignment: [Homework 6: Ride-Sharing Potential in MyCounties](#) Due Wednesday Nov 15, 2017

Mon Nov 6 7:30-9:00pm Precept

Wed Nov 8 Lecture

Synthesis of Nationwide Individual PersonTrips: Discuss Final Term Projects

Ref.: [List Final Projects Orf467F16](#) ; [Final Project Teams and Task Assignment](#)

Class Notes: [Current News](#)

Week 8

Mon Nov 13

Analyzing the ride-sharing potential of aTaxis in NJ and the Nation,

Readings: [Interplay Between Fleet-size, LoS and EmptyRepositioning](#) S. Zhu & A. Kornhauser

[A Ridesharing Analysis with a Hitchhiking Modification Applied to Taxi Trips in New York](#) A.

Schindele'16

[Quantifying the Potential for Dynamic Ride-Sharing of New York City's Taxicabs](#) S. Bhat'16

[Analyzing 1.1 Billion NYC Taxi and Uber Trips, with a Vengeance](#) T. Schneider

Nationwide Person Trip DataBase: <http://orf467.princeton.edu/db>

Class Notes: [AVO Analysis of aTaxi Trips Throughout NJ](#)

[Current News](#)

Mon Nov 13Precept

First impressions of Trips originating from you home county from Kyle's [NationWideTrips'16 Directory](#)

Please work on your own. I'm unable to be there.

Wed Nov 15

More on: Analyzing the ride-sharing potential of aTaxis in NJ and the Nation. Visitors (Dr. Stan Young & Dr.Venu Garikapati)from National Renewable Energy Lab to learn about what you are doing.

Readings: [Initial assessment and modeling framework development for automated mobility districts](#) & [Next Generation Integrated Mobility: Driving Smart Cities](#)

Class [Current News](#)

Week 9

Mon Nov 20

Toward Real-Time Intelligent Transportation Systems (ITS): Advanced Traveler Information Systems (ATIS):

In-vehicle Satellite Navigation: From TravTek to Navigation Based Services; Global Positioning Systems (GPS)

Readings: [Demers,A, et al](#) "Competing With the Ghost of ADVANCE: Experimenting with Real-Time ATIS", Fontaine, M.D., et al,

511 Traffic <http://www.trafficland.com/>; [Bay Area South Florida](#) ; [Virginia TampaBay](#) ; [Minnesota Traffic.com](#) ; [Real-time ATIS](#) <http://www.photoenforced.com/us.html>; Class [Notes](#) [Current News](#)

[Couple things for fun:](#)

<http://orfe.princeton.edu/~alaink/Presentations/DinkyFutureFinalAlainAndrew.ppt>

<http://orfe.princeton.edu/~alaink/Presentations/OpenBelowGradeDinkyStationConcepts.pdf>

<http://orfe.princeton.edu/~alaink/Presentations/RadicalImprovements3wPRT.pptx>

Wed Nov 22

NO CLASS (exam the previous evening);

Week 10

Mon Nov 27

Dr. Chenyi Chen *16 DeepDriving: Application of Deep Learning to Automated Driving

[Fundamentals of Machine Learning](#) and specific approaches to Computer Vision for Collision Avoidance and Self-Driving & Introduction to ChenyiChen Automated Driving Simulator

Ref.: C. Chen, et. al. [DeepDriving: Learning Affordance for Direct Perception in Autonomous Driving Using GTAV to Learn Distances TRB Final](#) A. Filipowicz & A. Kornhauser; [Capsule Networks \(CapsNets\) - Tutorial](#); [Computer Vision for Autonomous Vehicles: Problems, Datasets & State-of-the-Art](#)

Class Notes: [Fundamentals of Machine Learning](#) & “[Extracting Cognition out of Images](#)”. Chenyi Chen *16

Tue Nov 28 Precept

[USA aTaxi16 Empty Vehicle Management Work Session](#) Progress report of Final Projects: [Final Project Teams and Task Assignment](#)

Wed Nov 29

Empty aTaxi repositioning in your USA County

Hold over: Look at version2 of OnePixelExample:

[V2 OnePixelExample FinalOriginPixel17031 17.xlsx](#)

Class Notes: [Management of Empty aTaxis](#)

Assignment: [HW7: Initial Investigation of Empty Vehicle Repositioning Needs for Shared aTaxis to serve your county's intra-county trips.](#) .

Readings: Shirley Zhu's Thesis ([Zhu'16MakingTransportationGreat Thesis.pdf](#)) and “[Interplay Between Fleet-size, LoS and EmptyRepositioning](#)” S. Zhu & A. Kornhauser

Week 11

Sunday Dec 3

Mon Dec 4

NJ aTaxi Work Session : **Empty aTaxi Management**

Readings: [aTaxisFinalProject Analysis of Demand for and Management of USA aTaxi System Current News](#)

Mon Dec 4 Precept 7:30pm Review for exam

Wed Dec 6

Exam: Wednesday Dec 6 1:30- 2:50pm 101 Sherrerd

Exam covering weeks 1-10 [Instructions](#)

Week 12

Mon Dec 11

NJ aTaxi Work Session : **Empty aTaxi Management**

Class Notes: [Management of Empty aTaxis](#)

Assignment: [HW7: Initial Investigation of Empty Vehicle Repositioning Needs for Shared aTaxis to serve your county's intra-county trips.](#) .

Readings: Shirley Zhu's Thesis ([Zhu'16MakingTransportationGreat Thesis.pdf](#)) and “[Interplay Between Fleet-size, LoS and EmptyRepositioning](#)” S. Zhu & A. Kornhauser

Assignment:

Mon Dec 11 Precept

NJ aTaxi Work Session : [Homework 6](#) & [HW7](#) work session

Assignment:

Wed Dec 13

Final Project Planning Session

Assignment: Final Project *Assessment of RideSharing, ‘Last-Mile’ and Optimal Empty Vehicle Management of Large Regional aTaxi Operation*

Readings:

Reading Period 10:00 am - 1:00pm Saturday Jan 13, Final Workshop on Term Project; Lunch will be served.

[Schedule](#)