**SENSITIVITY OF PATH TRAVEL TIME TO PATH FLOW**

**Thursday – March 3, 2011**
4:00 - 5:00 pm

**Location:**
Transportation Center
Chambers Hall - Ruan Conference Center – Lower Level
600 Foster St., Evanston

**ABSTRACT:** Network traffic simulation is an approach to tackle the task of strategy evaluation and optimization in transportation systems. Enhancing the application of simulation models to more interesting and wider range of problems requires knowledge of their mathematical properties. These properties are hard to study due to rule-based and algorithmic nature of the simulators. In this work, the authors seek to overcome this void by defining a set of implicit variables and functions that facilitate the communication process regarding traffic simulation models. One of the properties of traffic simulation models is sensitivity of path travel time to path flow. The sensitivities are necessary in capturing marginal effects which is a requirement for improving the convergence ability of simulation-based dynamic traffic assignment and enhancing their application domain to problems such as system optimal traffic assignment and toll design. They also would improve the performance of online traffic control algorithms by providing the opportunity of generating multiple scenarios from one scenario in short amount of time. Estimating each of the derivatives is equivalent to a rerunning of simulation which is computationally very demanding considering the number of input and output variables in the system. This study addresses this issue and provides a general cause and effect analysis framework for capturing the sensitivities. To test the performance of the framework, it is implemented in the DYNASMART traffic simulation model. The performance of the techniques is evaluated through comparing their derivative values to the values obtained from brute force method.

**BIO:** Hamed Babai is a PHD candidate in Transportation Center of Northwestern University, expecting to graduate in March 2011. He received his bachelor’s degree in Civil Engineering from Sharif University of Technology, Tehran, Iran in 2004. He continued his Master’s degree in Transportation Engineering program of Sharif University of Technology and received his degree in 2006. His Master’s thesis is titled “Simulation-based dynamic traffic assignment with application of numerical derivatives”. In his research, he focused on the development of traffic simulators and integrating them with descent direction techniques for solving Dynamic User Equilibrium problem. His paper titled “Two numerical differentiation techniques for average path travel time of cell-based traffic simulation models” is to appear soon in journal of Transportation Research Part B.

During his PHD, he has focused on the mathematical properties of traffic simulators with special interest in path travel time vector. His dissertation is titled “Properties of simulated path travel times”. Each chapter of his dissertation explores a property of path travel time vector as a function of path departing flow vector and discusses the implications for simulation optimization algorithms of traffic network.