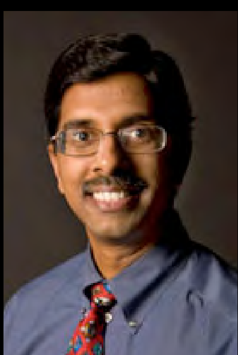
Short Course on

Activity-Based Modeling of Transport Network Demand and Performance

Organized by the Center for Transportation Research (CTR) at The University of Texas at Austin

Course Directors

Dr. Chandra R. Bhat, CTR, University of Texas at Austin



Ram M. Pendyala, Georgia Tech

Konstadinos G. Goulias, University of California at Santa Barbara

Background

The fundamental difference between the trip-based and activity-based approaches is that the former focuses directly on "travel choices" as the decision entities of interest, while the activity-based approach views travel as a demand derived from the need to pursue activities that are distributed in time and space and focuses on "activity participation behavior" as the underlying driver of travel demand. The philosophy of the activity-based approach is to understand the behavioral basis for individual decisions regarding participation in activities, and the resulting travel needs and choices. This behavioral basis includes all of the factors that influence the how, why, when and where of activities performed and travel undertaken. Among these factors are the needs, preferences, prejudices and habits of individuals (and households), the cultural/social norms of the community, and the service characteristics of the transportation system and surrounding built environment. The transport service characteristics themselves have to be dynamically represented across time and space, to reflect queue formation in specific parts of the transportation network through a completely integrated system of travel demand, route choice, and network simulation. Such integrated time-dependent model systems enable the realistic representation of transportation network conditions and traveler behaviors. The real value of the integrated approach is in being able to evaluate the impacts of alternative traffic congestion alleviation, greenhouse gas emissions (GHG) control, and energy consumption reduction policies, and the implications of new technologies such as connected and automated vehicles (CAVs). A dynamic integrated model system of activity-travel behavior in transport networks would be capable of reflecting demand-side market adoption and use behaviors as well as supply-side network effects within an agent-based microsimulation framework operating at the level of individuals and households.

Why join the course?

This course will introduce attendees to the basics of the activity-based network modeling approach, the big data-supported transportation planning and operations (D-STOP) opportunities, and a number of unique elements of the activity-based modeling framework that have been implemented in the Los Angeles area and are scheduled to be implemented in the New York area. The unified modeling framework, developed at the Center for Transportation Research (CTR) at the University of Texas at Austin, the Georgia Institute of Technology, the University of California at Santa Barbara, and multiple other Universities in the world, constitutes a pragmatic and field-tested comprehensive approach that is deeply embedded in the foundations of human behavioral decision-making. The model system, which has been extensively tested and applied in a number of settings, advances the state-of-the-art of activity-travel demand forecasting beyond the daily activity-pattern and tour-based approaches employed in several metropolitan areas. It is a next generation application platform that offers a more flexible solution to contemporary transportation policy analysis, offers a stronger foundation for meeting current and future model requirements, and can take advantage of new technologies and methods as they emerge.

In short, the course will enable researchers and practitioners alike to move to the forefront of model development to address the increasingly complex land-use, built environment, transport, and environmental policies, the analyses of which far exceed the capabilities of the usual modeling/simulation techniques.

Who should attend?

The course is designed for researchers interested in learning about cutting edge travel modeling methods founded in strong behavioural theories, and practitioners (from consulting, local, state, and federal planning agencies, and transit agencies) interested in learning about a flexible and practical suite of modeling tools that may be used to analyse the impacts of a variety of technology, pricing, and land-use policies to better plan, invest, design, and manage transportation systems. Attendees are expected to have a basic knowledge of transportation analysis methods and mathematical modeling techniques.

Instructors

The course directors are Professors Chandra R. Bhat (CTR, University of Texas at Austin), Ram M. Pendyala (Georgia Tech), and Konstadinos G. Goulias (University of California at Santa Barbara). Depending on the location of the course, other participating instructors may include Dr. Jennifer Duthie (CTR at the University of Texas at Austin), Prof. Kai Nagel (TU Berlin), Prof. Srinivas Peeta (Purdue University), Prof. Travis Waller (University of New South Wales), Prof. Amalia Polydoropoulou (University of the Aegean), and Prof. Xuesong Zhou (Arizona State University). All of the instructors have extensive experience in agent-based modeling of human movements and dynamic network analysis, and have been pioneers in the development of concepts and methods that are now widely adopted around the world.

