Transportation Center Seminar Series presents…..

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Modeling Driver Behavior as a Stochastic Hazard-Based Risk-Taking Process

Thursday, Nov. 20, 2008
4:00 – 5:00 pm
Refreshments available at 3:30 pm

Location:
Transportation Center, Northwestern U.
Chambers Hall – lower level
600 Foster, Evanston, IL

Abstract: Acceleration models are at the core of operational driving behaviors, and include car-following models which capture interactions between a lead and following vehicles. The main assumption in these models is that the behavior of the following vehicle (e.g. change in acceleration) is directly related to a stimulus observed/perceived by the driver, defined relative to the lead vehicle (e.g. difference in speeds, headways etc.). In addition to the operational aspect, lane changing models capture the tactical side of driving. Most lane changing models were kept in a deterministic rule-based framework where changing lanes is directly related to the desirability of such maneuver, its necessity and its possibility/safety. An important aspect heretofore missing from previous formulations pertains to the stochastic “unsafe” character of the cognitive processes followed by drivers, such as perception, judgment and execution while driving.

After exploring specifications of existing microscopic traffic models in terms of capturing congestion dynamics and modeling accident-prone behaviors, the objective of the presented research is to explore and evaluate a car-following/lane changing model that reflects the psychological and cognitive aspects of the driving process and captures risk taking behavior under uncertainty. In the car-following model, Tversky and Kahneman’s Prospect Theory provides a theoretical and operational basis to weigh a driver’s different alternatives. In the lane-changing model, a hazard-based framework is used; driving is a continuous story divided into different experienced episodes. Each episode is terminated probabilistically based on the surrounding traffic conditions as well as the drivers’ characteristics. The resulting microscopic traffic model is implemented and tested in order to assess its properties and those of the resulting traffic stream behavior. Promising results have been found especially in terms of stochastic equilibrium. Accidents can be generated as an inherent output of the model dynamics and no “artificial constraints” are needed to prevent them.

Biography: Samer Hani Hamdar is a Ph. D. candidate and a research assistant at the Northwestern University Transportation Center. He holds a MS degree from the University of Maryland, College Park, and a BE degree from the American University of Beirut, both in Civil and Environmental Engineering. Mr. Hamdar worked on different projects covering different transportation areas. These projects include a National Science Foundation (NSF) Project titled “Modeling Driver Behavior from a Cognitive Perspective” and a Federal Highway (FHWA) Project titled “Incorporating Weather Effect in Traffic Estimation and Prediction”. His primary research interests include Driver and Pedestrian Behavior Modeling, Traffic Flow Theory, Intelligent Transportation Systems, Transportation Planning and Evaluation, Transportation Safety, Evacuation Modeling and Disaster Management. He has an international research background having participated in projects in Germany, Saudi Arabia, and the US.