Location and course offering

An inaugural one-day executive version of the course will be offered at the Third Conference of the Transportation Research Group (CTRG) of India on December 17, 2015 in Kolkata, India. A five-day full hands-on course will be first offered in Austin, Texas in May 2016 (dates to be announced soon). This will be followed by a course offering in Berlin planned for Summer 2016. Additional offerings in the Middle East, Australia, South America, Asia, and North America are under development for the subsequent academic year.

Unique elements of the modeling framework in this course

The modeling framework covered in this course is unique in that it (a) includes a visual population synthesizer that employs new algorithms to simultaneously consider household and person characteristics in the synthesis process, thus *producing a synthetic population that is congruent with external control totals* at both the household and person levels, (b) accommodates *intra-household interactions* in activity-travel choices among all individuals (children and adults) in a household, (c) incorporates spatial-temporal dependencies and constraints in activity-travel patterns between and within individuals of a household by using *continuous-time* as the overarching basis for pattern generation and activity scheduling, (d) adopts a behaviorally robust activity-based approach by focusing *explicitly on activity episode generation and scheduling characteristics* (including chaining into tours and travel choices associated with the activity episodes), (d) allows *enhanced sensitivity of travel demand and holistic assessment of traveler response to land-use attributes, built environment and development patterns, and multi-modal (and inter-modal) transportation policies and demographic changes in the population,* (e) incorporates *vehicle-driver allocation models* along with an explicit household *vehicle type choice simulator* (vehicle fleet composition defined by body type, fuel type, make/model, and vintage), (f) facilitates *environmental justice* (EJ) analyses by incorporating the ability to examine the effects of policies on any defined segment of the population, and (g) allows *seamless interfacing and integration* with land-use and demographic model outputs, GIS/Geo-database input layers, GIS output visualization abilities/needs, querying and reporting capabilities, population synthesizer outputs, and freight forecasting and external trip model outputs.

Full Course Content

Module 1: Model estimation basics and land-use/demographic modeling (1.5 days)

- Discrete choice modeling, including multiple discrete-continuous (MDC) model systems
- Land-use modeling methods, including new MDC-based approaches
- Accessibility metrics and computations
- Population synthesis methods and the PopGen (Population Generation) software
- Base year demographic models and demographic evolution models
- Household vehicle type holdings and use models, and driver-vehicle allocation models

Module 2: Activity-based travel modeling (1.5 day)

- Modeling time-space prism constraints
- Inter-individual interactions and household-level activity generation
- Activity-travel scheduling and the CEMDAP (Comprehensive Econometric Microsimulator for Daily Activity-travel Patterns) software
- Sensitivity analysis and validation metrics
- Policy analysis examples

Module 3: Route choice and dynamic network modeling (1.5 day)

- Route choice modeling, including path choice set development
- Network representation and queue modeling
- Shortest path algorithms and implementation
- Macroscopic, mesoscopic and microscopic network models
- Evaluating effects of new technologies on networks, including connected/automated vehicles

Module 4: Integrated models (0.5 day)

- Integrated land-use and transportation models
- Demand-supply models and equilibrium/convergence concepts
- Interfacing transportation, air quality, energy, and greenhouse gas (GHG) emissions models
- Freight analysis, special event analysis, and mega-region planning models
- Pricing and revenue analytics
- Big data-based predictive analytics for planning and real-time operations

Tuition Costs for India Course in Kolkata, December 17, 2015

Please contact Dr. Ashish Verma (ashishv@civil.iisc.ernet.in) or Prof. Partha Chakraborthy (partha@iitk.ac.in) or Prof. Bhargab Maitra (bhargab@civil.iitkgp.ernet.in)

Tuition Costs for Austin Course in May 2016

Information will be released in January, along with fellowship opportunities. Please contact Maureen Kelly (maureenk@mail.utexas.edu) after January 15, 2016.